IEC 61970-301

Edition 4.0 2013-05

INTERNATIONAL STANDARD

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

Interface de programmation d'application pour système de gestion d'énergie (EMS-API) –
Partie 301: Base de modèle d'information commun (CIM)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

PRICE CODE
CODE PRIX XH

ICS 33.200

ISBN 978-2-83220-813-7

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ENERGY MANAGEMENT SYSTEM APPLICATION PROGRAM INTERFACE (EMS-API) –

Part 301: Common information model (CIM) base

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International Standard IEC 61970-301 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

This fourth edition cancels and replaces the third edition, published in 2011. This fourth edition constitutes a technical revision.

Major changes from the third edition include the following:

- extensions have been added to support UCTE exchange;
- several classes have been moved from IEC 61970 to the Assets package in IEC 61968;
- the transformer regulation model has been modified and expanded to support phase shifting transformer models needed by ENTSO-E;
- zero and negative sequence impedance terms have been added where missing;
- new StateVariables package has been added to support exchange of network model solutions from power flow, state estimation, etc.;
- additional classes that have been added included:
  - PhaseTapChanger

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  - RatioTapChanger
  - ImpedanceVariationCurve
  - RatioVariationCurve
  - TapSchedule
  - SwitchSchedule
  - PhaseVariationCurve
  - EquivalentInjection added to the Equivalents package
  - WindGeneratingUnit and NuclearGeneratingUnit added as subtypes of GeneratingUnit
- classes that were removed included:
  - Company
  - HeatExchanger
  - MeasurementType class removed and replaced with attribute Measurement.measurementType.
  - Datatypes ShortLength and LongLength were removed and replaced with Length.
  - Load, CustomerLoad, and InductionMotorLoad.
  - Subtytpes of ConformLoad and NonConFormLoad
- various editorial changes to cleanup the UML model.

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

FDIS	Report on voting
57/1331/FDIS	57/1349/RVD

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

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

A list of all parts of the IEC 61970 series, under the general title: *Energy management system application program interface (EMS-API)*, can be found on the IEC website.

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

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

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INTRODUCTION

This standard is one of several parts of the IEC 61970 series which define an application program interface (API) for an energy management system (EMS). This part of IEC 61970 was originally based upon the work of the EPRI control center API (CCAPI) research project (RP-3654-1). The principle objectives of the EPRI CCAPI project were to

- reduce the cost and time needed to add new applications to an EMS;
- protect the investment of existing applications or systems that are working effectively with an EMS.

The principal objective of the IEC 61970 series of standards is to produce standards which facilitate the integration of EMS applications developed independently by different vendors, between entire EMS systems developed independently, or between an EMS system and other systems concerned with different aspects of power system operations, such as generation or distribution management systems (DMS). This is accomplished by defining application program interfaces to enable these applications or systems access to public data and exchange information independent of how such information is represented internally.

The common information model (CIM) specifies the semantics for this API. The component interface specifications (CIS), which are contained in other parts of the IEC 61970 standards, specify the content of the messages exchanged.

The CIM is an abstract model that represents all the major objects in an electric utility enterprise typically needed to model the operational aspects of a utility. This model includes public classes and attributes for these objects, as well as the relationships between them.

The objects represented in the CIM are abstract in nature and may be used in a wide variety of applications. The use of the CIM goes far beyond its application in an EMS. This standard should be understood as a tool to enable integration in any domain where a common power system model is needed to facilitate interoperability and plug compatibility between applications and systems independent of any particular implementation.

This standard defines the CIM Base set of packages which provide a logical view of the functional aspects of an Energy Management System including SCADA. Other functional areas are standardized in separate IEC documents that augment and reference this base CIM standard. For example, IEC 61968-11 addresses distribution models and references this base CIM standard. While there are multiple IEC standards dealing with different parts of the CIM, there is a single, unified information model comprising the CIM behind all these individual standards documents.

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning a computer-based implementation of an object-oriented power system model in a relational database. As such, it does not conflict with the development of any logical power system model including the Common Information Model (CIM), where implementation of the model is not defined.

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ENERGY MANAGEMENT SYSTEM APPLICATION PROGRAM INTERFACE (EMS-API) –

Part 301: Common information model (CIM) base

1 Scope

This part of IEC 61970 deals with the common information model (CIM), an abstract model that represents all the major objects in an electric utility enterprise typically involved in utility operations.

The object classes represented in the CIM are abstract in nature and may be used in a wide variety of applications. The use of the CIM goes far beyond its application in an EMS. This standard should be understood as a tool to enable integration in any domain where a common power system model is needed to facilitate interoperability and plug compatibility between applications and systems independent of any particular implementation.

By providing a standard way of representing power system resources as object classes and attributes, along with their relationships, the CIM facilitates the integration of Energy Management System (EMS) applications developed independently by different vendors, between entire EMS systems developed independently, or between an EMS system and other systems concerned with different aspects of power system operations, such as generation or distribution management. SCADA (supervisory control and data acquisition) is modeled to the extent necessary to support power system simulation and inter-control center communication. The CIM facilitates integration by defining a common language (i.e. semantics) based on the CIM to enable these applications or systems to access public data and exchange information independent of how such information is represented internally.

Due to the size of the complete CIM, the object classes contained in the CIM are grouped into a number of logical Packages, each of which represents a certain part of the overall power system being modeled. Collections of these Packages are progressed as separate International Standards. This particular International Standard specifies a Base set of packages which provide a logical view of the functional aspects of Energy Management System (EMS) information within the electric utility enterprise that is shared between all applications. Other standards specify more specific parts of the model that are needed by only certain applications. Subclause 4.2 below provides the current grouping of packages into standards documents.

2 Normative references

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

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

IEC 61970-2, *Energy management system application program interface (EMS-API) – Part 2: Glossary*

ISO 8601, *Data elements and interchange formats – Information interchange – Representation of dates and times*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61970-2 and the following apply.

NOTE For general glossary definitions, see the International Electrotechnical Vocabulary, IEC 60050.

3.1
energy management system
EMS
computer system comprising a software platform providing basic support services and a set of applications providing the functionality needed for the effective operation of electrical generation and transmission facilities so as to assure adequate security of energy supply at minimum cost

3.2
application program interface
API
set of public functions provided by an executable application component for use by other executable application components

4 CIM specification

4.1 CIM modeling notation

The CIM is defined using object-oriented modeling techniques. Specifically, the CIM specification uses the Unified Modeling Language (UML) notation, which defines the CIM as a group of packages.

Each package in the CIM contains one or more class diagrams showing graphically all the classes in that package and their relationships. Each class is then defined in the text in terms of its attributes and relationships to other classes.

The UML notation is described in Object Management Group (OMG) documents and several published textbooks.

4.2 CIM packages

The CIM is partitioned into a set of packages. A package is a general purpose means of grouping related model elements. The packages have been chosen to make the model easier to design, understand and review. The CIM consists of the complete set of packages. Entities may have associations that cross many package boundaries. Each application will use information represented in several packages.

The comprehensive CIM is partitioned into groups of packages for convenience in managing and maintaining them. These groups are assigned to different working groups within the IEC.

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The CIM package in IEC 61970-301 (this document) is overseen by the same working group that handles the following packages:

- Domain
- Core
- OperationalLimits
- Topology
- Wires
- Generation
- Generation.GenerationDynamics
- Generation.Production
- LoadModel
- Outage
- Protection
- Equivalents
- Meas
- SCADA
- ControlArea
- Contingency
- StateVariables

The packages in the IEC 61968 series of standards describe additional parts of the CIM that deal with other logical views of utility operations including include assets, location, activities, consumers, documentation, work management, and distribution-specific network models.

Note that the package boundaries do not imply application boundaries. An application may use CIM entities from several packages. It is also anticipated CIM packages outside of this document will have dependencies upon some of the packages described in this document, and particularly the Domain and Core packages, though other dependencies will also exist.

Figure 1 shows the packages defined for IEC 61970-301 CIM Base and their dependency relationships. The dashed line indicates a dependency relationship, with the arrowhead pointing from the dependent package to the package on which it has a dependency.

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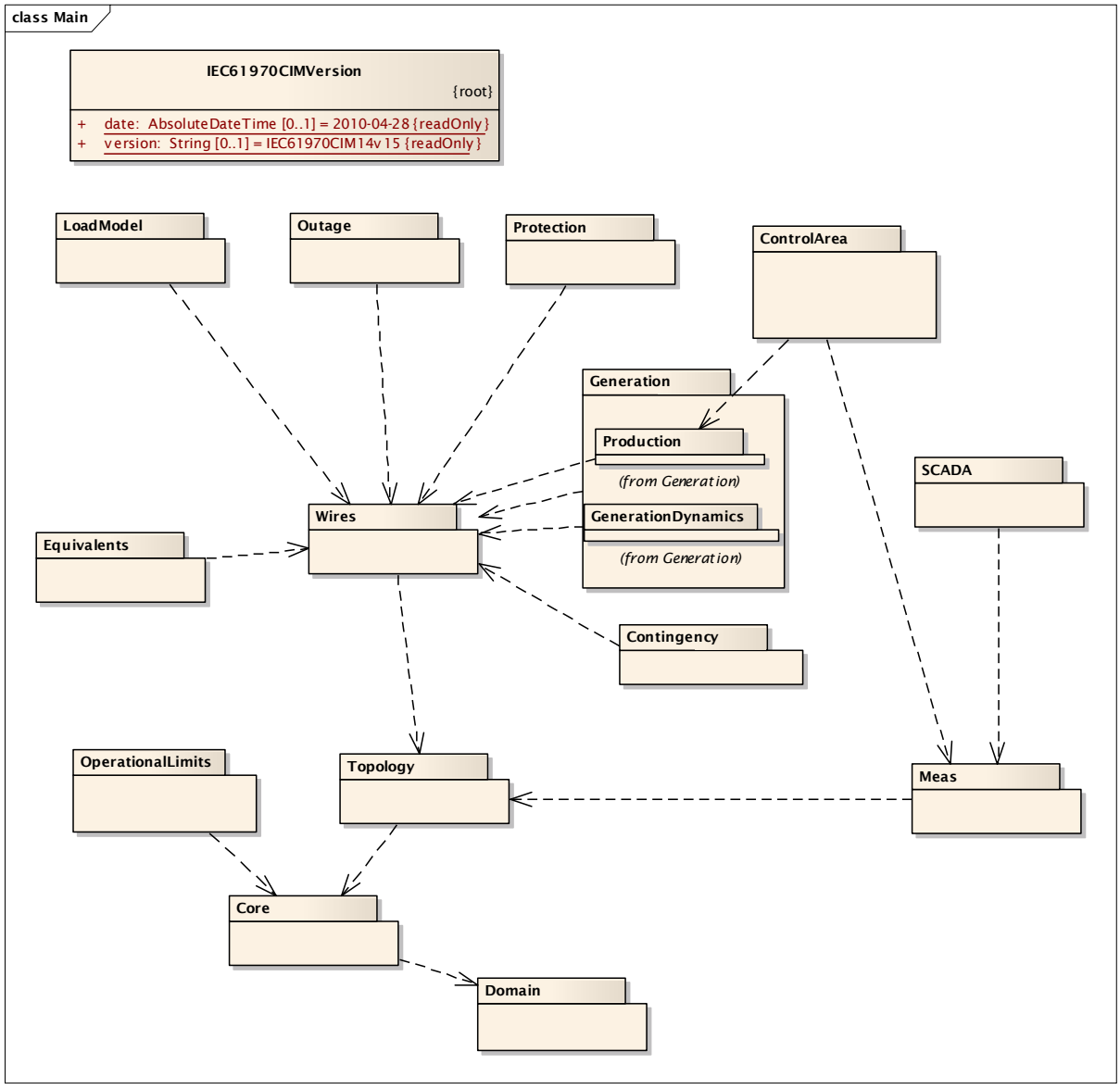

Figure 1 – CIM IEC 61970-301 package diagram

Clause 6 contains the specification for each of the CIM packages.

NOTE The contents of the CIM defined in this specification were auto-generated from the CIM UML electronic model release IEC61970CIM14v15, which is available through the CIM Users Group.

4.3 CIM classes and relationships

4.3.1 Classes

The class diagram(s) for each CIM package shows all the classes in the package and their relationships. Where relationships exist with classes in other packages, those classes are also shown.

Classes and objects model what is in a power system that needs to be represented in a common way to EMS applications. A class is a description of an object found in the real world, such as a power transformer, generator, or load that needs to be represented as part of the overall power system model in an EMS. Other types of objects include things such as schedules and measurements that EMS applications also need to process, analyze, and store. Such objects need a common representation to achieve the purposes of the EMS-API

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standard for plug-compatibility and interoperability. A particular object in a power system with a unique identity is modeled as an instance of the class to which it belongs.

It should also be noted that the CIM is defined to facilitate data exchange. As defined in this document, CIM entities have no behavior. For a specific interface, a profile is defined consisting of a subset of CIM classes, attributes, and associations. A profile defines the message payload for an interface.

Classes have attributes that describe the characteristics of the objects. Each class in the CIM contains the attributes that describe and identify a specific instance of the class. Only the attributes that are of public interest to EMS applications are included in the class descriptions.

Each attribute has a type, which identifies what kind of attribute it is. Typical attributes are of type Integer, Float, Boolean, String, and Enumeration, which are called primitive types. However, many additional types are defined as part of the CIM specification. For example, ShuntCompensator has a "maxU" attribute of type Voltage. The definition of data types is contained in the Domain Package described in 4.2. The UML stereotypes of Primitive, enumeration, and Datatype are added to classes used as types. The Datatype stereotype is used with a specific CIM semantics for a triple of attributes {value, unit, multiplier}, which implies custom mapping to serialization artifacts such as RDFS, OWL, and XSD. Classes with these stereotypes do not participate in generalization or association relationships and are simply used as types for attributes.

All CIM attributes are implicitly optional in the sense that profiles using the CIM may eliminate any attributes.

Relationships between classes reveal how they are structured in terms of each other. CIM classes are related in a variety of ways, as described in 4.3.2, 4.3.3 and 4.3.4.

4.3.2 Generalization

A generalization is a relationship between a more general and a more specific class. The more specific class can contain only additional information. For example, a PowerTransformer is a specific type of Equipment. Generalization provides for the specific class to inherit attributes and relationships from all the more general classes above it.

Figure 2 is an example of generalization. In this example taken from the Wires package, a Breaker is a more specific type of ProtectedSwitch, which in turn is a more specific type of Switch, which is a more specific type of ConductingEquipment, etc. A PowerTransformer is another more specific type of Equipment. Note that PowerSystemResource inherits from class IdentifiedObject which is not on the diagram.

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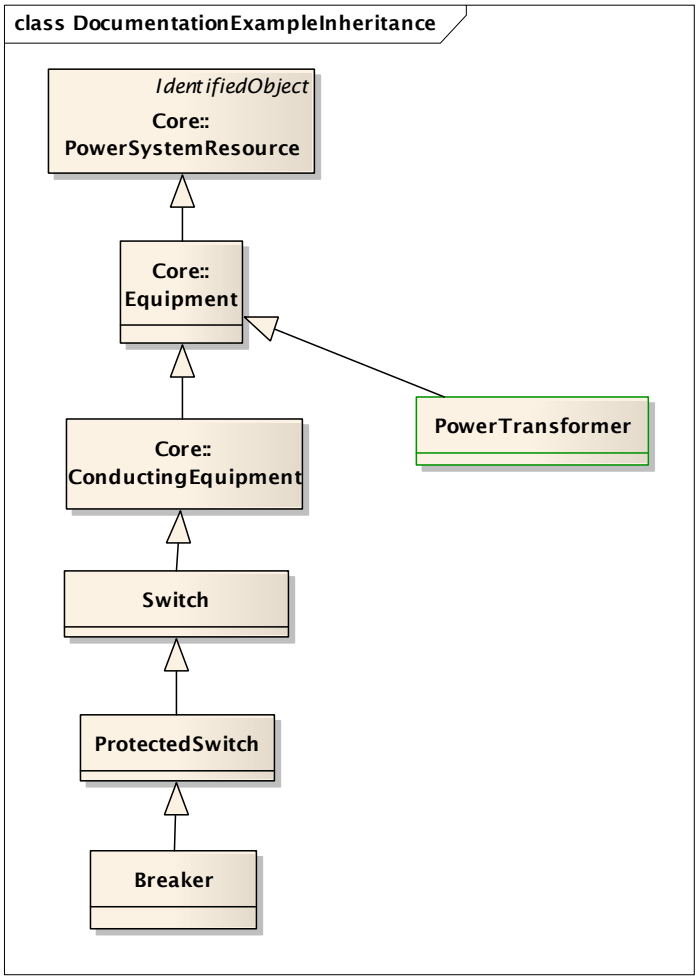

Figure 2 – Example of generalization

4.3.3 Simple association

An association is a conceptual connection between classes. Each association has two "association ends". The "association ends" were called "roles" prior to the UML 2.0 specification. Each association end describes the role the target class (i.e. the class the association end goes *to*) has in relation to the source class (i.e. the class the association end goes *from*). Association ends are usually given the name of the target class with or without a verb phrase. Each association end also has multiplicity/cardinality, which is an indication of how many objects may participate in the given relationship. In the CIM, associations are not named, only association ends are named. For example, in the CIM there is an association between a BaseVoltage and a VoltageLevel (see Figure 3 which is taken from the Wires package). Multiplicity is shown at both ends of the association. In this example, a VoltageLevel object may reference 1 BaseVoltage, and a BaseVoltage may be referenced by 0 or more VoltageLevel objects.

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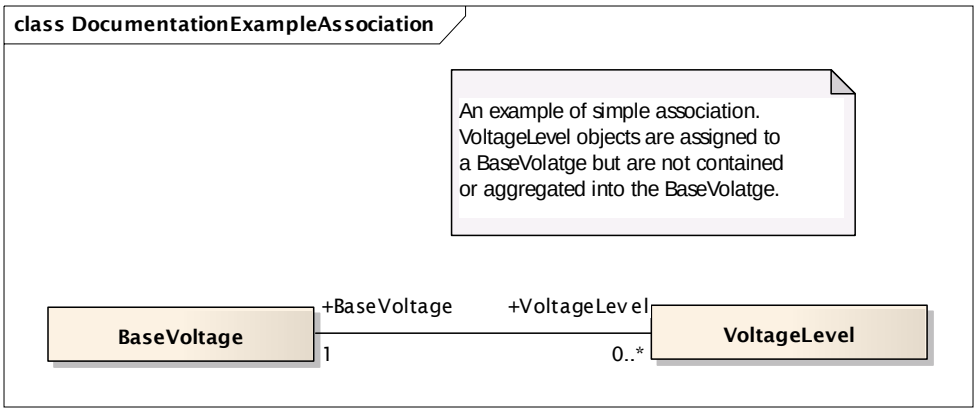

Figure 3 – Example of simple association

4.3.4 Aggregation

Aggregation is a special case of association. Aggregation indicates that the relationship between the classes is some sort of whole-part relationship, where the whole class “consists of” or “contains” the part class, and the part class is “part of” the whole class. The part class does not inherit from the whole class as in generalization. Figure 4 illustrates an aggregation between the EquipmentContainer class and the Equipment class, which is taken from the Core package. As shown, an Equipment can be a member of zero or one EquipmentContainer objects, but an EquipmentContainer object can contain any number of Equipment objects.

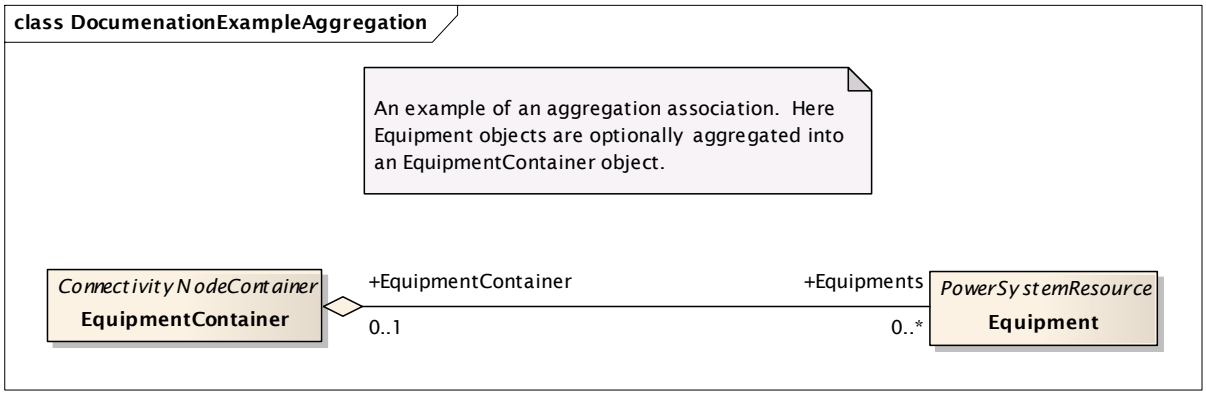

Figure 4 – Example of aggregation

4.4 CIM model concepts and examples

4.4.1 Concepts

The CIM classes, attributes, types, and relationships are specified in Clauses 5 and 6. Clause 6 comprises a complete description of the IEC 61970-301 CIM Base model. To help understand how to interpret the CIM, some key model concepts used in the CIM are introduced and described in 4.4.2 to 4.4.8.

4.4.2 Containment, equipment hierarchies and naming

4.4.2.1 Containment structure

Figure 5 shows the concept of equipment containers to form hierarchies in the CIM. Equipment containers represent ways of organizing and naming equipment typically found within a substation. As may be seen, there is some flexibility provided in which containers are used in a specific application of the CIM in order to accommodate different international practices as well as differences typically found between transmission and distribution

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substations. Bay, VoltageLevel, Substation, Line, and Plant are all types of EquipmentContainers. In general, a Bay is contained within a specific VoltageLevel, which in turn is contained within a Substation. Substations and Lines may be contained within SubGeographicRegions and GeographicRegions.

One containment hierarchy is used with the IdentifiedObject class to create hierarchical naming intended for human consumption. One hierarchy is specifically used to name equipment according to its function in the power system. This is the functional naming hierarchy. Other common identifications beside functional names are asset serial numbers. The functional name is different from a serial number in that it relates to the function of a particular equipment position or location in the power system. Regardless of what specific piece of physical equipment is placed at a location, the functional name is the same but the serial number varies depending on the physical equipment currently used.

4.4.2.2 IdentifiedObject class

The IdentifiedObject class contained in the Core package is inherited by all PowerSystemResource and many other classes. This class contains six attributes to be used for naming all PowerSystemResource objects. It is intended that values should be assigned to each attribute in a manner consistent with the attribute definitions.

The following are definitions and conventions for how to use the IdentifiedObject attributes when naming PowerSystemResource objects (for more details, refer to documentation for IdentifiedObject and its attributes in Clause 6):

- name: A free text name.
- localName: A local short name of the instance. Objects that are structured in a functional naming hierarchy have this name local to each particular level in the hierarchy. The name shall be unique among objects contained by the same parent.
- pathName: Objects that are structured in a functional naming hierarchy have a pathName which contains all the IdentifiedObject.localNames from the object to the root. The pathName, then, is a concatenation of all these names from the leaf object up to the root of the containment hierarchy, similar to a file path name. For example, if node "A" contains node "B" that contains node "C", then the pathName for node "C" may look like "A.B.C". The type of delimiters used between localNames is not specified but is a local implementation issue.
- aliasName: A free text name of the instance. This attribute can also be used for localization.
- description: A free format description of the instance.
- mRID (Master Resource ID): A globally unique machine-readable identifier for an object instance.

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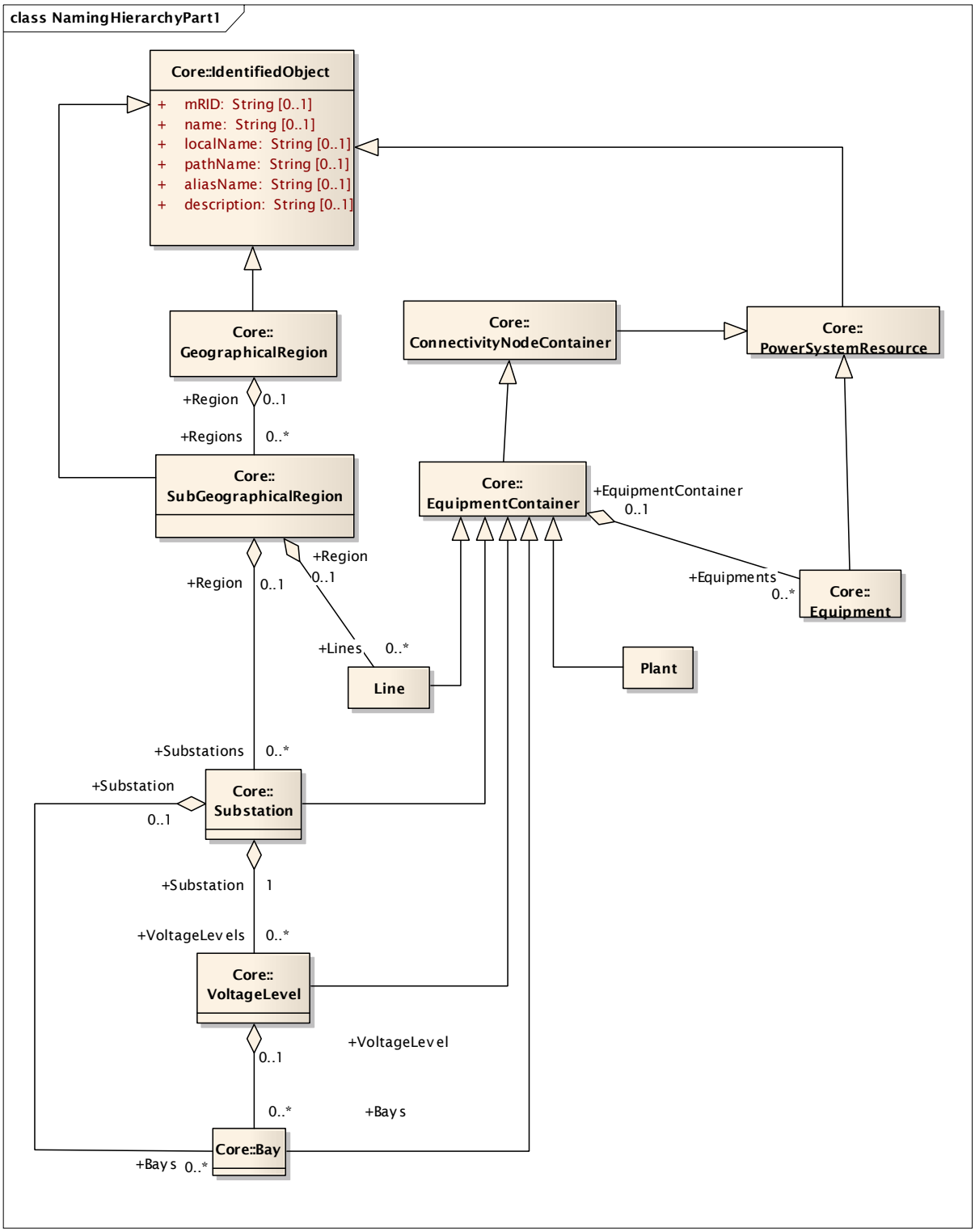

Figure 5 – Equipment containers

The diagrams NamingHierarchyPart1 and NamingHierarchyPart2 in the Wires package show the functional naming hierarchy (refer to the Wires package documentation in Clause 6 for the details).

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4.4.3 Connectivity model

4.4.3.1 Connectivity description

Figure 6 shows the Topology class diagram which models connectivity between different types of ConductingEquipment. Also included is a portion of the Meas package class diagram dealing with measurements to illustrate how measurements are associated with conducting equipment.

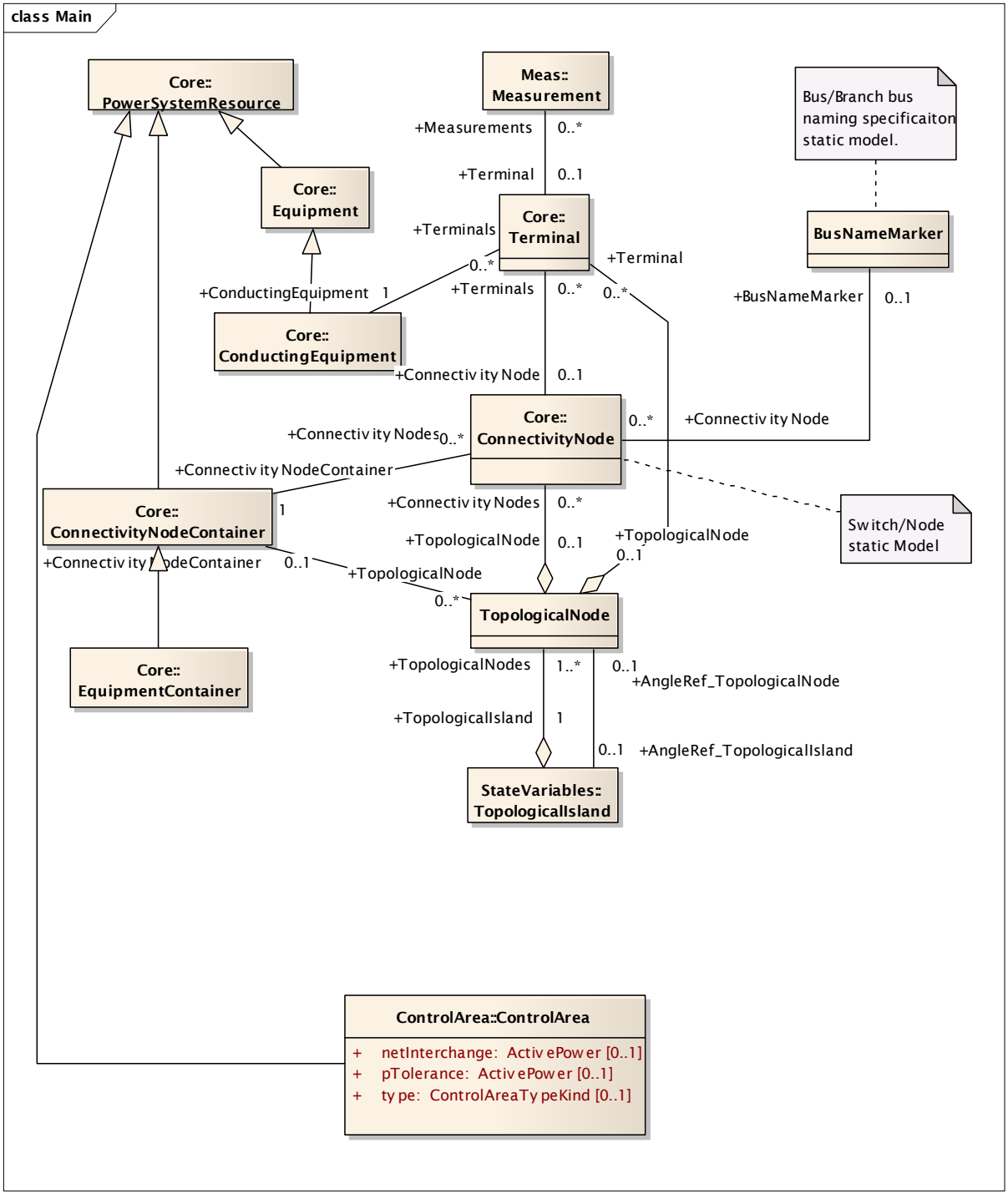

Figure 6 – Connectivity model

To model connectivity, Terminal and ConnectivityNode classes are defined. A Terminal belongs to one ConductingEquipment, although ConductingEquipment may have any number

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of Terminals. Each Terminal may be connected to a ConnectivityNode, which is a point where terminals of conducting equipment are connected together with zero impedance. A ConnectivityNode may have any number of Terminals connected, and may be a member of a TopologicalNode (i.e. a bus), which is in turn a member of a TopologicalIsland. TopologicalNodes and TopologicalIslands are created as a result of a topology processor evaluating the “as built” topology and the actual Switch positions.

It is possible to exchange messages directly involving TopologicalNode and bypassing the ConnectivityNode details by using the TopologicalNode to Terminal association. This is often useful for exchanges involving bus/branch models which do not typically contain switch details.

EquipmentContainers, which are a specialization of a ConnectivityNodeContainer, may contain zero or more ConnectivityNodes. The associations, ConductingEquipment–Terminal and Terminal–ConnectivityNode, capture the as built topology of an actual power system network. For each Terminal connected to a ConnectivityNode, the associations of the other Terminal(s) connected to the same ConectivityNode identify the ConductingEqupment object(s) that are electrically connected. Similar connectivity at the “bus/branch” level of detail can be expressed using the TopologicalNode instead of the ConnectivityNode. The BusNameMarker class, which has an association to ConnectivityNode, is used to carry user bus names to be applied to TopologicalNodes. TopologicalNodes are created from ConnectivityNodes as a result of topology processing.

To model the analog values such as voltage and power, each Terminal has an association with a Measurement class from the Meas package. Although not shown in Figure 6, a Measurement object is associated with at least one MeasurementValue object. Each MeasurementValue object is an instance of a measurement from a specific source, for example, a telemetered measurement.

Clause 6 contains a complete description of each class in Figure 6 along with the definition of all the attributes and relationships supported in each class.

4.4.3.2 Connectivity and containment example

To illustrate how the connectivity model and containment model would appear as objects, a small example is presented in Figure 7. The example shows a transmission line with a T-junction spanning two substations and a substation having two voltage levels with a transformer between them. The transmission line consists of two different cables. One of the voltage levels is shown with a busbar section having a single busbar and two very simple switchgear bays connecting to the busbar.

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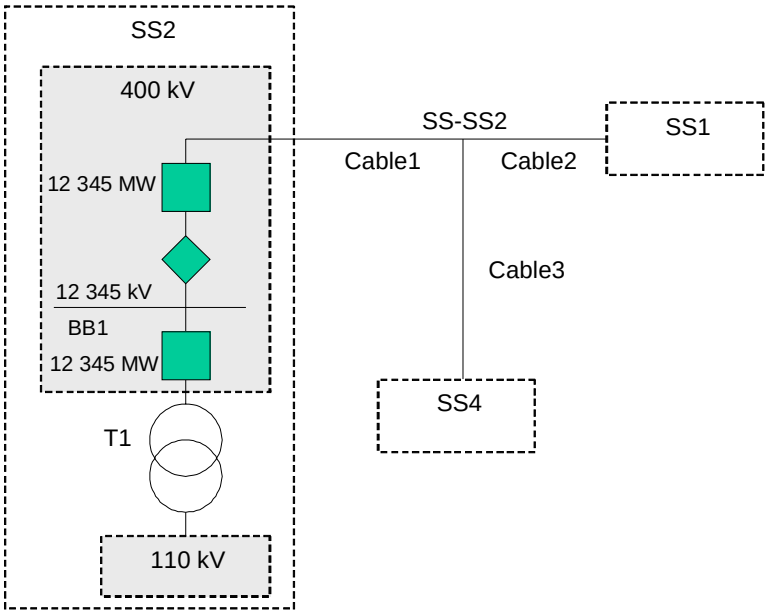

Figure 7 – Simple network example

Figure 8 shows how connectivity is modeled in the CIM as well as one way (but not necessarily the only way) containment is modeled for the diagram in Figure 8. The shaded square boxes represent EquipmentContainers, and the white square boxes represent ConductingEquipment. Darker shading indicates the EquipmentContainer is higher up in the containment hierarchy (i.e. Substation is highest, VoltageLevel next, etc.). White circles represent ConnectivityNodes, and black small circles represent Terminals. A Terminal belongs to a ConductingEquipment, and a ConnectivityNode belongs to an EquipmentContainer. This means that the borders (or contact points) between ConductingEquipment are their Terminals interconnected via ConnectivityNodes.

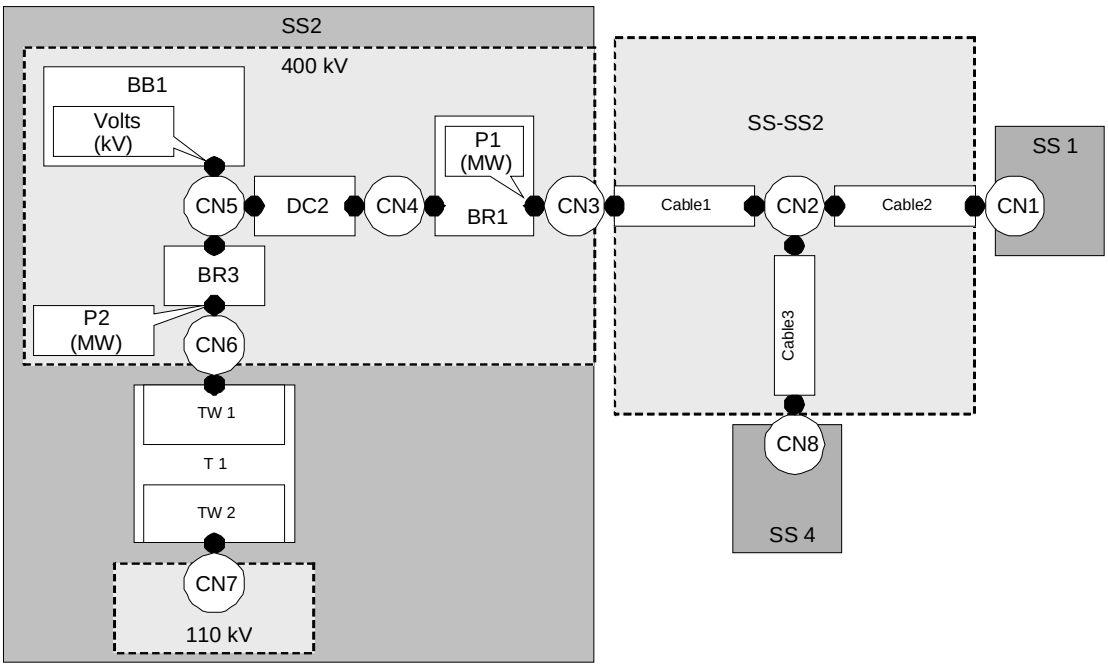

Figure 8 – Simple network connectivity modeled with CIM Topology

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The Line SS1-SS2 contains three ACLineSegments (Cable1, Cable2, and Cable3) and associated ConnectivityNode (CN2) to model a T junction, which provides a connection to SS4. This represents just one way that this configuration could be modeled. Each ACLineSegment has two Terminals. Cable1 is connected to CN3 and CN2 via these Terminals. CN3 is contained by the VoltageLevel 400 kV. The Breaker BR1 has two terminals of which one is connected to CN3.

Measurements are represented by square callouts where the arrow points to a Terminal. P1 is connected to the right Terminal belonging to Breaker BR1. Note that P1 is drawn inside the box representing BR1. This is because a Measurement may belong to a PowerSystemResource (PSR), as is the case with BR1. P2 is drawn inside the VoltageLevel 400 kV, which means it belongs to the 400 kV VoltageLevel instead of BR3.

4.4.4 Inheritance hierarchy

Figure 9 shows an overview of the inheritance hierarchy modeled in the CIM. This overview, which is included as one of the Wires package diagrams, actually spans most of the CIM packages.

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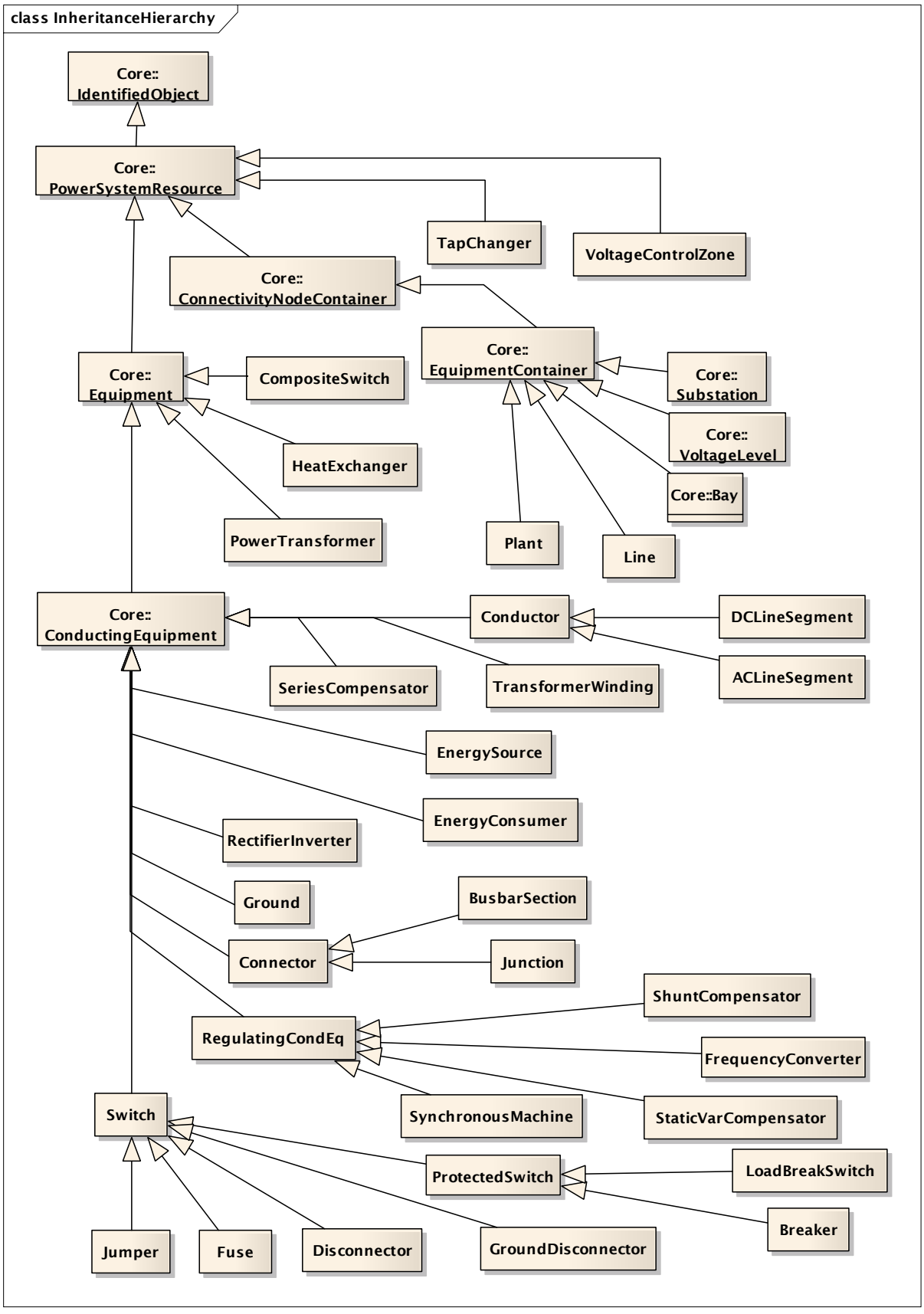

Figure 9 – Equipment inheritance hierarchy

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4.4.5 Transformer model

Figure 10 shows a portion of the Wires class diagram which models a PowerTransformer device.

As shown in Figure 10, a PowerTransformer is a specialized class of Equipment, which is a specialized class of a PowerSystemResource. This is shown by the use of the generalization-type of relationship, which uses an arrow to point to the general class, and permits the PowerTransformer to inherit attributes from both Equipment and PowerSystemResource.

A PowerTransformer also has a relationship to the TransformerWinding, which is modeled with an aggregation-type of relationship using a diamond symbol to point from the part class to the whole class. As shown in Figure 10, a PowerTransformer may have (or contain) one or more TransformerWindings, but a TransformerWinding can only belong to (or be a member of) one PowerTransformer.

The TransformerWinding has other relationships as well:

- a generalization relationship with ConductingEquipment;
- two association relationships with the WindingTest class, such that a TransformerWinding object may be From from 0, 1, or more WindingTest objects and To 0, 1, or more WindingTest objects;
- aggregation relationships with the PhaseTapChanger and RatioTapChanger classes, such that a TransformerWinding object may have 0 or 1 PhaseTapChanger objects and 0 or 1 RatioTapChanger objects associated with it.

Clause 6 contains a complete description of each class in Figure 10 along with the definition of all the attributes and relationships supported in each class.

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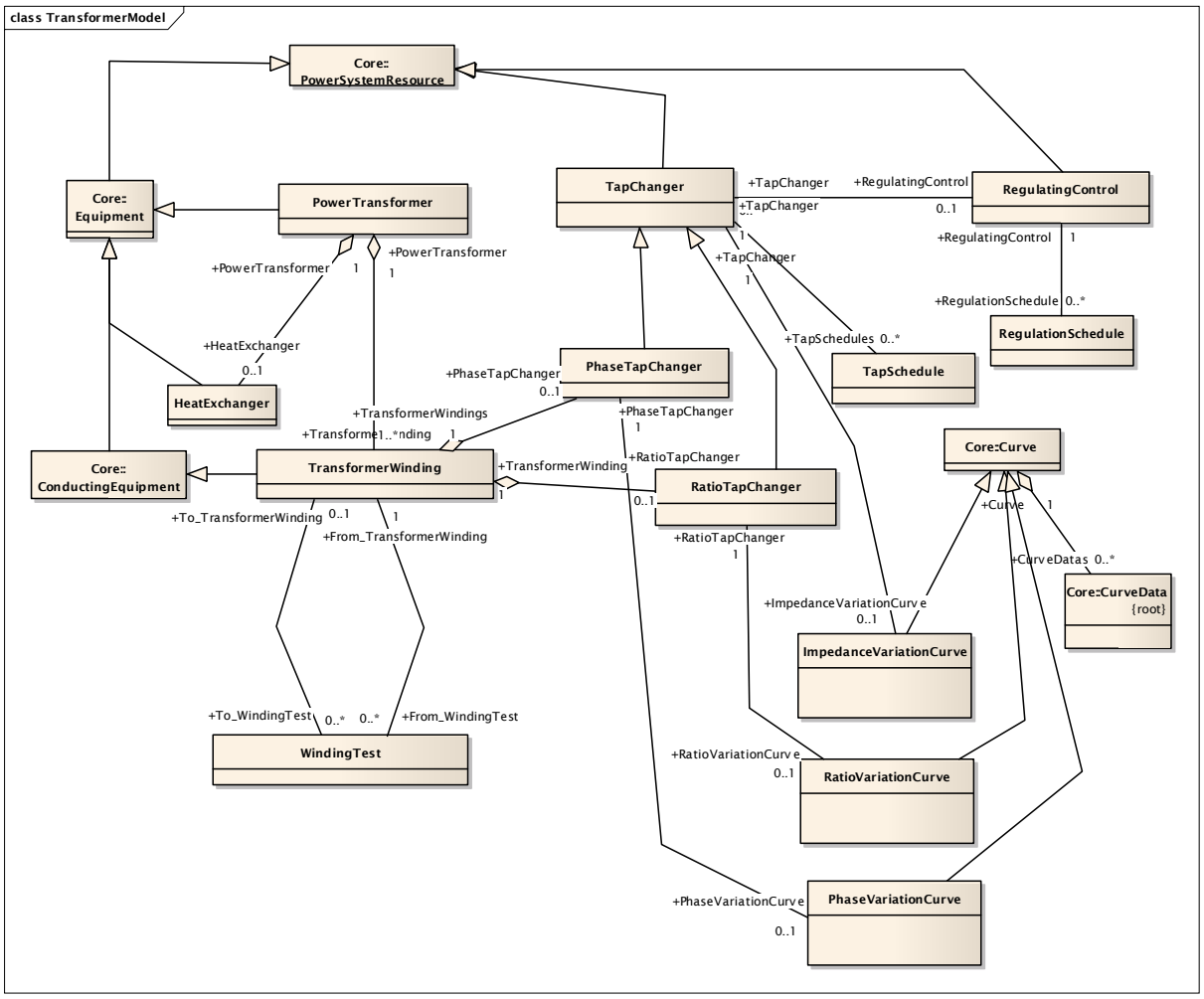

Figure 10 – Transformer model

4.4.6 Regulating transformer modeling

4.4.6.1 Regulating transformer modeling overview

Multiple types of regulating transformers are supported by the CIM model. Depending on the regulation capabilities, the effects of tap movement will be defined using either the RatioTapChanger class or the PhaseTapChanger class. Both of these classes are subtypes of the TapChanger class. For all the RatioTapChangers and PhaseTapChangers, the following attributes are required and have the same meaning.

TapChanger.highStep
TapChanger.lowStep
TapChanger.ltcFlag
TapChanger.neutralStep
TapChanger.neutralU
TapChanger.normalStep
TapChanger.regulationStatus

Other attributes are required and may have slightly different meaning depending on the type of transformer.

4.4.6.2 Voltage ratio transformer modeling

The RatioTapChanger class is used to define a transformer that changes the voltage ratio without impacting the phase angle across the transformer. The additional required attributes for a RatioTapChanger are:

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TapChanger.stepVoltageIncrement
RatioTapChanger.tculControlMode

4.4.6.3 Linear phase shifter transformer modeling

A phase shifting transformer is linear if the phase shift increment per tap step is uniform over the full range of the tap changer. A linear phase shifter is modeled using the PhaseTapChanger class. The additional required attributes for a linear phase shifting transformer are:

PhaseTapChanger.stepPhaseShiftIncrement

4.4.6.4 Symmetrical phase shifter modeling

A symmetrical phase shifter construction causes the turns ratio and voltage magnitude transformation to remain constant while the voltage phase is shifted. The changes to voltage magnitude and phase over the full range of tap steps for a symmetrical phase shifter is shown in Figure 11 below.

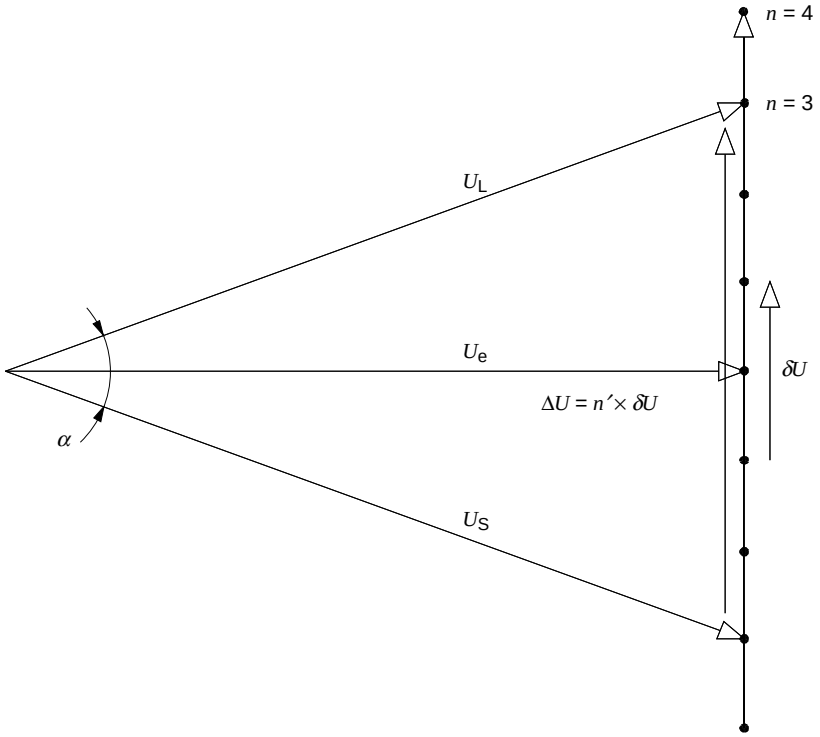

Figure 11 – Symmetrical Phase Shifter

The phase shift angle can be represented as:

$$\alpha \quad 2\arctan\frac{n'\Delta U}{2U_e} \quad 2\arctan\frac{n'\delta U}{2}$$

$$\rho = 1$$

where

α is the phase shift angle;

n' is the current tap position;

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ΔU is the voltage change;

U_e is the voltage at neutral tap;

δU is the PU voltage change;

ρ is the transformation ratio.

For a symmetrical phase shifter, the PhaseTapChanger.phaseTapChangerType attribute shall be set to “symmetrical”. The PhaseTapChanger.windingConnectionAngle shall be either +90° or –90°. With +90° there is a positive phase angle increase as the tap position increases. With –90° the phase angle becomes a larger negavite angle as the tap position increases. The additional required attributes for a symmetrical phase shifting transformer are:

TapChanger.stepVoltageIncrement
PhaseTapChanger.phaseTapChangerType
PhaseTapChanger.stepPhaseShiftIncrement
PhaseTapChanger.windingConnectionAngle
PhaseTapChanger.xStepMax
PhaseTapChanger.xStepMin

4.4.6.5 Asymmetrical phase shifter modeling

An asymmetrical phase shifter construction causes the voltage ratio to change as the phase shift changes. The changes to voltage magnitude and phase over the full range of tap steps for an asymmetrical phase shifter is shown in Figure 12 below.

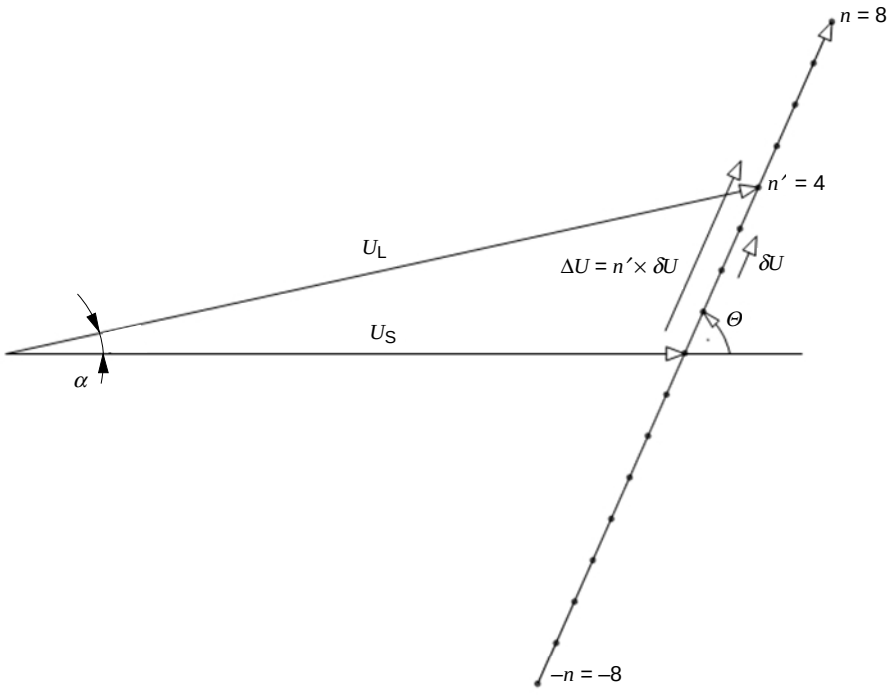

Figure 12 – Asymmetrical Phase Shifter

The phase shift angle can be represented as:

$$\alpha \quad \arctan\left(\frac{n'\,\delta U \sin\Theta}{1 \quad n'\,\delta U \cos\Theta}\right)$$

$$\rho \quad \frac{1}{\sqrt{n'\,\delta u \sin\Theta^{\,2} \quad 1 \quad n'\,\delta U \cos\Theta}}$$

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where

α is the phase shift angle;

n' is the current tap position;

δU is the PU voltage change;

Θ is the winding connection angle;

ρ is the transformation ratio.

For an asymmetrical phase shifter, the PhaseTapChanger.phaseTapChangerType attribute shall be set to “asymmetrical”. The PhaseTapChanger.windingConnectionAngle shall be a multiple of 30°: –90°, –60°, –30°, 30°, 60°, 90°, etc.). An asymmetrical phase shifter with a 90° winding connection angle is not the same as a symmertrical phase shifter. The additional required attributes for an asymmetrical phase shifting transformer are:

TapChanger.stepVoltageIncrement
PhaseTapChanger.phaseTapChangerType
PhaseTapChanger.stepPhaseShiftIncrement
PhaseTapChanger.windingConnectionAngle
PhaseTapChanger.xStepMax
PhaseTapChanger.xStepMin

4.4.7 Measurements and controls

4.4.7.1 Measurement overview

Measurements are used to represent the state variables that can be found in industrial processes. Each industrial process has its specific types of measurements. A power system typically has power flows, voltages, positions (e.g., breakers, isolators), fault indications (air pressure, oil pressure over temperature, etc.), counters (e.g., energy), etc.

The name "Measurement" would seem to indicate that all the state variables are measured. This is not always strictly the case as many measurements are calculated by SCADA or EMS/DMS functions, such as State Estimator or Power Flow calculations. As a consequence, a measurement may have a number of alternate values (e.g., manually supplied, telemetered, state estimated, optimized etc.). This is supported by the Measurement and MeasurementValue models in the Meas package. The classes in the StateVariable package have been added to the CIM model specifically for the purpose of supporting exchange of values calculated by functions such as State Estimator and Power Flow.

4.4.7.2 Control overview

Controls are used to represent control variables. Power system control variables typically are set points, raise lower commands, select before execute commands and on/off commands etc. The Meas package supports control variables with the Control model.

4.4.7.3 Use of measurement-related classes

A PowerSystemResource (PSR) may have zero to many measurements associated with it by containing one or more measurements. Each measurement may have one or more measurement values. Observing the following guidelines will enable applications to navigate and find the required measurement values in a consistent way (see Figure 13):

a) Measurements of a PowerSystemResource are classified by the attribute measurementType. The values to be used for Measurement.measurementType are specified in Table 1.

b) MeasurementValues of a Measurement are classified by MeasurementValueSource.

c) MeasurementValueSource inherits from IdentifiedObject. The values to be used for MeasurementValueSource.name and MeasurementValueSource.description are given in Table 2. This table provides a number of source names to be used where possible.

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However, the exact names to be used for specific applications are defined in related IEC 61970 Component Interface Specifications (CIS).

d) The tables may be extended for proprietary needs. The names added shall start with a unique name (e.g. the company name) and an underscore. Example: xyz_AverageTemperature.

e) The ValueAliasSet is used for discrete measurements and describes mappings from values to symbolic names, such as enumeration literals having specific integer values. Different communication protocols (e.g. for RTUs (Remote Terminal Unit) and for control centers as ICCP or ELCOM) use different data encodings. A system may have a system wide mapping for all Discrete values or group the Discrete values and make a mapping per group. Creation of a single system wide mapping that covers existing communication protocols is outside the scope of this specification.

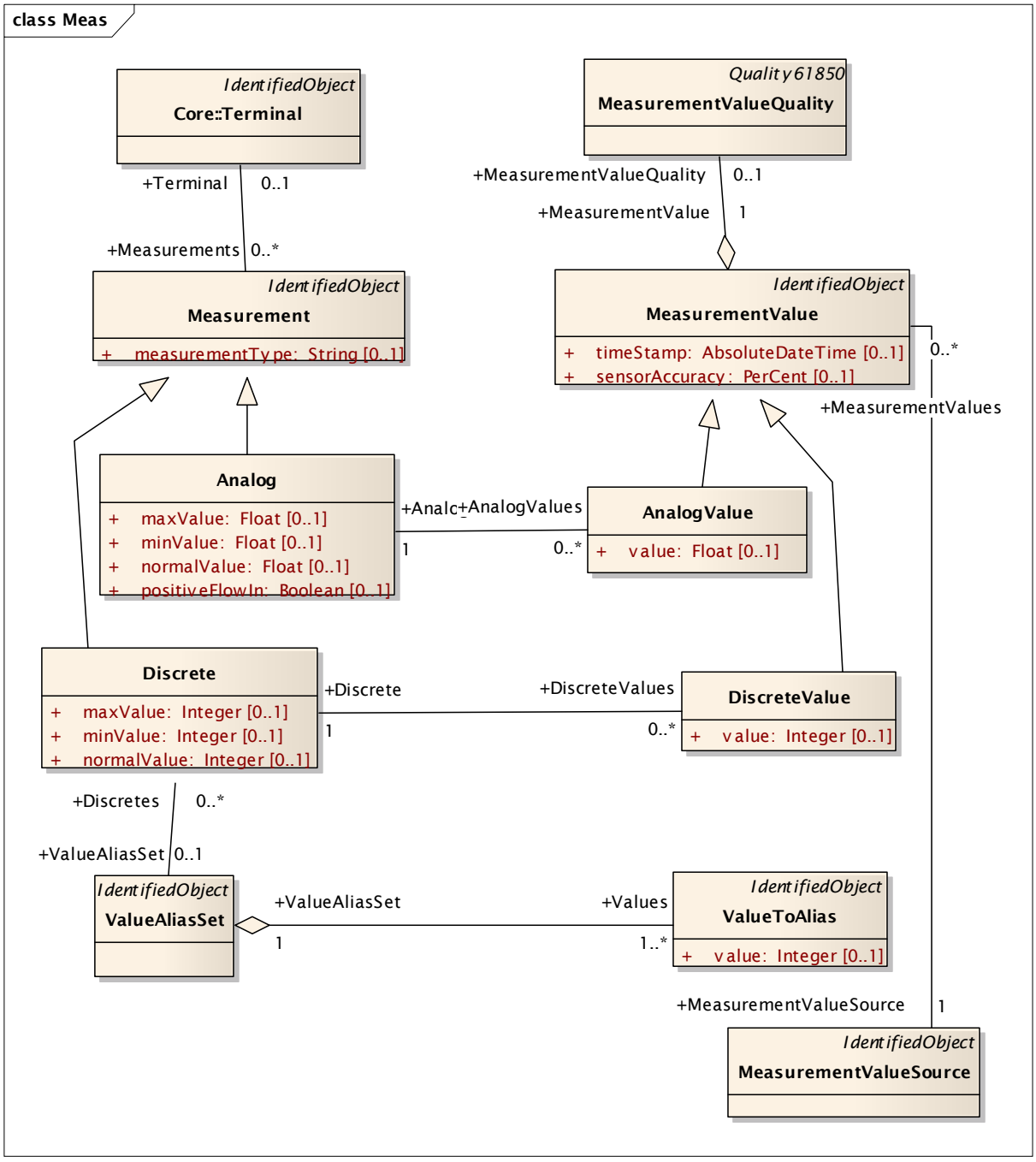

Figure 13 – Navigating from PSR to MeasurementValue

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Table 1 – MeasurementType naming conventions

measurementType	IEC 61850 name	description
Current	Amp	Current (rms) of a non-three phase circuit
ThreePhaseCurrent	AvAmps	Total current (rms) in a three phase circuit
PhaseCurrent	A	Measured phase current
Frequency	Hz	Frequency
PowerFactor	PwrFact	Power Factor not allocated to a phase
ThreePhasePowerFactor	TotPF	Average power factor in a three phase circuit
ThreePhaseApparentPower	TotVA	Total apparent power in a three phase circuit
ThreePhaseReactivePower	TotVAr	Total reactive power in a three phase circuit
ThreePhaseActivePower	TotW	Total real power in a three phase circuit.
ApparentPower	VoltAmp	Apparent power in a non-three phase circuit
ReactivePower	VoltAmpr	Reactive power in a non-three phase circuit
Voltage	Vol	Voltage (rms) not allocated to a phase
ActivePower	Watt	Real power in a non-three phase circuit
Pressure	Pres	Pressure
Temperature	Tmp	Temperature
Angle	Ang	Angle between voltage and current
ApparentEnergy	TotVAh	Apparent energy
ReactiveEnergy	TotVArh	Reactive energy
ActiveEnergy	TotWh	Real energy
Automatic	Auto	Automatic operation (not manual)
LocalOperation	Loc	Local operation (not remote)
SwitchPosition	Pos	Switch position [2bits= intermediate, open, closed, ignore]
TapPosition	TapPos	Tap position of power transformer or phaseshifter
Operation Count	OperCnt	Operation count – typically for switches

Table 1 describes various types of measurements also defined in IEC 61850-7-4. The meaning of the columns in Table 1 are as follows:

- measurementType (Measurement.measurementType) is the IEC 61970 measurement type name;
- 61850 Name is the name assigned to the data in IEC 61850 (refer to Clause 6 of IEC 61850-7-4:2010, data object name semantics);
- description of the data.

It shall be noted that Table 1 is a non exhaustive list and that the mapping between measurements as defined in a control center and a substation is non-trivial.

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Table 2 – MeasurementValueSource naming conventions

name	description
SCADA	Telemetered values received from a local SCADA system
CCLink	Value received from a remote control center via TASE.2 or other control center protocol
Operator	Operator entered value (always manually maintained, PSR is not connected to an RTU)
Estimated	Value updated by a state estimator
PowerFlow	Value updated as result of a Powerflow
Forecasted	Value that is planned or forecasted.
Calculated	Calculated from other measurement values (e.g., a sum)
Allocated	Calculated by a load allocator

Following these conventions:

- each Measurement instance represents a technological quantity of a PowerSystemResource;
- each MeasurementValue of a Measurement represents a value for the technological quantity, as supplied from a single source;
- the source attribute in MeasurementValueQuality then indicates whether the source actually provided the current value, or whether it had been substituted or defaulted.

4.4.7.4 Attachment of measurements

As mentioned in 4.4.7.3 and as shown in Figure 13, Measurements are contained by a PowerSystemResource. This is sufficient for Measurements that are not related to connectivity, e.g. temperature, weight, size.

To specify the location of a Measurement in the network, an association to Terminal is used. Examples include power flows, voltages, and currents. Voltages have no direction and can be attached wherever appropriate in relation to the sensor placement. Flows have direction and shall be attached such the flow direction is evident from the placement.

Figure 14 shows two examples of the placement of Measurements.

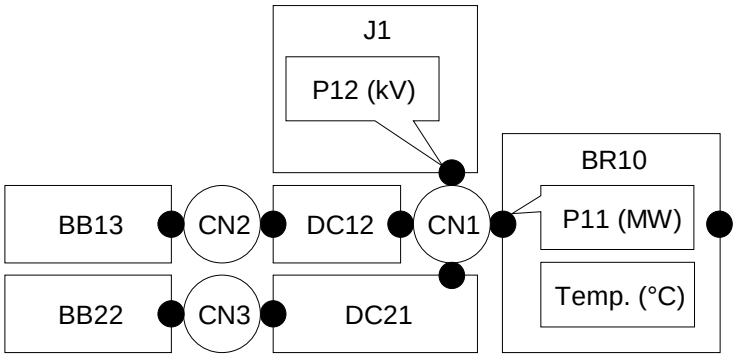

Figure 14 – Measurement placement

P12 is a voltage Measurement that measures the voltage at the Junction J1. P12 is topologically related to the ConnectivityNode CN1 via the Terminal in Junction J1. P11 is a Measurement that measures the flow through Breaker BR10 at the side connected to the

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ConnectivityNode CN1. P11 is topologically related to the ConnectivityNode CN1 via the left Terminal in Breaker BR10. Temp is a Measurement that measures the Breaker temperature. As a temperature is not related to connectivity, it has no relation to a Terminal - it just belongs to the Breaker BR10.

4.4.8 Regulating control models

Regulation control, such as automatic voltage control at generators or voltage tap control at transformers is modelled using a class named RegulationControl. The RegulatingControl class provides the capability to model multiple equipment participating in a regulation scheme. These regulation schemes may be physical or manually implemented in actual power system operation, but are reflected in the models used for power system analysis purposes. Figure 15 shows how RegulatingCondEq and TapChanger classes can participate in regulation.

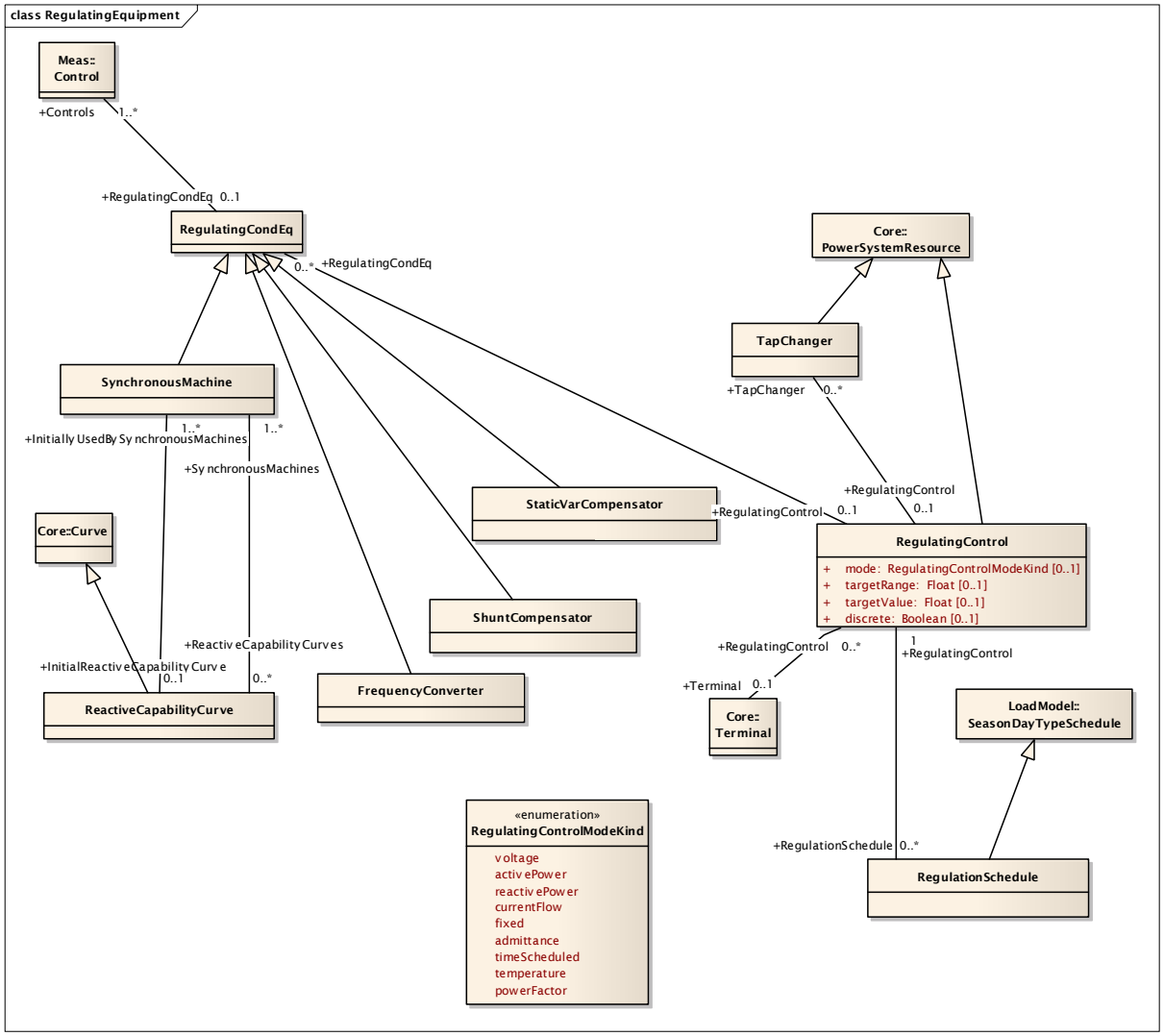

Figure 15 – Regulating control models

4.5 Modeling guidelines

4.5.1 Modeling for change

Subclauses 4.5.2 to 4.5.5 provide guidelines on how to maintain and extend the CIM.

The CIM is meant to contain classes and attributes that will be exchanged over public interfaces between major applications. The goal is to keep, as much as possible, only the generic features from which a detailed implementation may be derived. In general, it is easier

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to change the value or domain of an attribute than to change a class definition. This makes the model more robust because it is able to support a broader class of requirements, and more stable because new requirements may be able to be handled without requiring changes to the model.

4.5.2 Process for amendments to the CIM

It may be desirable to amend the CIM to either revise the existing model or to extend the CIM to model additional elements of an electric utility power system. The recommended process for such amendments is as follows.

a) Prepare a Use Case(s) to describe the desired changes. This should include proposed changes to the appropriate class diagrams showing new/revised classes, attributes, and associations.

b) The Use Case(s) is then reviewed by the appropriate IEC Working Group to decide if the requested changes should be treated as revisions to the current CIM standard, or if they should be treated as private amendments, not requiring a change to the standard itself.

c) Proposed amendments accepted by the working group will be added to a list of outstanding issues, and at the appropriate time, a new version of the CIM model will be prepared and an update made to the appropriate IEC CIM specification.

4.5.3 Changes to the CIM UML model

From a modeling perspective, when the CIM is extended, the approach is to start with the existing CIM UML model. The extensions may be added in any of several ways that are available in UML, but in all cases the approach is to inspect the current model and determine the best way to build off of the existing class diagrams. The extensions may take the form of any of the following, starting from the simplest to the most complex:

- adding additional attributes or associations to existing classes;
- adding new classes that are specializations of existing classes;
- adding new classes via associations with existing classes.

The main objective is to reuse the existing CIM to the maximum extent possible. From a packaging point of view, extensions should be made to existing Packages where possible. If the extensions comprise a new domain of application, then consideration should be given to creating a new Package for the additions, but still creating the necessary associations to the existing package, keeping in mind that even though a new Package is being created, the CIM is still a single model.

4.5.4 Changes to the CIM standards documents

From a documentation perspective, when the CIM is extended, a decision shall be made whether the changes constitute updates to existing CIM standards documents, or whether a new specific IEC 61970-3xx is required. In either case, the extensions will then become part of the IEC standard CIM.

4.5.5 CIM profiles

An implementation of the CIM need not include all classes, attributes, or associations in the standard CIM specification to be compliant with the CIM standard. Profiles may be defined to specify which elements shall be included (i.e. mandatory elements) in a particular use of the CIM, as well as which are optional. These profiles are defined in the IEC 61970-4xx series of standards.

An example is the profile for exchanging power system models. This profile specifies how the CIM is to be used for exchanging power system models in XML, and also specifies the mandatory and optional classes, attributes, and associations to be supported for this use of the CIM. Profiles can be maintained using tools such tools listed in the MTEI MTEI-wiki group available from <http://cimug.ucaiug.org>..

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4.6 Modeling tools

Previous editions of CIM were created and maintained using IBM®'s Rational® ROSE[1], but this release was constructed using Sparx Systems Enterprise Architect[2] product. The entire CIM UML model exists as an Enterprise Architect project file and is viewable with that tool, including the class diagrams and descriptions of classes, attributes, types, and relationships. Viewing the CIM in this fashion provides a graphical navigation interface that permits all CIM specification data to be viewed via point-and-click from the class diagram in each package. A free viewer is available through Sparx Systems.

Ideally, the CIM information model is independent of any specific UML tool, though experience has shown that exchanges between different tools are often less than perfect. Until tool interoperability is proven effective, future changes to the CIM specification, resulting in new versions of this standard, will be incorporated first into the Enterprise Architect project description to ensure a single source for the CIM model data.

Clause 6 of this document was auto-generated using a publicly available tool called jCleanCim which uses the automation interfaces of Microsoft Word™[3] and Enterprise Architect and using the standard IEC format and styles.

4.7 User implementation conventions

This subclause 4.7 provides recommended user conventions when using the CIM in actual system implementations.

The following ConductingEquipment classes have two terminals: ACLineSegment, DCLineSegment, Jumper, Fuse, Breaker, Disconnector, LoadBreakSwitch, SeriesCompensator. All other ConductingEquipment leaf classes have a single terminal.

4.8 CIM modeling examples

Power system models have been created from the CIM UML model in various ways. The first example is an RDF (Resource Description Framework) Schema version of the CIM, which uses XML (eXtensible Markup Language) to describe a power system network model. IEC 61970-501 and other profile standards in development are used to specify the model exchange format. RDF Schema versions of the CIM have been used to create XML model files of actual networks for purposes of interoperability testing. An RDF Schema version of the CIM is generated from the CIM UML model file using software tools based on the RDF Schema specification of the CIM.

It should be noted that an RDF schema version of the CIM is still metadata rather than an instantiation of an actual network. However, complete network model files with descriptions of all network elements and their electrical connectivity can be generated by system suppliers using proprietary export tools, and then imported by other systems via a similar import tool, which is used to populate a local network engineering tool database. Examples of such CIM XML models include the Siemens 100 bus model, the Areva 60 bus model, and the ABB 40 bus model files[4] used for CIM XML interoperability testing.

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1 Rational® ROSE is the trade name of a product previously supplied by IBM®. This information is given for the convenience of users of this document and does not constitute an endorsement by the IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

2 Enterprise Architect 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 the IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

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4 Siemens100 bus model, Areva 60 bus model, and ABB 40 model are the trade names of products supplied by Siemens, Areva, and ABB. This information is given for the convenience of users of this document and does not

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5 Detailed model

5.1 Overview

The Common Information Model (CIM) represents a comprehensive logical view of Energy Management System information. This definition includes the public classes and attributes, as well as the relationships between them. Subclause 5.2 describes how Clause 6 is structured. Clause 6 is automatically generated from the CIM model maintained with the tools described in 4.6.

5.2 Context

The CIM is partioned into subpackages. The Domain package defines datatypes used by the other packages. The Generation package is subdivided into Production and GenerationDynamics packages. Classes within the packages are listed alphabetically. Native class attributes are listed first, followed by inherited attributes in order of depth of inheritance, then by attribute name. Native associations are listed first for each class, followed by inherited associations in order of depth of inheritance, then alphabetically by class name, then alphabetically by association end name. The associations are described according to the role of each class participating in the association. The association ends are listed under the class at each end of an association.

Figure 16 shows the top level packages included in this document.

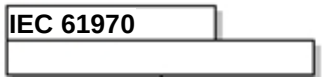

Figure 16 – CIM top level packages

For each package, the model information for each class is fully described. Attribute and association end information for native and inherited attributes is listed as below. For any inherited attributes or association ends the “description” column will contain text indicating the attributes is inherited from a specific class. The description column for native attributes and association ends contains the actual description.

Table 3 – Attributes

name	type	description
native1	Float	A floating point native attribute of the class is described here
native2	ActivePower	Documenation for another native attribute of type ActivePower
Name	Float	Inherited from class IdentifiedObject

In Table 3, in some cases, an attribute is a constant, in which case the phrase “(const)” is added in the name column of the attributes table. In such cases, the attribute normally has an initial value also which is preceded by an equal sign and appended to the attribute name.

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Table 4 – Association ends

[mult from]	[mult to] name	type	description
[0..*]	[0..1] PSRType	PSRType	PSRType (custom classification) for this PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	The Measurements that are included in the naming hierarchy where the PSR is the containing object
[1..1]	[0..*] OperatingShare	OperatingShare	The linkage to any number of operating share objects
[0..*]	[0..*] PsrLists	PsrList	
[1..1]	[0..1] OutageSchedule	OutageSchedule	A power system resource may have an outage schedule
[0..*]	[0..*] ReportingGroup	ReportingGroup	Reporting groups to which this PSR belongs

In Table 4, the first column describes the multiplicity at the other end of the association (i.e. the multiplicity of the class for which association ends are being described). The multiplicity of the association end itself is included in brackets. The association end name is listed in plain text. The class at the other end of the association is listed in the “type” column. A multiplicity of zero indicates an optional association. A multiplicity of “*” indicates any number is allowed. For example, a multiplicity of [1..*] indicates a range from 1 to any larger number is allowed.

In the case that a class is an enumeration, Table 3 is replaced by Table 5 as shown below, since enumeration literals have no type. There are no inherited enumeration literals for an enumeration class.

Table 5 – Enums

literal	description
native1	This is the first native enumeration value
native2	This is the second native enumeration value
native3	There are typically no inherited attributes for enumerations

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6 Package architecture

6.1 Top package IEC61970

6.1.1 General

Figure 17 shows logical diagram Main.

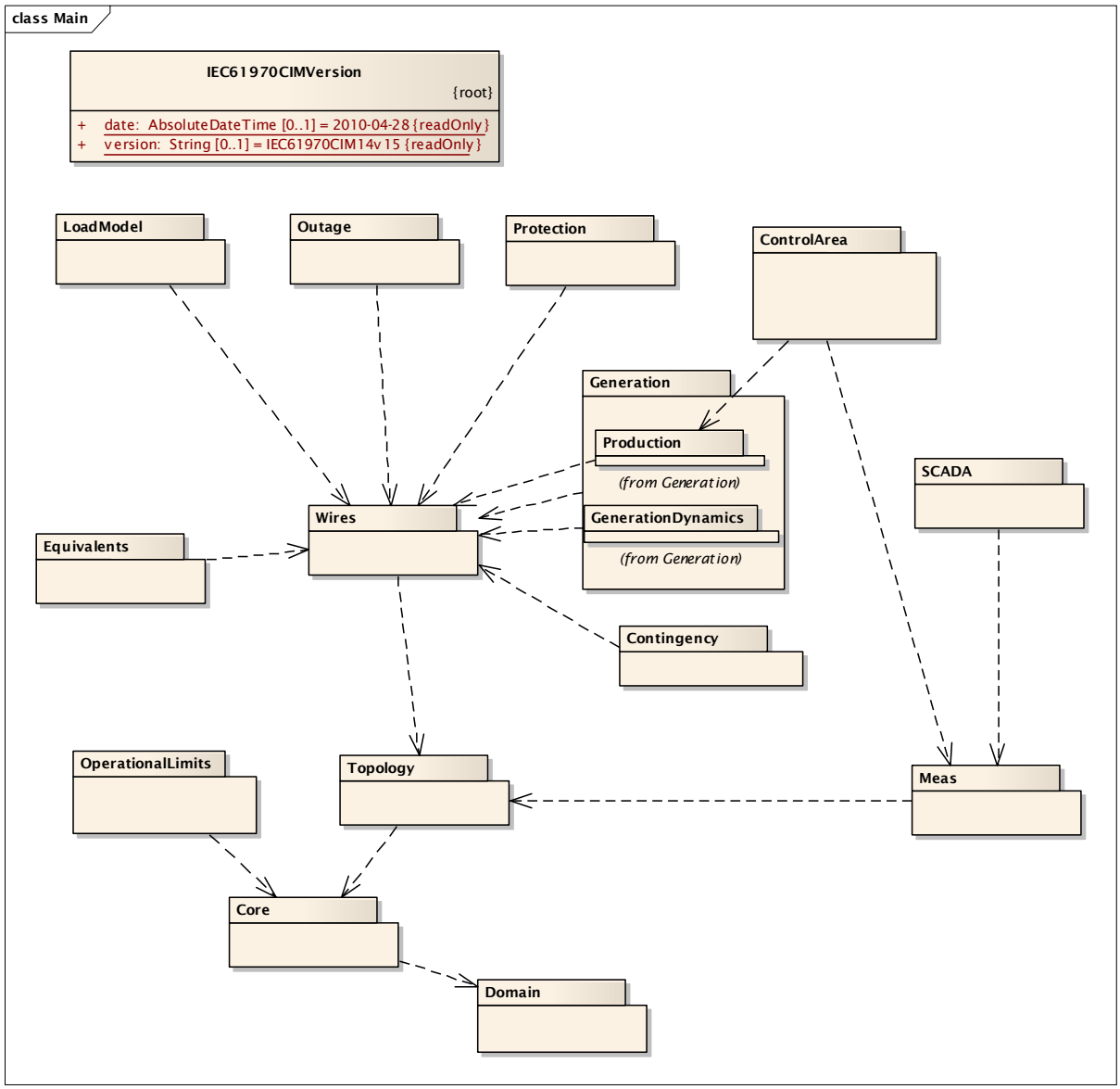

Figure 17 – Logical diagram IEC61970::Main

This diagram shows all IEC 61970 packages and their logical dependencies.

6.1.2 IEC61970CIMVersion root class

This is the IEC 61970 CIM version number assigned to this UML model file.

Table 6 shows all attributes of IEC61970CIMVersion.

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Table 6 – Attributes of IEC61970::IEC61970CIMVersion

name	type	description
date=2010-04-28 (const)	AbsoluteDateTime	Form is YYYY-MM-DD for example for January 5, 2009 it is 2009-01-05
version=IEC61970CIM14v15 (const)	String	Form is IEC61970CIMXXvYY where XX is the major CIM package version and the YY is the minor version. For example IEC61970CIM13v18

6.1.3 Package Domain

6.1.3.1 General

The domain package is a data dictionary of quantities and units that define datatypes for attributes (properties) that may be used by any class in any other package.

This package contains the definition of primitive datatypes, including units of measure and permissible values. Each datatype contains a value attribute and an optional unit of measure, which is specified as a static variable initialized to the textual description of the unit of measure. The value of the "units" string may be country or customer specific. Typical values are given. Permissible values for enumerations are listed in the documentation for the attribute using UML constraint syntax inside curly braces. Lengths of variable strings are listed in the descriptive text where required.

Figure 18 shows logical diagram CombinedDatatypes.

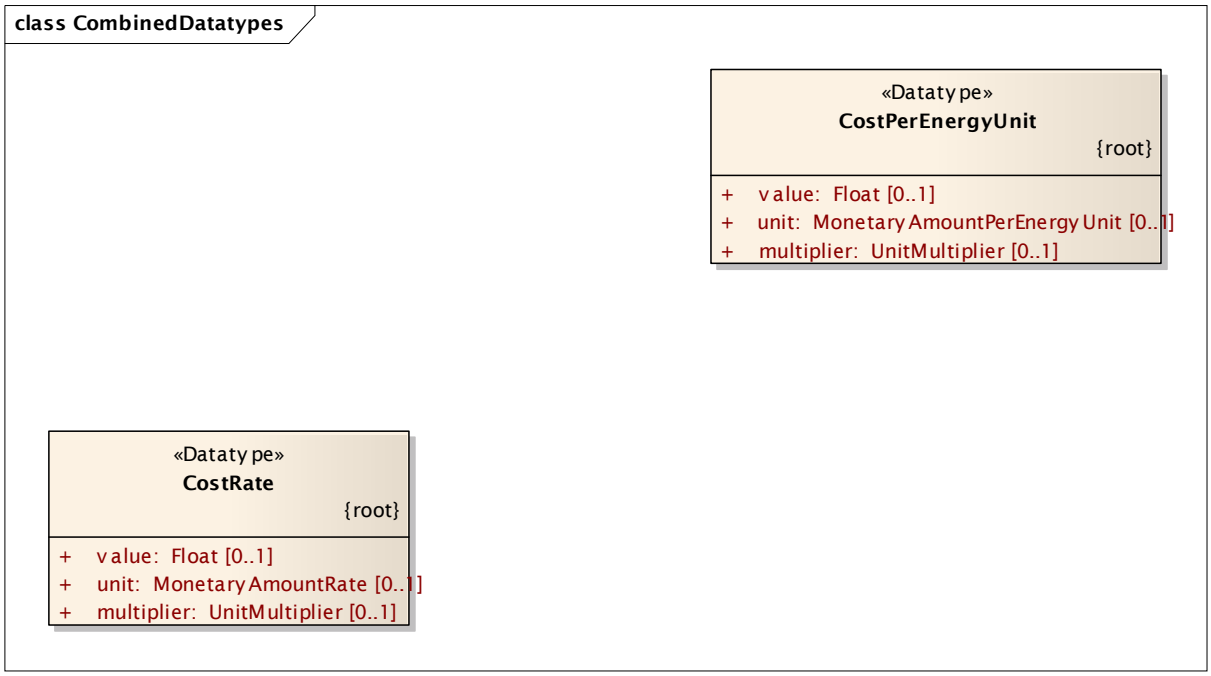

Figure 18 – Logical diagram Domain::CombinedDatatypes

This diagram includes the datatypes that are combined from datatypes in the other diagrams.

Figure 19 shows logical diagram BasicDatatypes.

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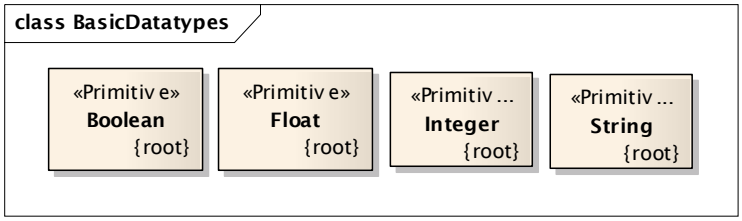

Figure 19 – Logical diagram Domain::BasicDatatypes

This diagram shows basic datatypes that are the basis for all other datatypes.

Figure 20 shows logical diagram ElectricityDatatypes.

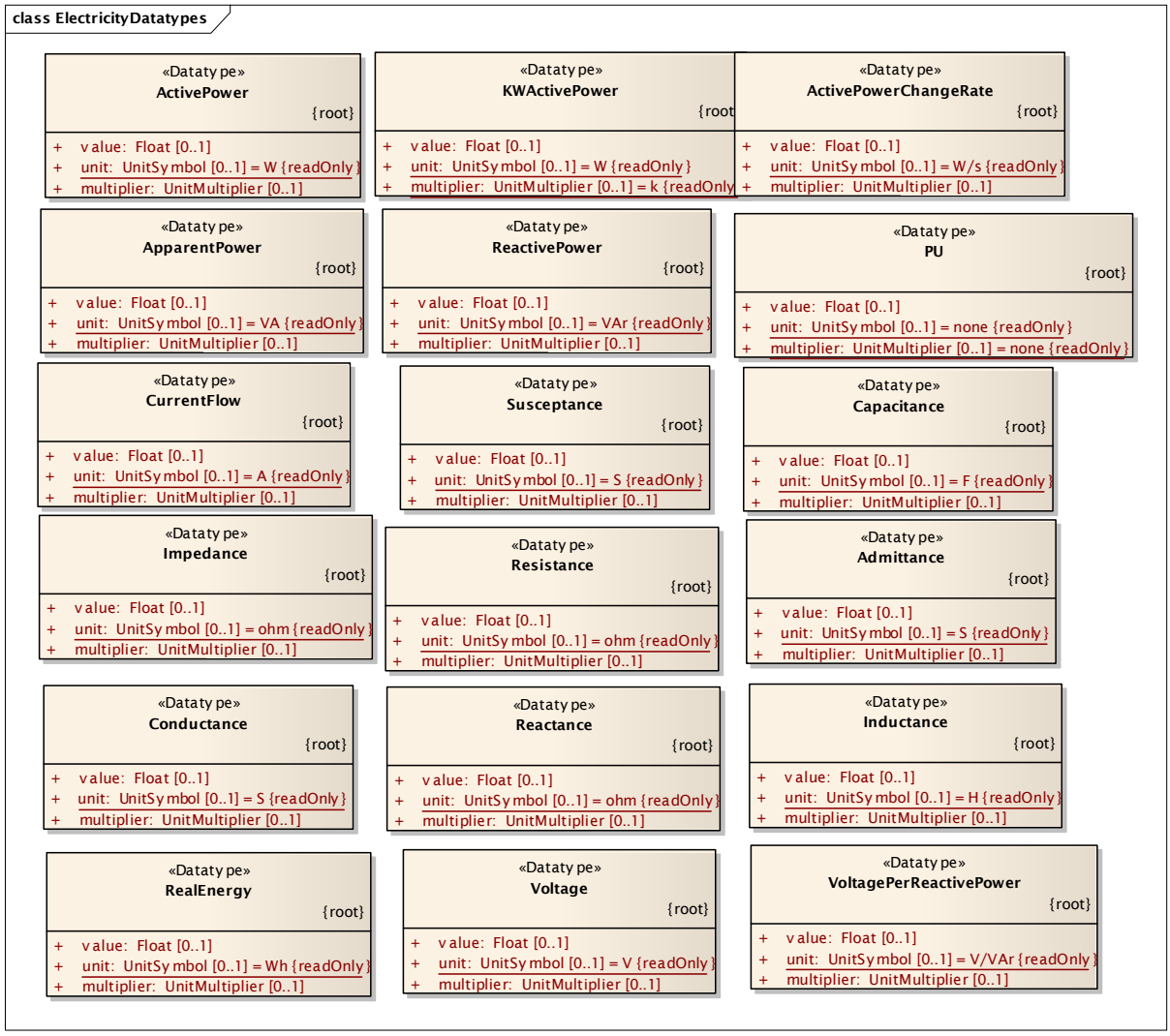

Figure 20 – Logical diagram Domain::ElectricityDatatypes

This diagram shows electricity related data types.

Figure 21 shows logical diagram EnumeratedUnitDatatypes.

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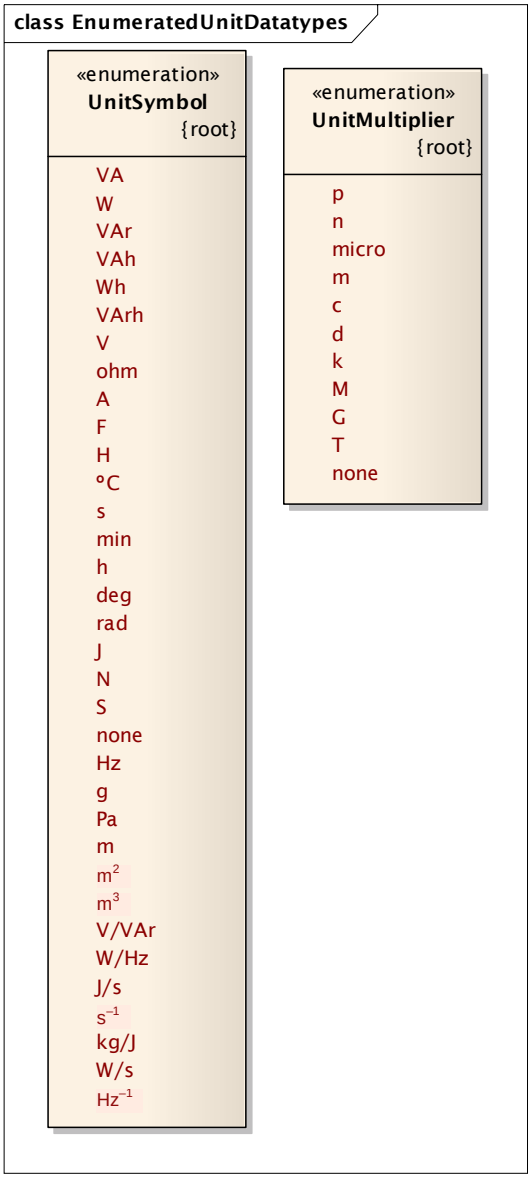

Figure 21 – Logical diagram Domain::EnumeratedUnitDatatypes

This diagram shows enumerated data types related to the SI unit system.

Figure 22 shows logical diagram GeneralDatatypes.

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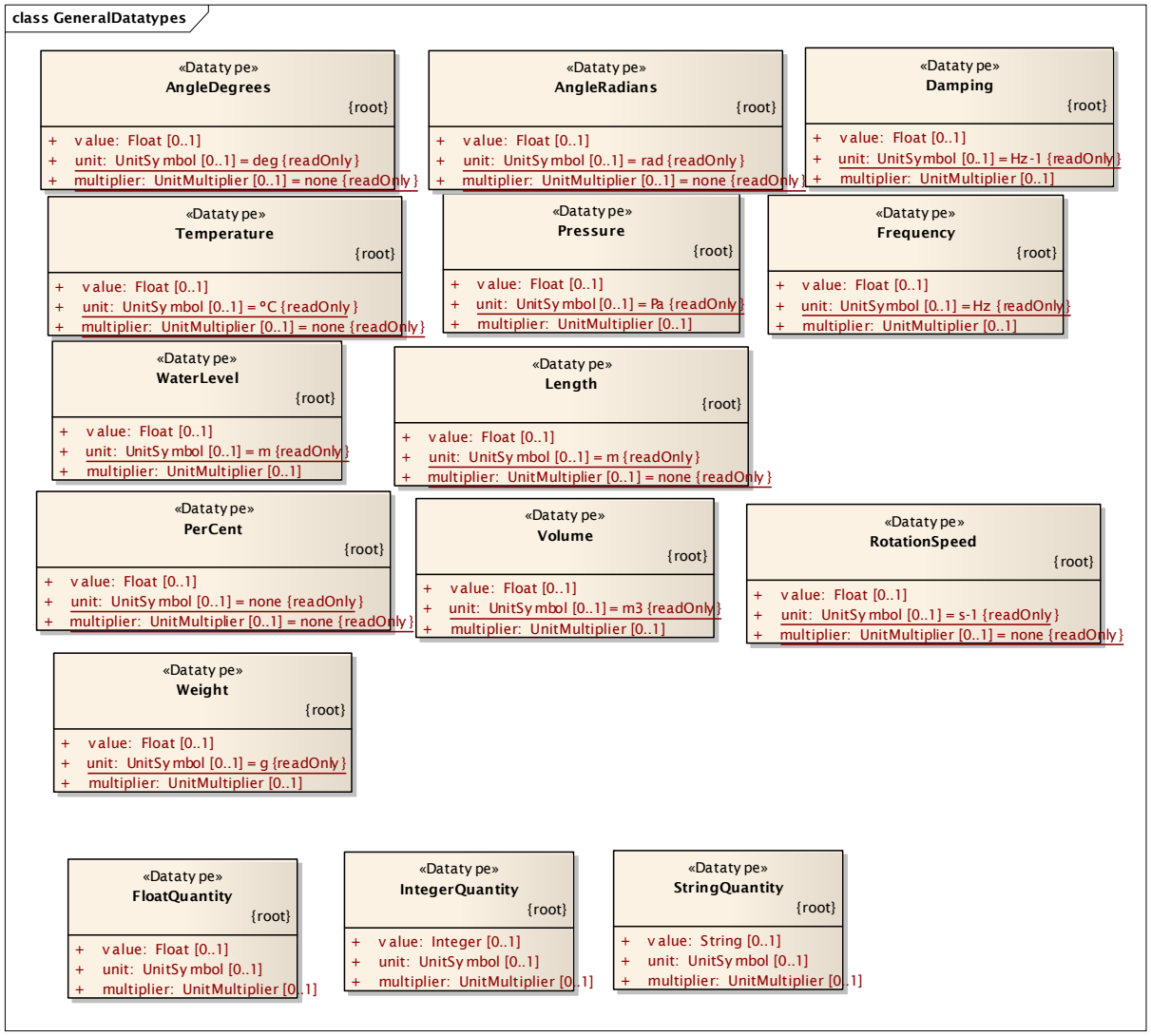

Figure 22 – Logical diagram Domain::GeneralDatatypes

This diagram shows general related data types.

Figure 23 shows logical diagram MonetaryDatatypes.

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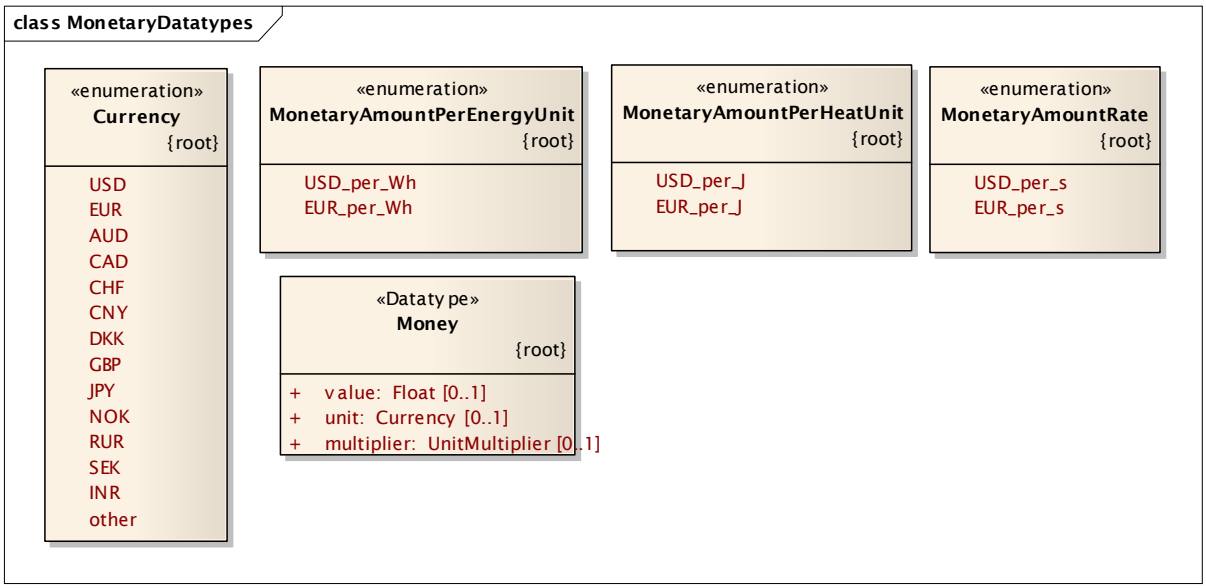

Figure 23 – Logical diagram Domain::MonetaryDatatypes

This diagram shows monetary related data types.

Figure 24 shows logical diagram TimeDatatypes.

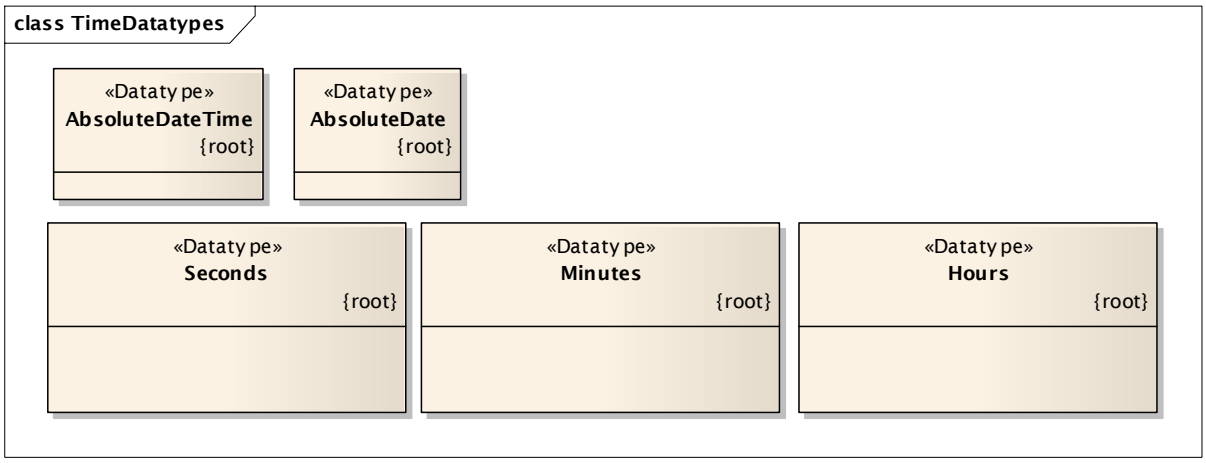

Figure 24 – Logical diagram Domain::TimeDatatypes

This diagram shows time related data types.

6.1.3.2 AbsoluteDate datatype

Date and time as "yyyy-mm-dd", which conforms with ISO 8601. UTC time zone is specified as "yyyy-mm-dd".

Table 7 shows all attributes of AbsoluteDate.

Table 7 – Attributes of Domain::AbsoluteDate

name	type	description
value	String	String representation of date, refer to description of the class

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6.1.3.3 AbsoluteDateTime datatype

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".

AbsoluteDateTime can be used both for calendar time, e.g. 2007-02-07T10:30, and for relative time, e.g. 10:30.

Table 8 shows all attributes of AbsoluteDateTime.

Table 8 – Attributes of Domain::AbsoluteDateTime

name	type	description
value	String	String representation of date and time, refer to description of the class

6.1.3.4 ActivePower datatype

Product of RMS value of the voltage and the RMS value of the in-phase component of the current.

Table 9 shows all attributes of ActivePower.

Table 9 – Attributes of Domain::ActivePower

name	type	description
value	Float	
unit=W (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.5 ActivePowerChangeRate datatype

Table 10 shows all attributes of ActivePowerChangeRate.

Table 10 – Attributes of Domain::ActivePowerChangeRate

name	type	description
value	Float	
unit=W/s (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.6 Admittance datatype

Ratio of current to voltage.

Table 11 shows all attributes of Admittance.

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Table 11 – Attributes of Domain::Admittance

name	type	description
value	Float	
unit=S (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.7 AngleDegrees datatype

Measurement of angle in degrees.

Table 12 shows all attributes of AngleDegrees.

Table 12 – Attributes of Domain::AngleDegrees

name	type	description
value	Float	
unit=deg (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.8 AngleRadians datatype

Phase angle in radians.

Table 13 shows all attributes of AngleRadians.

Table 13 – Attributes of Domain::AngleRadians

name	type	description
value	Float	
unit=rad (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.9 ApparentPower datatype

Product of the RMS value of the voltage and the RMS value of the current.

Table 14 shows all attributes of ApparentPower.

Table 14 – Attributes of Domain::ApparentPower

name	type	description
value	Float	
unit=VA (const)	UnitSymbol	
multiplier	UnitMultiplier	

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6.1.3.10 Boolean primitive

A type with the value space "true" and "false".

6.1.3.11 Capacitance datatype

A Farad, the typical unit, is the capacitance in which a charge of 1 Coulomb produces 1 Volt potential difference between its terminals.

Table 15 shows all attributes of Capacitance.

Table 15 – Attributes of Domain::Capacitance

name	type	description
value	Float	
unit=F (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.12 Conductance datatype

Factor by which voltage shall be multiplied to give corresponding power lost from a circuit. Real part of admittance.

Table 16 shows all attributes of Conductance.

Table 16 – Attributes of Domain::Conductance

name	type	description
value	Float	
unit=S (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.13 CostPerEnergyUnit datatype

Cost, in units of currency, per quantity of electrical energy generated.

Table 17 shows all attributes of CostPerEnergyUnit.

Table 17 – Attributes of Domain::CostPerEnergyUnit

name	type	description
value	Float	
unit	MonetaryAmountPerEnergyUnit	
multiplier	UnitMultiplier	

6.1.3.14 CostRate datatype

Cost, in units of currency, per hour of elapsed time.

Table 18 shows all attributes of CostRate.

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Table 18 – Attributes of Domain::CostRate

name	type	description
value	Float	
unit	MonetaryAmountRate	
multiplier	UnitMultiplier	

6.1.3.15 Currency enumeration

Monetary currencies. Apologies for this list not being exhaustive.

Table 19 shows all literals of Currency.

Table 19 – Literals of Domain::Currency

literal	description
USD	US dollar
EUR	European euro
AUD	Australian dollar
CAD	Canadian dollar
CHF	Swiss francs
CNY	Chinese yuan renminbi
DKK	Danish crown
GBP	British pound
JPY	Japanese yen
NOK	Norwegian crown
RUR	Russian ruble
SEK	Swedish crown
INR	India rupees
other	Another type of currency.

6.1.3.16 CurrentFlow datatype

Electrical current (positive flow is out of the ConductingEquipment into the ConnectivityNode).

Table 20 shows all attributes of CurrentFlow.

Table 20 – Attributes of Domain::CurrentFlow

name	type	description
value	Float	
unit=A (const)	UnitSymbol	
multiplier	UnitMultiplier	

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6.1.3.17 Damping datatype

Per-unit active power variation with per-unit frequency referenced on the system apparent power base. Typical values in range 1,0 to 2,0.

Table 21 shows all attributes of Damping.

Table 21 – Attributes of Domain::Damping

name	type	description
value	Float	
unit=Hz^{-1} (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.18 Float primitive

A floating point number. The range is unspecified and not limited.

6.1.3.19 FloatQuantity datatype

Quantity with float value and associated unit information.

Table 22 shows all attributes of FloatQuantity.

Table 22 – Attributes of Domain::FloatQuantity

name	type	description
value	Float	
unit	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.20 Frequency datatype

Cycles per second.

Table 23 shows all attributes of Frequency.

Table 23 – Attributes of Domain::Frequency

name	type	description
value	Float	
unit=Hz (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.21 Hours datatype

Time, in hours.

Table 24 shows all attributes of Hours.

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Table 24 – Attributes of Domain::Hours

name	type	description
value	Float	
unit=h (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.22 Impedance datatype

Ratio of voltage to current.

Table 25 shows all attributes of Impedance.

Table 25 – Attributes of Domain::Impedance

name	type	description
value	Float	
unit=ohm (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.23 Inductance datatype

Inductance.

Table 26 shows all attributes of Inductance.

Table 26 – Attributes of Domain::Inductance

name	type	description
value	Float	
unit=H (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.24 Integer primitive

An integer number. The range is unspecified and not limited.

6.1.3.25 IntegerQuantity datatype

Quantity with integer value and associated unit information.

Table 27 shows all attributes of IntegerQuantity.

Table 27 – Attributes of Domain::IntegerQuantity

name	type	description
value	Integer	
unit	UnitSymbol	
multiplier	UnitMultiplier	

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6.1.3.26 KWActivePower datatype

Active power in kilowatts.

Table 28 shows all attributes of KWActivePower.

Table 28 – Attributes of Domain::KWActivePower

name	type	description
value	Float	
unit=W (const)	UnitSymbol	
multiplier=k (const)	UnitMultiplier	

6.1.3.27 Length datatype

Unit of length.

Table 29 shows all attributes of Length.

Table 29 – Attributes of Domain::Length

name	type	description
value	Float	
unit=m (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.28 Minutes datatype

Time in minutes.

Table 30 shows all attributes of Minutes.

Table 30 – Attributes of Domain::Minutes

name	type	description
value	Float	
unit=min (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.29 MonetaryAmountPerEnergyUnit enumeration

Monetary amount per energy unit.

Table 31 shows all literals of MonetaryAmountPerEnergyUnit.

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Table 31 – Literals of Domain::MonetaryAmountPerEnergyUnit

literal	description
USD_per_Wh	
EUR_per_Wh	

6.1.3.30 MonetaryAmountPerHeatUnit enumeration

Monetary amount per joule.

Table 32 shows all literals of MonetaryAmountPerHeatUnit.

Table 32 – Literals of Domain::MonetaryAmountPerHeatUnit

literal	description
USD_per_J	
EUR_per_J	

6.1.3.31 MonetaryAmountRate enumeration

Monetary amount per second.

Table 33 shows all literals of MonetaryAmountRate.

Table 33 – Literals of Domain::MonetaryAmountRate

literal	description
USD_per_s	
EUR_per_s	

6.1.3.32 Money datatype

Amount of money.

Table 34 shows all attributes of Money.

Table 34 – Attributes of Domain::Money

name	type	description
value	Float	
unit	Currency	
multiplier	UnitMultiplier	

6.1.3.33 PerCent datatype

Normally 0 to 100 on a defined base.

Table 35 shows all attributes of PerCent.

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Table 35 – Attributes of Domain::PerCent

name	type	description
value	Float	Normally 0 to 100 on a defined base
unit=none (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.34 Pressure datatype

Pressure in pascals.

Table 36 shows all attributes of Pressure.

Table 36 – Attributes of Domain::Pressure

name	type	description
value	Float	
unit=Pa (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.35 PU datatype

Per Unit - a positive or negative value referred to a defined base. Values typically range from –10 to +10.

Table 37 shows all attributes of PU.

Table 37 – Attributes of Domain::PU

name	type	description
value	Float	
unit=none (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.36 Reactance datatype

Reactance (imaginary part of impedance) at rated frequency.

Table 38 shows all attributes of Reactance.

Table 38 – Attributes of Domain::Reactance

name	type	description
value	Float	
unit=ohm (const)	UnitSymbol	
multiplier	UnitMultiplier	

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6.1.3.37 ReactivePower datatype

Product of RMS value of the voltage and the RMS value of the quadrature component of the current.

Table 39 shows all attributes of ReactivePower.

Table 39 – Attributes of Domain::ReactivePower

name	type	description
value	Float	
unit=VAr (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.38 RealEnergy datatype

Real electrical energy.

Table 40 shows all attributes of RealEnergy.

Table 40 – Attributes of Domain::RealEnergy

name	type	description
value	Float	
unit=Wh (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.39 Resistance datatype

Resistance (real part of impedance).

Table 41 shows all attributes of Resistance.

Table 41 – Attributes of Domain::Resistance

name	type	description
value	Float	
unit=ohm (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.40 RotationSpeed datatype

Number of revolutions per second.

Table 42 shows all attributes of RotationSpeed.

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Table 42 – Attributes of Domain::RotationSpeed

name	type	description
value	Float	
unit=s^{-1} (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.41 Seconds datatype

Time, in seconds.

Table 43 shows all attributes of Seconds.

Table 43 – Attributes of Domain::Seconds

name	type	description
value	Float	Time, in seconds
unit=s (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.42 String primitive

A string consisting of a sequence of 8 bit characters. The character encoding is UTF-8. The string length is unspecified and unlimited.

6.1.3.43 StringQuantity datatype

Quantity with string value (when it is not important whether it is an integral or a floating point number) and associated unit information.

Table 44 shows all attributes of StringQuantity.

Table 44 – Attributes of Domain::StringQuantity

name	type	description
value	String	
unit	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.44 Susceptance datatype

Imaginary part of admittance.

Table 45 shows all attributes of Susceptance.

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Table 45 – Attributes of Domain::Susceptance

name	type	description
value	Float	
unit=S (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.45 Temperature datatype

Value of temperature in degrees Celsius.

Table 46 shows all attributes of Temperature.

Table 46 – Attributes of Domain::Temperature

name	type	description
value	Float	
unit=ºC (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.46 UnitMultiplier enumeration

The unit multipliers defined for the CIM.

Table 47 shows all literals of UnitMultiplier.

Table 47 – Literals of Domain::UnitMultiplier

literal	description
p	Pico 10**-12
n	Nano 10**-9
micro	Micro 10**-6
m	Milli 10**-3
c	Centi 10**-2
d	Deci 10**-1
k	Kilo 10**3
M	Mega 10**6
G	Giga 10**9
T	Tera 10**12
none	

6.1.3.47 UnitSymbol enumeration

The units defined for usage in the CIM.

Table 48 shows all literals of UnitSymbol.

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Table 48 – Literals of Domain::UnitSymbol

literal	description
VA	Apparent power in volt-amperes
W	Active power in watts
VAr	Reactive power in volt-ampere reactive
VAh	Apparent energy in volt-ampere hours
Wh	Real energy in watt hours
VArh	Reactive energy in volt-ampere reactive hours
V	Voltage in volts
ohm	Resistance in ohms
A	Current in amperes
F	Capacitance in farads
H	Inductance in henries
ºC	Relative temperature in degrees Celsius
s	Time in seconds
min	Time in minutes
h	Time in hours
deg	Plane angle in degrees
rad	Plane angle in radians
J	Energy in joules
N	Force in newtons
S	Conductance in siemens
none	Dimension less quantity, e.g. count, per unit, etc.
Hz	Frequency in hertz
g	Mass in grams
Pa	Pressure in pascals (N/m^2)
m	Length in meters
m^2	Area in square meters
m^3	Volume in cubic meters
V/VAr	Volt per volt-ampere reactive
W/Hz	Watts per hertz
J/s	Joules per second
s^{-1}	Per second
kg/J	Mass per energy
W/s	Watts per second
Hz^{-1}	Per Hertz

6.1.3.48 Voltage datatype

Electrical voltage.

Table 49 shows all attributes of Voltage.

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Table 49 – Attributes of Domain::Voltage

name	type	description
value	Float	
unit=V (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.49 VoltagePerReactivePower datatype

Voltage variation with reactive power.

Table 50 shows all attributes of VoltagePerReactivePower.

Table 50 – Attributes of Domain::VoltagePerReactivePower

name	type	description
value	Float	
unit=V/VAr (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.50 Volume datatype

Volume.

Table 51 shows all attributes of Volume.

Table 51 – Attributes of Domain::Volume

name	type	description
value	Float	
unit=m^3 (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.51 WaterLevel datatype

Reservoir water level referred to a given datum such as mean sea level.

Table 52 shows all attributes of WaterLevel.

Table 52 – Attributes of Domain::WaterLevel

name	type	description
value	Float	
unit=m (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.52 Weight datatype

The weight of an object.

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Table 53 shows all attributes of Weight.

Table 53 – Attributes of Domain::Weight

name	type	description
value	Float	
unit=g (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.4 Package Core

6.1.4.1 General

Contains the core PowerSystemResource and ConductingEquipment entities shared by all applications plus common collections of those entities. Not all applications require all the Core entities. This package does not depend on any other package except the Domain package, but most of the other packages have associations and generalizations that depend on it.

Figure 25 shows logical diagram Reporting.

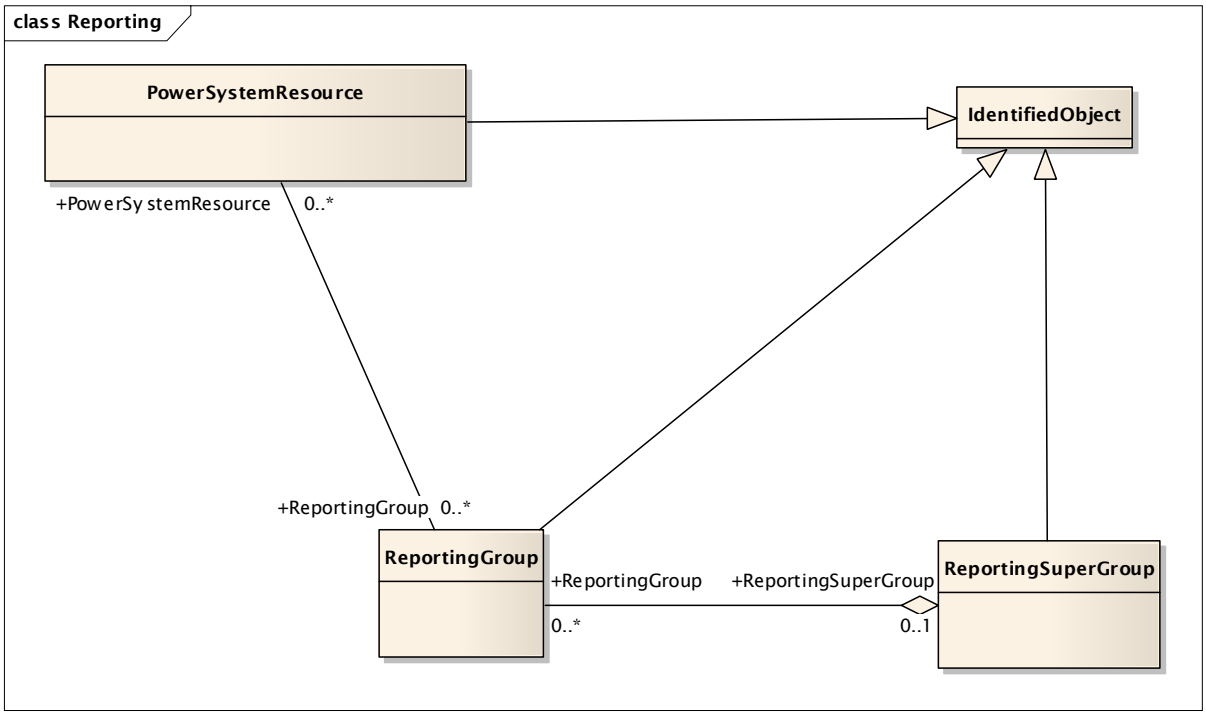

Figure 25 – Logical diagram Core::Reporting

Figure 26 shows logical diagram Main.

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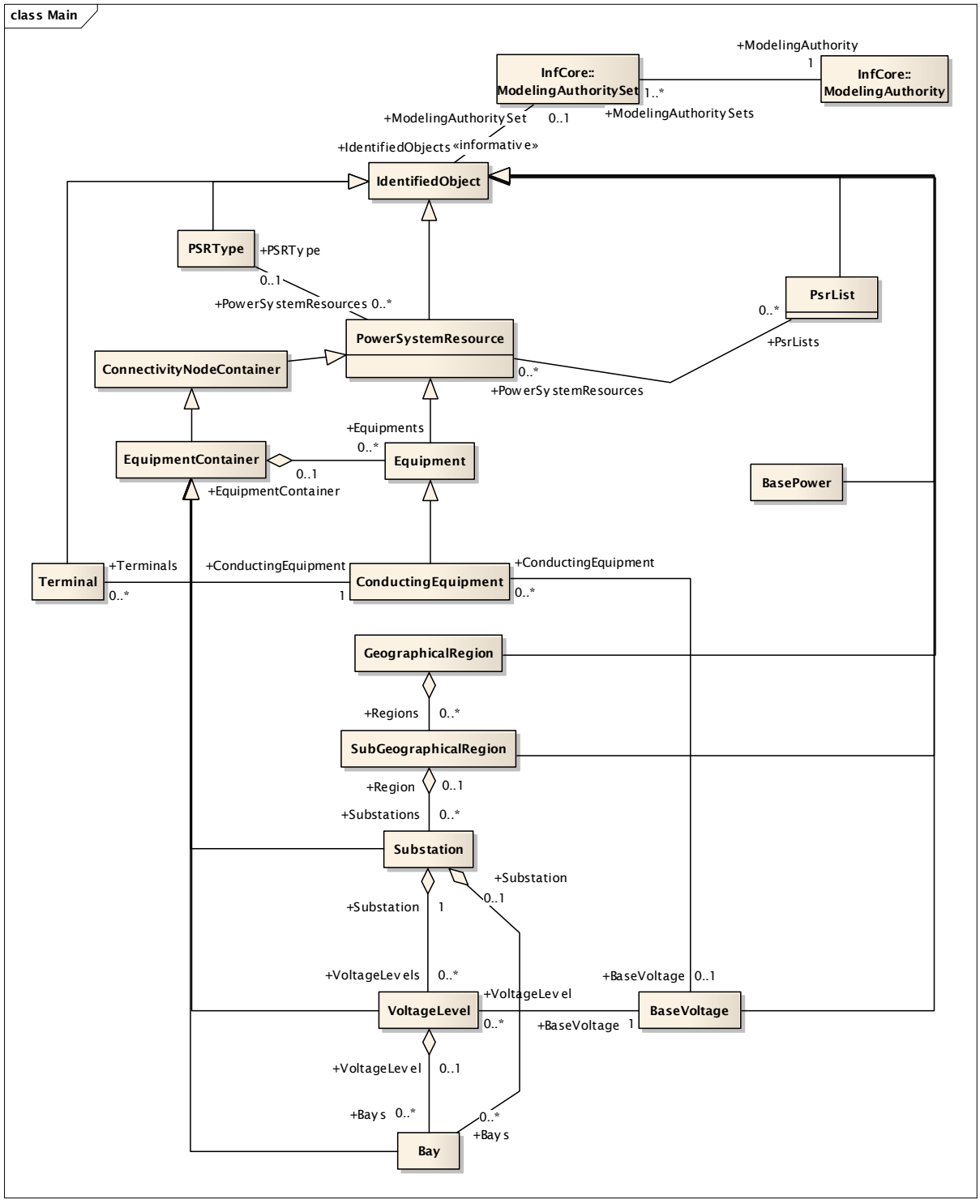

Figure 26 – Logical diagram Core::Main

This diagram is intended to show all classes needed for any application of the CIM for modeling transmission and generation systems.

Figure 27 shows logical diagram CurveSchedule.

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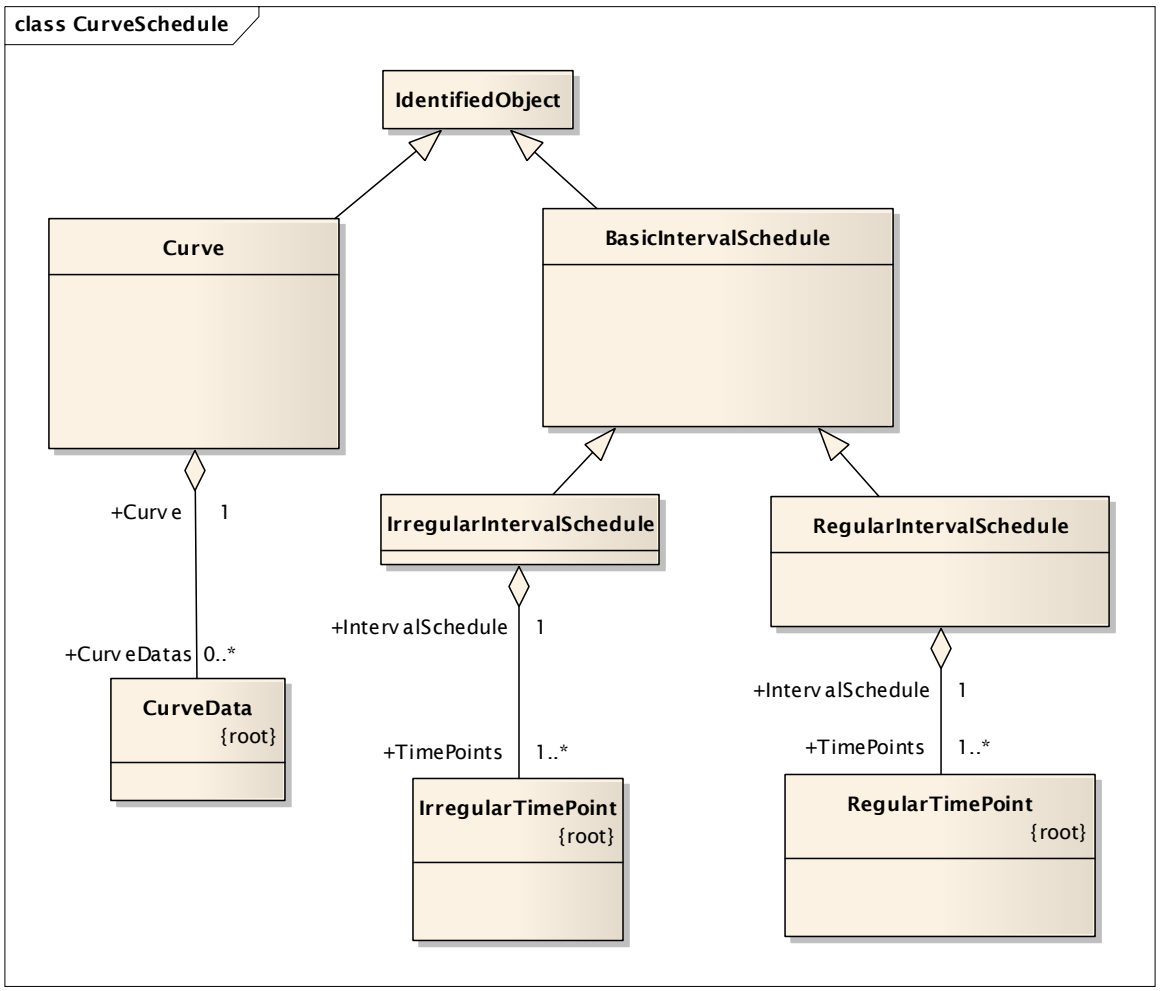

Figure 27 – Logical diagram Core::CurveSchedule

Figure 28 shows logical diagram Datatypes.

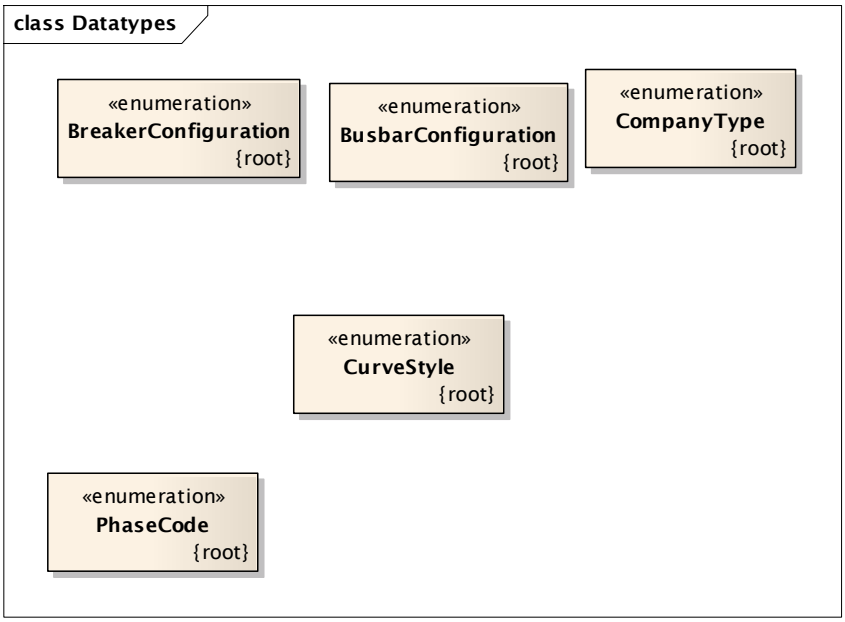

Figure 28 – Logical diagram Core::Datatypes

This diagram shows the data types specific to the Core package.

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Figure 29 shows logical diagram DocumenationExampleAggregation.

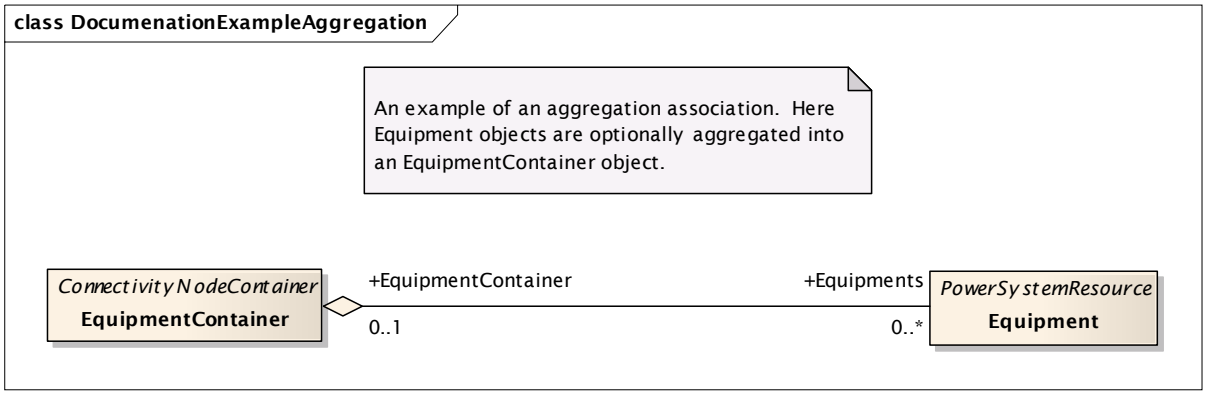

Figure 29 – Logical diagram Core::DocumentationExampleAggregation

Figure 30 shows logical diagram DocumentationExampleAssociation.

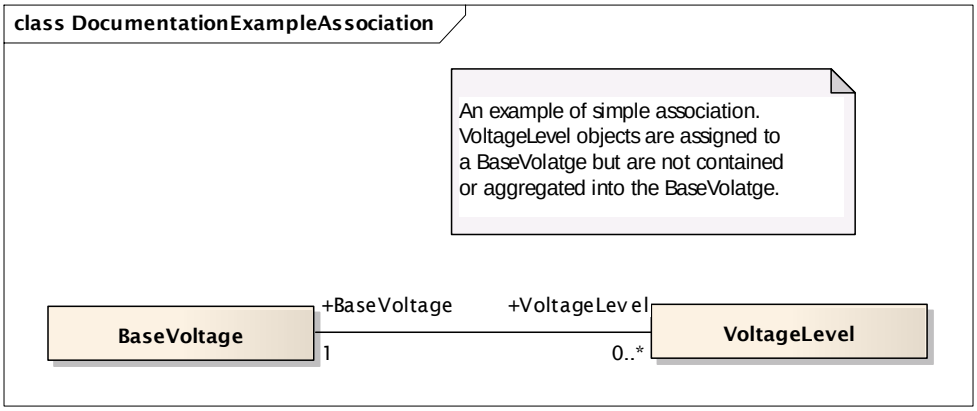

Figure 30 – Logical diagram Core::DocumentationExampleAssociation

This diagram is an example used for documentation purposes. It shows how a simple association and an aggregation association are expressed in UML diagrams.

Figure 31 shows logical diagram Ownership.

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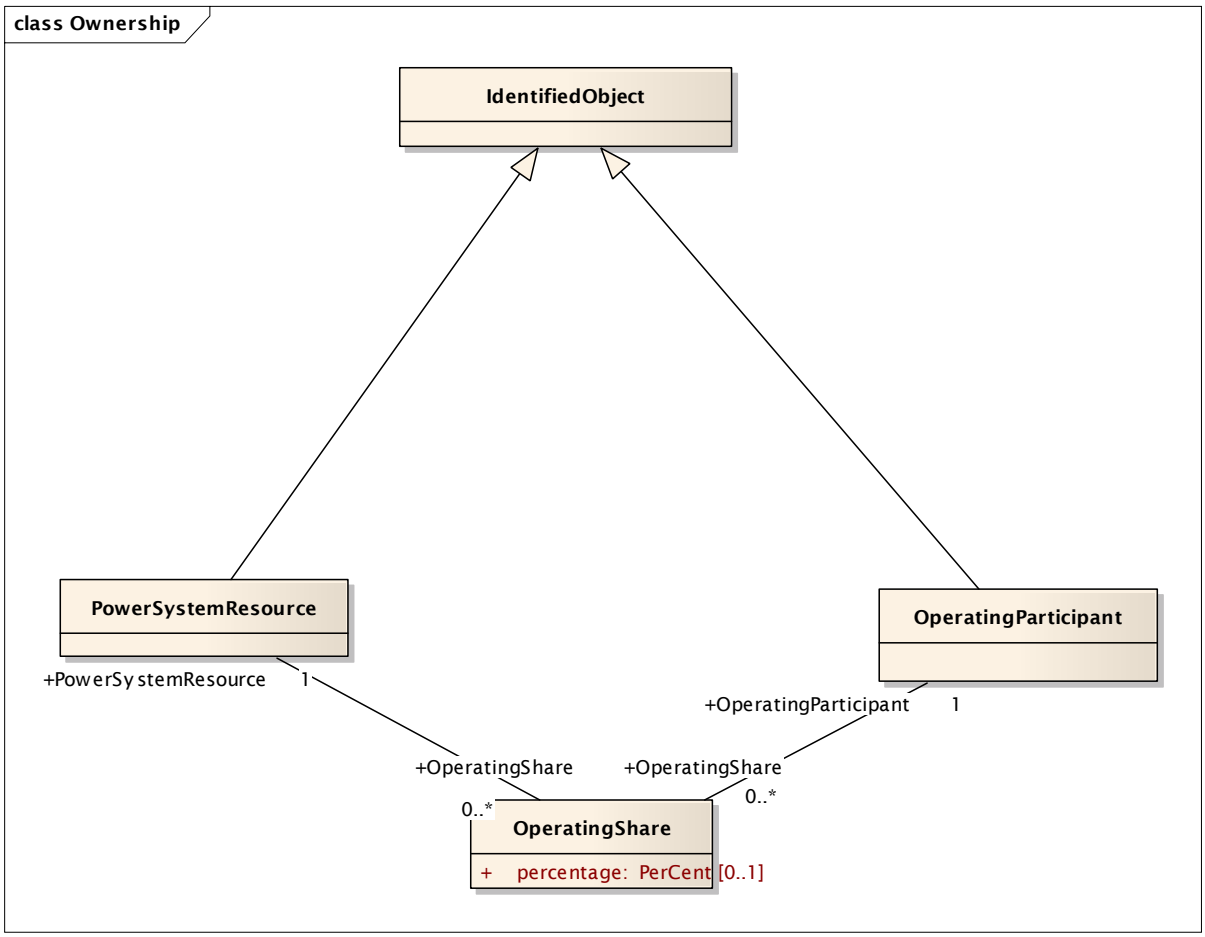

Figure 31 – Logical diagram Core::Ownership

6.1.4.2 ReportingGroup

A reporting group is used for various ad hoc groupings used for reporting.

Table 54 shows all attributes of ReportingGroup.

Table 54 – Attributes of Core::ReportingGroup

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 55 shows all association ends of ReportingGroup with other classes.

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Table 55 – Association ends of Core::ReportingGroup with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] ReportingSuperGroup	ReportingSuperGroup	Reporting super group to which this reporting group belongs
[0..*]	[0..*] PowerSystemResource	PowerSystemResource	PSR's which belong to this reporting group
[0..1]	[0..*] BusNameMarker	BusNameMarker	The BusNameMarkers that belong to this reporting group
[0..1]	[0..*] TopologicalNode	TopologicalNode	The topological nodes that belong to the reporting group

6.1.4.3 ReportingSuperGroup

A reporting super group, groups reporting groups for a higher level report.

Table 56 shows all attributes of ReportingSuperGroup.

Table 56 – Attributes of Core::ReportingSuperGroup

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 57 shows all association ends of ReportingSuperGroup with other classes.

Table 57 – Association ends of Core::ReportingSuperGroup with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] ReportingGroup	ReportingGroup	Reporting groups that are grouped under this group group

6.1.4.4 BasePower

The BasePower class defines the base power used in the per unit calculations.

Table 58 shows all attributes of BasePower.

Table 58 – Attributes of Core::BasePower

name	type	description
basePower	ApparentPower	Definition of base power
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject

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name	type	description
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

6.1.4.5 BaseVoltage

Defines a nominal base voltage which is referenced in the system.

Table 59 shows all attributes of BaseVoltage.

Table 59 – Attributes of Core::BaseVoltage

name	type	description
isDC	Boolean	If true, this is a direct current base voltage and items assigned to this base voltage are also associated with direct current capabilities. False indicates alternating current
nominalVoltage	Voltage	The PowerSystemResource's base voltage
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 60 shows all association ends of BaseVoltage with other classes.

Table 60 – Association ends of Core::BaseVoltage with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] ConductingEquipment	ConductingEquipment	Use association to ConductingEquipment only when there is no VoltageLevel container used
[1..1]	[0..*] VoltageLevel	VoltageLevel	The VoltageLevels having this BaseVoltage
[0..1]	[0..*] TopologicalNode	TopologicalNode	The topological nodes at the base voltage

6.1.4.6 BasicIntervalSchedule

Schedule of values at points in time.

Table 61 shows all attributes of BasicIntervalSchedule.

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Table 61 – Attributes of Core::BasicIntervalSchedule

name	type	description
startTime	AbsoluteDateTime	The time for the first time point
value1Unit	UnitSymbol	Value1 units of measure
value1Multiplier	UnitMultiplier	Multiplier for value1
value2Unit	UnitSymbol	Value2 units of measure
value2Multiplier	UnitMultiplier	Multiplier for value2
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

6.1.4.7 Bay

A collection of power system resources (within a given substation) including conducting equipment, protection relays, measurements, and telemetry.

Table 62 shows all attributes of Bay.

Table 62 – Attributes of Core::Bay

name	type	description
bayEnergyMeasFlag	Boolean	Indicates the presence/absence of energy measurements
bayPowerMeasFlag	Boolean	Indicates the presence/absence of active/reactive power measurements
breakerConfiguration	BreakerConfiguration	Breaker configuration
busBarConfiguration	BusbarConfiguration	Busbar configuration
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 63 shows all association ends of Bay with other classes.

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Table 63 – Association ends of Core::Bay with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] Substation	Substation	The association is used in the naming hierarchy
[0..*]	[0..1] VoltageLevel	VoltageLevel	The association is used in the naming hierarchy
[0..1]	[0..*] Equipments	Equipment	inherited from: EquipmentContainer
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	inherited from: ConnectivityNodeContainer
[0..1]	[0..*] TopologicalNode	TopologicalNode	inherited from: ConnectivityNodeContainer
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.4.8 BreakerConfiguration enumeration

Switching arrangement for Bay.

Table 64 shows all literals of BreakerConfiguration.

Table 64 – Literals of Core::BreakerConfiguration

literal	description
singleBreaker	
breakerAndAHalf	
doubleBreaker	
noBreaker	

6.1.4.9 BusbarConfiguration enumeration

Busbar layout for Bay.

Table 65 shows all literals of BusbarConfiguration.

Table 65 – Literals of Core::BusbarConfiguration

literal	description
singleBus	
doubleBus	
mainWithTransfer	
ringBus	

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6.1.4.10 CompanyType enumeration

Type of company.

Table 66 shows all literals of CompanyType.

Table 66 – Literals of Core::CompanyType

literal	description
pool	
municipal	
isPrivate	

6.1.4.11 ConductingEquipment

The parts of the power system that are designed to carry current or that are conductively connected therewith. ConductingEquipment is contained within an EquipmentContainer that may be a Substation, or a VoltageLevel or a Bay within a Substation.

Table 67 shows all attributes of ConductingEquipment.

Table 67 – Attributes of Core::ConductingEquipment

name	type	description
phases	PhaseCode	Describes the phases carried by a conducting equipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 68 shows all association ends of ConductingEquipment with other classes.

Table 68 – Association ends of Core::ConductingEquipment with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	Use association to ConductingEquipment only when there is no VoltageLevel container used
[1..1]	[0..*] Terminals	Terminal	ConductingEquipment has 1 or 2 terminals that may be connected to other ConductingEquipment terminals via ConnectivityNodes
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	Protection equipment may be used to protect specific Conducting Equipment. Multiple equipment may be protected or monitored by multiple protection equipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	Conducting equipment may have multiple clearance tags for authorized

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[mult from]	[mult to] name	type	description
			field work
[1..1]	[0..1] SvStatus	SvStatus	The status state associated with the conducting equipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.4.12 ConnectivityNode

Connectivity nodes are points where terminals of conducting equipment are connected together with zero impedance.

Table 69 shows all attributes of ConnectivityNode.

Table 69 – Attributes of Core::ConnectivityNode

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 70 shows all association ends of ConnectivityNode with other classes.

Table 70 – Association ends of Core::ConnectivityNode with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] ConnectivityNodeContainer	ConnectivityNodeContainer	Container of this connectivity node
[0..*]	[0..1] TopologicalNode	TopologicalNode	Several ConnectivityNode(s) may combine together to form a single TopologicalNode, depending on the current state of the network
[0..*]	[0..1] BusNameMarker	BusNameMarker	The associated name of the bus (TopologicalNode) containing the ConnectivityNode is derived by an algorithm that uses the bus name marker
[0..1]	[0..*] Terminals	Terminal	Terminals interconnect with zero impedance at a node. Measurements on a node apply to all of its terminals

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6.1.4.13 ConnectivityNodeContainer

A base class for all objects that may contain ConnectivityNodes or TopologicalNodes.

Table 71 shows all attributes of ConnectivityNodeContainer.

Table 71 – Attributes of Core::ConnectivityNodeContainer

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 72 shows all association ends of ConnectivityNodeContainer with other classes.

Table 72 – Association ends of Core::ConnectivityNodeContainer with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	Connectivity nodes contained by this container
[0..1]	[0..*] TopologicalNode	TopologicalNode	The topological nodes which belong to this connectivity node container
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.4.14 Curve

A multi-purpose curve or functional relationship between an independent variable (X-axis) and dependent (Y-axis) variables.

Table 73 shows all attributes of Curve.

Table 73 – Attributes of Core::Curve

name	type	description
curveStyle	CurveStyle	The style or shape of the curve
xMultiplier	UnitMultiplier	Multiplier for X-axis
xUnit	UnitSymbol	The X-axis units of measure
y1Multiplier	UnitMultiplier	Multiplier for Y1-axis
y1Unit	UnitSymbol	The Y1-axis units of measure

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name	type	description
y2Multiplier	UnitMultiplier	Multiplier for Y2-axis
y2Unit	UnitSymbol	The Y2-axis units of measure
y3Multiplier	UnitMultiplier	Multiplier for Y3-axis
y3Unit	UnitSymbol	The Y3-axis units of measure
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 74 shows all association ends of Curve with other classes.

Table 74 – Association ends of Core::Curve with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] CurveDatas	CurveData	The point data values that define a curve

6.1.4.15 CurveData root class

Multi-purpose data points for defining a curve.

Table 75 shows all attributes of CurveData.

Table 75 – Attributes of Core::CurveData

name	type	description
xvalue	Float	The data value of the X-axis variable, depending on the X-axis units
y1value	Float	The data value of the first Y-axis variable, depending on the Y-axis units
y2value	Float	The data value of the second Y-axis variable (if present), depending on the Y-axis units
y3value	Float	The data value of the third Y-axis variable (if present), depending on the Y-axis units

Table 76 shows all association ends of CurveData with other classes.

Table 76 – Association ends of Core::CurveData with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Curve	Curve	The Curve defined by this CurveData

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6.1.4.16 CurveStyle enumeration

Style or shape of curve.

Table 77 shows all literals of CurveStyle.

Table 77 – Literals of Core::CurveStyle

literal	description
constantYValue	
straightLineYValues	
rampYValue	
formula	

6.1.4.17 Equipment

The parts of a power system that are physical devices, electronic or mechanical.

Table 78 shows all attributes of Equipment.

Table 78 – Attributes of Core::Equipment

name	type	description
normallyInService	Boolean	The equipment is normally in service.
aggregate	Boolean	The single instance of equipment represents multiple pieces of equipment that have been modeled together as an aggregate. Examples would be PowerTransformers or SychronousMachines operating in parallel modeled as a single aggregate PowerTransformer or aggregate SynchronousMachine. This is not to be used to indicate equipment that is part of a group of interdependent equipment produced by a network production program
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 79 shows all association ends of Equipment with other classes.

Table 79 – Association ends of Core::Equipment with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	The association is used in the naming hierarchy
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	The equipment limit sets associated with the equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	The contingency element associated

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[mult from]	[mult to] name	type	description
			with the equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.4.18 EquipmentContainer

A modeling construct to provide a root class for containing equipment.

Table 80 shows all attributes of EquipmentContainer.

Table 80 – Attributes of Core::EquipmentContainer

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 81 shows all association ends of EquipmentContainer with other classes.

Table 81 – Association ends of Core::EquipmentContainer with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] Equipments	Equipment	The association is used in the naming hierarchy
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	inherited from: ConnectivityNodeContainer
[0..1]	[0..*] TopologicalNode	TopologicalNode	inherited from: ConnectivityNodeContainer
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

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6.1.4.19 GeographicalRegion

A geographical region of a power system network model.

Table 82 shows all attributes of GeographicalRegion.

Table 82 – Attributes of Core::GeographicalRegion

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 83 shows all association ends of GeographicalRegion with other classes.

Table 83 – Association ends of Core::GeographicalRegion with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] Regions	SubGeographicalRegion	The association is used in the naming hierarchy

6.1.4.20 IdentifiedObject root class

This is a root class to provide common naming attributes for all classes needing naming attributes.

Table 84 shows all attributes of IdentifiedObject.

Table 84 – Attributes of Core::IdentifiedObject

name	type	description
mRID	String	A Model Authority issues mRIDs. Given that each Model Authority has a unique id and this id is part of the mRID, then the mRID is globally unique
name	String	The name is a free text human readable name of the object. It may be non unique and may not correlate to a naming hierarchy
localName	String	The localName is a human readable name of the object. It is only used with objects organized in a naming hierarchy. The simplest naming hierarchy has just one parent (the root) giving a flat naming hierarchy. However, the naming hierarchy usually has several levels, e.g. Substation, VoltageLevel, Equipment etc. Children of the same parent have names that are unique among them. If the uniqueness requirement cannot be met IdentifiedObject.localName shall not be used, use IdentifiedObject.name instead
pathName	String	The pathname is a system unique name composed from all IdentifiedObject.localNames in a naming hierarchy path from the object to the root
aliasName	String	The aliasName is free text human readable name of the object alternative to IdentifiedObject.name. It may be non unique and may not correlate to a naming hierarchy
description	String	The description is a free human readable text describing or naming the object. It may be non unique and may not correlate to a naming hierarchy

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6.1.4.21 IrregularIntervalSchedule

The schedule has TimePoints where the time between them varies.

Table 85 shows all attributes of IrregularIntervalSchedule.

Table 85 – Attributes of Core::IrregularIntervalSchedule

name	type	description
startTime	AbsoluteDateTime	inherited from: BasicIntervalSchedule
value1Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
value2Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 86 shows all association ends of IrregularIntervalSchedule with other classes.

Table 86 – Association ends of Core::IrregularIntervalSchedule with other classes

[mult from]	[mult to] name	type	description
[1..1]	[1..*] TimePoints	IrregularTimePoint	The point data values that define a curve

6.1.4.22 IrregularTimePoint root class

TimePoints for a schedule where the time between the points varies.

Table 87 shows all attributes of IrregularTimePoint.

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Table 87 – Attributes of Core::IrregularTimePoint

name	type	description
time	Seconds	The time is relative the BasicTimeSchedule.startTime
value1	Float	The first value at the time. The meaning of the value is defined by the class inhering the IrregularIntervalSchedule
value2	Float	The second value at the time. The meaning of the value is defined by the class inhering the IrregularIntervalSchedule

Table 88 shows all association ends of IrregularTimePoint with other classes.

Table 88 – Association ends of Core::IrregularTimePoint with other classes

[mult from]	[mult to] name	type	description
[1..*]	[1..1] IntervalSchedule	IrregularIntervalSchedule	An IrregularTimePoint belongs to an IrregularIntervalSchedule

6.1.4.23 OperatingParticipant

An operator of multiple PowerSystemResource objects. Multiple OperatingParticipants may operate the same PowerSystemResource object. This can be used for modeling jointly owned units where each owner operates as a contractual share.

Table 89 shows all attributes of OperatingParticipant.

Table 89 – Attributes of Core::OperatingParticipant

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 90 shows all association ends of OperatingParticipant with other classes.

Table 90 – Association ends of Core::OperatingParticipant with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] OperatingShare	OperatingShare	The operating shares of an operating participant. An operating participant can be reused for any number of PSRs

6.1.4.24 OperatingShare root class

Specifies the contract relationship between a PowerSystemResource and a contract participant.

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Table 91 shows all attributes of OperatingShare.

Table 91 – Attributes of Core::OperatingShare

name	type	description
percentage	PerCent	Percentage ownership for this device. The percentage indicates the percentage ownership of the PSROwner for the PowerSystemResource. The total percentage ownership for a PowerSystemResource should add to 100 %

Table 92 shows all association ends of OperatingShare with other classes.

Table 92 – Association ends of Core::OperatingShare with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] OperatingParticipant	OperatingParticipant	The linkage to an owner and its linkage attributes like percentage ownership. The ownership percentage should add to 100 % for all owners of a PowerSystemResource, but a PSROwner may own any percentage of any number of PowerSystemResource objects
[0..*]	[1..1] PowerSystemResource	PowerSystemResource	The PowerSystemResource to which the attributes apply. The percentage ownership of all owners of a PowerSystemResource should add to 100 %

6.1.4.25 PhaseCode enumeration

Enumeration of phase identifiers.

Table 93 shows all literals of PhaseCode.

Table 93 – Literals of Core::PhaseCode

literal	description
ABCN	
ABC	
ABN	
ACN	
BCN	
AB	
AC	
BC	
AN	
BN	
CN	
A	
B	
C	

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literal	description
N	
splitSecondary1N	Split-secondary phase 1 and Neutral
splitSecondary2N	Split-secondary phase 2 and Neutral
splitSecondary12N	Split-secondary phases 1 and 2, with Neutral

6.1.4.26 PowerSystemResource

A power system resource can be an item of equipment such as a Switch, an EquipmentContainer containing many individual items of equipment such as a Substation, or an organizational entity such as Company or SubControlArea. This provides for the nesting of collections of PowerSystemResources within other PowerSystemResources. For example, a Switch could be a member of a Substation and a Substation could be a member of a division of a Company.

Table 94 shows all attributes of PowerSystemResource.

Table 94 – Attributes of Core::PowerSystemResource

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 95 shows all association ends of PowerSystemResource with other classes.

Table 95 – Association ends of Core::PowerSystemResource with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] PSRType	PSRType	PSRType (custom classification) for this PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	The Measurements that are included in the naming hierarchy where the PSR is the containing object
[1..1]	[0..*] OperatingShare	OperatingShare	The linkage to any number of operating share objects
[0..*]	[0..*] PsrLists	PsrList	
[1..1]	[0..1] OutageSchedule	OutageSchedule	A power system resource may have an outage schedule
[0..*]	[0..*] ReportingGroup	ReportingGroup	Reporting groups to which this PSR belongs
[0..*]	[0..1] Location	Location	Location of this power system resource

6.1.4.27 PsrList

Arbitrary list of PowerSystemResources. Can be used for various purposes, including grouping for report generation.

Table 96 shows all attributes of PsrList.

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Table 96 – Attributes of Core::PsrList

name	type	description
typePSRList	String	Type of power system resources in this list
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 97 shows all association ends of PsrList with other classes.

Table 97 – Association ends of Core::PsrList with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] PowerSystemResources	PowerSystemResource	

6.1.4.28 PSRType

Classifying instances of the same class, e.g. overhead and underground ACLineSegments. This classification mechanism is intended to provide flexibility outside the scope of this standard, i.e. provide customization that is non standard.

Table 98 shows all attributes of PSRType.

Table 98 – Attributes of Core::PSRType

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 99 shows all association ends of PSRType with other classes.

Table 99 – Association ends of Core::PSRType with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] PowerSystemResources	PowerSystemResource	Power system resources classified with this PSRType

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6.1.4.29 RegularIntervalSchedule

The schedule has TimePoints where the time between them is constant.

Table 100 shows all attributes of RegularIntervalSchedule.

Table 100 – Attributes of Core::RegularIntervalSchedule

name	type	description
timeStep	Seconds	The time between each pair of subsequent RegularTimePoints
endTime	AbsoluteDateTime	The time for the last time point
startTime	AbsoluteDateTime	inherited from: BasicIntervalSchedule
value1Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
value2Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 101 shows all association ends of RegularIntervalSchedule with other classes.

Table 101 – Association ends of Core::RegularIntervalSchedule with other classes

[mult from]	[mult to] name	type	description
[1..1]	[1..*] TimePoints	RegularTimePoint	The point data values that define a curve

6.1.4.30 RegularTimePoint root class

TimePoints for a schedule where the time between the points is constant.

Table 102 shows all attributes of RegularTimePoint.

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Table 102 – Attributes of Core::RegularTimePoint

name	type	description
sequenceNumber	Integer	The position of the RegularTimePoint in the sequence. Note that time points don't have to be sequential, i.e. time points may be omitted. The actual time for a RegularTimePoint is computed by multiplying the RegularIntervalSchedule.timeStep with the RegularTimePoint.sequenceNumber and add the BasicIntervalSchedule.startTime
value1	Float	The first value at the time. The meaning of the value is defined by the class inhering the RegularIntervalSchedule
value2	Float	The second value at the time. The meaning of the value is defined by the class inhering the RegularIntervalSchedule

Table 103 shows all association ends of RegularTimePoint with other classes.

Table 103 – Association ends of Core::RegularTimePoint with other classes

[mult from]	[mult to] name	type	description
[1..*]	[1..1] IntervalSchedule	RegularIntervalSchedule	A RegularTimePoint belongs to a RegularIntervalSchedule

6.1.4.31 SubGeographicalRegion

A subset of a geographical region of a power system network model.

Table 104 shows all attributes of SubGeographicalRegion.

Table 104 – Attributes of Core::SubGeographicalRegion

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 105 shows all association ends of SubGeographicalRegion with other classes.

Table 105 – Association ends of Core::SubGeographicalRegion with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] Substations	Substation	The association is used in the naming hierarchy
[0..1]	[0..*] Lines	Line	A Line can be contained by a SubGeographical Region
[0..*]	[0..1] Region	GeographicalRegion	The association is used in the naming hierarchy

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6.1.4.32 Substation

A collection of equipment for purposes other than generation or utilization, through which electric energy in bulk is passed for the purposes of switching or modifying its characteristics.

Table 106 shows all attributes of Substation.

Table 106 – Attributes of Core::Substation

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 107 shows all association ends of Substation with other classes.

Table 107 – Association ends of Core::Substation with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] VoltageLevels	VoltageLevel	The association is used in the naming hierarchy
[0..*]	[0..1] Region	SubGeographicalRegion	The association is used in the naming hierarchy
[0..1]	[0..*] Bays	Bay	The association is used in the naming hierarchy
[0..1]	[0..*] Equipments	Equipment	inherited from: EquipmentContainer
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	inherited from: ConnectivityNodeContainer
[0..1]	[0..*] TopologicalNode	TopologicalNode	inherited from: ConnectivityNodeContainer
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.4.33 Terminal

An electrical connection point to a piece of conducting equipment. Terminals are connected at physical connection points called "connectivity nodes".

Table 108 shows all attributes of Terminal.

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Table 108 – Attributes of Core::Terminal

name	type	description
connected	Boolean	The connected status is related to a bus-branch model and the TopologicalNode-Terminal relation. True implies the Terminal is connected to the related TopologicalNode and false implies it is not. In a bus-branch model the connected status is used to tell if equipment is disconnected without having to change the connectivity described by the TopologicalNode-Terminal relation. A valid case is that ConductingEquipment can be connected in one end and open in the other. In particular for an ACLineSegment where the charging can be significant this is a relevant case
sequenceNumber	Integer	The orientation of the terminal connections for a multiple terminal conducting equipment. The sequence numbering starts with 1 and additional terminals should follow in increasing order. The first terminal is the "starting point" for a two terminal branch. In the case of class TransformerWinding only one terminal is used so its sequenceNumber shall be 1
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 109 shows all association ends of Terminal with other classes.

Table 109 – Association ends of Core::Terminal with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] ConductingEquipment	ConductingEquipment	ConductingEquipment has 1 or 2 terminals that may be connected to other ConductingEquipment terminals via ConnectivityNodes
[0..1]	[0..*] RegulatingControl	RegulatingControl	The terminal is regulated by a control
[0..*]	[0..1] ConnectivityNode	ConnectivityNode	Terminals interconnect with zero impedance at a node. Measurements on a node apply to all of its terminals.
[0..*]	[0..1] TopologicalNode	TopologicalNode	The topological node associated with the terminal. This can be used as an alternative to the connectivity node path to topological node, thus making it unnecesary to model connectivity nodes in some cases. Note that if the connectivity nodes are in the model, this association would probably not be used
[1..1]	[0..*] BranchGroupTerminal	BranchGroupTerminal	The directed branch group terminals for which the terminal is monitored

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[mult from]	[mult to] name	type	description
[0..1]	[0..*] Measurements	Measurement	One or more measurements may be associated with a terminal in the network. Measurement-Terminal defines where the measurement is placed in the network topology Some Measurements represent quantities related to a particular sensor position, e.g. a voltage transformer (PT) at a busbar or a current transformer (CT) at the bar between a breaker and an isolator. The sensing position is captured by the Measurement - Terminal association that makes it possible to place the sensing position at a well defined place. The place is defined by the connection of the Terminal to ConductingEquipment
[1..1]	[0..2] TieFlow	TieFlow	The control area tie flows to which this terminal associates
[0..1]	[0..*] OperationalLimitSet	OperationalLimitSet	The operational limits sets that apply specifically to this terminal. Other operational limits sets may apply to this terminal through the association to Equipment
[1..1]	[0..*] HasSecond_MutualCoupling	MutualCoupling	Mutual couplings with the branch associated as the first branch
[1..1]	[0..*] HasFirst_MutualCoupling	MutualCoupling	Mutual couplings associated with the branch as the first branch
[1..1]	[0..1] SvPowerFlow	SvPowerFlow	The power flow state associated with the terminal

6.1.4.34 Unit

Quantity being measured. The Unit.name shall be unique among all specified quantities and describe the quantity. The Unit.aliasName is meant to be used for localization.

Table 110 shows all attributes of Unit.

Table 110 – Attributes of Core::Unit

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 111 shows all association ends of Unit with other classes.

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Table 111 – Association ends of Core::Unit with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] Controls	Control	The Controls having the Unit
[1..1]	[0..*] ProtectionEquipments	ProtectionEquipment	The Protection Equipments having the Unit
[1..1]	[0..*] Measurements	Measurement	The Measurements having the Unit

6.1.4.35 VoltageLevel

Collection of equipment at one common system voltage forming a switchgear. The equipment typically consist of breakers, busbars, instrumentation, control, regulation and protection devices as well as assemblies of all these.

Table 112 shows all attributes of VoltageLevel.

Table 112 – Attributes of Core::VoltageLevel

name	type	description
highVoltageLimit	Voltage	The busbar's high voltage limit
lowVoltageLimit	Voltage	The busbar's low voltage limit
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 113 shows all association ends of VoltageLevel with other classes.

Table 113 – Association ends of Core::VoltageLevel with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] Bays	Bay	The association is used in the naming hierarchy
[0..*]	[1..1] BaseVoltage	BaseVoltage	The base voltage used for all equipment within the VoltageLevel
[0..*]	[1..1] Substation	Substation	The association is used in the naming hierarchy
[0..1]	[0..*] Equipments	Equipment	inherited from: EquipmentContainer
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	inherited from: ConnectivityNodeContainer
[0..1]	[0..*] TopologicalNode	TopologicalNode	inherited from: ConnectivityNodeContainer
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource

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[mult from]	[mult to] name	type	description
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.5 Package OperationalLimits

6.1.5.1 General

The OperationalLimits package models a specification of limits associated with equipment and other operational entities.

Figure 32 shows logical diagram OperationalLimits.

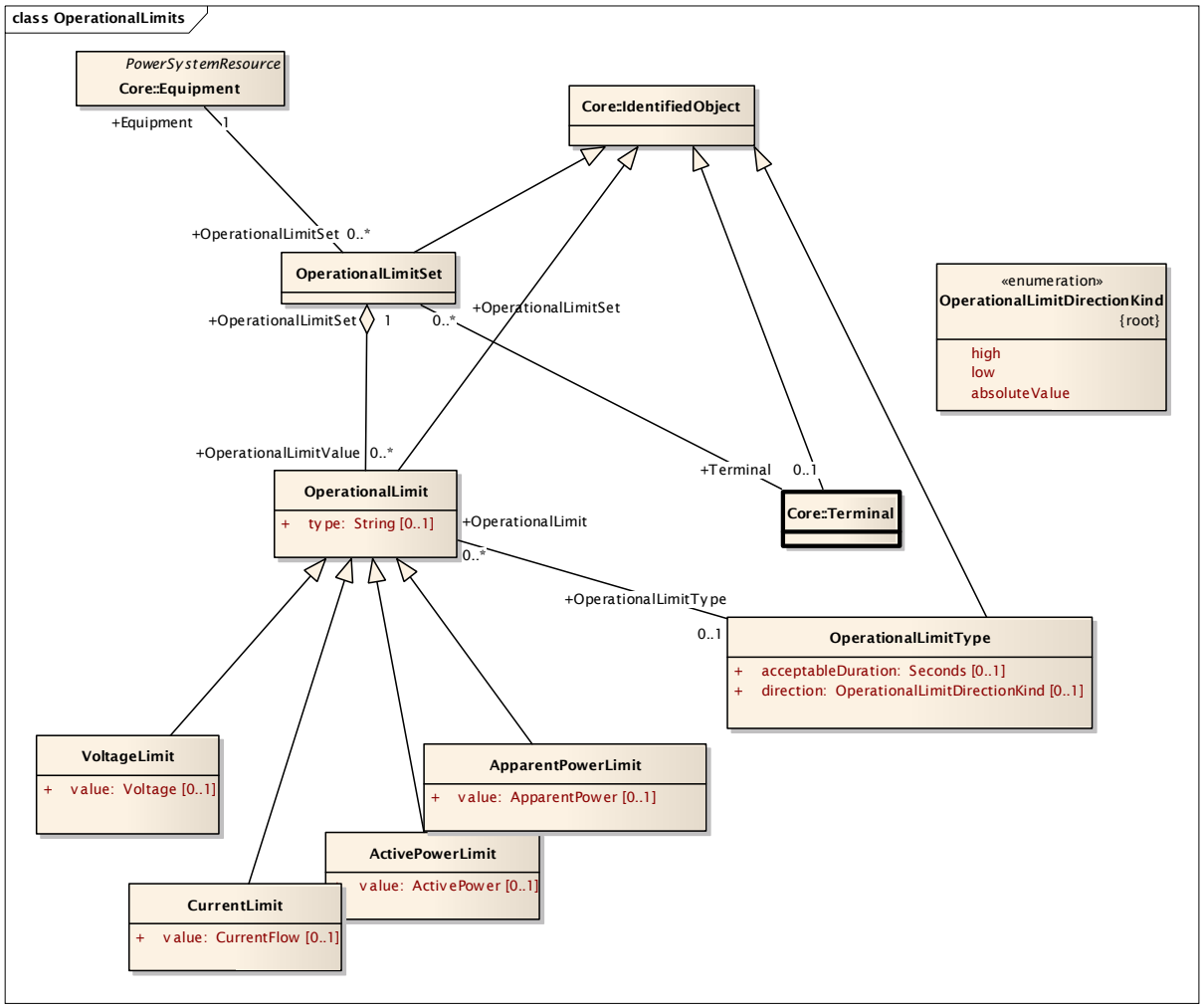

Figure 32 – Logical diagram OperationalLimits::OperationalLimits

Operational limits as they tie back into the core model.

Figure 33 shows logical diagram BranchGroup.

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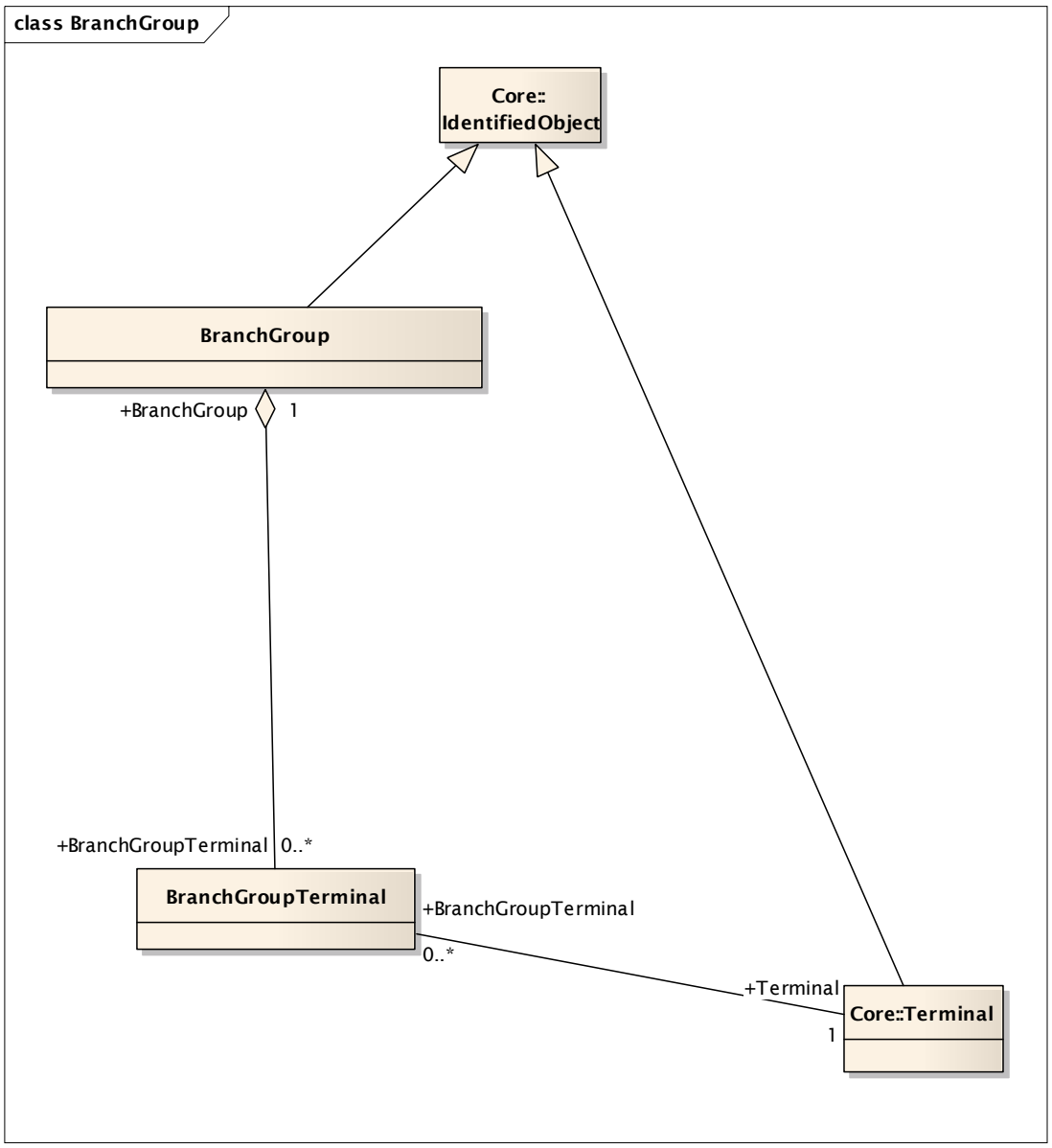

Figure 33 – Logical diagram OperationalLimits::BranchGroup

6.1.5.2 OperationalLimitDirectionKind enumeration

The direction of an operational limit.

Table 114 shows all literals of OperationalLimitDirectionKind.

Table 114 – Literals of OperationalLimits::OperationalLimitDirectionKind

literal	description
high	The limit is a high limit. If applied to a terminal flow, the positive direction is into the terminal
low	The limit is a low limit. If applied to a terminal flow, the positive direction is into the terminal
absoluteValue	If the absolute value of the monitored value is above the limit value, the limit is violated. In effect, the limit is both a high limit and its negative a low limit

6.1.5.3 OperationalLimitType

A type of limit. The meaning of a specific limit is described in this class.

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Table 115 shows all attributes of OperationalLimitType.

Table 115 – Attributes of OperationalLimits::OperationalLimitType

name	type	description
acceptableDuration	Seconds	The nominal acceptable duration of the limit. Limits are commonly expressed in terms of the time limit for which the limit is normally acceptable. The actual acceptable duration of a specific limit may depend on other local factors such as temperature or wind speed
direction	OperationalLimitDirectionKind	The direction of the limit
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 116 shows all association ends of OperationalLimitType with other classes.

Table 116 – Association ends of OperationalLimits::OperationalLimitType with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] OperationalLimit	OperationalLimit	The operational limits associated with this type of limit

6.1.5.4 ActivePowerLimit

Limit on active power flow.

Table 117 shows all attributes of ActivePowerLimit.

Table 117 – Attributes of OperationalLimits::ActivePowerLimit

name	type	description
value	ActivePower	Value of active power limit
type	String	inherited from: OperationalLimit
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 118 shows all association ends of ActivePowerLimit with other classes.

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Table 118 – Association ends of OperationalLimits::ActivePowerLimit with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] OperationalLimitSet	OperationalLimitSet	inherited from: OperationalLimit
[0..*]	[0..1] OperationalLimitType	OperationalLimitType	inherited from: OperationalLimit

6.1.5.5 ApparentPowerLimit

Apparent power limit.

Table 119 shows all attributes of ApparentPowerLimit.

Table 119 – Attributes of OperationalLimits::ApparentPowerLimit

name	type	description
value	ApparentPower	The apparent power limit
type	String	inherited from: OperationalLimit
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 120 shows all association ends of ApparentPowerLimit with other classes.

Table 120 – Association ends of OperationalLimits::ApparentPowerLimit with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] OperationalLimitSet	OperationalLimitSet	inherited from: OperationalLimit
[0..*]	[0..1] OperationalLimitType	OperationalLimitType	inherited from: OperationalLimit

6.1.5.6 BranchGroup

A group of branch terminals whose directed flow summation is to be monitored. A branch group need not form a cutset of the network.

Table 121 shows all attributes of BranchGroup.

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Table 121 – Attributes of OperationalLimits::BranchGroup

name	type	description
maximumActivePower	ActivePower	The maximum active power flow
maximumReactivePower	ReactivePower	The maximum reactive power flow
minimumActivePower	ActivePower	The minimum active power flow
minimumReactivePower	ReactivePower	The minimum reactive power flow
monitorActivePower	Boolean	Monitor the active power flow
monitorReactivePower	Boolean	Monitor the reactive power flow
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 122 shows all association ends of BranchGroup with other classes.

Table 122 – Association ends of OperationalLimits::BranchGroup with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] BranchGroupTerminal	BranchGroupTerminal	The directed branch group terminals to be summed

6.1.5.7 BranchGroupTerminal root class

A specific directed terminal flow for a branch group.

Table 123 shows all attributes of BranchGroupTerminal.

Table 123 – Attributes of OperationalLimits::BranchGroupTerminal

name	type	description
positiveFlowIn	Boolean	The flow into the terminal is summed if set true. The flow out of the terminal is summed if set false

Table 124 shows all association ends of BranchGroupTerminal with other classes.

Table 124 – Association ends of OperationalLimits::BranchGroupTerminal with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Terminal	Terminal	The terminal to be summed
[0..*]	[1..1] BranchGroup	BranchGroup	The branch group to which the directed branch group terminals belong

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6.1.5.8 CurrentLimit

Operational limit on current.

Table 125 shows all attributes of CurrentLimit.

Table 125 – Attributes of OperationalLimits::CurrentLimit

name	type	description
value	CurrentFlow	Limit on current flow
type	String	inherited from: OperationalLimit
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 126 shows all association ends of CurrentLimit with other classes.

Table 126 – Association ends of OperationalLimits::CurrentLimit with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] OperationalLimitSet	OperationalLimitSet	inherited from: OperationalLimit
[0..*]	[0..1] OperationalLimitType	OperationalLimitType	inherited from: OperationalLimit

6.1.5.9 OperationalLimit

A value associated with a specific kind of limit.

Table 127 shows all attributes of OperationalLimit.

Table 127 – Attributes of OperationalLimits::OperationalLimit

name	type	description
type	String	Used to specify high/low and limit levels
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 128 shows all association ends of OperationalLimit with other classes.

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Table 128 – Association ends of OperationalLimits::OperationalLimit with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] OperationalLimitSet	OperationalLimitSet	The limit set to which the limit values belong
[0..*]	[0..1] OperationalLimitType	OperationalLimitType	The limit type associated with this limit

6.1.5.10 OperationalLimitSet

Set of limits associated with equipment. Sets of limits might apply to a specific temperature, or season for example. A set of limits may contain many different severities of limit levels that would apply to the same equipment. The set may contain limits of different types such as apparent power and current limits or high and low voltage limits that are logically applied together as a set.

Table 129 shows all attributes of OperationalLimitSet.

Table 129 – Attributes of OperationalLimits::OperationalLimitSet

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 130 shows all association ends of OperationalLimitSet with other classes.

Table 130 – Association ends of OperationalLimits::OperationalLimitSet with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Equipment	Equipment	The equipment to which the limit set applies
[0..*]	[0..1] Terminal	Terminal	The terminal specifically associated to this operational limit set. If no terminal is associated, all terminals of the equipment are implied
[1..1]	[0..*] OperationalLimitValue	OperationalLimit	Values of equipment limits

6.1.5.11 VoltageLimit

Operational limit applied to voltage.

Table 131 shows all attributes of VoltageLimit.

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Table 131 – Attributes of OperationalLimits::VoltageLimit

name	type	description
value	Voltage	Limit on voltage. High or low limit depends on the OperatoinalLimit.limitKind
type	String	inherited from: OperationalLimit
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 132 shows all association ends of VoltageLimit with other classes.

Table 132 – Association ends of OperationalLimits::VoltageLimit with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] OperationalLimitSet	OperationalLimitSet	inherited from: OperationalLimit
[0..*]	[0..1] OperationalLimitType	OperationalLimitType	inherited from: OperationalLimit

6.1.6 Package Topology

6.1.6.1 General

Extension to the Core Package that in association with the Terminal class models Connectivity, that is the physical definition of how equipment is connected together. In addition it models Topology, that is the logical definition of how equipment is connected via closed switches. The Topology definition is independent of the other electrical characteristics.

Figure 34 shows logical diagram TopologicalNodeTerminal.

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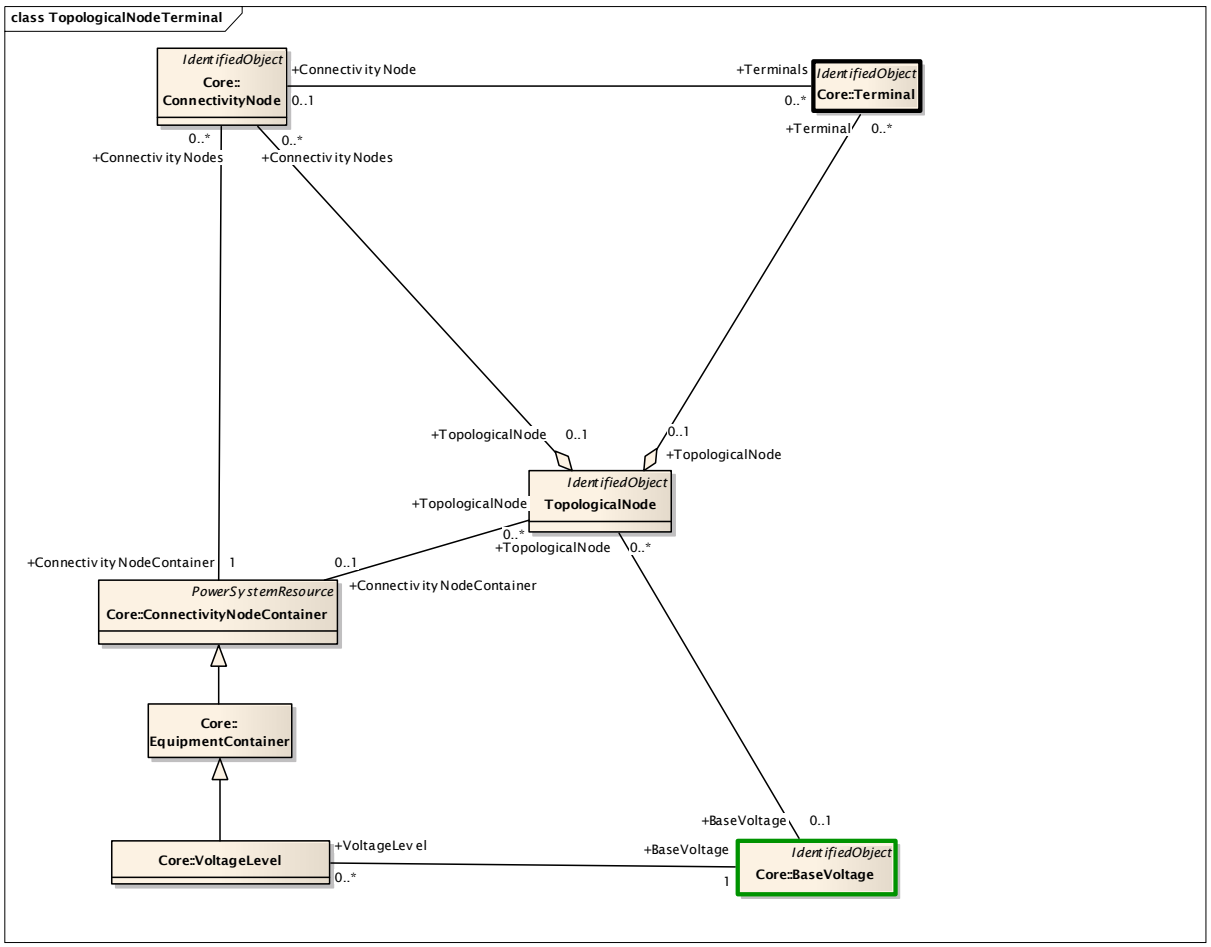

Figure 34 – Logical diagram Topology::TopologicalNodeTerminal

Figure 35 shows logical diagram Topology.

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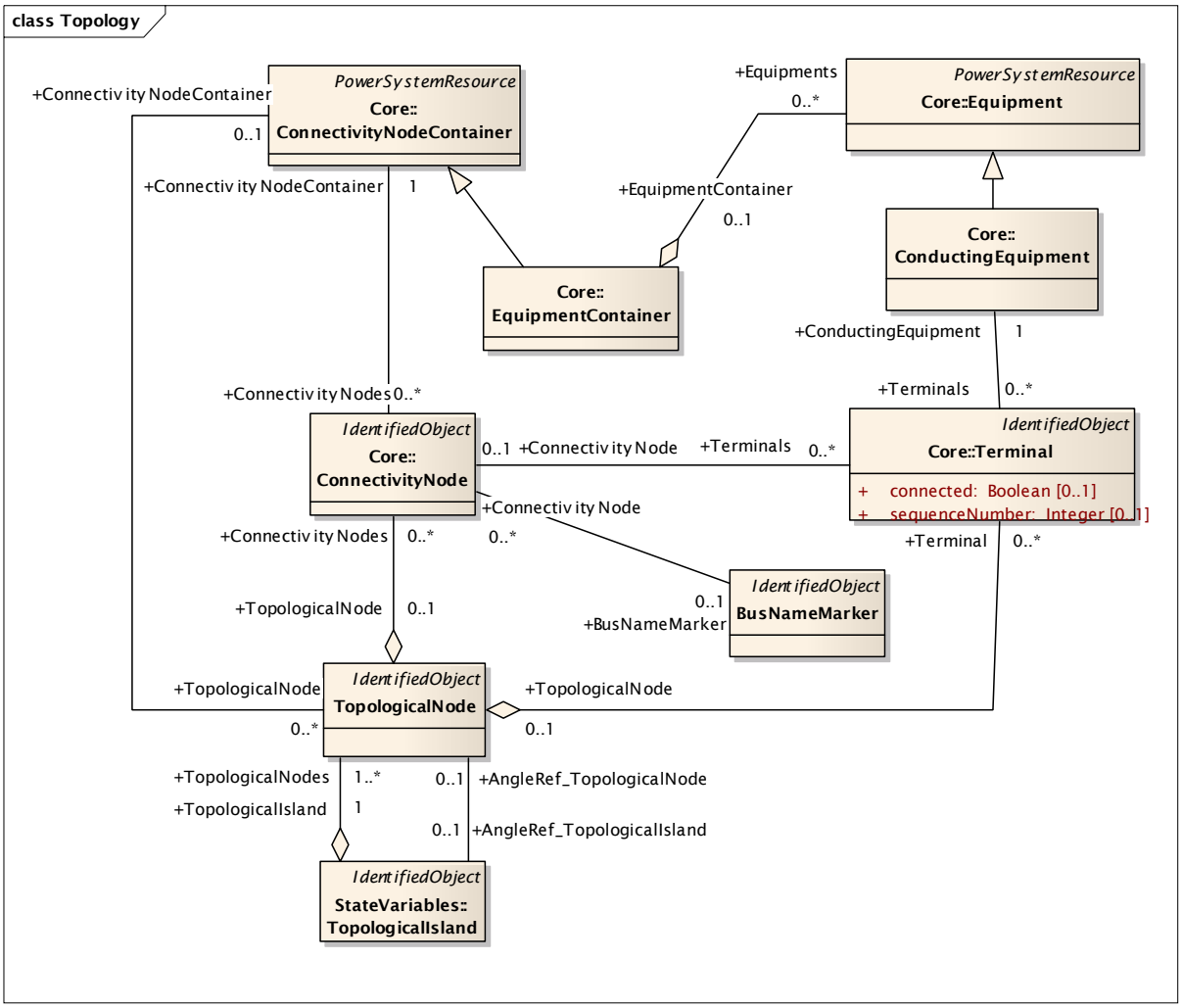

Figure 35 – Logical diagram Topology::Topology

Figure 36 shows logical diagram TopologyMeasRelations.

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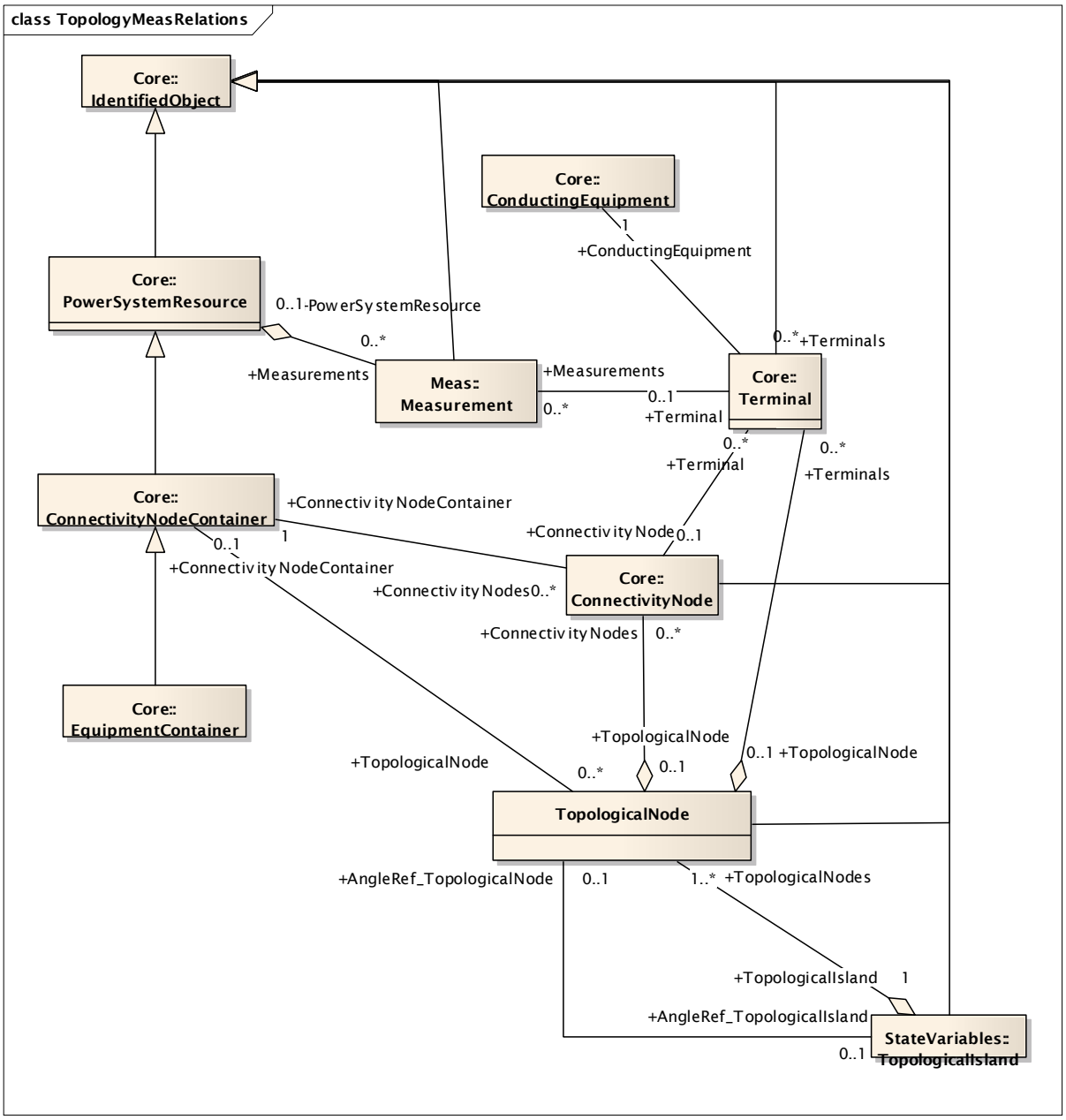

Figure 36 – Logical diagram Topology::TopologyMeasRelations

Figure 37 shows logical diagram TopologyReporting.

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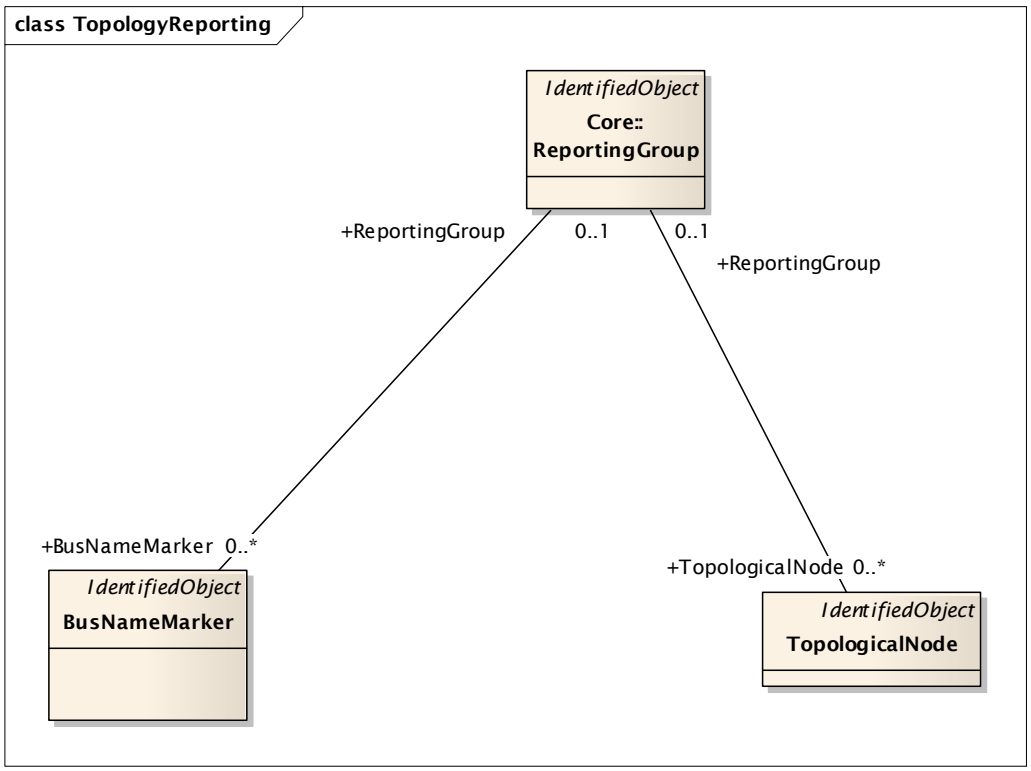

Figure 37 – Logical diagram Topology::TopologyReporting

Figure 38 shows logical diagram Main.

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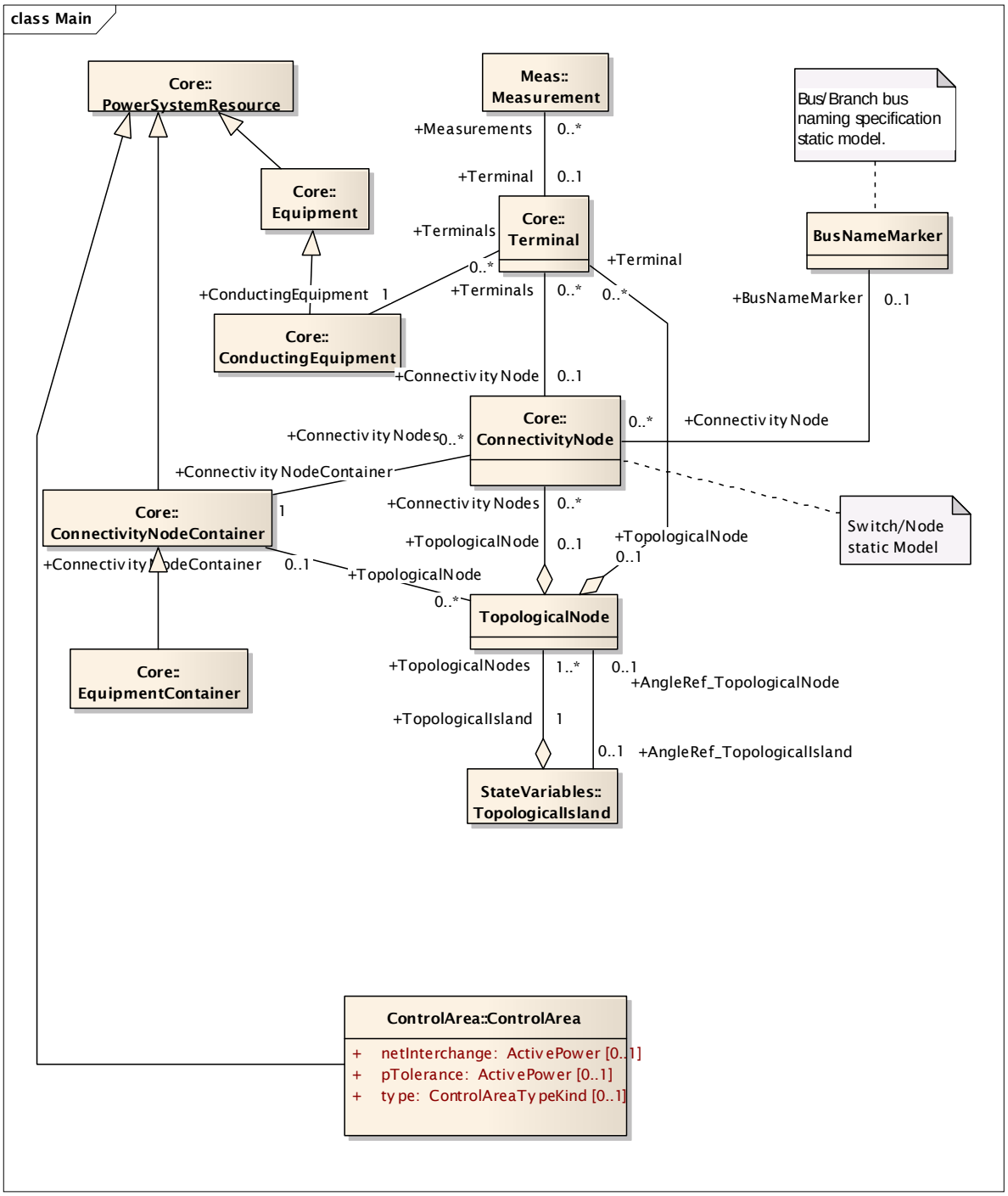

Figure 38 – Logical diagram Topology::Main

This diagram shows all classes included in the Topology package as well as the key external classes that have associations with Topology classes.

6.1.6.2 BusNameMarker

Used to apply user standard names to topology busses. Typically used for "bus/branch" case generation. Associated with one or more ConnectivityNodes that are normally a part of the bus name. The associated ConnectivityNodes are to be connected by non-retained switches. For a ring bus station configuration, all busbar connectivity nodes in the ring are typically associated. For a breaker and a half scheme, both busbars would be associated. For a ring

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bus, all busbars would be associated. For a "straight" busbar configuration, only the main connectivity node at the busbar would be associated.

Table 133 shows all attributes of BusNameMarker.

Table 133 – Attributes of Topology::BusNameMarker

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 134 shows all association ends of BusNameMarker with other classes.

Table 134 – Association ends of Topology::BusNameMarker with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] ConnectivityNode	ConnectivityNode	The list of nodes which have the same bus name in the normal topology. Note that this list of ConnectivityNodes should be connected by objects derived from Switch that are normally closed
[0..*]	[0..1] ReportingGroup	ReportingGroup	The reporting group to which this BusNameMarker belongs

6.1.6.3 TopologicalNode

For a detailed substation model a TopologicalNode is a set of connectivity nodes that, in the current network state, are connected together through any type of closed switches, including jumpers. Topological nodes changes as the current network state changes (i.e. switches, breakers, etc. change state).

For a planning model switch statuses are not used to form TopologicalNodes. Instead they are manually created or deleted in a model builder tool. TopologicalNodes maintained this way are also called "busses".

Table 135 shows all attributes of TopologicalNode.

Table 135 – Attributes of Topology::TopologicalNode

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 136 shows all association ends of TopologicalNode with other classes.

Table 136 – Association ends of Topology::TopologicalNode with other classes

[mult from]	[mult to] name	type	description
[1..*]	[1..1] TopologicalIsland	TopologicalIsland	A topological node belongs to a topological island
[0..*]	[0..1] ReportingGroup	ReportingGroup	The reporting group to which the topological node belongs
[0..*]	[0..1] ConnectivityNodeContainer	ConnectivityNodeContainer	The connectivity node container to which the toplogical node belongs
[0..*]	[0..1] BaseVoltage	BaseVoltage	The base voltage of the topologocial node
[0..1]	[0..*] ConnectivityNodes	ConnectivityNode	Several ConnectivityNode(s) may combine together to form a single TopologicalNode, depending on the current state of the network
[0..1]	[0..1] AngleRef_TopologicalIsland	TopologicalIsland	The island for which the node is an angle reference. Normally there is one angle reference node for each island
[0..1]	[0..*] Terminal	Terminal	The terminals associated with the topological node. This can be used as an alternative to the connectivity node path to terminal, thus making it unnecesary to model connectivity nodes in some cases. Note that if the connectivity nodes are in the model, this association would probably not be used
[1..1]	[0..1] SvVoltage	SvVoltage	The state voltage associated with the topological node
[1..1]	[0..1] SvInjection	SvInjection	The injection state associated with the topological node
[1..1]	[0..1] SvShortCircuit	SvShortCircuit	The short circuit state associated with the topological node

6.1.7 Package Wires

6.1.7.1 General

Extension to the Core and Topology package that models information on the electrical characteristics of Transmission and Distribution networks. This package is used by network applications such as State Estimation, Load Flow and Optimal Power Flow.

Figure 39 shows logical diagram DocumentationExampleInheritance.

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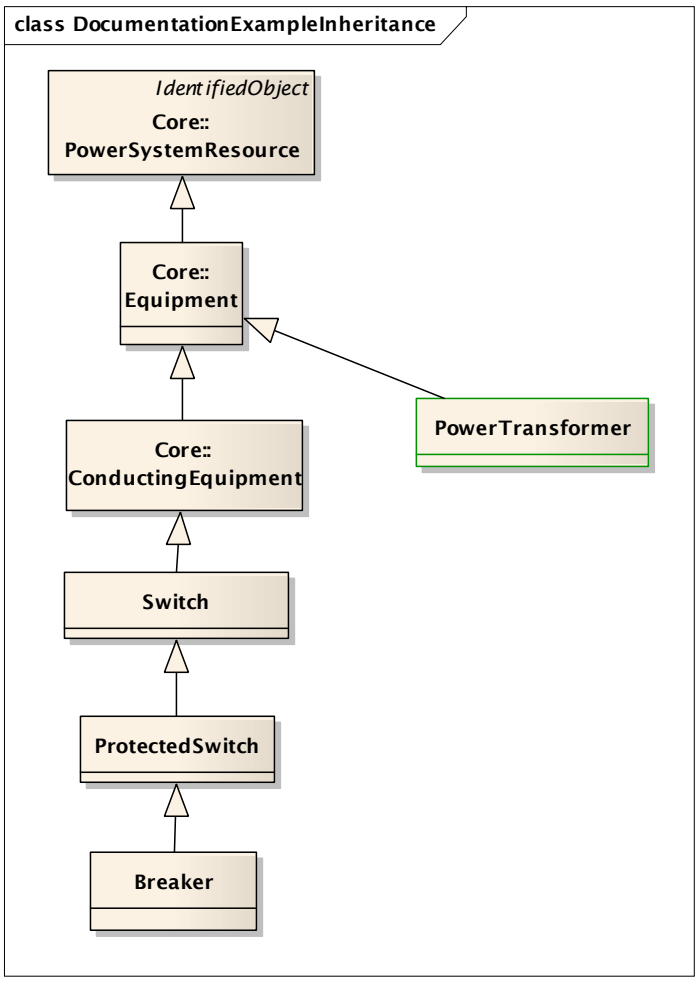

Figure 39 – Logical diagram Wires::DocumentationExampleInheritance

This diagram shows an example of inheritance in UML. This diagram is only to support figures in the documentation.

Figure 40 shows logical diagram MutualCoupling.

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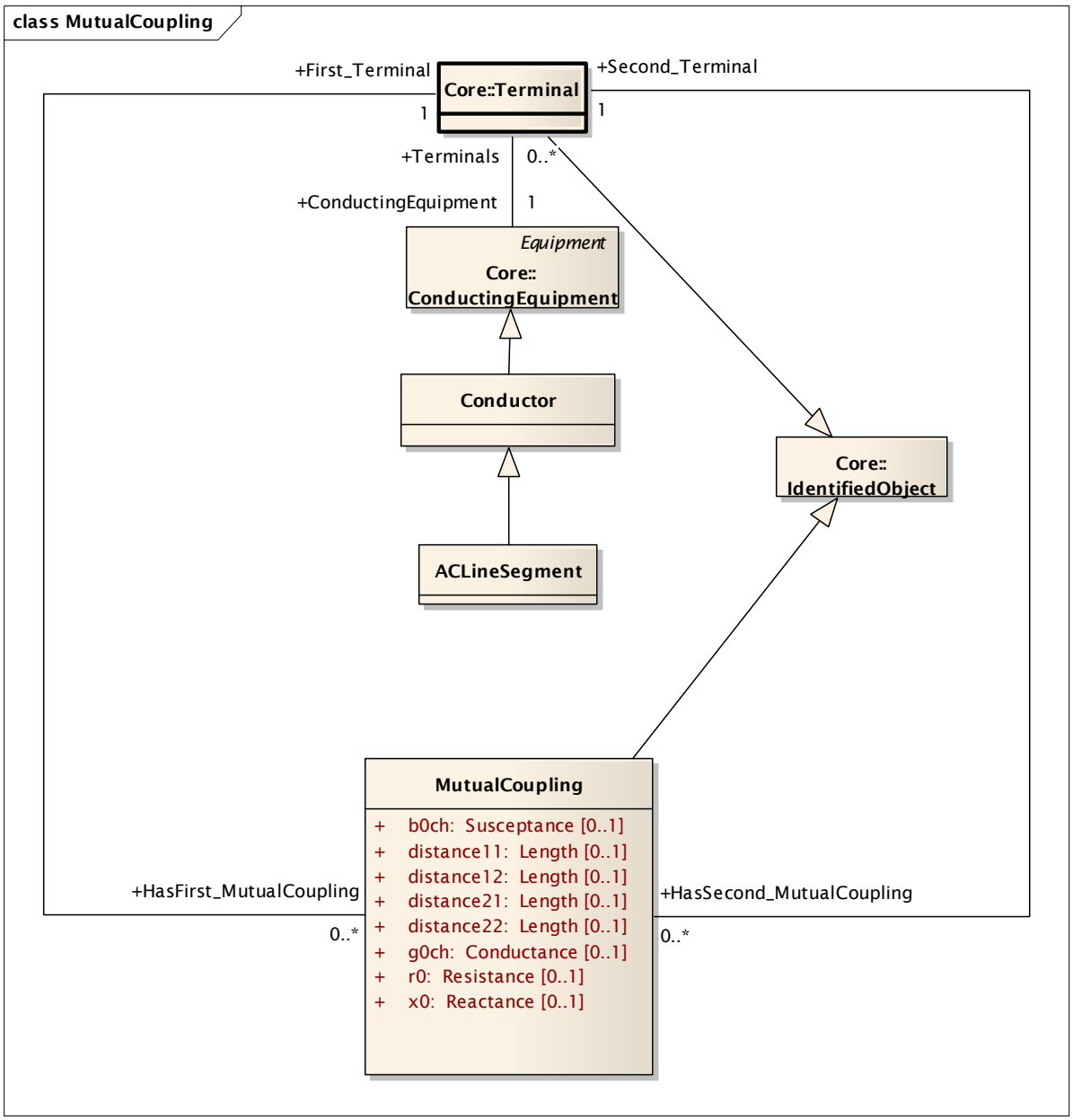

Figure 40 – Logical diagram Wires::MutualCoupling

Figure 41 shows logical diagram Schedules.

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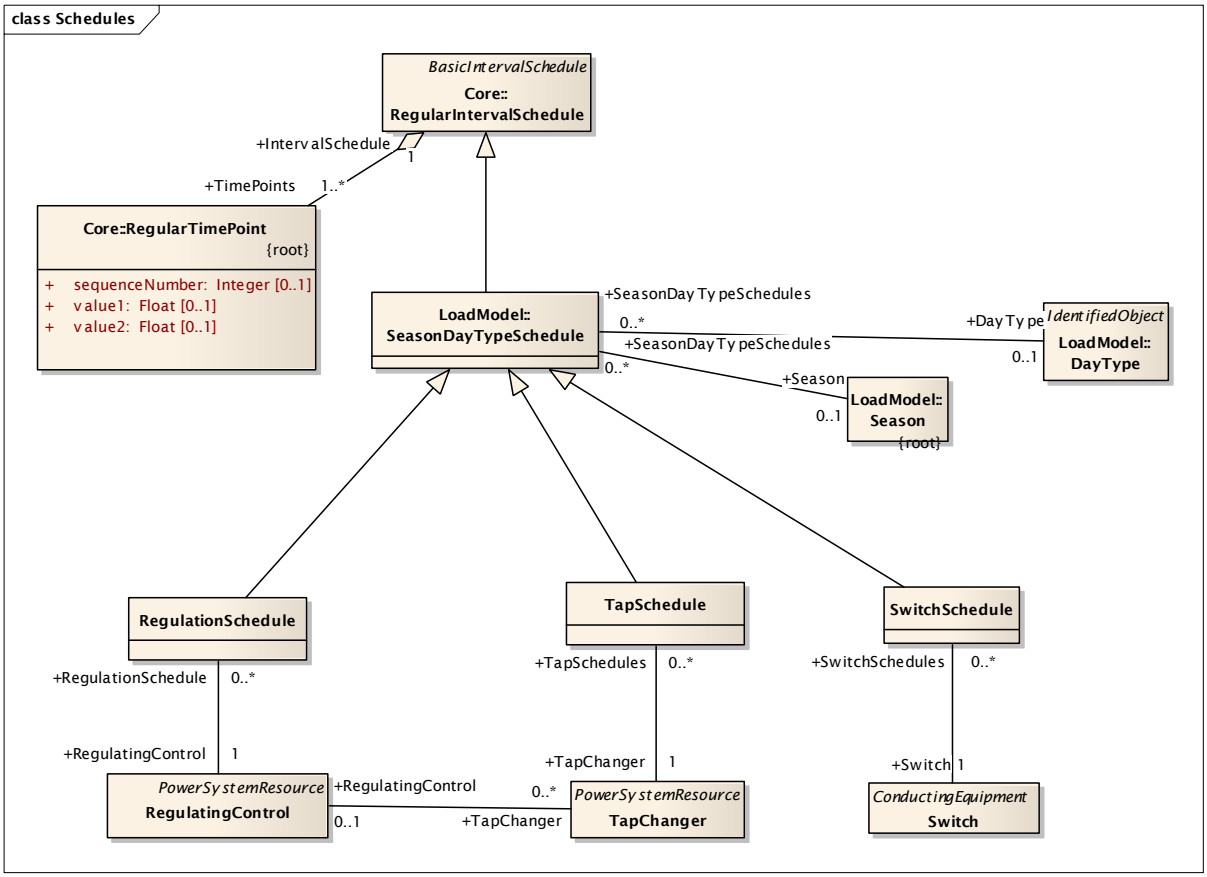

Figure 41 – Logical diagram Wires::Schedules

Figure 42 shows logical diagram Datatypes.

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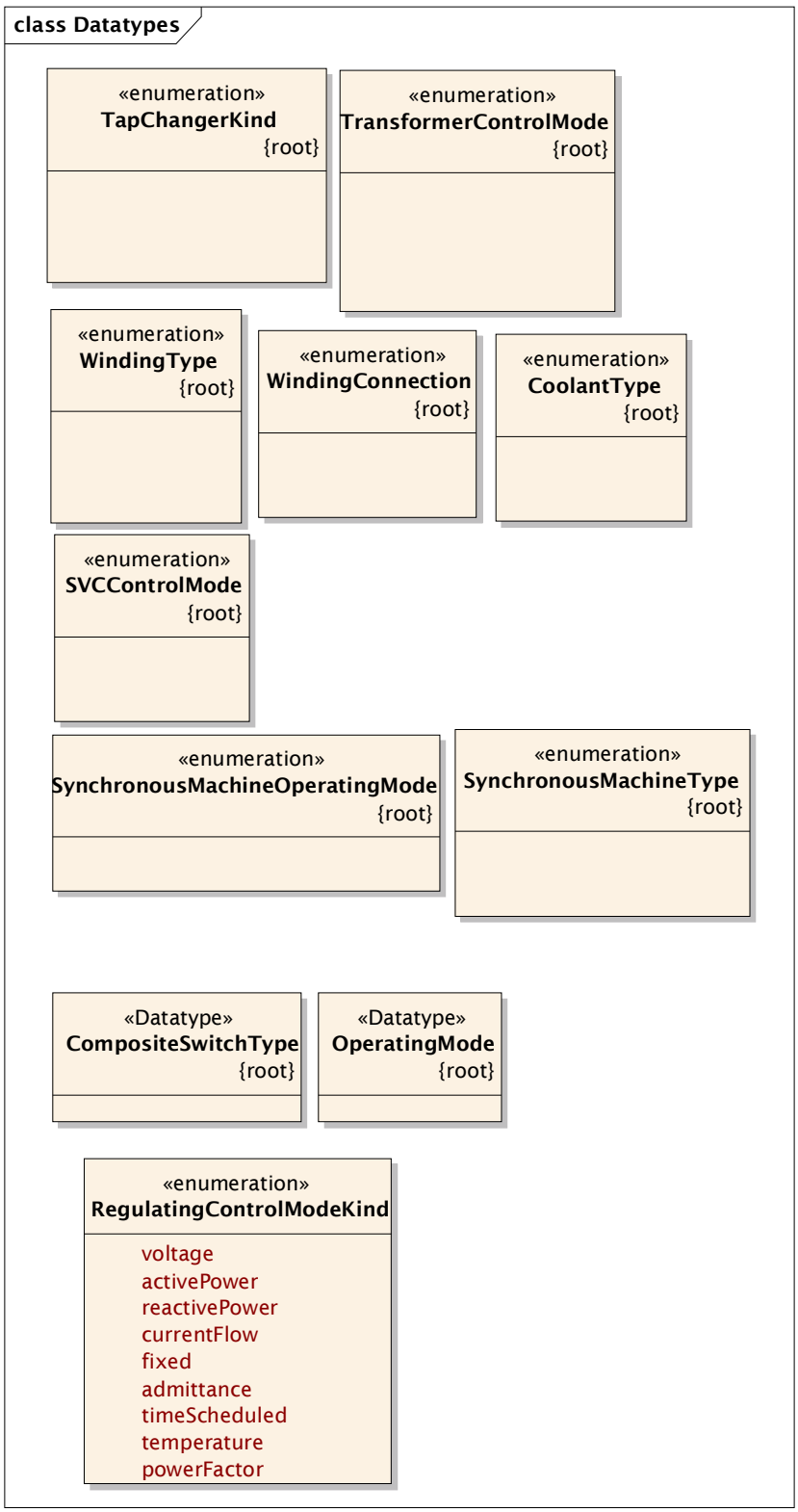

Figure 42 – Logical diagram Wires::Datatypes

This diagram shows the data types specific to the Wires package.

Figure 43 shows logical diagram InheritanceHierarchy.

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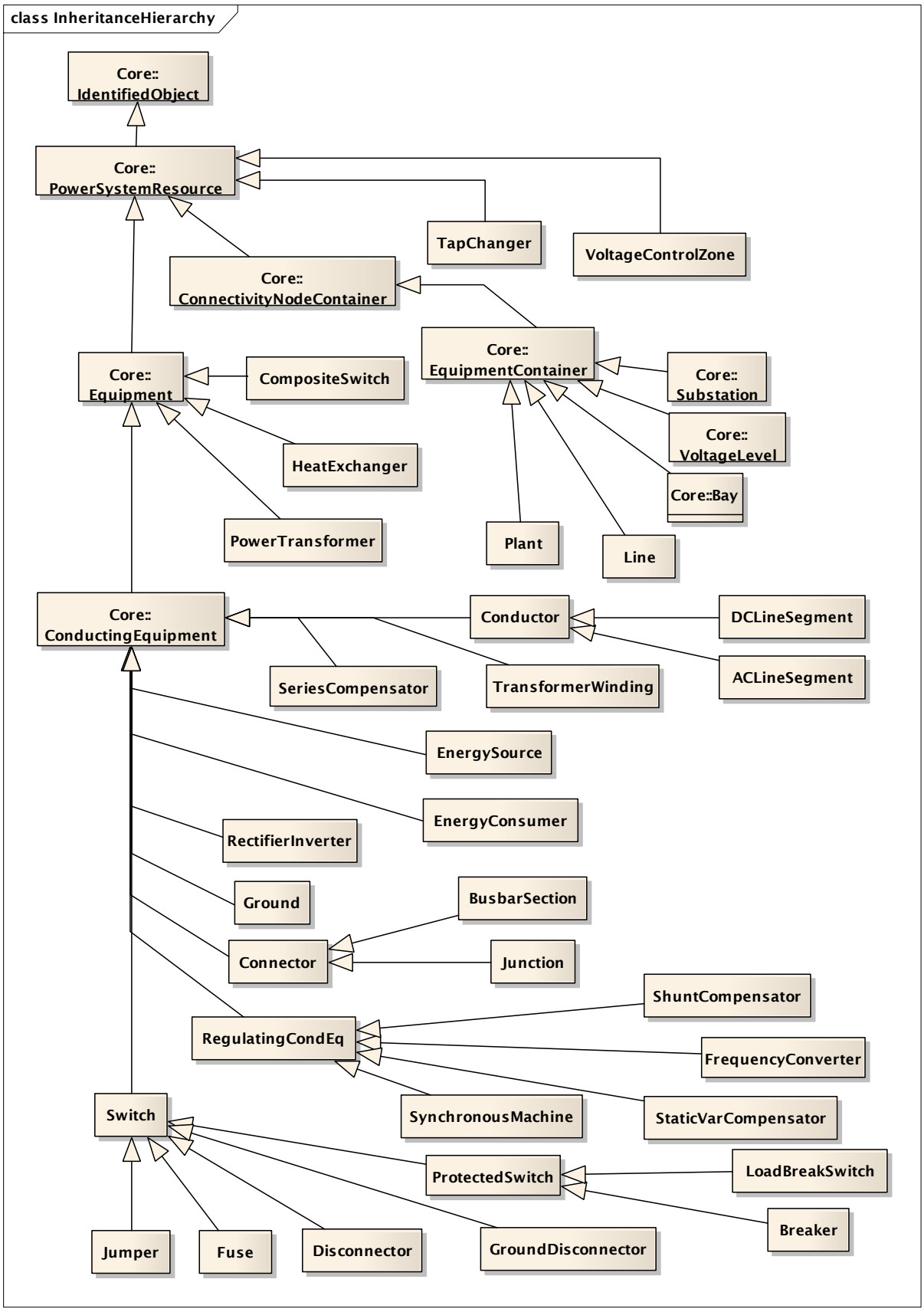

Figure 43 – Logical diagram Wires::InheritanceHierarchy

This diagram describes inheritance between classes in and related to the Wires package.

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Figure 44 shows logical diagram LineModel.

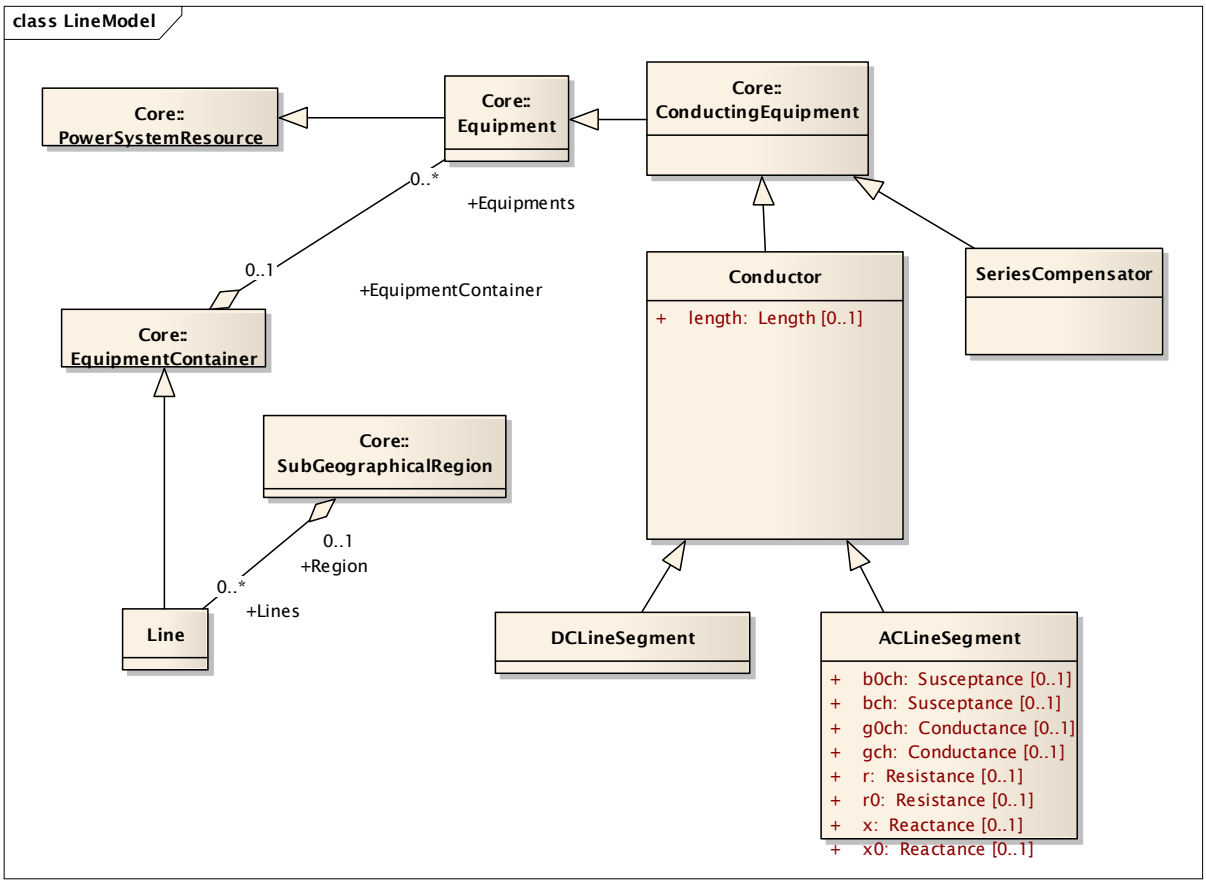

Figure 44 – Logical diagram Wires::LineModel

This diagram shows all classes related to the transmission line model.

Figure 45 shows logical diagram NamingHierarchyPart1.

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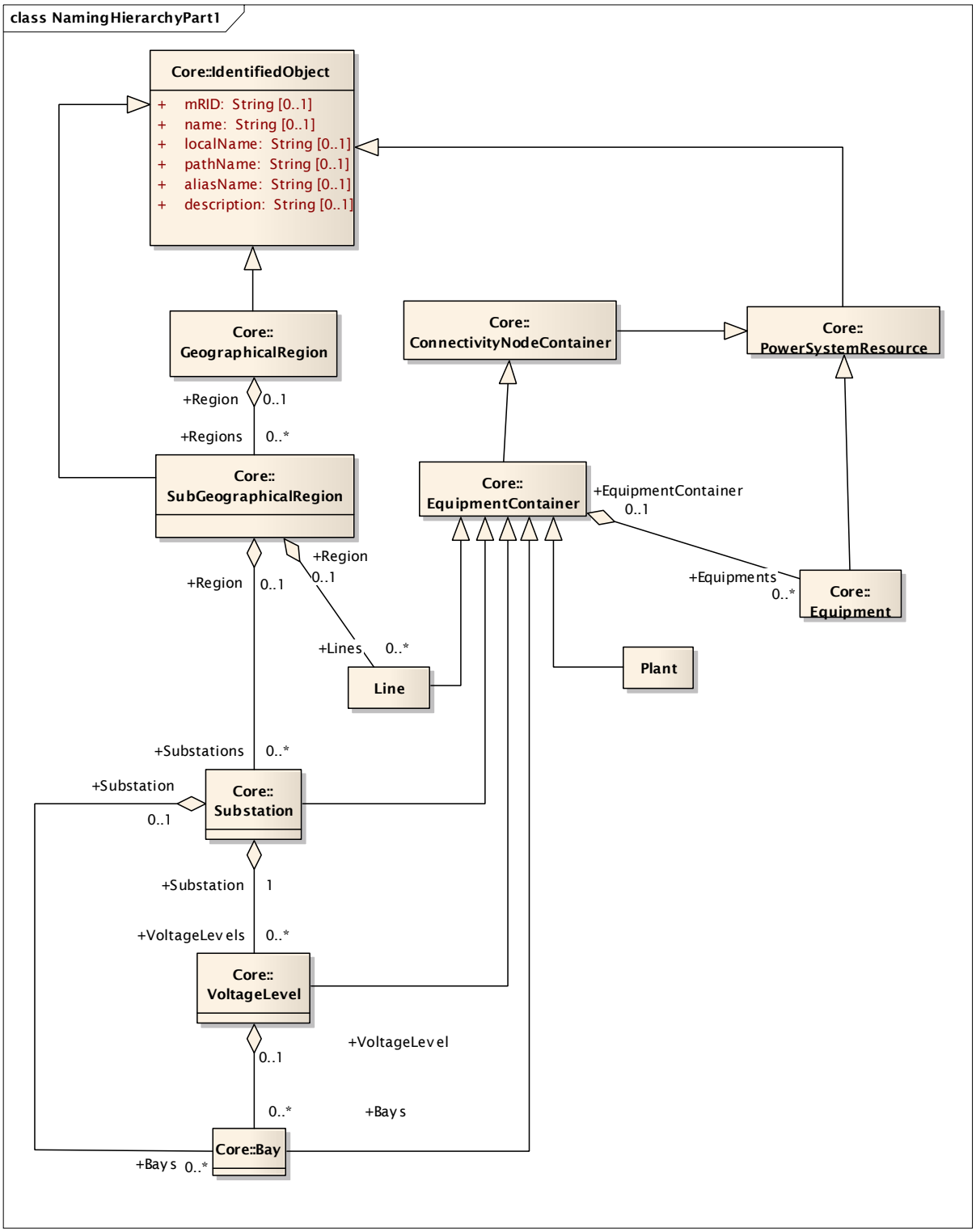

Figure 45 – Logical diagram Wires::NamingHierarchyPart1

This diagram shows the upper part of the naming hierarchy. The hierarchy is a way to organize and name equipment. Hence it is tightly related to the IdentifiedObject and its attributes. The Equipment class is further specialized into many subtypes that are all contained by subclasses of the EquipmentContainer.

Figure 46 shows logical diagram NamingHierarchyPart2.

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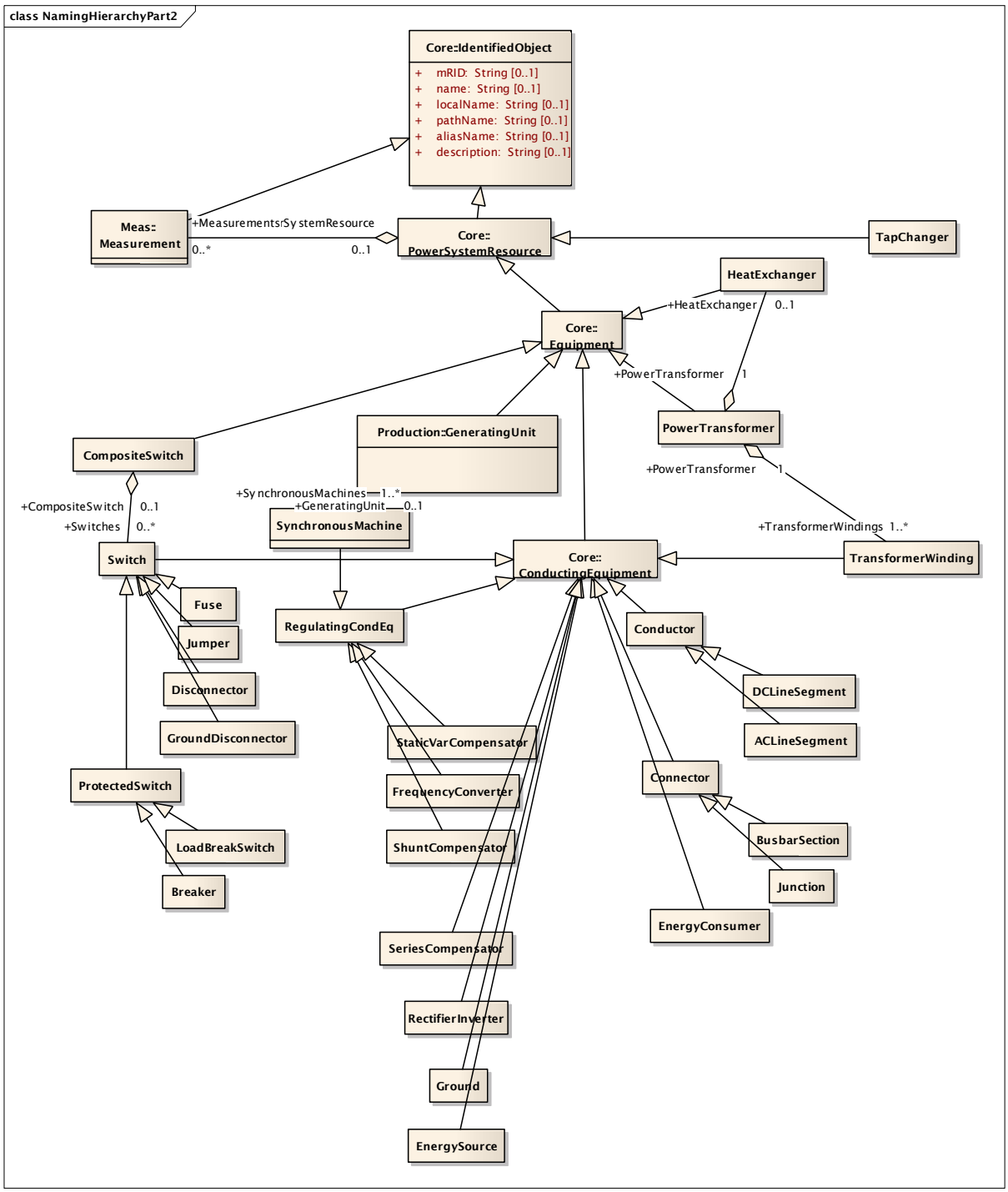

Figure 46 – Logical diagram Wires::NamingHierarchyPart2

The diagram shows the lower part of the naming hierarchy. It shows how the Equipment class is further specialized into many subtypes that are all contained by subclasses of the EquipmentContainer. For the subclasses of equipment container refer to part 1 of the diagram.

Figure 47 shows logical diagram RegulatingEquipment.

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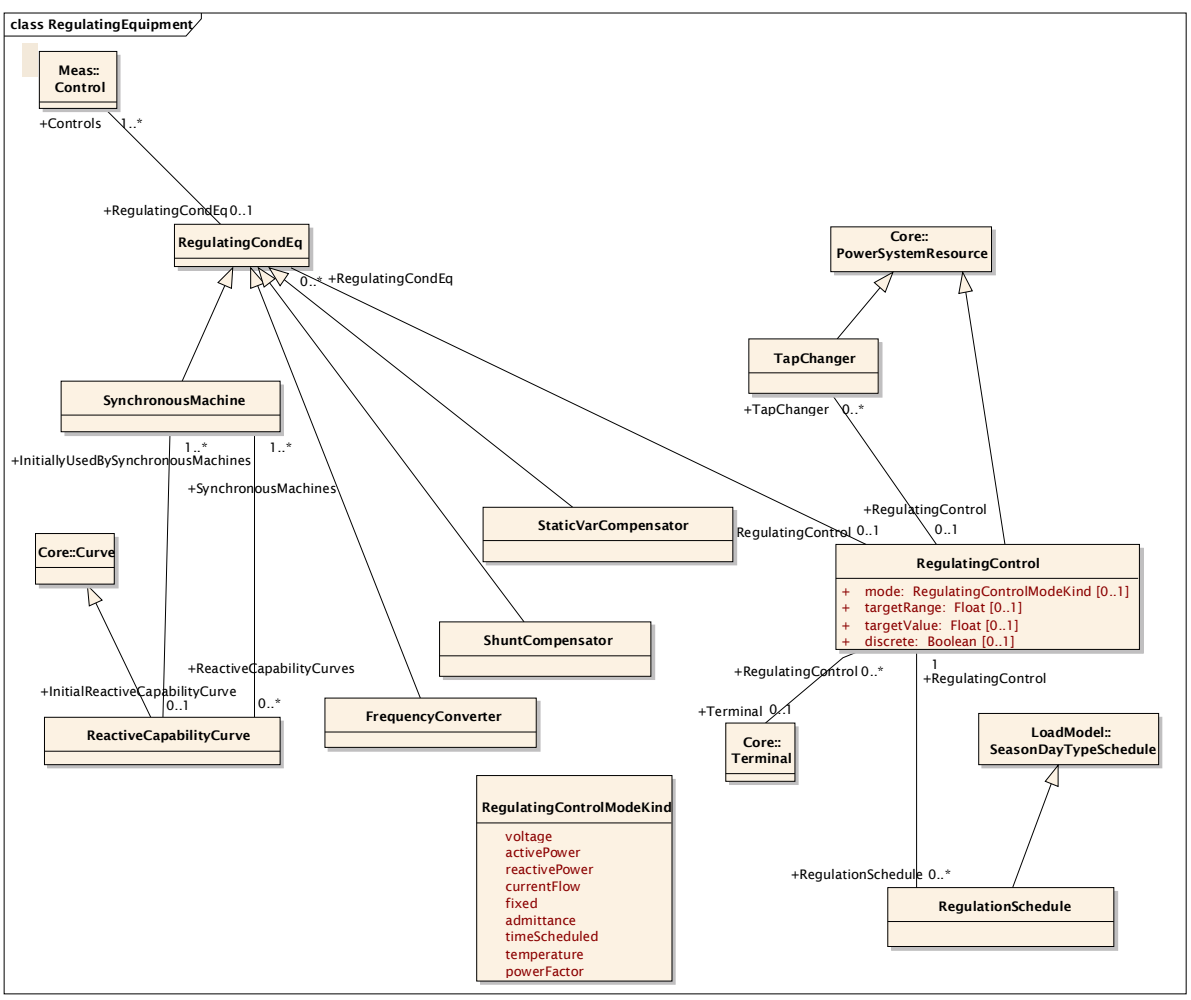

Figure 47 – Logical diagram Wires::RegulatingEquipment

The diagram shows all classes related to equipment regulation and reactive power compensation.

Figure 48 shows logical diagram TransformerModel.

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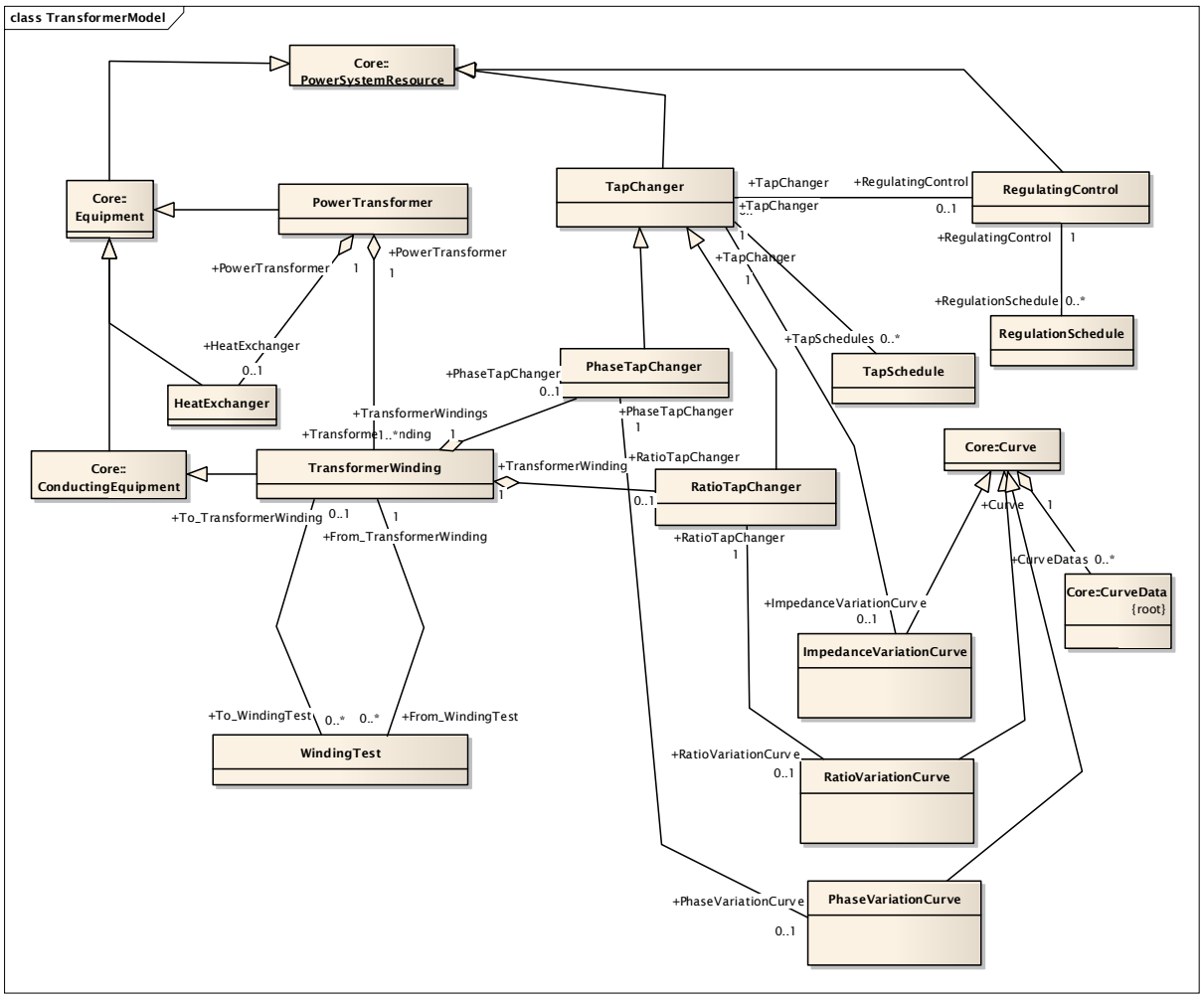

Figure 48 – Logical diagram Wires::TransformerModel

This diagram shows all classes related to the transformer model.

Figure 49 shows logical diagram VoltageControl.

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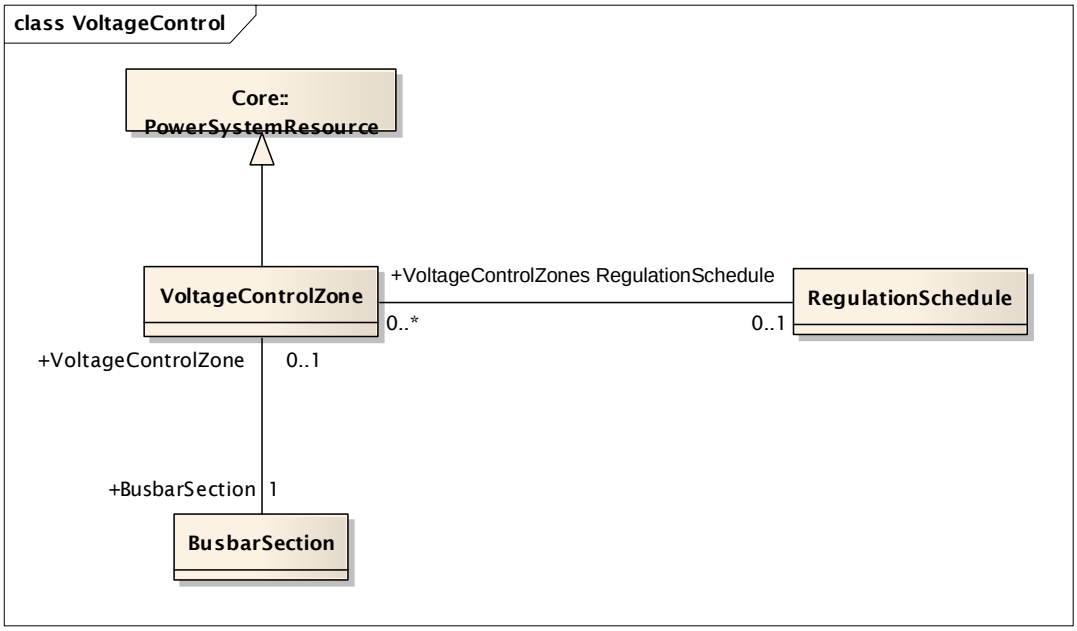

Figure 49 – Logical diagram Wires::VoltageControl

This diagram shows all classes related to area voltage control.

6.1.7.2 ImpedanceVariationCurve

An Impedance Variation Curve describes the change in Transformer Winding impedance values in relationship to tap step changes. The tap step is represented using the xValue, resistance using y1value, reactance using y2value, and magnetizing susceptance using y3value.

The resistance (r), reactance (x), and magnetizing susceptance (b) of the associated TransformerWinding define the impedance when the tap is at neutral step. The curve values represent the change to the impedance from the neutral step values. The impedance at a non-neutral step is calculated by adding the neutral step impedance (from the TransformerWinding) to the delta value from the curve.

Table 137 shows all attributes of ImpedanceVariationCurve.

Table 137 – Attributes of Wires::ImpedanceVariationCurve

name	type	description
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject

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name	type	description
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 138 shows all association ends of ImpedanceVariationCurve with other classes.

Table 138 – Association ends of Wires::ImpedanceVariationCurve with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] TapChanger	TapChanger	An ImpedanceVariationCurve is defines impedance changes for a TapChanger
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.7.3 PhaseVariationCurve

A Phase Variation Curve describes the phase shift in relationship to tap step changes. The tap step is represented using the xValue and the phase shift using y1value.

Table 139 shows all attributes of PhaseVariationCurve.

Table 139 – Attributes of Wires::PhaseVariationCurve

name	type	description
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 140 shows all association ends of PhaseVariationCurve with other classes.

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Table 140 – Association ends of Wires::PhaseVariationCurve with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] PhaseTapChanger	PhaseTapChanger	A PhaseVariationCurve defines phase shift changes for a PhaseTapChanger
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.7.4 RatioVariationCurve

A Ratio Variation Curve describes the change in tap ratio in relationship to tap step changes. The tap step is represented using the xValue and the ratio using y1value.

Table 141 shows all attributes of RatioVariationCurve.

Table 141 – Attributes of Wires::RatioVariationCurve

name	type	description
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 142 shows all association ends of RatioVariationCurve with other classes.

Table 142 – Association ends of Wires::RatioVariationCurve with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] RatioTapChanger	RatioTapChanger	A RatioVariationCurve defines tap ratio changes for a RatioTapChanger
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.7.5 RegulatingControlModeKind enumeration

The kind of regulation model. For example: regulating voltage, reactive power, active power, etc.

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Table 143 shows all literals of RegulatingControlModeKind.

Table 143 – Literals of Wires::RegulatingControlModeKind

literal	description
voltage	Voltage is specified
activePower	Active power is specified
reactivePower	Reactive power is specified
currentFlow	Current flow is specified
fixed	The regulation mode is fixed, and thus not regulating
admittance	Admittance is specified
timeScheduled	Control switches on/off by time of day. The times may change on the weekend, or in different seasons
temperature	Control switches on/off based on the local temperature (i.e. a thermostat)
powerFactor	

6.1.7.6 SwitchSchedule

Schedule of switch positions. If RegularTimePoint.value1 is 0, the switch is open. If 1, the switch is closed.

Table 144 shows all attributes of SwitchSchedule.

Table 144 – Attributes of Wires::SwitchSchedule

name	type	description
timeStep	Seconds	inherited from: RegularIntervalSchedule
endTime	AbsoluteDateTime	inherited from: RegularIntervalSchedule
startTime	AbsoluteDateTime	inherited from: BasicIntervalSchedule
value1Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
value2Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 145 shows all association ends of SwitchSchedule with other classes.

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Table 145 – Association ends of Wires::SwitchSchedule with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Switch	Switch	A SwitchSchedule is associated with a Switch
[0..*]	[0..1] DayType	DayType	inherited from: SeasonDayTypeSchedule
[0..*]	[0..1] Season	Season	inherited from: SeasonDayTypeSchedule
[1..1]	[1..*] TimePoints	RegularTimePoint	inherited from: RegularIntervalSchedule

6.1.7.7 ACLineSegment

A wire or combination of wires, with consistent electrical characteristics, building a single electrical system, used to carry alternating current between points in the power system.

Table 146 shows all attributes of ACLineSegment.

Table 146 – Attributes of Wires::ACLineSegment

name	type	description
b0ch	Susceptance	Zero sequence shunt (charging) susceptance, uniformly distributed, of the entire line section
bch	Susceptance	Positive sequence shunt (charging) susceptance, uniformly distributed, of the entire line section. This value represents the full charging over the full length of the line
g0ch	Conductance	Zero sequence shunt (charging) conductance, uniformly distributed, of the entire line section
gch	Conductance	Positive sequence shunt (charging) conductance, uniformly distributed, of the entire line section
r	Resistance	Positive sequence series resistance of the entire line section
r0	Resistance	Zero sequence series resistance of the entire line section
x	Reactance	Positive sequence series reactance of the entire line section
x0	Reactance	Zero sequence series reactance of the entire line section
length	Length	inherited from: Conductor
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 147 shows all association ends of ACLineSegment with other classes.

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Table 147 – Association ends of Wires::ACLineSegment with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.8 Breaker

A mechanical switching device capable of making, carrying, and breaking currents under normal circuit conditions and also making, carrying for a specified time, and breaking currents under specified abnormal circuit conditions e.g. those of short circuit.

Table 148 shows all attributes of Breaker.

Table 148 – Attributes of Wires::Breaker

name	type	description
ratedCurrent	CurrentFlow	Fault interrupting current rating
inTransitTime	Seconds	The transition time from open to close
normalOpen	Boolean	inherited from: Switch
switchOnCount	Integer	inherited from: Switch
switchOnDate	AbsoluteDateTime	inherited from: Switch
retained	Boolean	inherited from: Switch
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 149 shows all association ends of Breaker with other classes.

Table 149 – Association ends of Wires::Breaker with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ProtectedSwitch
[1..1]	[0..*] RecloseSequences	RecloseSequence	inherited from: ProtectedSwitch
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	inherited from: Switch
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	inherited from: Switch
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	inherited from: Switch
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.9 BusbarSection

A conductor, or group of conductors, with negligible impedance, that serves to connect other conducting equipment within a single substation.

Voltage measurements are typically obtained from VoltageTransformers that are connected to busbar sections. A busbar section may have many physical terminals but for analysis is modeled with exactly one logical terminal.

Table 150 shows all attributes of BusbarSection.

Table 150 – Attributes of Wires::BusbarSection

name	type	description
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject

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name	type	description
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 151 shows all association ends of BusbarSection with other classes.

Table 151 – Association ends of Wires::BusbarSection with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..1] VoltageControlZone	VoltageControlZone	A VoltageControlZone is controlled by a designated BusbarSection
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.10 CompositeSwitch

A model of a set of individual Switches normally enclosed within the same cabinet and possibly with interlocks that restrict the combination of switch positions. These are typically found in medium voltage distribution networks.

A CompositeSwitch could represent a Ring-Main-Unit (RMU), or pad-mounted switchgear, with primitive internal devices such as an internal busbar plus 3 or 4 internal switches each of which may individually be open or closed. A CompositeSwitch and a set of contained Switches can also be used to represent a multi-position switch e.g. a switch that can connect a circuit to Ground, Open or Busbar.

Table 152 shows all attributes of CompositeSwitch.

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Table 152 – Attributes of Wires::CompositeSwitch

name	type	description
compositeSwitchType	CompositeSwitchType	An alphanumeric code that can be used as a reference to extar information such as the description of the interlocking scheme if any
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 153 shows all association ends of CompositeSwitch with other classes.

Table 153 – Association ends of Wires::CompositeSwitch with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] Switches	Switch	Switches contained in this Composite switch
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.11 CompositeSwitchType datatype

An alphanumeric code that can be used as a reference to extar information such as the description of the interlocking scheme if any.

Table 154 shows all attributes of CompositeSwitchType.

Table 154 – Attributes of Wires::CompositeSwitchType

name	type	description
value	String	

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6.1.7.12 Conductor

Combination of conducting material with consistent electrical characteristics, building a single electrical system, used to carry current between points in the power system.

Table 155 shows all attributes of Conductor.

Table 155 – Attributes of Wires::Conductor

name	type	description
length	Length	Segment length for calculating line section capabilities
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 156 shows all association ends of Conductor with other classes.

Table 156 – Association ends of Wires::Conductor with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

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6.1.7.13 Connector

A conductor, or group of conductors, with negligible impedance, that serves to connect other conducting equipment within a single substation and are modeled with a single logical terminal.

Table 157 shows all attributes of Connector.

Table 157 – Attributes of Wires::Connector

name	type	description
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 158 shows all association ends of Connector with other classes.

Table 158 – Association ends of Wires::Connector with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.14 CoolantType enumeration

Method of cooling a machine.

Table 159 shows all literals of CoolantType.

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Table 159 – Literals of Wires::CoolantType

literal	description
air	
hydrogenGas	
water	

6.1.7.15 DCLineSegment

A wire or combination of wires not insulated from one another, with consistent electrical characteristics, used to carry direct current between points in the DC region of the power system.

Table 160 shows all attributes of DCLineSegment.

Table 160 – Attributes of Wires::DCLineSegment

name	type	description
dcSegmentInductance	Inductance	Inductance of the DC line segment
dcSegmentResistance	Resistance	Resistance of the DC line segment
length	Length	inherited from: Conductor
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 161 shows all association ends of DCLineSegment with other classes.

Table 161 – Association ends of Wires::DCLineSegment with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource

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[mult from]	[mult to] name	type	description
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.16 Disconnector

A manually operated or motor operated mechanical switching device used for changing the connections in a circuit, or for isolating a circuit or equipment from a source of power. It is required to open or close circuits when negligible current is broken or made.

Table 162 shows all attributes of Disconnector.

Table 162 – Attributes of Wires::Disconnector

name	type	description
normalOpen	Boolean	inherited from: Switch
switchOnCount	Integer	inherited from: Switch
switchOnDate	AbsoluteDateTime	inherited from: Switch
retained	Boolean	inherited from: Switch
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 163 shows all association ends of Disconnector with other classes.

Table 163 – Association ends of Wires::Disconnector with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	inherited from: Switch
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	inherited from: Switch
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	inherited from: Switch
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment

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[mult from]	[mult to] name	type	description
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.17 EnergyConsumer

Generic user of energy - a point of consumption on the power system model.

Table 164 shows all attributes of EnergyConsumer.

Table 164 – Attributes of Wires::EnergyConsumer

name	type	description
customerCount	Integer	Number of individual customers represented by this Demand
pfixed	ActivePower	Active power of the load that is a fixed quantity
pfixedPct	PerCent	Fixed active power as per cent of load group fixed active power
qfixed	ReactivePower	Reactive power of the load that is a fixed quantity
qfixedPct	PerCent	Fixed reactive power as per cent of load group fixed reactive power
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 165 shows all association ends of EnergyConsumer with other classes.

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Table 165 – Association ends of Wires::EnergyConsumer with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] LoadResponse	LoadResponseCharacteristic	The load response characteristic of this load
[1..*]	[0..1] PowerCutZone	PowerCutZone	An energy consumer is assigned to a power cut zone
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.18 EnergySource

A generic equivalent for an energy supplier on a transmission or distribution voltage level.

Table 166 shows all attributes of EnergySource.

Table 166 – Attributes of Wires::EnergySource

name	type	description
xn	Reactance	Negative sequence Thevenin reactance
rn	Resistance	Negative sequence Thevenin resistance
nominalVoltage	Voltage	Phase-to-phase nominal voltage
x	Reactance	Positive sequence Thevenin reactance
r	Resistance	Positive sequence Thevenin resistance
voltageAngle	AngleRadians	Phase angle of a-phase open circuit
voltageMagnitude	Voltage	Phase-to-phase open circuit voltage magnitude
x0	Reactance	Zero sequence Thevenin reactance
r0	Resistance	Zero sequence Thevenin resistance
activePower	ActivePower	High voltage source load
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject

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name	type	description
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 167 shows all association ends of EnergySource with other classes.

Table 167 – Association ends of Wires::EnergySource with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.19 FrequencyConverter

A device to convert from one frequency to another (e.g. frequency F1 to F2) comprises a pair of FrequencyConverter instances. One converts from F1 to DC, the other converts the DC to F2.

Table 168 shows all attributes of FrequencyConverter.

Table 168 – Attributes of Wires::FrequencyConverter

name	type	description
frequency	Frequency	Frequency on the AC side
maxP	ActivePower	The maximum active power on the DC side at which the frequency converter should operate
maxU	Voltage	The maximum voltage on the DC side at which the frequency converter should operate
minP	ActivePower	The minimum active power on the DC side at which the frequency converter should operate
minU	Voltage	The minimum voltage on the DC side at which

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name	type	description
		the frequency converter should operate
operatingMode	OperatingMode	Operating mode for the frequency converter
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 169 shows all association ends of FrequencyConverter with other classes.

Table 169 – Association ends of Wires::FrequencyConverter with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] RegulatingControl	RegulatingControl	inherited from: RegulatingCondEq
[0..1]	[1..*] Controls	Control	inherited from: RegulatingCondEq
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.20 Fuse

An overcurrent protective device with a circuit opening fusible part that is heated and severed by the passage of overcurrent through it. A fuse is considered a switching device because it breaks current.

Table 170 shows all attributes of Fuse.

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Table 170 – Attributes of Wires::Fuse

name	type	description
ratingCurrent	CurrentFlow	Fault interrupting current rating
normalOpen	Boolean	inherited from: Switch
switchOnCount	Integer	inherited from: Switch
switchOnDate	AbsoluteDateTime	inherited from: Switch
retained	Boolean	inherited from: Switch
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 171 shows all association ends of Fuse with other classes.

Table 171 – Association ends of Wires::Fuse with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	inherited from: Switch
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	inherited from: Switch
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	inherited from: Switch
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

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6.1.7.21 Ground

A common point for connecting grounded conducting equipment such as shunt capacitors. The power system model can have more than one ground.

Table 172 shows all attributes of Ground.

Table 172 – Attributes of Wires::Ground

name	type	description
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 173 shows all association ends of Ground with other classes.

Table 173 – Association ends of Wires::Ground with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.22 GroundDisconnector

A manually operated or motor operated mechanical switching device used for isolating a circuit or equipment from Ground.

Table 174 shows all attributes of GroundDisconnector.

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Table 174 – Attributes of Wires::GroundDisconnector

name	type	description
normalOpen	Boolean	inherited from: Switch
switchOnCount	Integer	inherited from: Switch
switchOnDate	AbsoluteDateTime	inherited from: Switch
retained	Boolean	inherited from: Switch
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 175 shows all association ends of GroundDisconnector with other classes.

Table 175 – Association ends of Wires::GroundDisconnector with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	inherited from: Switch
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	inherited from: Switch
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	inherited from: Switch
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.23 HeatExchanger

Equipment for the cooling of electrical equipment and the extraction of heat.

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Table 176 shows all attributes of HeatExchanger.

Table 176 – Attributes of Wires::HeatExchanger

name	type	description
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 177 shows all association ends of HeatExchanger with other classes.

Table 177 – Association ends of Wires::HeatExchanger with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] PowerTransformer	PowerTransformer	A transformer may have a heat exchanger
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.24 Jumper

A short section of conductor with negligible impedance which can be manually removed and replaced if the circuit is de-energized. Note that zero-impedance branches can be modeled by an ACLineSegment with a zero impedance ConductorType.

Table 178 shows all attributes of Jumper.

Table 178 – Attributes of Wires::Jumper

name	type	description
normalOpen	Boolean	inherited from: Switch
switchOnCount	Integer	inherited from: Switch
switchOnDate	AbsoluteDateTime	inherited from: Switch
retained	Boolean	inherited from: Switch

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name	type	description
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 179 shows all association ends of Jumper with other classes.

Table 179 – Association ends of Wires::Jumper with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	inherited from: Switch
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	inherited from: Switch
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	inherited from: Switch
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.25 Junction

A point where one or more conducting equipments are connected with zero resistance.

Table 180 shows all attributes of Junction.

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Table 180 – Attributes of Wires::Junction

name	type	description
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 181 shows all association ends of Junction with other classes.

Table 181 – Association ends of Wires::Junction with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.26 Line

Contains equipment beyond a substation belonging to a power transmission line.

Table 182 shows all attributes of Line.

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Table 182 – Attributes of Wires::Line

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 183 shows all association ends of Line with other classes.

Table 183 – Association ends of Wires::Line with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] Region	SubGeographicalRegion	A Line can be contained by a SubGeographical Region
[0..1]	[0..*] Equipments	Equipment	inherited from: EquipmentContainer
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	inherited from: ConnectivityNodeContainer
[0..1]	[0..*] TopologicalNode	TopologicalNode	inherited from: ConnectivityNodeContainer
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.27 LoadBreakSwitch

A mechanical switching device capable of making, carrying, and breaking currents under normal operating conditions.

Table 184 shows all attributes of LoadBreakSwitch.

Table 184 – Attributes of Wires::LoadBreakSwitch

name	type	description
ratedCurrent	CurrentFlow	Current carrying capacity of a wire or cable under stated thermal conditions
normalOpen	Boolean	inherited from: Switch
switchOnCount	Integer	inherited from: Switch
switchOnDate	AbsoluteDateTime	inherited from: Switch
retained	Boolean	inherited from: Switch
phases	PhaseCode	inherited from: ConductingEquipment

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name	type	description
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 185 shows all association ends of LoadBreakSwitch with other classes.

Table 185 – Association ends of Wires::LoadBreakSwitch with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ProtectedSwitch
[1..1]	[0..*] RecloseSequences	RecloseSequence	inherited from: ProtectedSwitch
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	inherited from: Switch
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	inherited from: Switch
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	inherited from: Switch
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.28 MutualCoupling

This class represents the zero sequence line mutual coupling.

Table 186 shows all attributes of MutualCoupling.

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Table 186 – Attributes of Wires::MutualCoupling

name	type	description
b0ch	Susceptance	Zero sequence mutual coupling shunt (charging) susceptance, uniformly distributed, of the entire line section
distance11	Length	Distance from the first line's specified terminal to start of coupled region
distance12	Length	Distance from the first line's from specified terminal to end of coupled region
distance21	Length	Distance from the second line's specified terminal to start of coupled region
distance22	Length	Distance from the second line's specified terminal to end of coupled region
g0ch	Conductance	Zero sequence mutual coupling shunt (charging) conductance, uniformly distributed, of the entire line section
r0	Resistance	Zero sequence branch-to-branch mutual impedance coupling, resistance
x0	Reactance	Zero sequence branch-to-branch mutual impedance coupling, reactance
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 187 shows all association ends of MutualCoupling with other classes.

Table 187 – Association ends of Wires::MutualCoupling with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Second_Terminal	Terminal	The starting terminal for the calculation of distances along the second branch of the mutual coupling
[0..*]	[1..1] First_Terminal	Terminal	The starting terminal for the calculation of distances along the first branch of the mutual coupling. Normally MutualCoupling would only be used for terminals of AC line segments. The first and second terminals of a mutual coupling should point to different AC line segments

6.1.7.29 OperatingMode datatype

Textual name for an operating mode.

Table 188 shows all attributes of OperatingMode.

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Table 188 – Attributes of Wires::OperatingMode

name	type	description
value	String	

6.1.7.30 PhaseTapChanger

A specialization of a voltage tap changer that has detailed modeling for phase shifting capabilities. A phase shifting tap changer is also in general a voltage magnitude transformer. The symmetrical and asymmetrical transformer tap changer models are defined here.

Table 189 shows all attributes of PhaseTapChanger.

Table 189 – Attributes of Wires::PhaseTapChanger

name	type	description
nominalVoltageOutOfPhase	Voltage	Similar to TapChanger.nominalVoltage, but this is the nominal voltage in the out of phase winding at the nominal tap step. A typical case may have zero voltage at the nominal step, indicating no phase shift at the nominal voltage
phaseTapChangerType	PhaseTapChangerKind	The type of phase shifter construction
stepPhaseShiftIncrement	AngleDegrees	Phase shift per step position. A positive value indicates a positive phase shift from the winding where the tap is located to the other winding (for a two-winding transformer). The actual phase shift increment might be more accurately computed from the symmetrical or asymmetrical models or a tap step table lookup if those are available
voltageStepIncrementOutOfPhase	Voltage	The voltage step increment on the out of phase winding. This voltage step on the out of phase winding of the phase shifter. Similar to TapChanger.voltageStepIncrement, but it is applied only to the out of phase winding
windingConnectionAngle	AngleDegrees	The phase angle between the in-phase winding and the out-of -phase winding used for creating phase shift. It is only possible to have a symmemtrical transformer if this angle is 90 degrees
xStepMax	Reactance	The reactance at the maximum tap step
xStepMin	Reactance	The reactance at the minimum tap step
highStep	Integer	inherited from: TapChanger
initialDelay	Seconds	inherited from: TapChanger
lowStep	Integer	inherited from: TapChanger
ltcFlag	Boolean	inherited from: TapChanger
neutralStep	Integer	inherited from: TapChanger
neutralU	Voltage	inherited from: TapChanger
normalStep	Integer	inherited from: TapChanger
regulationStatus	Boolean	inherited from: TapChanger
stepVoltageIncrement	PerCent	inherited from: TapChanger
subsequentDelay	Seconds	inherited from: TapChanger
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject

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name	type	description
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 190 shows all association ends of PhaseTapChanger with other classes.

Table 190 – Association ends of Wires::PhaseTapChanger with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] TransformerWinding	TransformerWinding	The transformer winding to which the phase tap changer belongs
[1..1]	[0..1] PhaseVariationCurve	PhaseVariationCurve	A PhaseTapChanger can have an associated PhaseVariationCurve to define phase shift variations with tap step changes
[0..1]	[1..1] Winding	DistributionTransformerWinding	Transformer winding to which this phase tap changer belongs
[0..*]	[0..1] RegulatingControl	RegulatingControl	inherited from: TapChanger
[1..1]	[0..1] SvTapStep	SvTapStep	inherited from: TapChanger
[1..1]	[0..1] ImpedanceVariationCurve	ImpedanceVariationCurve	inherited from: TapChanger
[1..1]	[0..*] TapSchedules	TapSchedule	inherited from: TapChanger
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.31 PhaseTapChangerKind enumeration

The construction type of the phase shifting tap changer.

Table 191 shows all literals of PhaseTapChangerKind.

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Table 191 – Literals of Wires::PhaseTapChangerKind

literal	description
asymmetrical	Asymmetrical phase shifter construction. The assymetrical construction type causes the voltage ratio to change as the phase shift changes. An asymmetrical phase shifter can have the out-of-phase winding connected at 90° or otherwise
symmetrical	The phase shifter construction is symmetrical. A symmetrical construction causes the turns ratio and voltage magnitude transformation to remain constant while the voltage phase is shifted. A symmetrical construction typically requires the out of phase winding to be connected at 90°
unknown	Unknown construction type.

6.1.7.32 Plant

A Plant is a collection of equipment for purposes of generation.

Table 192 shows all attributes of Plant.

Table 192 – Attributes of Wires::Plant

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 193 shows all association ends of Plant with other classes.

Table 193 – Association ends of Wires::Plant with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] Equipments	Equipment	inherited from: EquipmentContainer
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	inherited from: ConnectivityNodeContainer
[0..1]	[0..*] TopologicalNode	TopologicalNode	inherited from: ConnectivityNodeContainer
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

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6.1.7.33 PowerTransformer

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 (active power flow).

Table 194 shows all attributes of PowerTransformer.

Table 194 – Attributes of Wires::PowerTransformer

name	type	description
bmagSat	PerCent	Core shunt magnetizing susceptance in the saturation region
magBaseU	Voltage	The reference voltage at which the magnetizing saturation measurements were made
magSatFlux	PerCent	Core magnetizing saturation curve knee flux level
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 195 shows all association ends of PowerTransformer with other classes.

Table 195 – Association ends of Wires::PowerTransformer with other classes

[mult from]	[mult to] name	type	description
[1..1]	[1..*] TransformerWindings	TransformerWinding	A transformer has windings
[1..1]	[0..1] HeatExchanger	HeatExchanger	A transformer may have a heat exchanger
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.34 ProtectedSwitch

A ProtectedSwitch is a switching device that can be operated by ProtectionEquipment.

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Table 196 shows all attributes of ProtectedSwitch.

Table 196 – Attributes of Wires::ProtectedSwitch

name	type	description
normalOpen	Boolean	inherited from: Switch
switchOnCount	Integer	inherited from: Switch
switchOnDate	AbsoluteDateTime	inherited from: Switch
retained	Boolean	inherited from: Switch
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 197 shows all association ends of ProtectedSwitch with other classes.

Table 197 – Association ends of Wires::ProtectedSwitch with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	Protection equipments that operate this ProtectedSwitch
[1..1]	[0..*] RecloseSequences	RecloseSequence	A breaker may have zero or more automatic reclosures after a trip occurs
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	inherited from: Switch
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	inherited from: Switch
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	inherited from: Switch
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

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6.1.7.35 RatioTapChanger

A tap changer that changes the voltage ratio impacting the voltage magnitude but not directly the phase angle across the transformer.

Table 198 shows all attributes of RatioTapChanger.

Table 198 – Attributes of Wires::RatioTapChanger

name	type	description
tculControlMode	TransformerControlMode	Specifies the regulation control mode (voltage or reactive) of the RatioTapChanger
highStep	Integer	inherited from: TapChanger
initialDelay	Seconds	inherited from: TapChanger
lowStep	Integer	inherited from: TapChanger
ltcFlag	Boolean	inherited from: TapChanger
neutralStep	Integer	inherited from: TapChanger
neutralU	Voltage	inherited from: TapChanger
normalStep	Integer	inherited from: TapChanger
regulationStatus	Boolean	inherited from: TapChanger
stepVoltageIncrement	PerCent	inherited from: TapChanger
subsequentDelay	Seconds	inherited from: TapChanger
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 199 shows all association ends of RatioTapChanger with other classes.

Table 199 – Association ends of Wires::RatioTapChanger with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] TransformerWinding	TransformerWinding	The transformer winding to which the ratio tap changer belongs
[1..1]	[0..1] RatioVariationCurve	RatioVariationCurve	A RatioTapChanger can have an associated RatioVariationCurve to define tap ratio variations with tap step changes
[0..1]	[1..1] Winding	DistributionTransformerWinding	Winding to which this ratio tap changer belongs
[0..*]	[0..1] RegulatingControl	RegulatingControl	inherited from: TapChanger
[1..1]	[0..1] SvTapStep	SvTapStep	inherited from: TapChanger
[1..1]	[0..1] ImpedanceVariationCurve	ImpedanceVariationCurve	inherited from: TapChanger
[1..1]	[0..*] TapSchedules	TapSchedule	inherited from: TapChanger
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from:

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[mult from]	[mult to] name	type	description
			PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.36 ReactiveCapabilityCurve

Reactive power rating envelope versus the synchronous machine's active power, in both the generating and motoring modes. For each active power value there is a corresponding high and low reactive power limit value. Typically there will be a separate curve for each coolant condition, such as hydrogen pressure. The Y1 axis values represent reactive minimum and the Y2 axis values represent reactive maximum.

Table 200 shows all attributes of ReactiveCapabilityCurve.

Table 200 – Attributes of Wires::ReactiveCapabilityCurve

name	type	description
coolantTemperature	Temperature	The machine's coolant temperature (e.g., ambient air or stator circulating water)
hydrogenPressure	Pressure	The hydrogen coolant pressure
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 201 shows all association ends of ReactiveCapabilityCurve with other classes.

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Table 201 – Association ends of Wires::ReactiveCapabilityCurve with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..*] InitiallyUsedBySynchronous Machines	SynchronousMachine	Synchronous machines using this curve as default
[0..*]	[1..*] SynchronousMachines	SynchronousMachine	Synchronous machines using this curve
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.7.37 RectifierInverter

Bi-directional AC-DC conversion equipment that can be used to control DC current, DC voltage, DC power flow, or firing angle.

Table 202 shows all attributes of RectifierInverter.

Table 202 – Attributes of Wires::RectifierInverter

name	type	description
ratedU	Voltage	Rectifier/inverter primary base voltage
bridges	Integer	Number of bridges
commutatingReactance	Reactance	Commutating reactance at AC bus frequency
commutatingResistance	Resistance	Commutating resistance
compoundResistance	Resistance	Compounding resistance
minCompoundVoltage	Voltage	Minimum compounded DC voltage
frequency	Frequency	Frequency on the AC side
maxP	ActivePower	The maximum active power on the DC side at which the converter should operate
minP	ActivePower	The minimum active power on the DC side at which the converter should operate.
maxU	Voltage	The maximum voltage on the DC side at which the converter should operate
minU	Voltage	The minimum voltage on the DC side at which the converter should operate
operatingMode	OperatingMode	Operating mode for the converter
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 203 shows all association ends of RectifierInverter with other classes.

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Table 203 – Association ends of Wires::RectifierInverter with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.38 RegulatingCondEq

A type of conducting equipment that can regulate a quanity (i.e. voltage or flow) at a specific point in the network.

Table 204 shows all attributes of RegulatingCondEq.

Table 204 – Attributes of Wires::RegulatingCondEq

name	type	description
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 205 shows all association ends of RegulatingCondEq with other classes.

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Table 205 – Association ends of Wires::RegulatingCondEq with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] RegulatingControl	RegulatingControl	The regulating control scheme in which this equipment participates
[0..1]	[1..*] Controls	Control	The controller outputs used to actually govern a regulating device, e.g. the magnetization of a synchronous machine or capacitor bank breaker actuator
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.39 RegulatingControl

Specifies a set of equipment that works together to control a power system quantity such as voltage or flow.

Table 206 shows all attributes of RegulatingControl.

Table 206 – Attributes of Wires::RegulatingControl

name	type	description
mode	RegulatingControlModeKind	The regulating control mode presently available. This specifications allows for determining the kind of regualation without need for obtaining the units from a schedule
targetRange	Float	This is the case input target range. This performs the same function as the value2 attribute on the regulation schedule in the case that schedules are not used. The units of those appropriate for the mode
targetValue	Float	The target value specified for case input. This value can be used for the target value without the use of schedules. The value has the units appropriate to the mode attribute
discrete	Boolean	The regulation is performed in a discrete mode
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject

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name	type	description
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 207 shows all association ends of RegulatingControl with other classes.

Table 207 – Association ends of Wires::RegulatingControl with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] TapChanger	TapChanger	The tap changers participating in regulation
[0..*]	[0..1] Terminal	Terminal	The terminal associated with this regulating control
[0..1]	[0..*] RegulatingCondEq	RegulatingCondEq	The equipment participating in regulating control
[1..1]	[0..*] RegulationSchedule	RegulationSchedule	Schedule for this Regulating regulating control
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.40 RegulationSchedule

A pre-established pattern over time for a controlled variable, e.g. busbar voltage.

Table 208 shows all attributes of RegulationSchedule.

Table 208 – Attributes of Wires::RegulationSchedule

name	type	description
lineDropCompensation	Boolean	Flag to indicate that line drop compensation is to be applied
lineDropR	Resistance	Line drop resistance
lineDropX	Reactance	Line drop reactance
timeStep	Seconds	inherited from: RegularIntervalSchedule
endTime	AbsoluteDateTime	inherited from: RegularIntervalSchedule
startTime	AbsoluteDateTime	inherited from: BasicIntervalSchedule
value1Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
value2Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
mRID	String	inherited from: IdentifiedObject

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name	type	description
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 209 shows all association ends of RegulationSchedule with other classes.

Table 209 – Association ends of Wires::RegulationSchedule with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] RegulatingControl	RegulatingControl	Regulating controls that have this Schedule
[0..1]	[0..*] VoltageControlZones	VoltageControlZone	A VoltageControlZone may have a voltage regulation schedule
[0..*]	[0..1] DayType	DayType	inherited from: SeasonDayTypeSchedule
[0..*]	[0..1] Season	Season	inherited from: SeasonDayTypeSchedule
[1..1]	[1..*] TimePoints	RegularTimePoint	inherited from: RegularIntervalSchedule

6.1.7.41 Resistor

Resistor, typically used in filter configurations or as earthing resistor for transformers. Used for electrical model of distribution networks.

Table 210 shows all attributes of Resistor.

Table 210 – Attributes of Wires::Resistor

name	type	description
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 211 shows all association ends of Resistor with other classes.

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Table 211 – Association ends of Wires::Resistor with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.42 SeriesCompensator

A Series Compensator is a series capacitor or reactor or an AC transmission line without charging susceptance. It is a two-terminal device.

Table 212 shows all attributes of SeriesCompensator.

Table 212 – Attributes of Wires::SeriesCompensator

name	type	description
r	Resistance	Positive sequence resistance
x	Reactance	Positive sequence reactance
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 213 shows all association ends of SeriesCompensator with other classes.

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Table 213 – Association ends of Wires::SeriesCompensator with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.43 ShuntCompensator

A shunt capacitor or reactor or switchable bank of shunt capacitors or reactors. A section of a shunt compensator is an individual capacitor or reactor. A negative value for reactivePerSection indicates that the compensator is a reactor. ShuntCompensator is a single terminal device. Ground is implied.

Table 214 shows all attributes of ShuntCompensator.

Table 214 – Attributes of Wires::ShuntCompensator

name	type	description
aVRDelay	Seconds	Time delay required for the device to be connected or disconnected by automatic voltage regulation (AVR)
b0PerSection	Susceptance	Zero sequence shunt (charging) susceptance per section
bPerSection	Susceptance	Positive sequence shunt (charging) susceptance per section
g0PerSection	Conductance	Zero sequence shunt (charging) conductance per section
gPerSection	Conductance	Positive sequence shunt (charging) conductance per section
maximumSections	Integer	For a capacitor bank, the maximum number of sections that may be switched in
maxU	Voltage	The maximum voltage at which the capacitor bank should operate
minU	Voltage	The minimum voltage at which the capacitor bank should operate
nomQ	ReactivePower	Nominal reactive power output of the capacitor bank at the nominal voltage. This number should be positive

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name	type	description
nomU	Voltage	The nominal voltage at which the nominal reactive power was measured. This should normally be within 10 % of the voltage at which the capacitor is connected to the network
normalSections	Integer	For a capacitor bank, the normal number of sections switched in. This number should correspond to the nominal reactive power (nomQ)
reactivePerSection	ReactivePower	For a capacitor bank, the size in reactive power of each switchable section at the nominal voltage
switchOnCount	Integer	The switch on count since the capacitor count was last reset or initialized
switchOnDate	AbsoluteDateTime	The date and time when the capacitor bank was last switched on
voltageSensitivity	VoltagePerReactivePower	Voltage sensitivity required for the device to regulate the bus voltage, in voltage/reactive power
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 215 shows all association ends of ShuntCompensator with other classes.

Table 215 – Association ends of Wires::ShuntCompensator with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..1] SvShuntCompensatorSections	SvShuntCompensatorSections	The state for the number of shunt compensator sections in service
[0..*]	[0..1] RegulatingControl	RegulatingControl	inherited from: RegulatingCondEq
[0..1]	[1..*] Controls	Control	inherited from: RegulatingCondEq
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource

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[mult from]	[mult to] name	type	description
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.44 StaticVarCompensator

A facility for providing variable and controllable shunt reactive power. The SVC typically consists of a stepdown transformer, filter, thyristor-controlled reactor, and thyristor-switched capacitor arms.

The SVC may operate in fixed MVar output mode or in voltage control mode. When in voltage control mode, the output of the SVC will be proportional to the deviation of voltage at the controlled bus from the voltage setpoint. The SVC characteristic slope defines the proportion. If the voltage at the controlled bus is equal to the voltage setpoint, the SVC MVar output is zero.

Table 216 shows all attributes of StaticVarCompensator.

Table 216 – Attributes of Wires::StaticVarCompensator

name	type	description
capacitiveRating	Reactance	Maximum available capacitive reactive power
inductiveRating	Reactance	Maximum available inductive reactive power
sVCControlMode	SVCControlMode	SVC control mode
slope	VoltagePerReactivePower	The characteristics slope of an SVC defines how the reactive power output changes in proportion to the difference between the regulated bus voltage and the voltage setpoint
voltageSetPoint	Voltage	The reactive power output of the SVC is proportional to the difference between the voltage at the regulated bus and the voltage setpoint. When the regulated bus voltage is equal to the voltage setpoint, the reactive power output is zero
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 217 shows all association ends of StaticVarCompensator with other classes.

Table 217 – Association ends of Wires::StaticVarCompensator with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] RegulatingControl	RegulatingControl	inherited from: RegulatingCondEq
[0..1]	[1..*] Controls	Control	inherited from: RegulatingCondEq
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.45 SVCControlMode enumeration

Static VAr Compensator control mode.

Table 218 shows all literals of SVCControlMode.

Table 218 – Literals of Wires::SVCControlMode

literal	description
reactivePower	
voltage	
off	

6.1.7.46 Switch

A generic device designed to close, or open, or both, one or more electric circuits.

Table 219 shows all attributes of Switch.

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Table 219 – Attributes of Wires::Switch

name	type	description
normalOpen	Boolean	The attribute is used in cases when no Measurement for the status value is present. If the Switch has a status measurement the Discrete.normalValue is expected to match with the Switch.normalOpen
switchOnCount	Integer	The switch on count since the switch was last reset or initialized
switchOnDate	AbsoluteDateTime	The date and time when the switch was last switched on
retained	Boolean	Branch is retained in a bus branch model
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 220 shows all association ends of Switch with other classes.

Table 220 – Association ends of Wires::Switch with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	A Switch can be associated with SwitchSchedules
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	Composite switch this Switch belongs to
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	A switch may be operated by many schedules
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

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6.1.7.47 SynchronousMachine

An electromechanical device that operates synchronously with the network. It is a single machine operating either as a generator or synchronous condenser or pump.

Table 221 shows all attributes of SynchronousMachine.

Table 221 – Attributes of Wires::SynchronousMachine

name	type	description
aVRToManualLag	Seconds	Time delay required when switching from Automatic Voltage Regulation (AVR) to Manual for a lagging MVAr violation
aVRToManualLead	Seconds	Time delay required when switching from Automatic Voltage Regulation (AVR) to Manual for a leading MVAr violation
baseQ	ReactivePower	Default base reactive power value. This value represents the initial reactive power that can be used by any application function
condenserP	ActivePower	Active power consumed when in condenser mode operation
coolantCondition	Float	Temperature or pressure of coolant medium
coolantType	CoolantType	Method of cooling the machine
damping	Damping	Damping torque coefficient, a proportionality constant that, when multiplied by the angular velocity of the rotor poles with respect to the magnetic field (frequency), results in the damping torque
inertia	PU	The energy stored in the rotor when operating at rated speed. This value is used in the accelerating power reference frame for operator training simulator solutions
manualToAVR	Seconds	Time delay required when switching from Manual to Automatic Voltage Regulation. This value is used in the accelerating power reference frame for powerflow solutions
maxQ	ReactivePower	Maximum reactive power limit. This is the maximum (nameplate) limit for the unit
maxU	Voltage	Maximum voltage limit for the unit
minQ	ReactivePower	Minimum reactive power limit for the unit
minU	Voltage	Minimum voltage limit for the unit
operatingMode	SynchronousMachineOperatingMode	Current mode of operation
qPercent	PerCent	Percent of the coordinated reactive control that comes from this machine
r	Resistance	Positive sequence resistance of the synchronous machine
r0	Resistance	Zero sequence resistance of the synchronous machine
r2	Resistance	Negative sequence resistance
ratedS	ApparentPower	Nameplate apparent power rating for the unit
referencePriority	Integer	Priority of unit for reference bus selection. 0 = don t care (default) 1 = highest priority. 2 is less than 1 and so on
type	SynchronousMachineType	Modes that this synchronous machine can operate in
x	Reactance	Positive sequence reactance of the synchronous machine

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name	type	description
x0	Reactance	Zero sequence reactance of the synchronous machine
x2	Reactance	Negative sequence reactance
xDirectSubtrans	Reactance	Direct-axis subtransient reactance, also known as X"d
xDirectSync	Reactance	Direct-axis synchronous reactance. The quotient of a sustained value of that AC component of armature voltage that is produced by the total direct-axis flux due to direct-axis armature current and the value of the AC component of this current, the machine running at rated speed. (Xd)
xDirectTrans	Reactance	Direct-axis transient reactance, also known as X'd
xQuadSubtrans	Reactance	Quadrature-axis subtransient reactance, also known as X"q
xQuadSync	Reactance	Quadrature-axis synchronous reactance (Xq) , the ratio of the component of reactive armature voltage, due to the quadrature-axis component of armature current, to this component of current, under steady state conditions and at rated frequency
xQuadTrans	Reactance	Quadrature-axis transient reactance, also known as X'q
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 222 shows all association ends of SynchronousMachine with other classes.

Table 222 – Association ends of Wires::SynchronousMachine with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..1] HydroPump	HydroPump	The synchronous machine drives the turbine which moves the water from a low elevation to a higher elevation. The direction of machine rotation for pumping may or may not be the same as for generating
[1..*]	[0..1] InitialReactiveCapabilityCurve	ReactiveCapabilityCurve	The default ReactiveCapabilityCurve for use by a SynchronousMachine
[1..*]	[0..*] ReactiveCapabilityCurves	ReactiveCapabilityCurve	All available Reactive capability curves for this SynchronousMachine
[1..*]	[0..1] GeneratingUnit	GeneratingUnit	A synchronous machine may operate as a generator and as such becomes a member of a generating unit
[0..*]	[0..*] PrimeMovers	PrimeMover	Prime movers that drive this SynchronousMachine

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[mult from]	[mult to] name	type	description
[0..*]	[0..1] RegulatingControl	RegulatingControl	inherited from: RegulatingCondEq
[0..1]	[1..*] Controls	Control	inherited from: RegulatingCondEq
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.48 SynchronousMachineOperatingMode enumeration

Synchronous machine operating mode.

Table 223 shows all literals of SynchronousMachineOperatingMode.

Table 223 – Literals of Wires::SynchronousMachineOperatingMode

literal	description
generator	
condenser	

6.1.7.49 SynchronousMachineType enumeration

Synchronous machine type.

Table 224 shows all literals of SynchronousMachineType.

Table 224 – Literals of Wires::SynchronousMachineType

literal	description
generator	
condenser	
generator_or_condenser	

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6.1.7.50 TapChanger

Mechanism for changing transformer winding tap positions.

Table 225 shows all attributes of TapChanger.

Table 225 – Attributes of Wires::TapChanger

name	type	description
highStep	Integer	Highest possible tap step position, advance from neutral
initialDelay	Seconds	For an LTC, the delay for initial tap changer operation (first step change)
lowStep	Integer	Lowest possible tap step position, retard from neutral
ltcFlag	Boolean	Specifies whether or not a TapChanger has load tap changing capabilities
neutralStep	Integer	The neutral tap step position for this winding
neutralU	Voltage	Voltage at which the winding operates at the neutral tap setting
normalStep	Integer	The tap step position used in "normal" network operation for this winding. For a "Fixed" tap changer indicates the current physical tap setting
regulationStatus	Boolean	Specifies the default regulation status of the TapChanger. True is regulating. False is not regulating
stepVoltageIncrement	PerCent	Tap step increment, in per cent of nominal voltage, per step position. For a symmetrical PhaseTapChanger, the stepVoltageIncrement is used in the formula for calculation of the phase angle. For a symmetrical PhaseTapChanger, the voltage magnitude does not change with tap step
subsequentDelay	Seconds	For an LTC, the delay for subsequent tap changer operation (second and later step changes)
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 226 shows all association ends of TapChanger with other classes.

Table 226 – Association ends of Wires::TapChanger with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] RegulatingControl	RegulatingControl	The tap changers participating in regulation
[1..1]	[0..1] SvTapStep	SvTapStep	The tap step state associated with the tap changer
[1..1]	[0..1] ImpedanceVariationCurve	ImpedanceVariationCurve	A TapChanger can have an associated ImpedanceVariationCurve to define impedance variations with tap step changes
[1..1]	[0..*] TapSchedules	TapSchedule	A TapChanger can have TapSchedules
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource

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[mult from]	[mult to] name	type	description
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.51 TapChangerKind enumeration

Transformer tap changer type. Indicates the capabilities of the tap changer independent of the operating mode.

Table 227 shows all literals of TapChangerKind.

Table 227 – Literals of Wires::TapChangerKind

literal	description
fixed	Not capable of control. This is also indicated by no association of TapChanger to a RegulatingControl
voltageControl	Capable of voltage control
phaseControl	Capable of phase control
voltageAndPhaseControl	Capable of voltage and phase control

6.1.7.52 TapSchedule

A pre-established pattern over time for a tap step.

Table 228 shows all attributes of TapSchedule.

Table 228 – Attributes of Wires::TapSchedule

name	type	description
lineDropCompensation	Boolean	Flag to indicate that line drop compensation is to be applied
lineDropR	Resistance	Line drop resistance
lineDropX	Reactance	Line drop reactance
timeStep	Seconds	inherited from: RegularIntervalSchedule
endTime	AbsoluteDateTime	inherited from: RegularIntervalSchedule
startTime	AbsoluteDateTime	inherited from: BasicIntervalSchedule
value1Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
value2Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject

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name	type	description
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 229 shows all association ends of TapSchedule with other classes.

Table 229 – Association ends of Wires::TapSchedule with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] TapChanger	TapChanger	A TapSchedule is associated with a TapChanger
[0..*]	[0..1] DayType	DayType	inherited from: SeasonDayTypeSchedule
[0..*]	[0..1] Season	Season	inherited from: SeasonDayTypeSchedule
[1..1]	[1..*] TimePoints	RegularTimePoint	inherited from: RegularIntervalSchedule

6.1.7.53 TransformerControlMode enumeration

Control modes for a transformer.

Table 230 shows all literals of TransformerControlMode.

Table 230 – Literals of Wires::TransformerControlMode

literal	description
volt	Voltage control
reactive	Reactive power flow control

6.1.7.54 TransformerWinding

A winding is associated with each defined terminal of a transformer (or phase shifter).

Table 231 shows all attributes of TransformerWinding.

Table 231 – Attributes of Wires::TransformerWinding

name	type	description
b	Susceptance	Magnetizing branch susceptance (B mag). The value can be positive or negative
b0	Susceptance	Zero sequence magnetizing branch susceptance
connectionType	WindingConnection	The type of connection of the winding
emergencyS	ApparentPower	The apparent power that the winding can carry under emergency conditions
g	Conductance	Magnetizing branch conductance (G mag)
g0	Conductance	Zero sequence magnetizing branch conductance
grounded	Boolean	Set if the winding is grounded
insulationU	Voltage	Basic insulation level voltage rating

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name	type	description
r	Resistance	Positive sequence series resistance of the winding. For a two winding transformer, the full resistance of the transformer should be entered on the primary (high voltage) winding
r0	Resistance	Zero sequence series resistance of the winding
ratedS	ApparentPower	The normal apparent power rating for the winding
ratedU	Voltage	The rated voltage (phase-to-phase) of the winding, usually the same as the neutral voltage
rground	Resistance	Ground resistance path through connected grounding transformer
shortTermS	ApparentPower	Apparent power that the winding can carry for a short period of time
windingType	WindingType	The type of winding
x	Reactance	Positive sequence series reactance of the winding. For a two winding transformer, the full reactance of the transformer should be entered on the primary (high voltage) winding
x0	Reactance	Zero sequence series reactance of the winding
xground	Reactance	Ground reactance path through connected grounding transformer
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 232 shows all association ends of TransformerWinding with other classes.

Table 232 – Association ends of Wires::TransformerWinding with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] From_WindingTest	WindingTest	The transformer winding tests for which the transformer winding (terminal) participates as the "from" part of the test
[1..*]	[1..1] PowerTransformer	PowerTransformer	A transformer has windings
[0..1]	[0..*] To_WindingTest	WindingTest	The winding tests for which the transformer winding (terminal) participates as the "to" end of the test
[1..1]	[0..1] PhaseTapChanger	PhaseTapChanger	The phase tap changer associated with the transformer winding
[1..1]	[0..1] RatioTapChanger	RatioTapChanger	The ratio tap changer associated with the transformer winding
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment

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[mult from]	[mult to] name	type	description
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.55 VoltageControlZone

An area of the power system network which is defined for secondary voltage control purposes. A voltage control zone consists of a collection of substations with a designated busbar section whose voltage will be controlled.

Table 233 shows all attributes of VoltageControlZone.

Table 233 – Attributes of Wires::VoltageControlZone

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 234 shows all association ends of VoltageControlZone with other classes.

Table 234 – Association ends of Wires::VoltageControlZone with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] RegulationSchedule	RegulationSchedule	A VoltageControlZone may have a voltage regulation schedule
[0..1]	[1..1] BusbarSection	BusbarSection	A VoltageControlZone is controlled by a designated BusbarSection
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource

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[mult from]	[mult to] name	type	description
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.7.56 WindingConnection enumeration

Winding connection type.

Table 235 shows all literals of WindingConnection.

Table 235 – Literals of Wires::WindingConnection

literal	description
D	Delta
Y	Wye
Z	ZigZag
Yn	Wye, with neutral brought out for grounding
Zn	ZigZag, with neutral brought out for grounding
A	Autotransformer common winding
I	Independent winding, for single-phase connections

6.1.7.57 WindingTest

Physical winding test data for the winding/tap pairs of a transformer (or phase shifter). This test data can be used to derive other attributes of specific transformer or phase shifter models.

Table 236 shows all attributes of WindingTest.

Table 236 – Attributes of Wires::WindingTest

name	type	description
excitingCurrent	PerCent	The exciting current on open-circuit test, expressed as a percentage of rated current, at nominal voltage
fromTapStep	Integer	The tap step number for the "from" winding of the test pair
leakageImpedance	Impedance	The leakage impedance measured at the "from" winding with the "to" winding short-circuited and all other windings open-circuited. Leakage impedance is expressed in units based on the apparent power and voltage ratings of the "from" winding
loadLoss	KWActivePower	The load loss kW ("to" winding short-circuited) from the test report
noLoadLoss	KWActivePower	The no load loss kW "to" winding open-circuited) from the test report
phaseShift	AngleDegrees	The phase shift measured at the open-circuited "to" winding, with the "from" winding set to the "from" winding's rated voltage and all other windings open-circuited
toTapStep	Integer	The tap step number for the "to" winding of the test pair
voltage	Voltage	The voltage measured at the open-circuited "to" winding, with the "from" winding set to the "from" winding's rated voltage and all other windings open-circuited
mRID	String	inherited from: IdentifiedObject

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name	type	description
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 237 shows all association ends of WindingTest with other classes.

Table 237 – Association ends of Wires::WindingTest with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] To_TransformerWinding	TransformerWinding	The winding to which the test was conducted. Note that although the "from" side of the test is required, the "to" side of a test is not always required
[0..*]	[1..1] From_TransformerWinding	TransformerWinding	The winding from which the test was conducted

6.1.7.58 WindingType enumeration

Winding type.

Table 238 shows all literals of WindingType.

Table 238 – Literals of Wires::WindingType

literal	description
primary	
secondary	
tertiary	
quaternary	

6.1.8 Package Generation

6.1.8.1 General

This package contains packages that have information for Unit Commitment and Economic Dispatch of Hydro and Thermal Generating Units, Load Forecasting, Automatic Generation Control, and Unit Modeling for Dynamic Training Simulator.

Figure 50 shows logical diagram Main.

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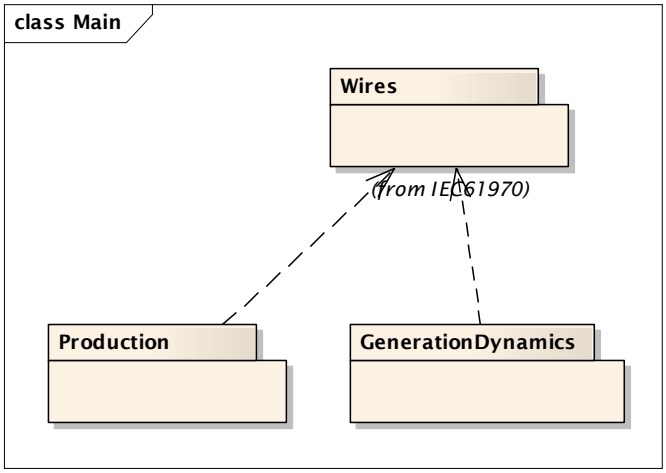

Figure 50 – Logical diagram Generation::Main

This diagram shows the two main packages comprising Gereration and their dependency relationship with the Wires package.

6.1.8.2 Package GenerationDynamics

6.1.8.2.1 General

The Generation Dynamics package contains prime movers, such as turbines and boilers, which are needed for simulation and educational purposes.

Figure 51 shows logical diagram Main.

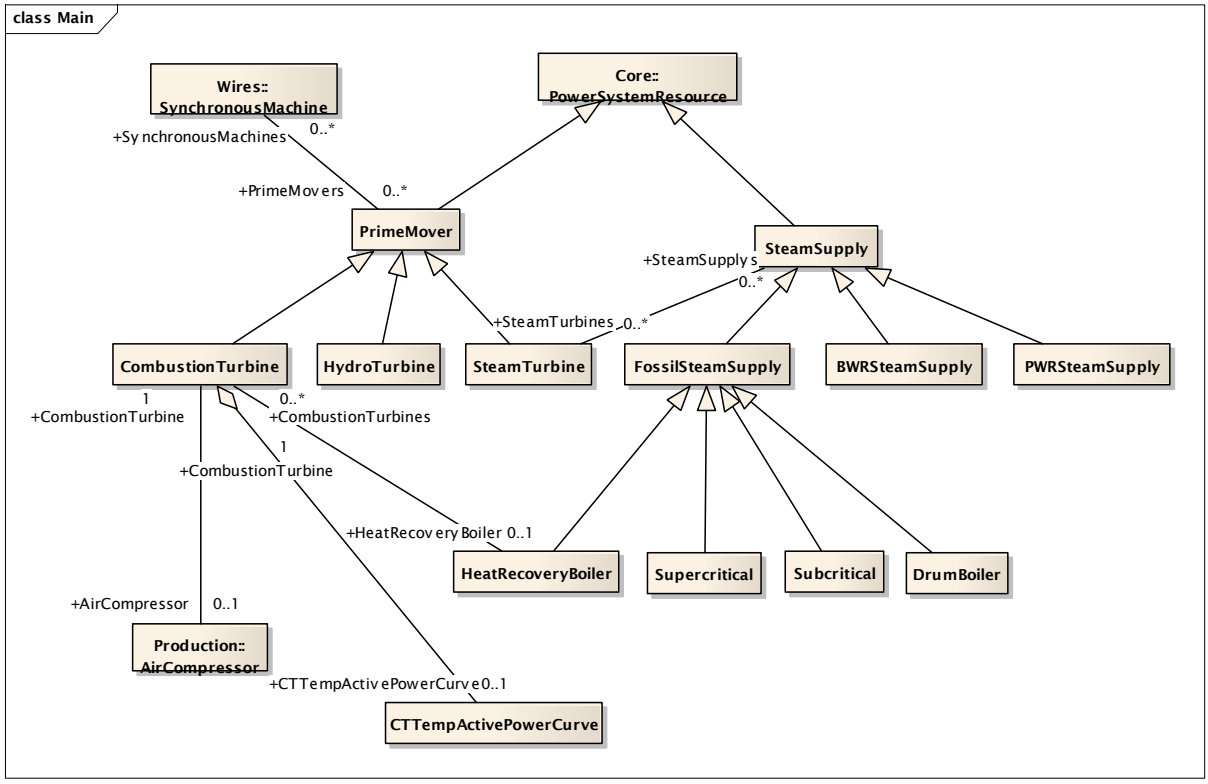

Figure 51 – Logical diagram GenerationDynamics::Main

This diagram shows all classes included in the GenerationDynamics package as well as the key external classes that have associations with GenerationDynamics classes.

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Figure 52 shows logical diagram Datatypes.

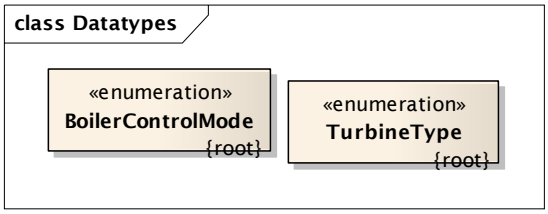

Figure 52 – Logical diagram GenerationDynamics::Datatypes

This diagram shows the data types specific to the GenerationDynamics package.

6.1.8.2.2 BoilerControlMode enumeration

Boiler control mode.

Table 239 shows all literals of BoilerControlMode.

Table 239 – Literals of GenerationDynamics::BoilerControlMode

literal	description
following	
coordinated	

6.1.8.2.3 BWRSteamSupply

Boiling water reactor used as a steam supply to a steam turbine.

Table 240 shows all attributes of BWRSteamSupply.

Table 240 – Attributes of GenerationDynamics::BWRSteamSupply

name	type	description
highPowerLimit	PU	High Power Limit
inCoreThermalTC	Seconds	In-Core Thermal Time Constant
integralGain	Float	Integral Gain
lowerLimit	PU	Initial Lower Limit
lowPowerLimit	PU	Low Power Limit
pressureLimit	PU	Pressure Limit
pressureSetpointGA	Float	Pressure Setpoint Gain Adjuster
pressureSetpointTC1	Seconds	Pressure Setpoint Time Constant
pressureSetpointTC2	Seconds	Pressure Setpoint Time Constant
proportionalGain	Float	Proportional Gain
rfAux1	PU	Coefficient for modeling the effect of off-nominal frequency and voltage on recirculation and core flow, which affects the BWR power output
rfAux2	PU	Coefficient for modeling the effect of off-nominal frequency and voltage on recirculation and core flow, which affects the BWR power output

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name	type	description
rfAux3	PU	Coefficient for modeling the effect of off-nominal frequency and voltage on recirculation and core flow, which affects the BWR power output
rfAux4	PU	Coefficient for modeling the effect of off-nominal frequency and voltage on recirculation and core flow, which affects the BWR power output
rfAux5	PU	Coefficient for modeling the effect of off-nominal frequency and voltage on recirculation and core flow, which affects the BWR power output
rfAux6	PU	Coefficient for modeling the effect of off-nominal frequency and voltage on recirculation and core flow, which affects the BWR power output
rfAux7	PU	Coefficient for modeling the effect of off-nominal frequency and voltage on recirculation and core flow, which affects the BWR power output
rfAux8	PU	Coefficient for modeling the effect of off-nominal frequency and voltage on recirculation and core flow, which affects the BWR power output
rodPattern	PU	Rod Pattern
rodPatternConstant	Float	Constant Associated With Rod Pattern
upperLimit	PU	Initial Upper Limit
steamSupplyRating	Float	inherited from: SteamSupply
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 241 shows all association ends of BWRSteamSupply with other classes.

Table 241 – Association ends of GenerationDynamics::BWRSteamSupply with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] SteamTurbines	SteamTurbine	inherited from: SteamSupply
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.2.4 CombustionTurbine

A prime mover that is typically fueled by gas or light oil.

Table 242 shows all attributes of CombustionTurbine.

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Table 242 – Attributes of GenerationDynamics::CombustionTurbine

name	type	description
ambientTemp	Temperature	Default ambient temperature to be used in modeling applications
auxPowerVersusFrequency	PU	Off-nominal frequency effect on turbine auxiliaries. Per unit reduction in auxiliary active power consumption versus per unit reduction in frequency (from rated frequency)
auxPowerVersusVoltage	PU	Off-nominal voltage effect on turbine auxiliaries. Per unit reduction in auxiliary active power consumption versus per unit reduction in auxiliary bus voltage (from a specified voltage level)
capabilityVersusFrequency	PU	Off-nominal frequency effect on turbine capability. Per unit reduction in unit active power capability versus per unit reduction in frequency (from rated frequency)
heatRecoveryFlag	Boolean	Flag that is set to true if the combustion turbine is associated with a heat recovery boiler
powerVariationByTemp	PU	Per unit change in power per (versus) unit change in ambient temperature
referenceTemp	Temperature	Reference temperature at which the output of the turbine was defined
timeConstant	Seconds	The time constant for the turbine
primeMoverRating	Float	inherited from: PrimeMover
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 243 shows all association ends of CombustionTurbine with other classes.

Table 243 – Association ends of GenerationDynamics::CombustionTurbine with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..1] AirCompressor	AirCompressor	A CAES air compressor is driven by combustion turbine
[0..*]	[0..1] HeatRecoveryBoiler	HeatRecoveryBoiler	A combustion turbine may have a heat recovery boiler for making steam
[1..1]	[0..1] CTTempActivePowerCurve	CTTempActivePowerCurve	A combustion turbine may have an active power versus ambient temperature relationship
[0..*]	[0..*] SynchronousMachines	SynchronousMachine	inherited from: PrimeMover
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource

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[mult from]	[mult to] name	type	description
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.2.5 CTTempActivePowerCurve

Relationship between the combustion turbine's power output rating in gross active power (X-axis) and the ambient air temperature (Y-axis).

Table 244 shows all attributes of CTTempActivePowerCurve.

Table 244 – Attributes of GenerationDynamics::CTTempActivePowerCurve

name	type	description
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 245 shows all association ends of CTTempActivePowerCurve with other classes.

Table 245 – Association ends of GenerationDynamics::CTTempActivePowerCurve with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] CombustionTurbine	CombustionTurbine	A combustion turbine may have an active power versus ambient temperature relationship
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.2.6 DrumBoiler

Drum boiler.

Table 246 shows all attributes of DrumBoiler.

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Table 246 – Attributes of GenerationDynamics::DrumBoiler

name	type	description
drumBoilerRating	Float	Rating of drum boiler in steam units
auxPowerVersusFrequency	PU	inherited from: FossilSteamSupply
auxPowerVersusVoltage	PU	inherited from: FossilSteamSupply
boilerControlMode	BoilerControlMode	inherited from: FossilSteamSupply
controlErrorBiasP	Float	inherited from: FossilSteamSupply
controlIC	Float	inherited from: FossilSteamSupply
controlPC	Float	inherited from: FossilSteamSupply
controlPEB	Float	inherited from: FossilSteamSupply
controlPED	PU	inherited from: FossilSteamSupply
controlTC	Float	inherited from: FossilSteamSupply
feedWaterIG	Float	inherited from: FossilSteamSupply
feedWaterPG	Float	inherited from: FossilSteamSupply
feedWaterTC	Seconds	inherited from: FossilSteamSupply
fuelDemandLimit	PU	inherited from: FossilSteamSupply
fuelSupplyDelay	Seconds	inherited from: FossilSteamSupply
fuelSupplyTC	Seconds	inherited from: FossilSteamSupply
maxErrorRateP	Float	inherited from: FossilSteamSupply
mechPowerSensorLag	Seconds	inherited from: FossilSteamSupply
minErrorRateP	Float	inherited from: FossilSteamSupply
pressureCtrlDG	Float	inherited from: FossilSteamSupply
pressureCtrlIG	Float	inherited from: FossilSteamSupply
pressureCtrlPG	Float	inherited from: FossilSteamSupply
pressureFeedback	Integer	inherited from: FossilSteamSupply
superHeater1Capacity	Float	inherited from: FossilSteamSupply
superHeater2Capacity	Float	inherited from: FossilSteamSupply
superHeaterPipePD	Float	inherited from: FossilSteamSupply
throttlePressureSP	PU	inherited from: FossilSteamSupply
steamSupplyRating	Float	inherited from: SteamSupply
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 247 shows all association ends of DrumBoiler with other classes.

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Table 247 – Association ends of GenerationDynamics::DrumBoiler with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] SteamTurbines	SteamTurbine	inherited from: SteamSupply
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.2.7 FossilSteamSupply

Fossil fueled boiler (e.g., coal, oil, gas).

Table 248 shows all attributes of FossilSteamSupply.

Table 248 – Attributes of GenerationDynamics::FossilSteamSupply

name	type	description
auxPowerVersusFrequency	PU	Off nominal frequency effect on auxiliary real power. Per unit active power variation versus per unit frequency variation
auxPowerVersusVoltage	PU	Off nominal voltage effect on auxiliary real power. Per unit active power variation versus per unit voltage variation
boilerControlMode	BoilerControlMode	The control mode of the boiler
controlErrorBiasP	Float	Active power Error Bias ratio
controlIC	Float	Integral Constant
controlPC	Float	Proportional Constant
controlPEB	Float	Pressure Error Bias ratio
controlPED	PU	Pressure Error Deadband
controlTC	Float	Time Constant
feedWaterIG	Float	Feedwater Integral Gain ratio
feedWaterPG	Float	Feedwater Proportional Gain ratio
feedWaterTC	Seconds	Feedwater Time Constant ratio.
fuelDemandLimit	PU	Fuel Demand Limit
fuelSupplyDelay	Seconds	Fuel Delay
fuelSupplyTC	Seconds	Fuel Supply Time Constant
maxErrorRateP	Float	Active power Maximum Error Rate Limit
mechPowerSensorLag	Seconds	Mechanical Power Sensor Lag
minErrorRateP	Float	Active power Minimum Error Rate Limit
pressureCtrlDG	Float	Pressure Control Derivative Gain ratio
pressureCtrlIG	Float	Pressure Control Integral Gain ratio
pressureCtrlPG	Float	Pressure Control Proportional Gain ratio
pressureFeedback	Integer	Pressure Feedback Indicator

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name	type	description
superHeater1Capacity	Float	Drum/Primary Superheater Capacity
superHeater2Capacity	Float	Secondary Superheater Capacity
superHeaterPipePD	Float	Superheater Pipe Pressure Drop Constant
throttlePressureSP	PU	Throttle Pressure Setpoint
steamSupplyRating	Float	inherited from: SteamSupply
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 249 shows all association ends of FossilSteamSupply with other classes.

Table 249 – Association ends of GenerationDynamics::FossilSteamSupply with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] SteamTurbines	SteamTurbine	inherited from: SteamSupply
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.2.8 HeatRecoveryBoiler

The heat recovery system associated with combustion turbines in order to produce steam for combined cycle plants.

Table 250 shows all attributes of HeatRecoveryBoiler.

Table 250 – Attributes of GenerationDynamics::HeatRecoveryBoiler

name	type	description
steamSupplyRating2	Float	The steam supply rating in kilopounds per hour, if dual pressure boiler
auxPowerVersusFrequency	PU	inherited from: FossilSteamSupply
auxPowerVersusVoltage	PU	inherited from: FossilSteamSupply
boilerControlMode	BoilerControlMode	inherited from: FossilSteamSupply
controlErrorBiasP	Float	inherited from: FossilSteamSupply
controlIC	Float	inherited from: FossilSteamSupply
controlPC	Float	inherited from: FossilSteamSupply

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name	type	description
controlPEB	Float	inherited from: FossilSteamSupply
controlPED	PU	inherited from: FossilSteamSupply
controlTC	Float	inherited from: FossilSteamSupply
feedWaterIG	Float	inherited from: FossilSteamSupply
feedWaterPG	Float	inherited from: FossilSteamSupply
feedWaterTC	Seconds	inherited from: FossilSteamSupply
fuelDemandLimit	PU	inherited from: FossilSteamSupply
fuelSupplyDelay	Seconds	inherited from: FossilSteamSupply
fuelSupplyTC	Seconds	inherited from: FossilSteamSupply
maxErrorRateP	Float	inherited from: FossilSteamSupply
mechPowerSensorLag	Seconds	inherited from: FossilSteamSupply
minErrorRateP	Float	inherited from: FossilSteamSupply
pressureCtrlDG	Float	inherited from: FossilSteamSupply
pressureCtrlIG	Float	inherited from: FossilSteamSupply
pressureCtrlPG	Float	inherited from: FossilSteamSupply
pressureFeedback	Integer	inherited from: FossilSteamSupply
superHeater1Capacity	Float	inherited from: FossilSteamSupply
superHeater2Capacity	Float	inherited from: FossilSteamSupply
superHeaterPipePD	Float	inherited from: FossilSteamSupply
throttlePressureSP	PU	inherited from: FossilSteamSupply
steamSupplyRating	Float	inherited from: SteamSupply
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 251 shows all association ends of HeatRecoveryBoiler with other classes.

Table 251 – Association ends of GenerationDynamics::HeatRecoveryBoiler with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] CombustionTurbines	CombustionTurbine	A combustion turbine may have a heat recovery boiler for making steam
[0..*]	[0..*] SteamTurbines	SteamTurbine	inherited from: SteamSupply
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

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6.1.8.2.9 HydroTurbine

A water driven prime mover. Typical turbine types are: Francis, Kaplan, and Pelton.

Table 252 shows all attributes of HydroTurbine.

Table 252 – Attributes of GenerationDynamics::HydroTurbine

name	type	description
gateRateLimit	Float	Gate Rate Limit
gateUpperLimit	PU	Gate Upper Limit
minHeadMaxP	ActivePower	Maximum efficiency active power at minimum head conditions
maxHeadMaxP	ActivePower	Maximum efficiency active power at maximum head conditions
speedRating	RotationSpeed	Rated speed in number of revolutions.
speedRegulation	PU	Speed Regulation
transientDroopTime	Seconds	Transient Droop Time Constant
transientRegulation	PU	Transient Regulation
turbineRating	ActivePower	Rated turbine active power
turbineType	TurbineType	Type of turbine.
waterStartingTime	Seconds	Water Starting Time
primeMoverRating	Float	inherited from: PrimeMover
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 253 shows all association ends of HydroTurbine with other classes.

Table 253 – Association ends of GenerationDynamics::HydroTurbine with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] SynchronousMachines	SynchronousMachine	inherited from: PrimeMover
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.2.10 PrimeMover

The machine used to develop mechanical energy used to drive a generator.

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Table 254 shows all attributes of PrimeMover.

Table 254 – Attributes of GenerationDynamics::PrimeMover

name	type	description
primeMoverRating	Float	Rating of prime mover
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 255 shows all association ends of PrimeMover with other classes.

Table 255 – Association ends of GenerationDynamics::PrimeMover with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] SynchronousMachines	SynchronousMachine	Synchronous machines this Prime mover drives
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.2.11 PWRSteamSupply

Pressurized water reactor used as a steam supply to a steam turbine.

Table 256 shows all attributes of PWRSteamSupply.

Table 256 – Attributes of GenerationDynamics::PWRSteamSupply

name	type	description
coldLegFBLagTC	PU	Cold Leg Feedback Lag Time Constant
coldLegFBLeadTC1	PU	Cold Leg Feedback Lead Time Constant
coldLegFBLeadTC2	PU	Cold Leg Feedback Lead Time Constant
coldLegFG1	PU	Cold Leg Feedback Gain 1
coldLegFG2	PU	Cold Leg Feedback Gain 2
coldLegLagTC	PU	Cold Leg Lag Time Constant
coreHTLagTC1	PU	Core Heat Transfer Lag Time Constant
coreHTLagTC2	PU	Core Heat Transfer Lag Time Constant
coreNeutronicsEffTC	PU	Core Neutronics Effective Time Constant

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name	type	description
coreNeutronicsHT	PU	Core Neutronics And Heat Transfer
feedbackFactor	PU	Feedback Factor
hotLegLagTC	PU	Hot Leg Lag Time Constant
hotLegSteamGain	PU	Hot Leg Steam Gain
hotLegToColdLegGain	PU	Hot Leg To Cold Leg Gain
pressureCG	PU	Pressure Control Gain
steamFlowFG	PU	Steam Flow Feedback Gain
steamPressureDropLagTC	PU	Steam Pressure Drop Lag Time Constant
steamPressureFG	PU	Steam Pressure Feedback Gain
throttlePressureFactor	PU	Throttle Pressure Factor
throttlePressureSP	PU	Throttle Pressure Setpoint
steamSupplyRating	Float	inherited from: SteamSupply
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 257 shows all association ends of PWRSteamSupply with other classes.

Table 257 – Association ends of GenerationDynamics::PWRSteamSupply with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] SteamTurbines	SteamTurbine	inherited from: SteamSupply
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.2.12 SteamSupply

Steam supply for steam turbine.

Table 258 shows all attributes of SteamSupply.

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Table 258 – Attributes of GenerationDynamics::SteamSupply

name	type	description
steamSupplyRating	Float	Rating of steam supply
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 259 shows all association ends of SteamSupply with other classes.

Table 259 – Association ends of GenerationDynamics::SteamSupply with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] SteamTurbines	SteamTurbine	Steam turbines may have steam supplied by a steam supply
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.2.13 SteamTurbine

Steam turbine.

Table 260 shows all attributes of SteamTurbine.

Table 260 – Attributes of GenerationDynamics::SteamTurbine

name	type	description
crossoverTC	Seconds	Crossover Time Constant
reheater1TC	Seconds	First Reheater Time Constant
reheater2TC	Seconds	Second Reheater Time Constant
shaft1PowerHP	Float	Fraction Of Power From Shaft 1 High Pressure Turbine output
shaft1PowerIP	Float	Fraction Of Power From Shaft 1 Intermediate Pressure Turbine output
shaft1PowerLP1	Float	Fraction Of Power From Shaft 1 First Low Pressure Turbine output
shaft1PowerLP2	Float	Fraction Of Power From Shaft 1 Second Low Pressure Turbine output
shaft2PowerHP	Float	Fraction Of Power From Shaft 2 High Pressure Turbine output

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name	type	description
shaft2PowerIP	Float	Fraction Of Power From Shaft 2 Intermediate Pressure Turbine output
shaft2PowerLP1	Float	Fraction Of Power From Shaft 2 First Low Pressure Turbine output
shaft2PowerLP2	Float	Fraction Of Power From Shaft 2 Second Low Pressure Turbine output
steamChestTC	Seconds	Steam Chest Time Constant
primeMoverRating	Float	inherited from: PrimeMover
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 261 shows all association ends of SteamTurbine with other classes.

Table 261 – Association ends of GenerationDynamics::SteamTurbine with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] SteamSupplys	SteamSupply	Steam turbines may have steam supplied by a steam supply
[0..*]	[0..*] SynchronousMachines	SynchronousMachine	inherited from: PrimeMover
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.2.14 Subcritical

Once-through subcritical boiler.

Table 262 shows all attributes of Subcritical.

Table 262 – Attributes of GenerationDynamics::Subcritical

name	type	description
auxPowerVersusFrequency	PU	inherited from: FossilSteamSupply
auxPowerVersusVoltage	PU	inherited from: FossilSteamSupply
boilerControlMode	BoilerControlMode	inherited from: FossilSteamSupply
controlErrorBiasP	Float	inherited from: FossilSteamSupply
controlIC	Float	inherited from: FossilSteamSupply
controlPC	Float	inherited from: FossilSteamSupply

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name	type	description
controlPEB	Float	inherited from: FossilSteamSupply
controlPED	PU	inherited from: FossilSteamSupply
controlTC	Float	inherited from: FossilSteamSupply
feedWaterIG	Float	inherited from: FossilSteamSupply
feedWaterPG	Float	inherited from: FossilSteamSupply
feedWaterTC	Seconds	inherited from: FossilSteamSupply
fuelDemandLimit	PU	inherited from: FossilSteamSupply
fuelSupplyDelay	Seconds	inherited from: FossilSteamSupply
fuelSupplyTC	Seconds	inherited from: FossilSteamSupply
maxErrorRateP	Float	inherited from: FossilSteamSupply
mechPowerSensorLag	Seconds	inherited from: FossilSteamSupply
minErrorRateP	Float	inherited from: FossilSteamSupply
pressureCtrlDG	Float	inherited from: FossilSteamSupply
pressureCtrlIG	Float	inherited from: FossilSteamSupply
pressureCtrlPG	Float	inherited from: FossilSteamSupply
pressureFeedback	Integer	inherited from: FossilSteamSupply
superHeater1Capacity	Float	inherited from: FossilSteamSupply
superHeater2Capacity	Float	inherited from: FossilSteamSupply
superHeaterPipePD	Float	inherited from: FossilSteamSupply
throttlePressureSP	PU	inherited from: FossilSteamSupply
steamSupplyRating	Float	inherited from: SteamSupply
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 263 shows all association ends of Subcritical with other classes.

Table 263 – Association ends of GenerationDynamics::Subcritical with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] SteamTurbines	SteamTurbine	inherited from: SteamSupply
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

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6.1.8.2.15 Supercritical

Once-through supercritical boiler.

Table 264 shows all attributes of Supercritical.

Table 264 – Attributes of GenerationDynamics::Supercritical

name	type	description
auxPowerVersusFrequency	PU	inherited from: FossilSteamSupply
auxPowerVersusVoltage	PU	inherited from: FossilSteamSupply
boilerControlMode	BoilerControlMode	inherited from: FossilSteamSupply
controlErrorBiasP	Float	inherited from: FossilSteamSupply
controlIC	Float	inherited from: FossilSteamSupply
controlPC	Float	inherited from: FossilSteamSupply
controlPEB	Float	inherited from: FossilSteamSupply
controlPED	PU	inherited from: FossilSteamSupply
controlTC	Float	inherited from: FossilSteamSupply
feedWaterIG	Float	inherited from: FossilSteamSupply
feedWaterPG	Float	inherited from: FossilSteamSupply
feedWaterTC	Seconds	inherited from: FossilSteamSupply
fuelDemandLimit	PU	inherited from: FossilSteamSupply
fuelSupplyDelay	Seconds	inherited from: FossilSteamSupply
fuelSupplyTC	Seconds	inherited from: FossilSteamSupply
maxErrorRateP	Float	inherited from: FossilSteamSupply
mechPowerSensorLag	Seconds	inherited from: FossilSteamSupply
minErrorRateP	Float	inherited from: FossilSteamSupply
pressureCtrlDG	Float	inherited from: FossilSteamSupply
pressureCtrlIG	Float	inherited from: FossilSteamSupply
pressureCtrlPG	Float	inherited from: FossilSteamSupply
pressureFeedback	Integer	inherited from: FossilSteamSupply
superHeater1Capacity	Float	inherited from: FossilSteamSupply
superHeater2Capacity	Float	inherited from: FossilSteamSupply
superHeaterPipePD	Float	inherited from: FossilSteamSupply
throttlePressureSP	PU	inherited from: FossilSteamSupply
steamSupplyRating	Float	inherited from: SteamSupply
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 265 shows all association ends of Supercritical with other classes.

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Table 265 – Association ends of GenerationDynamics::Supercritical with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] SteamTurbines	SteamTurbine	inherited from: SteamSupply
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.2.16 TurbineType enumeration

Type of turbine.

Table 266 shows all literals of TurbineType.

Table 266 – Literals of GenerationDynamics::TurbineType

literal	description
francis	
pelton	
kaplan	

6.1.8.3 Package Production

6.1.8.3.1 General

The production package is responsible for classes which describe various kinds of generators. These classes also provide production costing information which is used to economically allocate demand among committed units and calculate reserve quantities.

Figure 53 shows logical diagram Nuclear.

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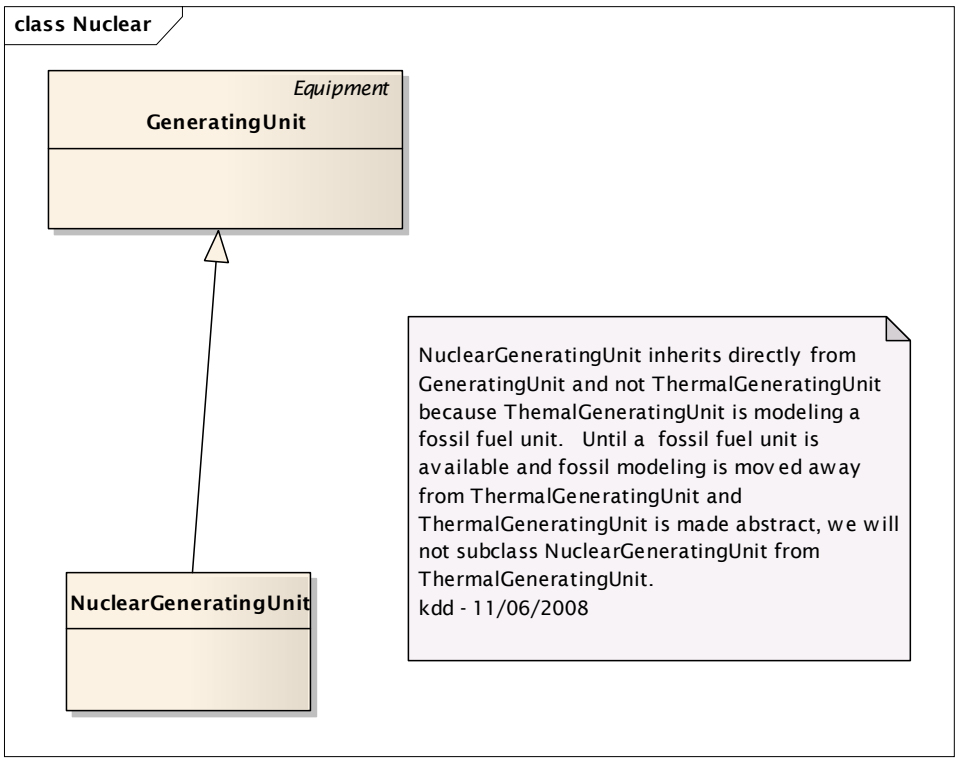

Figure 53 – Logical diagram Production::Nuclear

Figure 54 shows logical diagram Main.

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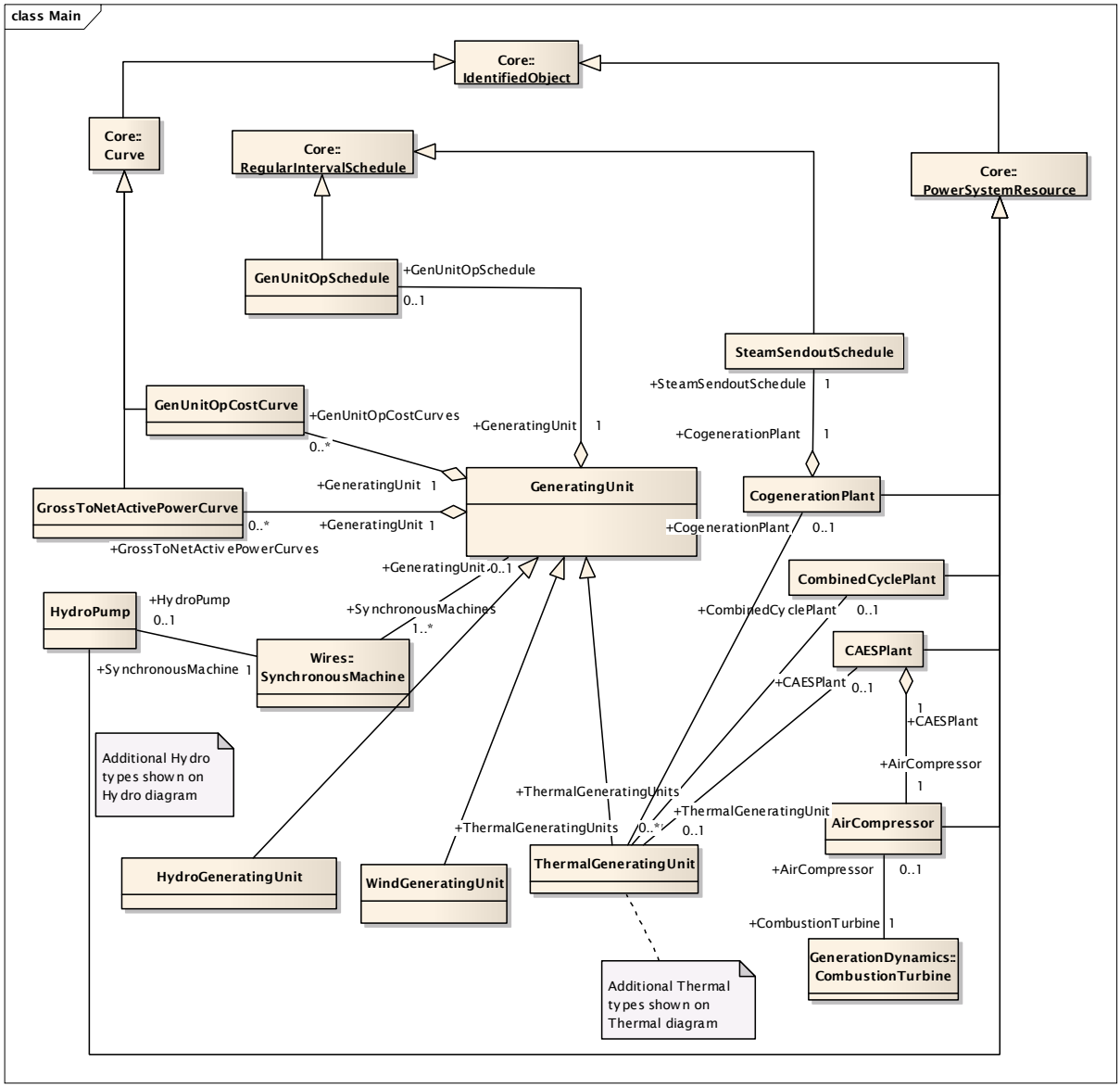

Figure 54 – Logical diagram Production::Main

This diagram shows all classes included in the Production package that are needed by both Hydro and Thermal generation. It also shows key external classes that have associations with Production classes.

Figure 55 shows logical diagram Datatypes.

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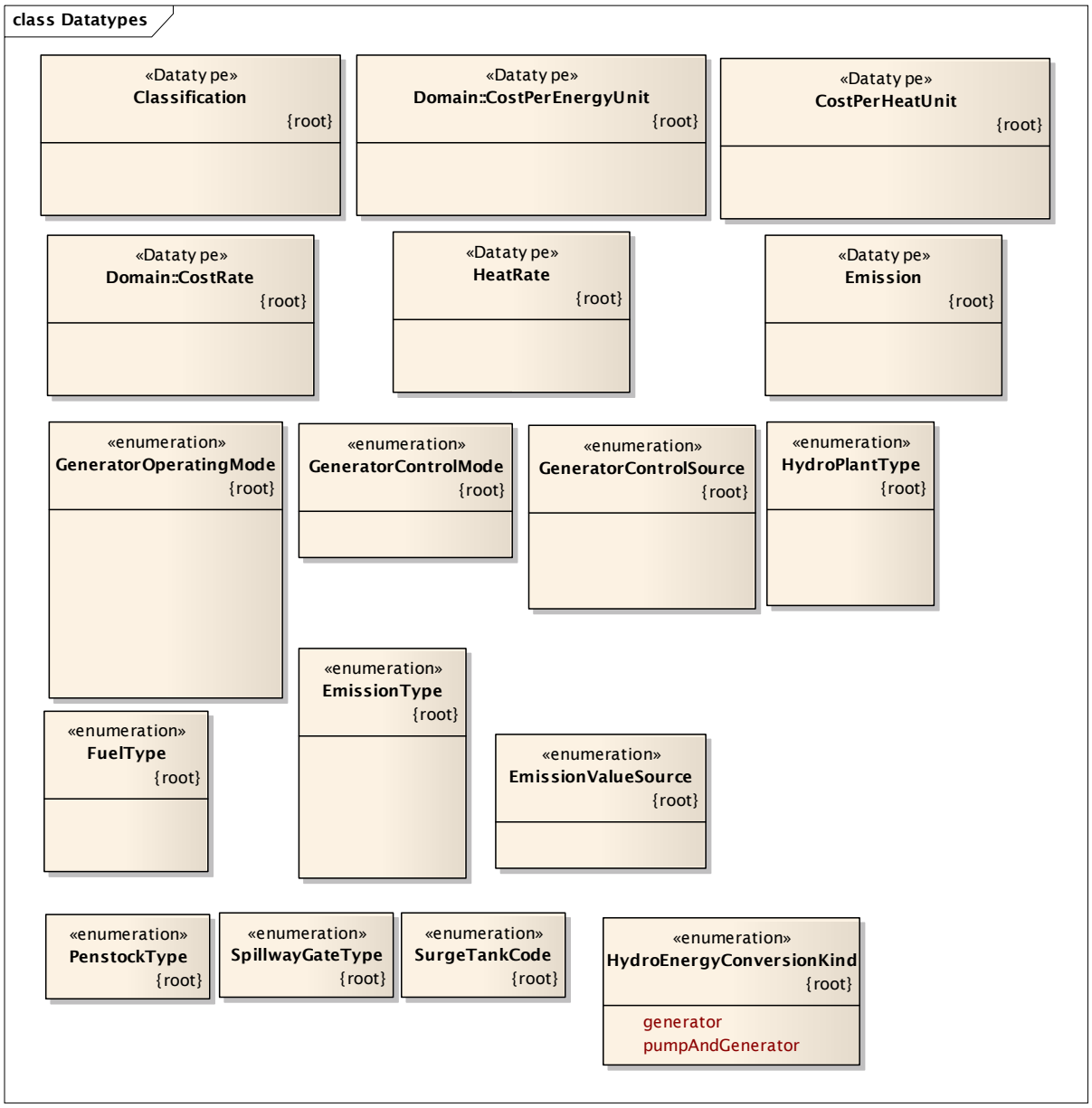

Figure 55 – Logical diagram Production::Datatypes

This diagram shows the data types specific to the Production package.

Figure 56 shows logical diagram Hydro.

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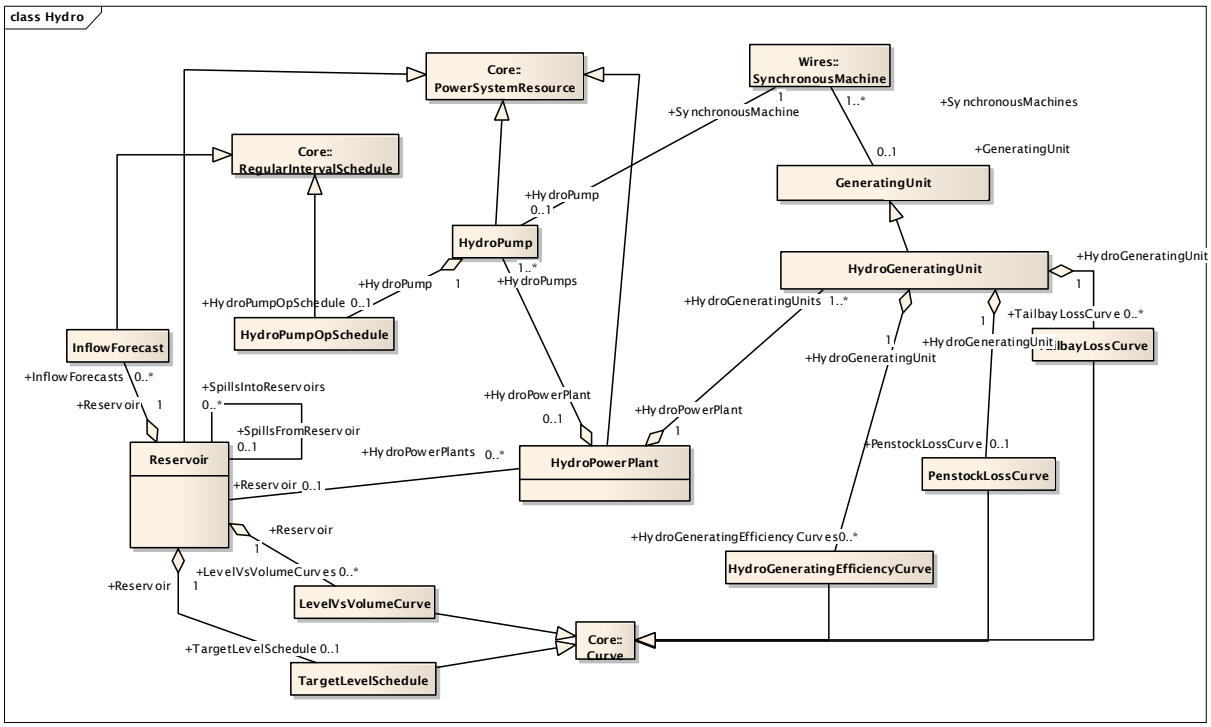

Figure 56 – Logical diagram Production::Hydro

This diagram shows all classes included in the Hydro package as well as the key external classes that have associations with Hydro classes.

Figure 57 shows logical diagram Thermal.

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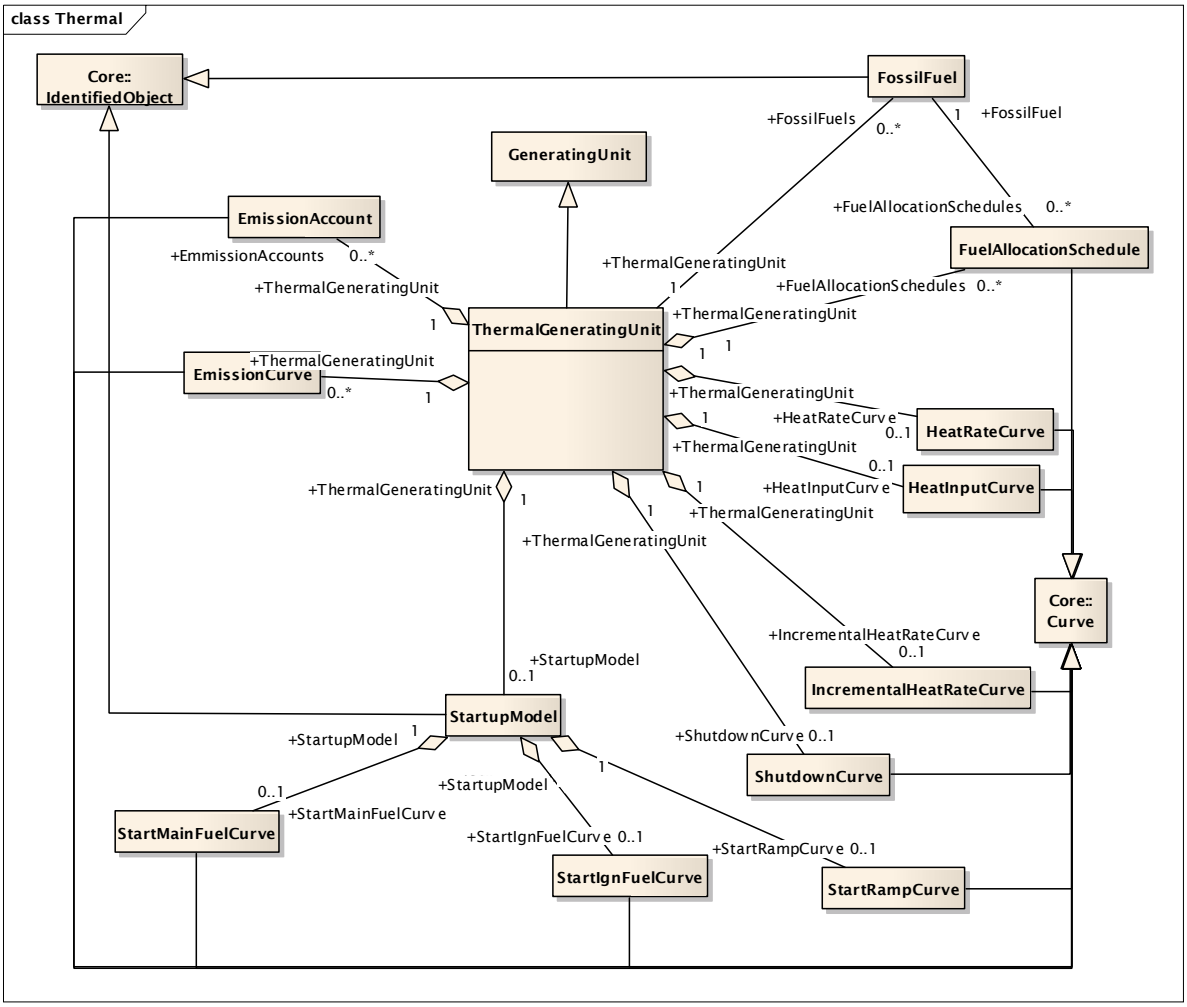

Figure 57 – Logical diagram Production::Thermal

This diagram shows all classes included in the Thermal package as well as the key external classes that have associations with Thermal classes.

6.1.8.3.2 HydroEnergyConversionKind enumeration

Specifies the capability of the hydro generating unit to convert energy as a generator or pump.

Table 267 shows all literals of HydroEnergyConversionKind.

Table 267 – Literals of Production::HydroEnergyConversionKind

literal	description
generator	Able to generate power, but not able to pump water for energy storage
pumpAndGenerator	Able to both generate power and pump water for energy storage

6.1.8.3.3 NuclearGeneratingUnit

A nuclear generating unit.

Table 268 shows all attributes of NuclearGeneratingUnit.

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Table 268 – Attributes of Production::NuclearGeneratingUnit

name	type	description
allocSpinResP	ActivePower	inherited from: GeneratingUnit
autoCntrlMarginP	ActivePower	inherited from: GeneratingUnit
baseP	ActivePower	inherited from: GeneratingUnit
controlDeadband	ActivePower	inherited from: GeneratingUnit
controlPulseHigh	Seconds	inherited from: GeneratingUnit
controlPulseLow	Seconds	inherited from: GeneratingUnit
controlResponseRate	ActivePowerChangeRate	inherited from: GeneratingUnit
dispReserveFlag	Boolean	inherited from: GeneratingUnit
efficiency	PU	inherited from: GeneratingUnit
energyMinP	HeatRate	inherited from: GeneratingUnit
fastStartFlag	Boolean	inherited from: GeneratingUnit
fuelPriority	Integer	inherited from: GeneratingUnit
genControlMode	GeneratorControlMode	inherited from: GeneratingUnit
genControlSource	GeneratorControlSource	inherited from: GeneratingUnit
genOperatingMode	GeneratorOperatingMode	inherited from: GeneratingUnit
governorMPL	PU	inherited from: GeneratingUnit
governorSCD	PerCent	inherited from: GeneratingUnit
highControlLimit	ActivePower	inherited from: GeneratingUnit
initialP	ActivePower	inherited from: GeneratingUnit
longPF	Float	inherited from: GeneratingUnit
lowControlLimit	ActivePower	inherited from: GeneratingUnit
lowerRampRate	ActivePowerChangeRate	inherited from: GeneratingUnit
maxEconomicP	ActivePower	inherited from: GeneratingUnit
maximumAllowableSpinningReserve	ActivePower	inherited from: GeneratingUnit
maxOperatingP	ActivePower	inherited from: GeneratingUnit
minEconomicP	ActivePower	inherited from: GeneratingUnit
minimumOffTime	Seconds	inherited from: GeneratingUnit
minOperatingP	ActivePower	inherited from: GeneratingUnit
modelDetail	Classification	inherited from: GeneratingUnit
normalPF	Float	inherited from: GeneratingUnit
penaltyFactor	Float	inherited from: GeneratingUnit
raiseRampRate	ActivePowerChangeRate	inherited from: GeneratingUnit
ratedGrossMaxP	ActivePower	inherited from: GeneratingUnit
ratedGrossMinP	ActivePower	inherited from: GeneratingUnit
ratedNetMaxP	ActivePower	inherited from: GeneratingUnit
shortPF	Float	inherited from: GeneratingUnit
spinReserveRamp	ActivePowerChangeRate	inherited from: GeneratingUnit
startupCost	Money	inherited from: GeneratingUnit
startupTime	Seconds	inherited from: GeneratingUnit
stepChange	ActivePower	inherited from: GeneratingUnit
tieLinePF	Float	inherited from: GeneratingUnit
variableCost	Money	inherited from: GeneratingUnit

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name	type	description
nominalP	ActivePower	inherited from: GeneratingUnit
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 269 shows all association ends of NuclearGeneratingUnit with other classes.

Table 269 – Association ends of Production::NuclearGeneratingUnit with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..*] SynchronousMachines	SynchronousMachine	inherited from: GeneratingUnit
[1..1]	[0..1] GenUnitOpSchedule	GenUnitOpSchedule	inherited from: GeneratingUnit
[1..1]	[0..*] GrossToNetActivePowerCurves	GrossToNetActivePowerCurve	inherited from: GeneratingUnit
[1..1]	[0..*] GenUnitOpCostCurves	GenUnitOpCostCurve	inherited from: GeneratingUnit
[1..1]	[0..*] ControlAreaGeneratingUnit	ControlAreaGeneratingUnit	inherited from: GeneratingUnit
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.3.4 WindGeneratingUnit

A wind driven generating unit.

Table 270 shows all attributes of WindGeneratingUnit.

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Table 270 – Attributes of Production::WindGeneratingUnit

name	type	description
allocSpinResP	ActivePower	inherited from: GeneratingUnit
autoCntrlMarginP	ActivePower	inherited from: GeneratingUnit
baseP	ActivePower	inherited from: GeneratingUnit
controlDeadband	ActivePower	inherited from: GeneratingUnit
controlPulseHigh	Seconds	inherited from: GeneratingUnit
controlPulseLow	Seconds	inherited from: GeneratingUnit
controlResponseRate	ActivePowerChangeRate	inherited from: GeneratingUnit
dispReserveFlag	Boolean	inherited from: GeneratingUnit
efficiency	PU	inherited from: GeneratingUnit
energyMinP	HeatRate	inherited from: GeneratingUnit
fastStartFlag	Boolean	inherited from: GeneratingUnit
fuelPriority	Integer	inherited from: GeneratingUnit
genControlMode	GeneratorControlMode	inherited from: GeneratingUnit
genControlSource	GeneratorControlSource	inherited from: GeneratingUnit
genOperatingMode	GeneratorOperatingMode	inherited from: GeneratingUnit
governorMPL	PU	inherited from: GeneratingUnit
governorSCD	PerCent	inherited from: GeneratingUnit
highControlLimit	ActivePower	inherited from: GeneratingUnit
initialP	ActivePower	inherited from: GeneratingUnit
longPF	Float	inherited from: GeneratingUnit
lowControlLimit	ActivePower	inherited from: GeneratingUnit
lowerRampRate	ActivePowerChangeRate	inherited from: GeneratingUnit
maxEconomicP	ActivePower	inherited from: GeneratingUnit
maximumAllowableSpinningReserve	ActivePower	inherited from: GeneratingUnit
maxOperatingP	ActivePower	inherited from: GeneratingUnit
minEconomicP	ActivePower	inherited from: GeneratingUnit
minimumOffTime	Seconds	inherited from: GeneratingUnit
minOperatingP	ActivePower	inherited from: GeneratingUnit
modelDetail	Classification	inherited from: GeneratingUnit
normalPF	Float	inherited from: GeneratingUnit
penaltyFactor	Float	inherited from: GeneratingUnit
raiseRampRate	ActivePowerChangeRate	inherited from: GeneratingUnit
ratedGrossMaxP	ActivePower	inherited from: GeneratingUnit
ratedGrossMinP	ActivePower	inherited from: GeneratingUnit
ratedNetMaxP	ActivePower	inherited from: GeneratingUnit
shortPF	Float	inherited from: GeneratingUnit
spinReserveRamp	ActivePowerChangeRate	inherited from: GeneratingUnit
startupCost	Money	inherited from: GeneratingUnit
startupTime	Seconds	inherited from: GeneratingUnit
stepChange	ActivePower	inherited from: GeneratingUnit
tieLinePF	Float	inherited from: GeneratingUnit
variableCost	Money	inherited from: GeneratingUnit

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name	type	description
nominalP	ActivePower	inherited from: GeneratingUnit
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 271 shows all association ends of WindGeneratingUnit with other classes.

Table 271 – Association ends of Production::WindGeneratingUnit with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..*] SynchronousMachines	SynchronousMachine	inherited from: GeneratingUnit
[1..1]	[0..1] GenUnitOpSchedule	GenUnitOpSchedule	inherited from: GeneratingUnit
[1..1]	[0..*] GrossToNetActivePowerCurves	GrossToNetActivePowerCurve	inherited from: GeneratingUnit
[1..1]	[0..*] GenUnitOpCostCurves	GenUnitOpCostCurve	inherited from: GeneratingUnit
[1..1]	[0..*] ControlAreaGeneratingUnit	ControlAreaGeneratingUnit	inherited from: GeneratingUnit
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.3.5 AirCompressor

Combustion turbine air compressor which is an integral part of a compressed air energy storage (CAES) plant.

Table 272 shows all attributes of AirCompressor.

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Table 272 – Attributes of Production::AirCompressor

name	type	description
airCompressorRating	Float	Rating of the CAES air compressor
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 273 shows all association ends of AirCompressor with other classes.

Table 273 – Association ends of Production::AirCompressor with other classes

[mult from]	[mult to] name	type	description
[1..1]	[1..1] CAESPlant	CAESPlant	An air compressor may be a member of a compressed air energy storage plant
[0..1]	[1..1] CombustionTurbine	CombustionTurbine	A CAES air compressor is driven by combustion turbine
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.3.6 CAESPlant

Compressed air energy storage plant.

Table 274 shows all attributes of CAESPlant.

Table 274 – Attributes of Production::CAESPlant

name	type	description
energyStorageCapacity	RealEnergy	The rated energy storage capacity
ratedCapacityP	ActivePower	The CAES plant's gross rated generating capacity
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 275 shows all association ends of CAESPlant with other classes.

Table 275 – Association ends of Production::CAESPlant with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..1] ThermalGeneratingUnit	ThermalGeneratingUnit	A thermal generating unit may be a member of a compressed air energy storage plant
[1..1]	[1..1] AirCompressor	AirCompressor	An air compressor may be a member of a compressed air energy storage plant
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.3.7 Classification datatype

1..n, with 1 the most detailed, highest priority, etc.

Table 276 shows all attributes of Classification.

Table 276 – Attributes of Production::Classification

name	type	description
value	Integer	
unit=none (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.8.3.8 CogenerationPlant

A set of thermal generating units for the production of electrical energy and process steam (usually from the output of the steam turbines). The steam sendout is typically used for industrial purposes or for municipal heating and cooling.

Table 277 shows all attributes of CogenerationPlant.

Table 277 – Attributes of Production::CogenerationPlant

name	type	description
cogenHPSendoutRating	Float	The high pressure steam sendout
cogenHPSteamRating	Float	The high pressure steam rating
cogenLPSendoutRating	Float	The low pressure steam sendout
cogenLPSteamRating	Float	The low pressure steam rating
ratedP	ActivePower	The rated output active power of the cogeneration plant
mRID	String	inherited from: IdentifiedObject

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name	type	description
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 278 shows all association ends of CogenerationPlant with other classes.

Table 278 – Association ends of Production::CogenerationPlant with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] ThermalGeneratingUnits	ThermalGeneratingUnit	A thermal generating unit may be a member of a cogeneration plant
[1..1]	[1..1] SteamSendoutSchedule	SteamSendoutSchedule	A cogeneration plant has a steam sendout schedule
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.3.9 CombinedCyclePlant

A set of combustion turbines and steam turbines where the exhaust heat from the combustion turbines is recovered to make steam for the steam turbines, resulting in greater overall plant efficiency.

Table 279 shows all attributes of CombinedCyclePlant.

Table 279 – Attributes of Production::CombinedCyclePlant

name	type	description
combCyclePlantRating	ActivePower	The combined cycle plant's active power output rating
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 280 shows all association ends of CombinedCyclePlant with other classes.

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Table 280 – Association ends of Production::CombinedCyclePlant with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] ThermalGeneratingUnits	ThermalGeneratingUnit	A thermal generating unit may be a member of a combined cycle plant
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.3.10 CostPerHeatUnit datatype

Cost, in units of currency, per quantity of heat generated.

Table 281 shows all attributes of CostPerHeatUnit.

Table 281 – Attributes of Production::CostPerHeatUnit

name	type	description
value	Float	
unit	MonetaryAmountPerHeatUnit	
multiplier	UnitMultiplier	

6.1.8.3.11 Emission datatype

Quantity of emission per fuel heat content.

Table 282 shows all attributes of Emission.

Table 282 – Attributes of Production::Emission

name	type	description
value	Float	
unit=kg/J (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.8.3.12 EmissionAccount

Accounts for tracking emissions usage and credits for thermal generating units. A unit may have zero or more emission accounts, and will typically have one for tracking usage and one for tracking credits.

Table 283 shows all attributes of EmissionAccount.

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Table 283 – Attributes of Production::EmissionAccount

name	type	description
emissionType	EmissionType	The type of emission, for example sulfur dioxide (SO_2). The y1AxisUnits of the curve contains the unit of measure (e.g. kg) and the emissionType is the type of emission (e.g. sulfer dioxide)
emissionValueSource	EmissionValueSource	The source of the emission value
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 284 shows all association ends of EmissionAccount with other classes.

Table 284 – Association ends of Production::EmissionAccount with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	A thermal generating unit may have one or more emission allowance accounts
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.13 EmissionCurve

Relationship between the unit's emission rate in units of mass per hour (Y-axis) and output active power (X-axis) for a given type of emission. This curve applies when only one type of fuel is being burned.

Table 285 shows all attributes of EmissionCurve.

Table 285 – Attributes of Production::EmissionCurve

name	type	description
emissionContent	Emission	The emission content per quantity of fuel burned
emissionType	EmissionType	The type of emission, which also gives the production rate measurement unit. The y1AxisUnits of the curve contains the unit of measure (e.g. kg) and the emissionType is the type of emission (e.g. sulfer dioxide)

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name	type	description
isNetGrossP	Boolean	Flag is set to true when output is expressed in net active power
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 286 shows all association ends of EmissionCurve with other classes.

Table 286 – Association ends of Production::EmissionCurve with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	A thermal generating unit may have one or more emission curves
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.14 EmissionType enumeration

The type of emission.

Table 287 shows all literals of EmissionType.

Table 287 – Literals of Production::EmissionType

literal	description
sulfurDioxide	
carbonDioxide	
nitrogenOxide	
hydrogenSulfide	
chlorine	
carbonDisulfide	

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6.1.8.3.15 EmissionValueSource enumeration

The source of the emission value.

Table 288 shows all literals of EmissionValueSource.

Table 288 – Literals of Production::EmissionValueSource

literal	description
measured	
calculated	

6.1.8.3.16 FossilFuel

The fossil fuel consumed by the non-nuclear thermal generating units, e.g. coal, oil, gas.

Table 289 shows all attributes of FossilFuel.

Table 289 – Attributes of Production::FossilFuel

name	type	description
fossilFuelType	FuelType	The type of fossil fuel, such as coal, oil, or gas
fuelCost	CostPerHeatUnit	The cost in terms of heat value for the given type of fuel
fuelDispatchCost	CostPerHeatUnit	The cost of fuel used for economic dispatching which includes: fuel cost, transportation cost, and incremental maintenance cost
fuelEffFactor	PU	The efficiency factor for the fuel (per unit) in terms of the effective energy absorbed
fuelHandlingCost	CostPerHeatUnit	Handling and processing cost associated with this fuel
fuelHeatContent	Float	The amount of heat per weight (or volume) of the given type of fuel
fuelMixture	PerCent	Relative amount of the given type of fuel, when multiple fuels are being consumed
fuelSulfur	PU	The fuel's fraction of pollution credit per unit of heat content
highBreakpointP	ActivePower	The active power output level of the unit at which the given type of fuel is switched on. This fuel (e.g., oil) is sometimes used to supplement the base fuel (e.g., coal) at high active power output levels
lowBreakpointP	ActivePower	The active power output level of the unit at which the given type of fuel is switched off. This fuel (e.g., oil) is sometimes used to stabilize the base fuel (e.g., coal) at low active power output levels
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 290 shows all association ends of FossilFuel with other classes.

Table 290 – Association ends of Production::FossilFuel with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] FuelAllocationSchedules	FuelAllocationSchedule	A fuel allocation schedule shall have a fossil fuel
[0..*]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	A thermal generating unit may have one or more fossil fuels

6.1.8.3.17 FuelAllocationSchedule

Amount of fuel of a given type which is allocated for consumption over a specified period of time.

Table 291 shows all attributes of FuelAllocationSchedule.

Table 291 – Attributes of Production::FuelAllocationSchedule

name	type	description
fuelAllocationEndDate	AbsoluteDateTime	The end time and date of the fuel allocation schedule
fuelAllocationStartDate	AbsoluteDateTime	The start time and date of the fuel allocation schedule
fuelType	FuelType	The type of fuel, which also indicates the corresponding measurement unit
maxFuelAllocation	Float	The maximum amount fuel that is allocated for consumption for the scheduled time period
minFuelAllocation	Float	The minimum amount fuel that is allocated for consumption for the scheduled time period, e.g., based on a "take-or-pay" contract
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 292 shows all association ends of FuelAllocationSchedule with other classes.

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Table 292 – Association ends of Production::FuelAllocationSchedule with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	A thermal generating unit may have one or more fuel allocation schedules
[0..*]	[1..1] FossilFuel	FossilFuel	A fuel allocation schedule shall have a fossil fuel
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.18 FuelType enumeration

Type of fuel.

Table 293 shows all literals of FuelType.

Table 293 – Literals of Production::FuelType

literal	description
coal	
oil	
gas	
lignite	The fuel is lignite coal. Note that this is a special type of coal, so the other enum of coal is reserved for hard coal types or if the exact type of coal is not known

6.1.8.3.19 GeneratingUnit

A single or set of synchronous machines for converting mechanical power into alternating-current power. For example, individual machines within a set may be defined for scheduling purposes while a single control signal is derived for the set. In this case there would be a GeneratingUnit for each member of the set and an additional GeneratingUnit corresponding to the set.

Table 294 shows all attributes of GeneratingUnit.

Table 294 – Attributes of Production::GeneratingUnit

name	type	description
allocSpinResP	ActivePower	The planned unused capacity (spinning reserve) which can be used to support emergency load
autoCntrlMarginP	ActivePower	The planned unused capacity which can be used to support automatic control overruns
baseP	ActivePower	For dispatchable units, this value represents the economic active power basepoint, for units that are not dispatchable, this value represents the fixed generation value. The value shall be between the operating low and high limits
controlDeadband	ActivePower	Unit control error deadband. When a unit's desired active power change is less than this deadband, then no control pulses will be sent to the unit
controlPulseHigh	Seconds	Pulse high limit which is the largest control pulse that the unit can respond to
controlPulseLow	Seconds	Pulse low limit which is the smallest control pulse that the unit can respond to

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name	type	description
controlResponseRate	ActivePowerChangeRate	Unit response rate which specifies the active power change for a control pulse of one second in the most responsive loading level of the unit
dispReserveFlag	Boolean	
efficiency	PU	The efficiency of the unit in converting mechanical energy, from the prime mover, into electrical energy
energyMinP	HeatRate	
fastStartFlag	Boolean	
fuelPriority	Integer	
genControlMode	GeneratorControlMode	The unit control mode
genControlSource	GeneratorControlSource	The source of controls for a generating unit
genOperatingMode	GeneratorOperatingMode	Operating mode for secondary control
governorMPL	PU	Governor Motor Position Limit
governorSCD	PerCent	Governor Speed Changer Droop. This is the change in generator power output divided by the change in frequency normalized by the nominal power of the generator and the nominal frequency and expressed in percent and negated. A positive value of speed change droop provides additional generator output upon a drop in frequency
highControlLimit	ActivePower	High limit for secondary (AGC) control
initialP	ActivePower	Default Initial active power which is used to store a powerflow result for the initial active power for this unit in this network configuration
longPF	Float	Generating unit economic participation factor
lowControlLimit	ActivePower	Low limit for secondary (AGC) control
lowerRampRate	ActivePowerChangeRate	
maxEconomicP	ActivePower	Maximum high economic active power limit, that should not exceed the maximum operating active power limit
maximumAllowableSpinningReserve	ActivePower	Maximum allowable spinning reserve. Spinning reserve will never be considered greater than this value regardless of the current operating point
maxOperatingP	ActivePower	This is the maximum operating active power limit the dispatcher can enter for this unit
minEconomicP	ActivePower	Low economic active power limit that shall be greater than or equal to the minimum operating active power limit
minimumOffTime	Seconds	Minimum time interval between unit shutdown and startup
minOperatingP	ActivePower	This is the minimum operating active power limit the dispatcher can enter for this unit
modelDetail	Classification	Detail level of the generator model data
normalPF	Float	Generating unit economic participation factor
penaltyFactor	Float	Defined as: 1 / (1 - Incremental Transmission Loss); with the Incremental Transmission Loss expressed as a plus or minus value. The typical range of penalty factors is (0.9 to 1.1)
raiseRampRate	ActivePowerChangeRate	
ratedGrossMaxP	ActivePower	The unit's gross rated maximum capacity (Book Value)
ratedGrossMinP	ActivePower	The gross rated minimum generation level which the unit can safely operate at while delivering power to the transmission grid

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name	type	description
ratedNetMaxP	ActivePower	The net rated maximum capacity determined by subtracting the auxiliary power used to operate the internal plant machinery from the rated gross maximum capacity
shortPF	Float	Generating unit economic participation factor
spinReserveRamp	ActivePowerChangeRate	
startupCost	Money	The initial startup cost incurred for each start of the GeneratingUnit.
startupTime	Seconds	Time it takes to get the unit on-line, from the time that the prime mover mechanical power is applied
stepChange	ActivePower	
tieLinePF	Float	Generating unit economic participation factor
variableCost	Money	The variable cost component of production per unit of ActivePower
nominalP	ActivePower	The nominal power of the generating unit. Used to give precise meaning to percentage based attributes such as the govenor speed change droop (govenorSCD attribute)
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 295 shows all association ends of GeneratingUnit with other classes.

Table 295 – Association ends of Production::GeneratingUnit with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..*] SynchronousMachines	SynchronousMachine	A synchronous machine may operate as a generator and as such becomes a member of a generating unit
[1..1]	[0..1] GenUnitOpSchedule	GenUnitOpSchedule	A generating unit may have an operating schedule, indicating the planned operation of the unit
[1..1]	[0..*] GrossToNetActivePower Curves	GrossToNetActivePower Curve	A generating unit may have a gross active power to net active power curve, describing the losses and auxiliary power requirements of the unit
[1..1]	[0..*] GenUnitOpCostCurves	GenUnitOpCostCurve	A generating unit may have one or more cost curves, depending upon fuel mixture and fuel cost
[1..1]	[0..*] ControlAreaGeneratingUnit	ControlAreaGeneratingUnit	ControlArea specifications for this generating unit
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource

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[mult from]	[mult to] name	type	description
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.3.20 GeneratorControlMode enumeration

Unit control modes.

Table 296 shows all literals of GeneratorControlMode.

Table 296 – Literals of Production::GeneratorControlMode

literal	description
setpoint	
pulse	

6.1.8.3.21 GeneratorControlSource enumeration

The source of controls for a generating unit.

Table 297 shows all literals of GeneratorControlSource.

Table 297 – Literals of Production::GeneratorControlSource

literal	description
unavailable	
offAGC	
onAGC	
plantControl	

6.1.8.3.22 GeneratorOperatingMode enumeration

Operating mode for secondary generator control.

Table 298 shows all literals of GeneratorOperatingMode.

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Table 298 – Literals of Production::GeneratorOperatingMode

literal	description
off	
manual	
fixed	
LFC	
AGC	
EDC	
MRN	
REG	

6.1.8.3.23 GenUnitOpCostCurve

Relationship between unit operating cost (Y-axis) and unit output active power (X-axis). The operating cost curve for thermal units is derived from heat input and fuel costs. The operating cost curve for hydro units is derived from water flow rates and equivalent water costs.

Table 299 shows all attributes of GenUnitOpCostCurve.

Table 299 – Attributes of Production::GenUnitOpCostCurve

name	type	description
isNetGrossP	Boolean	Flag is set to true when output is expressed in net active power
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 300 shows all association ends of GenUnitOpCostCurve with other classes.

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Table 300 – Association ends of Production::GenUnitOpCostCurve with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] GeneratingUnit	GeneratingUnit	A generating unit may have one or more cost curves, depending upon fuel mixture and fuel cost
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.24 GenUnitOpSchedule

The generating unit's Operator-approved current operating schedule (or plan), typically produced with the aid of unit commitment type analyses. The X-axis represents absolute time. The Y1-axis represents the status (0=off-line and unavailable: 1=available: 2=must run: 3=must run at fixed power value: etc.). The Y2-axis represents the must run fixed power value where required.

Table 301 shows all attributes of GenUnitOpSchedule.

Table 301 – Attributes of Production::GenUnitOpSchedule

name	type	description
timeStep	Seconds	inherited from: RegularIntervalSchedule
endTime	AbsoluteDateTime	inherited from: RegularIntervalSchedule
startTime	AbsoluteDateTime	inherited from: BasicIntervalSchedule
value1Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
value2Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 302 shows all association ends of GenUnitOpSchedule with other classes.

Table 302 – Association ends of Production::GenUnitOpSchedule with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] GeneratingUnit	GeneratingUnit	A generating unit may have an operating schedule, indicating the planned operation of the unit
[1..1]	[1..*] TimePoints	RegularTimePoint	inherited from: RegularIntervalSchedule

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6.1.8.3.25 GrossToNetActivePowerCurve

Relationship between the generating unit's gross active power output on the X-axis (measured at the terminals of the machine(s)) and the generating unit's net active power output on the Y-axis (based on utility-defined measurements at the power station). Station service loads, when modeled, should be treated as non-conforming bus loads. There may be more than one curve, depending on the auxiliary equipment that is in service.

Table 303 shows all attributes of GrossToNetActivePowerCurve.

Table 303 – Attributes of Production::GrossToNetActivePowerCurve

name	type	description
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 304 shows all association ends of GrossToNetActivePowerCurve with other classes.

Table 304 – Association ends of Production::GrossToNetActivePowerCurve with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] GeneratingUnit	GeneratingUnit	A generating unit may have a gross active power to net active power curve, describing the losses and auxiliary power requirements of the unit
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.26 HeatInputCurve

Relationship between unit heat input in energy per time for main fuel (Y1-axis) and supplemental fuel (Y2-axis) versus unit output in active power (X-axis). The quantity of main fuel used to sustain generation at this output level is prorated for throttling between definition points. The quantity of supplemental fuel used at this output level is fixed and not prorated.

Table 305 shows all attributes of HeatInputCurve.

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Table 305 – Attributes of Production::HeatInputCurve

name	type	description
auxPowerOffset	ActivePower	Power output - auxiliary power offset adjustment factor
auxPowerMult	PU	Power output - auxiliary power multiplier adjustment factor
heatInputEff	PU	Heat input - efficiency multiplier adjustment factor
heatInputOffset	HeatRate	Heat input - offset adjustment factor
isNetGrossP	Boolean	Flag is set to true when output is expressed in net active power
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 306 shows all association ends of HeatInputCurve with other classes.

Table 306 – Association ends of Production::HeatInputCurve with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	A thermal generating unit may have a heat input curve
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.27 HeatRate datatype

Heat generated, in energy per time unit of elapsed time.

Table 307 shows all attributes of HeatRate.

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Table 307 – Attributes of Production::HeatRate

name	type	description
value	Float	
unit=J/s (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.8.3.28 HeatRateCurve

Relationship between unit heat rate per active power (Y-axis) and unit output (X-axis). The heat input is from all fuels.

Table 308 shows all attributes of HeatRateCurve.

Table 308 – Attributes of Production::HeatRateCurve

name	type	description
isNetGrossP	Boolean	Flag is set to true when output is expressed in net active power
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 309 shows all association ends of HeatRateCurve with other classes.

Table 309 – Association ends of Production::HeatRateCurve with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	A thermal generating unit may have a heat rate curve
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

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6.1.8.3.29 HydroGeneratingEfficiencyCurve

Relationship between unit efficiency in percent and unit output active power for a given net head in meters. The relationship between efficiency, discharge, head, and power output is expressed as follows:

$$E = KP / HQ$$

where

E is the percentage;

P is the active power;

H is the height;

Q is the volume/time unit;

K is the constant.

For example, a curve instance for a given net head could relate efficiency (Y-axis) versus active power output (X-axis) or versus discharge on the X-axis.

Table 310 shows all attributes of HydroGeneratingEfficiencyCurve.

Table 310 – Attributes of Production::HydroGeneratingEfficiencyCurve

name	type	description
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 311 shows all association ends of HydroGeneratingEfficiencyCurve with other classes.

Table 311 – Association ends of Production::HydroGeneratingEfficiencyCurve with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] HydroGeneratingUnit	HydroGeneratingUnit	A hydro generating unit has an efficiency curve
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

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6.1.8.3.30 HydroGeneratingUnit

A generating unit whose prime mover is a hydraulic turbine (e.g. Francis, Pelton, Kaplan).

Table 312 shows all attributes of HydroGeneratingUnit.

Table 312 – Attributes of Production::HydroGeneratingUnit

name	type	description
energyConversionCapability	HydroEnergyConversionKind	Energy conversion capability for generating
hydroUnitWaterCost	Float	The equivalent cost of water that drives the hydro turbine, expressed as cost per volume
allocSpinResP	ActivePower	inherited from: GeneratingUnit
autoCntrlMarginP	ActivePower	inherited from: GeneratingUnit
baseP	ActivePower	inherited from: GeneratingUnit
controlDeadband	ActivePower	inherited from: GeneratingUnit
controlPulseHigh	Seconds	inherited from: GeneratingUnit
controlPulseLow	Seconds	inherited from: GeneratingUnit
controlResponseRate	ActivePowerChangeRate	inherited from: GeneratingUnit
dispReserveFlag	Boolean	inherited from: GeneratingUnit
efficiency	PU	inherited from: GeneratingUnit
energyMinP	HeatRate	inherited from: GeneratingUnit
fastStartFlag	Boolean	inherited from: GeneratingUnit
fuelPriority	Integer	inherited from: GeneratingUnit
genControlMode	GeneratorControlMode	inherited from: GeneratingUnit
genControlSource	GeneratorControlSource	inherited from: GeneratingUnit
genOperatingMode	GeneratorOperatingMode	inherited from: GeneratingUnit
governorMPL	PU	inherited from: GeneratingUnit
governorSCD	PerCent	inherited from: GeneratingUnit
highControlLimit	ActivePower	inherited from: GeneratingUnit
initialP	ActivePower	inherited from: GeneratingUnit
longPF	Float	inherited from: GeneratingUnit
lowControlLimit	ActivePower	inherited from: GeneratingUnit
lowerRampRate	ActivePowerChangeRate	inherited from: GeneratingUnit
maxEconomicP	ActivePower	inherited from: GeneratingUnit
maximumAllowableSpinningReserve	ActivePower	inherited from: GeneratingUnit
maxOperatingP	ActivePower	inherited from: GeneratingUnit
minEconomicP	ActivePower	inherited from: GeneratingUnit
minimumOffTime	Seconds	inherited from: GeneratingUnit
minOperatingP	ActivePower	inherited from: GeneratingUnit
modelDetail	Classification	inherited from: GeneratingUnit
normalPF	Float	inherited from: GeneratingUnit
penaltyFactor	Float	inherited from: GeneratingUnit
raiseRampRate	ActivePowerChangeRate	inherited from: GeneratingUnit
ratedGrossMaxP	ActivePower	inherited from: GeneratingUnit
ratedGrossMinP	ActivePower	inherited from: GeneratingUnit
ratedNetMaxP	ActivePower	inherited from: GeneratingUnit

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name	type	description
shortPF	Float	inherited from: GeneratingUnit
spinReserveRamp	ActivePowerChangeRate	inherited from: GeneratingUnit
startupCost	Money	inherited from: GeneratingUnit
startupTime	Seconds	inherited from: GeneratingUnit
stepChange	ActivePower	inherited from: GeneratingUnit
tieLinePF	Float	inherited from: GeneratingUnit
variableCost	Money	inherited from: GeneratingUnit
nominalP	ActivePower	inherited from: GeneratingUnit
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 313 shows all association ends of HydroGeneratingUnit with other classes.

Table 313 – Association ends of Production::HydroGeneratingUnit with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] TailbayLossCurve	TailbayLossCurve	A hydro generating unit has a tailbay loss curve
[1..*]	[1..1] HydroPowerPlant	HydroPowerPlant	The hydro generating unit belongs to a hydro power plant
[1..1]	[0..*] HydroGeneratingEfficiency Curves	HydroGeneratingEfficiency Curve	A hydro generating unit has an efficiency curve
[1..1]	[0..1] PenstockLossCurve	PenstockLossCurve	A hydro generating unit has a penstock loss curve
[0..1]	[1..*] SynchronousMachines	SynchronousMachine	inherited from: GeneratingUnit
[1..1]	[0..1] GenUnitOpSchedule	GenUnitOpSchedule	inherited from: GeneratingUnit
[1..1]	[0..*] GrossToNetActivePowerCurves	GrossToNetActivePower Curve	inherited from: GeneratingUnit
[1..1]	[0..*] GenUnitOpCostCurves	GenUnitOpCostCurve	inherited from: GeneratingUnit
[1..1]	[0..*] ControlAreaGeneratingUnit	ControlAreaGenerating Unit	inherited from: GeneratingUnit
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource

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[mult from]	[mult to] name	type	description
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.3.31 HydroPlantType enumeration

The type of hydro power plant.

Table 314 shows all literals of HydroPlantType.

Table 314 – Literals of Production::HydroPlantType

literal	description
runOfRiver	
pumpedStorage	
majorStorage	
minorStorage	

6.1.8.3.32 HydroPowerPlant

A hydro power station which can generate or pump. When generating, the generator turbines receive their water from an upper reservoir. When pumping, the pumps receive their water from a lower reservoir.

Table 315 shows all attributes of HydroPowerPlant.

Table 315 – Attributes of Production::HydroPowerPlant

name	type	description
dischargeTravelDelay	Seconds	Water travel delay from tailbay to next downstream hydro power station
genRatedP	ActivePower	The hydro plant's generating rating active power for rated head conditions
hydroPlantType	HydroPlantType	The type of hydro power plant
penstockType	PenstockType	Type and configuration of hydro plant penstock(s)
plantDischargeCapacity	Float	Total plant discharge capacity in cubic meters per second
plantRatedHead	Length	The plant's rated gross head
pumpRatedP	ActivePower	The hydro plant's pumping rating active power for rated head conditions
surgeTankCode	SurgeTankCode	A code describing the type (or absence) of surge tank that is associated with the hydro power plant
surgeTankCrestLevel	WaterLevel	The level at which the surge tank spills

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name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 316 shows all association ends of HydroPowerPlant with other classes.

Table 316 – Association ends of Production::HydroPowerPlant with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..*] HydroPumps	HydroPump	The hydro pump may be a member of a pumped storage plant or a pump for distributing water
[0..*]	[0..1] Reservoir	Reservoir	Generators discharge water to or pumps are supplied water from a downstream reservoir
[0..*]	[1..1] GenSourcePumpDischargeReservoir	Reservoir	Generators are supplied water from or pumps discharge water to an upstream reservoir
[1..1]	[1..*] HydroGeneratingUnits	HydroGeneratingUnit	The hydro generating unit belongs to a hydro power plant
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.3.33 HydroPump

A synchronous motor-driven pump, typically associated with a pumped storage plant.

Table 317 shows all attributes of HydroPump.

Table 317 – Attributes of Production::HydroPump

name	type	description
pumpDischAtMaxHead	Float	The pumping discharge (m^3/s) under maximum head conditions, usually at full gate
pumpDischAtMinHead	Float	The pumping discharge (m^3/s) under minimum head conditions, usually at full gate
pumpPowerAtMaxHead	ActivePower	The pumping power under maximum head conditions, usually at full gate
pumpPowerAtMinHead	ActivePower	The pumping power under minimum head conditions, usually at full gate
mRID	String	inherited from: IdentifiedObject

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name	type	description
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 318 shows all association ends of HydroPump with other classes.

Table 318 – Association ends of Production::HydroPump with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..1] HydroPumpOpSchedule	HydroPumpOpSchedule	The hydro pump has a pumping schedule over time, indicating when pumping is to occur
[0..1]	[1..1] SynchronousMachine	SynchronousMachine	The synchronous machine drives the turbine which moves the water from a low elevation to a higher elevation. The direction of machine rotation for pumping may or may not be the same as for generating
[1..*]	[0..1] HydroPowerPlant	HydroPowerPlant	The hydro pump may be a member of a pumped storage plant or a pump for distributing water
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.8.3.34 HydroPumpOpSchedule

The hydro pump's Operator-approved current operating schedule (or plan), typically produced with the aid of unit commitment type analyses.The unit's operating schedule status is typically given as: (0=unavailable) (1=avilable to startup or shutdown) (2=must pump).

Table 319 shows all attributes of HydroPumpOpSchedule.

Table 319 – Attributes of Production::HydroPumpOpSchedule

name	type	description
timeStep	Seconds	inherited from: RegularIntervalSchedule
endTime	AbsoluteDateTime	inherited from: RegularIntervalSchedule
startTime	AbsoluteDateTime	inherited from: BasicIntervalSchedule
value1Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
value2Unit	UnitSymbol	inherited from: BasicIntervalSchedule

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name	type	description
value2Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 320 shows all association ends of HydroPumpOpSchedule with other classes.

Table 320 – Association ends of Production::HydroPumpOpSchedule with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] HydroPump	HydroPump	The hydro pump has a pumping schedule over time, indicating when pumping is to occur.
[1..1]	[1..*] TimePoints	RegularTimePoint	inherited from: RegularIntervalSchedule

6.1.8.3.35 IncrementalHeatRateCurve

Relationship between unit incremental heat rate in (delta energy/time) per (delta active power) and unit output in active power. The IHR curve represents the slope of the HeatInputCurve. Note that the "incremental heat rate" and the "heat rate" have the same engineering units.

Table 321 shows all attributes of IncrementalHeatRateCurve.

Table 321 – Attributes of Production::IncrementalHeatRateCurve

name	type	description
isNetGrossP	Boolean	Flag is set to true when output is expressed in net active power
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 322 shows all association ends of IncrementalHeatRateCurve with other classes.

Table 322 – Association ends of Production::IncrementalHeatRateCurve with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	A thermal generating unit may have an incremental heat rate curve
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.36 InflowForecast

Natural water inflow to a reservoir, usually forecasted from predicted rain and snowmelt. Typically in one hour increments for up to 10 days. The forecast is given in average cubic meters per second over the time increment.

Table 323 shows all attributes of InflowForecast.

Table 323 – Attributes of Production::InflowForecast

name	type	description
timeStep	Seconds	inherited from: RegularIntervalSchedule
endTime	AbsoluteDateTime	inherited from: RegularIntervalSchedule
startTime	AbsoluteDateTime	inherited from: BasicIntervalSchedule
value1Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
value2Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 324 shows all association ends of InflowForecast with other classes.

Table 324 – Association ends of Production::InflowForecast with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Reservoir	Reservoir	A reservoir may have a "natural" inflow forecast
[1..1]	[1..*] TimePoints	RegularTimePoint	inherited from: RegularIntervalSchedule

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6.1.8.3.37 LevelVsVolumeCurve

Relationship between reservoir volume and reservoir level. The volume is at the y-axis and the reservoir level at the x-axis.

Table 325 shows all attributes of LevelVsVolumeCurve.

Table 325 – Attributes of Production::LevelVsVolumeCurve

name	type	description
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 326 shows all association ends of LevelVsVolumeCurve with other classes.

Table 326 – Association ends of Production::LevelVsVolumeCurve with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Reservoir	Reservoir	A reservoir may have a level versus volume relationship
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.38 PenstockLossCurve

Relationship between penstock head loss (in meters) and total discharge through the penstock (in cubic meters per second). One or more turbines may be connected to the same penstock.

Table 327 shows all attributes of PenstockLossCurve.

Table 327 – Attributes of Production::PenstockLossCurve

name	type	description
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve

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name	type	description
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 328 shows all association ends of PenstockLossCurve with other classes.

Table 328 – Association ends of Production::PenstockLossCurve with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] HydroGeneratingUnit	HydroGeneratingUnit	A hydro generating unit has a penstock loss curve
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.39 PenstockType enumeration

Type of hydro plant penstock.

6.1.8.3.40 Reservoir

A water storage facility within a hydro system, including: ponds, lakes, lagoons, and rivers. The storage is usually behind some type of dam.

Table 329 shows all attributes of Reservoir.

Table 329 – Attributes of Production::Reservoir

name	type	description
activeStorageCapacity	Volume	Storage volume between the full supply level and the normal minimum operating level
energyStorageRating	Float	The reservoir's energy storage rating in energy for given head conditions
fullSupplyLevel	WaterLevel	Full supply level, above which water will spill. This can be the spillway crest level or the top of closed gates
grossCapacity	Volume	Total capacity of reservoir
normalMinOperateLevel	WaterLevel	Normal minimum operating level below which the penstocks will draw air

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name	type	description
riverOutletWorks	String	River outlet works for riparian right releases or other purposes
spillTravelDelay	Seconds	The spillway water travel delay to the next downstream reservoir
spillwayCapacity	Float	The flow capacity of the spillway in cubic meters per second
spillwayCrestLength	Length	The length of the spillway crest
spillwayCrestLevel	WaterLevel	Spillway crest level above which water will spill
spillWayGateType	SpillwayGateType	Type of spillway gate, including parameters
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 330 shows all association ends of Reservoir with other classes.

Table 330 – Association ends of Production::Reservoir with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] SpillsIntoReservoirs	Reservoir	A reservoir may spill into a downstream reservoir
[1..1]	[0..*] LevelVsVolumeCurves	LevelVsVolumeCurve	A reservoir may have a level versus volume relationship
[1..1]	[0..*] InflowForecasts	InflowForecast	A reservoir may have a "natural" inflow forecast
[0..1]	[0..*] HydroPowerPlants	HydroPowerPlant	Generators discharge water to or pumps are supplied water from a downstream reservoir
[1..1]	[0..*] UpstreamFromHydroPowerPlants	HydroPowerPlant	Generators are supplied water from or pumps discharge water to an upstream reservoir
[1..1]	[0..1] TargetLevelSchedule	TargetLevelSchedule	A reservoir may have a water level target schedule
[0..*]	[0..1] SpillsFromReservoir	Reservoir	A reservoir may spill into a downstream reservoir
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

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6.1.8.3.41 ShutdownCurve

Relationship between the rate in gross active power/minute (Y-axis) at which a unit should be shutdown and its present gross MW output (X-axis).

Table 331 shows all attributes of ShutdownCurve.

Table 331 – Attributes of Production::ShutdownCurve

name	type	description
shutdownCost	Money	Fixed shutdown cost
shutdownDate	AbsoluteDateTime	The date and time of the most recent generating unit shutdown
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 332 shows all association ends of ShutdownCurve with other classes.

Table 332 – Association ends of Production::ShutdownCurve with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	A thermal generating unit may have a shutdown curve
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.42 SpillwayGateType enumeration

Type of spillway gate.

6.1.8.3.43 StartIgnFuelCurve

The quantity of ignition fuel (Y-axis) used to restart and repay the auxiliary power consumed versus the number of hours (X-axis) the unit was off line.

Table 333 shows all attributes of StartIgnFuelCurve.

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Table 333 – Attributes of Production::StartIgnFuelCurve

name	type	description
ignitionFuelType	FuelType	Type of ignition fuel
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 334 shows all association ends of StartIgnFuelCurve with other classes.

Table 334 – Association ends of Production::StartIgnFuelCurve with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] StartupModel	StartupModel	The unit's startup model may have a startup ignition fuel curve
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.44 StartMainFuelCurve

The quantity of main fuel (Y-axis) used to restart and repay the auxiliary power consumed versus the number of hours (X-axis) the unit was off line.

Table 335 shows all attributes of StartMainFuelCurve.

Table 335 – Attributes of Production::StartMainFuelCurve

name	type	description
mainFuelType	FuelType	Type of main fuel
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve

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name	type	description
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 336 shows all association ends of StartMainFuelCurve with other classes.

Table 336 – Association ends of Production::StartMainFuelCurve with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] StartupModel	StartupModel	The unit's startup model may have a startup main fuel curve
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.45 StartRampCurve

Rate in gross active power/minute (Y-axis) at which a unit can be loaded versus the number of hours (X-axis) the unit was off line.

Table 337 shows all attributes of StartRampCurve.

Table 337 – Attributes of Production::StartRampCurve

name	type	description
hotStandbyRamp	ActivePowerChangeRate	The startup ramp rate in gross for a unit that is on hot standby
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 338 shows all association ends of StartRampCurve with other classes.

Table 338 – Association ends of Production::StartRampCurve with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] StartupModel	StartupModel	The unit's startup model may have a startup ramp curve
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.46 StartupModel

Unit start up characteristics depending on how long the unit has been offline.

Table 339 shows all attributes of StartupModel.

Table 339 – Attributes of Production::StartupModel

name	type	description
fixedMaintCost	CostRate	Fixed Maintenance Cost
hotStandbyHeat	HeatRate	The amount of heat input per time unit required for hot standby operation
incrementalMaintCost	CostPerEnergyUnit	Incremental Maintenance Cost
minimumDownTime	Hours	The minimum number of hours the unit shall be down before restart
minimumRunTime	Hours	The minimum number of hours the unit shall be operating before being allowed to shut down
riskFactorCost	Money	The opportunity cost associated with the return in monetary unit. This represents the restart's "share" of the unit depreciation and risk of an event which would damage the unit
startupCost	Money	Total miscellaneous start up costs
startupDate	AbsoluteDateTime	The date and time of the most recent generating unit startup
startupPriority	Integer	Startup priority within control area where lower numbers indicate higher priorities. More than one unit in an area may be assigned the same priority
stbyAuxP	ActivePower	The unit's auxiliary active power consumption to maintain standby mode
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 340 shows all association ends of StartupModel with other classes.

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Table 340 – Association ends of Production::StartupModel with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	A thermal generating unit may have a startup model
[1..1]	[0..1] StartRampCurve	StartRampCurve	The unit's startup model may have a startup ramp curve
[1..1]	[0..1] StartIgnFuelCurve	StartIgnFuelCurve	The unit's startup model may have a startup ignition fuel curve
[1..1]	[0..1] StartMainFuelCurve	StartMainFuelCurve	The unit's startup model may have a startup main fuel curve

6.1.8.3.47 SteamSendoutSchedule

The cogeneration plant's steam sendout schedule in volume per time unit.

Table 341 shows all attributes of SteamSendoutSchedule.

Table 341 – Attributes of Production::SteamSendoutSchedule

name	type	description
timeStep	Seconds	inherited from: RegularIntervalSchedule
endTime	AbsoluteDateTime	inherited from: RegularIntervalSchedule
startTime	AbsoluteDateTime	inherited from: BasicIntervalSchedule
value1Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
value2Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 342 shows all association ends of SteamSendoutSchedule with other classes.

Table 342 – Association ends of Production::SteamSendoutSchedule with other classes

[mult from]	[mult to] name	type	description
[1..1]	[1..1] CogenerationPlant	CogenerationPlant	A cogeneration plant has a steam sendout schedule
[1..1]	[1..*] TimePoints	RegularTimePoint	inherited from: RegularIntervalSchedule

6.1.8.3.48 SurgeTankCode enumeration

Type (or absence) of surge tank that is associated with the hydro power plant.

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6.1.8.3.49 TailbayLossCurve

Relationship between tailbay head loss height (Y-axis) and the total discharge into the power station's tailbay volume per time unit (-axis). There could be more than one curve depending on the level of the tailbay reservoir or river level.

Table 343 shows all attributes of TailbayLossCurve.

Table 343 – Attributes of Production::TailbayLossCurve

name	type	description
curveStyle	CurveStyle	inherited from: Curve
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 344 shows all association ends of TailbayLossCurve with other classes.

Table 344 – Association ends of Production::TailbayLossCurve with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] HydroGeneratingUnit	HydroGeneratingUnit	A hydro generating unit has a tailbay loss curve
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.50 TargetLevelSchedule

Reservoir water level targets from advanced studies or "rule curves". Typically in one hour increments for up to 10 days.

Table 345 shows all attributes of TargetLevelSchedule.

Table 345 – Attributes of Production::TargetLevelSchedule

name	type	description
highLevelLimit	WaterLevel	High target level limit, above which the reservoir operation will be penalized
lowLevelLimit	WaterLevel	Low target level limit, below which the reservoir operation will be penalized
curveStyle	CurveStyle	inherited from: Curve

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name	type	description
xMultiplier	UnitMultiplier	inherited from: Curve
xUnit	UnitSymbol	inherited from: Curve
y1Multiplier	UnitMultiplier	inherited from: Curve
y1Unit	UnitSymbol	inherited from: Curve
y2Multiplier	UnitMultiplier	inherited from: Curve
y2Unit	UnitSymbol	inherited from: Curve
y3Multiplier	UnitMultiplier	inherited from: Curve
y3Unit	UnitSymbol	inherited from: Curve
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 346 shows all association ends of TargetLevelSchedule with other classes.

Table 346 – Association ends of Production::TargetLevelSchedule with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] Reservoir	Reservoir	A reservoir may have a water level target schedule
[1..1]	[0..*] CurveDatas	CurveData	inherited from: Curve

6.1.8.3.51 ThermalGeneratingUnit

A generating unit whose prime mover could be a steam turbine, combustion turbine, or diesel engine.

Table 347 shows all attributes of ThermalGeneratingUnit.

Table 347 – Attributes of Production::ThermalGeneratingUnit

name	type	description
oMCost	CostPerHeatUnit	Operating and maintenance cost for the thermal unit
allocSpinResP	ActivePower	inherited from: GeneratingUnit
autoCntrlMarginP	ActivePower	inherited from: GeneratingUnit
baseP	ActivePower	inherited from: GeneratingUnit
controlDeadband	ActivePower	inherited from: GeneratingUnit
controlPulseHigh	Seconds	inherited from: GeneratingUnit
controlPulseLow	Seconds	inherited from: GeneratingUnit
controlResponseRate	ActivePowerChangeRate	inherited from: GeneratingUnit
dispReserveFlag	Boolean	inherited from: GeneratingUnit
efficiency	PU	inherited from: GeneratingUnit

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name	type	description
energyMinP	HeatRate	inherited from: GeneratingUnit
fastStartFlag	Boolean	inherited from: GeneratingUnit
fuelPriority	Integer	inherited from: GeneratingUnit
genControlMode	GeneratorControlMode	inherited from: GeneratingUnit
genControlSource	GeneratorControlSource	inherited from: GeneratingUnit
genOperatingMode	GeneratorOperatingMode	inherited from: GeneratingUnit
governorMPL	PU	inherited from: GeneratingUnit
governorSCD	PerCent	inherited from: GeneratingUnit
highControlLimit	ActivePower	inherited from: GeneratingUnit
initialP	ActivePower	inherited from: GeneratingUnit
longPF	Float	inherited from: GeneratingUnit
lowControlLimit	ActivePower	inherited from: GeneratingUnit
lowerRampRate	ActivePowerChangeRate	inherited from: GeneratingUnit
maxEconomicP	ActivePower	inherited from: GeneratingUnit
maximumAllowableSpinningReserve	ActivePower	inherited from: GeneratingUnit
maxOperatingP	ActivePower	inherited from: GeneratingUnit
minEconomicP	ActivePower	inherited from: GeneratingUnit
minimumOffTime	Seconds	inherited from: GeneratingUnit
minOperatingP	ActivePower	inherited from: GeneratingUnit
modelDetail	Classification	inherited from: GeneratingUnit
normalPF	Float	inherited from: GeneratingUnit
penaltyFactor	Float	inherited from: GeneratingUnit
raiseRampRate	ActivePowerChangeRate	inherited from: GeneratingUnit
ratedGrossMaxP	ActivePower	inherited from: GeneratingUnit
ratedGrossMinP	ActivePower	inherited from: GeneratingUnit
ratedNetMaxP	ActivePower	inherited from: GeneratingUnit
shortPF	Float	inherited from: GeneratingUnit
spinReserveRamp	ActivePowerChangeRate	inherited from: GeneratingUnit
startupCost	Money	inherited from: GeneratingUnit
startupTime	Seconds	inherited from: GeneratingUnit
stepChange	ActivePower	inherited from: GeneratingUnit
tieLinePF	Float	inherited from: GeneratingUnit
variableCost	Money	inherited from: GeneratingUnit
nominalP	ActivePower	inherited from: GeneratingUnit
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 348 shows all association ends of ThermalGeneratingUnit with other classes.

Table 348 – Association ends of Production::ThermalGeneratingUnit with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..1] HeatRateCurve	HeatRateCurve	A thermal generating unit may have a heat rate curve
[0..*]	[0..1] CogenerationPlant	CogenerationPlant	A thermal generating unit may be a member of a cogeneration plant
[1..1]	[0..*] FuelAllocationSchedules	FuelAllocationSchedule	A thermal generating unit may have one or more fuel allocation schedules
[1..1]	[0..1] StartupModel	StartupModel	A thermal generating unit may have a startup model
[1..1]	[0..*] EmissionCurves	EmissionCurve	A thermal generating unit may have one or more emission curves
[1..1]	[0..1] ShutdownCurve	ShutdownCurve	A thermal generating unit may have a shutdown curve
[1..1]	[0..1] IncrementalHeatRateCurve	IncrementalHeatRateCurve	A thermal generating unit may have an incremental heat rate curve
[1..1]	[0..*] FossilFuels	FossilFuel	A thermal generating unit may have one or more fossil fuels
[0..1]	[0..1] CAESPlant	CAESPlant	A thermal generating unit may be a member of a compressed air energy storage plant
[0..*]	[0..1] CombinedCyclePlant	CombinedCyclePlant	A thermal generating unit may be a member of a combined cycle plant
[1..1]	[0..*] EmmissionAccounts	EmissionAccount	A thermal generating unit may have one or more emission allowance accounts
[1..1]	[0..1] HeatInputCurve	HeatInputCurve	A thermal generating unit may have a heat input curve
[0..1]	[1..*] SynchronousMachines	SynchronousMachine	inherited from: GeneratingUnit
[1..1]	[0..1] GenUnitOpSchedule	GenUnitOpSchedule	inherited from: GeneratingUnit
[1..1]	[0..*] GrossToNetActivePower Curves	GrossToNetActivePower Curve	inherited from: GeneratingUnit
[1..1]	[0..*] GenUnitOpCostCurves	GenUnitOpCostCurve	inherited from: GeneratingUnit
[1..1]	[0..*] ControlAreaGeneratingUnit	ControlAreaGeneratingUnit	inherited from: GeneratingUnit
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

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6.1.9 Package LoadModel

6.1.9.1 General

This package is responsible for modeling the energy consumers and the system load as curves and associated curve data. Special circumstances that may affect the load, such as seasons and daytypes, are also included here.

This information is used by Load Forecasting and Load Management.

Figure 58 shows logical diagram Main.

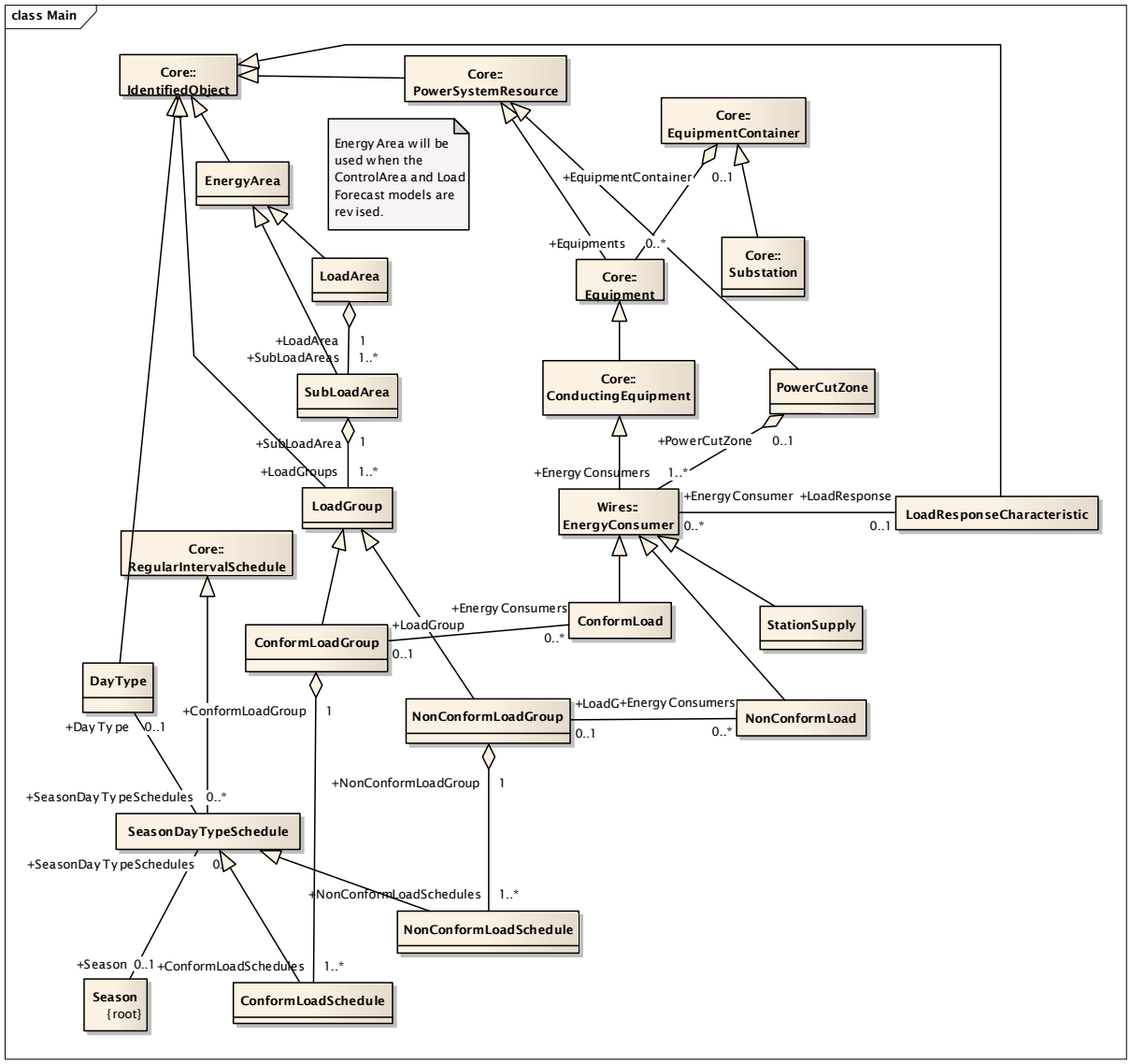

Figure 58 – Logical diagram LoadModel::Main

This diagram shows all classes included in the LoadModel package as well as the key external classes that have associations with LoadModel classes.

Figure 59 shows logical diagram Datatypes.

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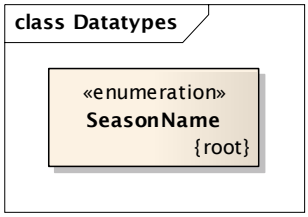

Figure 59 – Logical diagram LoadModel::Datatypes

6.1.9.2 ConformLoad

ConformLoad represent loads that follow a daily load change pattern where the pattern can be used to scale the load with a system load.

Table 349 shows all attributes of ConformLoad.

Table 349 – Attributes of LoadModel::ConformLoad

name	type	description
customerCount	Integer	inherited from: EnergyConsumer
pfixed	ActivePower	inherited from: EnergyConsumer
pfixedPct	PerCent	inherited from: EnergyConsumer
qfixed	ReactivePower	inherited from: EnergyConsumer
qfixedPct	PerCent	inherited from: EnergyConsumer
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 350 shows all association ends of ConformLoad with other classes.

Table 350 – Association ends of LoadModel::ConformLoad with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] LoadGroup	ConformLoadGroup	Group of this ConformLoad
[0..*]	[0..1] LoadResponse	LoadResponseCharacteristic	inherited from: EnergyConsumer
[1..*]	[0..1] PowerCutZone	PowerCutZone	inherited from: EnergyConsumer
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment

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[mult from]	[mult to] name	type	description
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.9.3 ConformLoadGroup

A group of loads conforming to an allocation pattern.

Table 351 shows all attributes of ConformLoadGroup.

Table 351 – Attributes of LoadModel::ConformLoadGroup

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 352 shows all association ends of ConformLoadGroup with other classes.

Table 352 – Association ends of LoadModel::ConformLoadGroup with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] EnergyConsumers	ConformLoad	Conform loads assigned to this ConformLoadGroup
[1..1]	[1..*] ConformLoadSchedules	ConformLoadSchedule	The ConformLoadSchedules in the ConformLoadGroup
[1..*]	[1..1] SubLoadArea	SubLoadArea	inherited from: LoadGroup

6.1.9.4 ConformLoadSchedule

A curve of load versus time (X-axis) showing the active power values (Y1-axis) and reactive power (Y2-axis) for each unit of the period covered. This curve represents a typical pattern of load over the time period for a given day type and season.

Table 353 shows all attributes of ConformLoadSchedule.

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Table 353 – Attributes of LoadModel::ConformLoadSchedule

name	type	description
timeStep	Seconds	inherited from: RegularIntervalSchedule
endTime	AbsoluteDateTime	inherited from: RegularIntervalSchedule
startTime	AbsoluteDateTime	inherited from: BasicIntervalSchedule
value1Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
value2Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 354 shows all association ends of ConformLoadSchedule with other classes.

Table 354 – Association ends of LoadModel::ConformLoadSchedule with other classes

[mult from]	[mult to] name	type	description
[1..*]	[1..1] ConformLoadGroup	ConformLoadGroup	The ConformLoadGroup where the ConformLoadSchedule belongs
[0..*]	[0..1] DayType	DayType	inherited from: SeasonDayTypeSchedule
[0..*]	[0..1] Season	Season	inherited from: SeasonDayTypeSchedule
[1..1]	[1..*] TimePoints	RegularTimePoint	inherited from: RegularIntervalSchedule

6.1.9.5 DayType

Group of similar days, e.g., Mon/Tue/Wed, Thu/Fri, Sat/Sun, Holiday1, Holiday2.

Table 355 shows all attributes of DayType.

Table 355 – Attributes of LoadModel::DayType

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 356 shows all association ends of DayType with other classes.

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Table 356 – Association ends of LoadModel::DayType with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] SeasonDayTypeSchedules	SeasonDayTypeSchedule	Schedules that use this DayType

6.1.9.6 EnergyArea

The class describes an area having energy production or consumption. The class is the basis for further specialization.

Table 357 shows all attributes of EnergyArea.

Table 357 – Attributes of LoadModel::EnergyArea

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 358 shows all association ends of EnergyArea with other classes.

Table 358 – Association ends of LoadModel::EnergyArea with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..1] ControlArea	ControlArea	The control area specification that is used for the load forecast

6.1.9.7 LoadArea

The class is the root or first level in a hierarchical structure for grouping of loads for the purpose of load flow load scaling.

Table 359 shows all attributes of LoadArea.

Table 359 – Attributes of LoadModel::LoadArea

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 360 shows all association ends of LoadArea with other classes.

Table 360 – Association ends of LoadModel::LoadArea with other classes

[mult from]	[mult to] name	type	description
[1..1]	[1..*] SubLoadAreas	SubLoadArea	The SubLoadAreas in the LoadArea
[0..1]	[0..1] ControlArea	ControlArea	inherited from: EnergyArea

6.1.9.8 LoadGroup

The class is the third level in a hierarchical structure for grouping of loads for the purpose of load flow load scaling.

Table 361 shows all attributes of LoadGroup.

Table 361 – Attributes of LoadModel::LoadGroup

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 362 shows all association ends of LoadGroup with other classes.

Table 362 – Association ends of LoadModel::LoadGroup with other classes

[mult from]	[mult to] name	type	description
[1..*]	[1..1] SubLoadArea	SubLoadArea	The SubLoadArea where the Loadgroup belongs

6.1.9.9 LoadResponseCharacteristic

Models the characteristic response of the load demand due to to changes in system conditions such as voltage and frequency. This is not related to demand response.

If LoadResponseCharacteristic.exponentModel is True, the voltage exponents are specified and used as to calculate:

Active power component = Pnominal * (Voltage/cim:BaseVoltage.nominalVoltage) ** cim:LoadResponseCharacteristic.pVoltageExponent

Reactive power component = Qnominal * (Voltage/cim:BaseVoltage.nominalVoltage)** cim:LoadResponseCharacteristic.qVoltageExponent

where * means "multiply" and ** is "raised to power of".

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Table 363 shows all attributes of LoadResponseCharacteristic.

Table 363 – Attributes of LoadModel::LoadResponseCharacteristic

name	type	description
exponentModel	Boolean	Indicates the exponential voltage dependency model (pVoltageExponent and qVoltageExponent) is to be used. If false, the coeficient model (consisting of pConstantImpedance, pConstantCurrent, pConstantPower, qConstantImpedance, qConstantCurrent, and qConstantPower) is to be used
pConstantCurrent	Float	Portion of active power load modeled as constant current. Used only if the useExponentModel is false. This value is normalized against the sum of pZ, pI, and pP
pConstantImpedance	Float	Portion of active power load modeled as constant impedance. Used only if the useExponentModel is false. This value is normalized against the sum of pZ, pI, and pP
pConstantPower	Float	Portion of active power load modeled as constant power. Used only if the useExponentModel is false. This value is normalized against the sum of pZ, pI, and pP
pFrequencyExponent	Float	Exponent of per unit frequency effecting active power
pVoltageExponent	Float	Exponent of per unit voltage effecting real power. This model used only when "useExponentModel" is true
qConstantCurrent	Float	Portion of reactive power load modeled as constant current. Used only if the useExponentModel is false. This value is normalized against the sum of qZ, qI, and qP
qConstantImpedance	Float	Portion of reactive power load modeled as constant impedance. Used only if the useExponentModel is false. This value is normalized against the sum of qZ, qI, and qP
qConstantPower	Float	Portion of reactive power load modeled as constant power. Used only if the useExponentModel is false. This value is normalized against the sum of qZ, qI, and qP
qFrequencyExponent	Float	Exponent of per unit frequency effecting reactive power
qVoltageExponent	Float	Exponent of per unit voltage effecting reactive power. This model used only when "useExponentModel" is true
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 364 shows all association ends of LoadResponseCharacteristic with other classes.

Table 364 – Association ends of LoadModel::LoadResponseCharacteristic with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] EnergyConsumer	EnergyConsumer	The set of loads that have the response characteristics

6.1.9.10 NonConformLoad

NonConformLoad represent loads that do not follow a daily load change pattern and changes are not correlated with the daily load change pattern.

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Table 365 shows all attributes of NonConformLoad.

Table 365 – Attributes of LoadModel::NonConformLoad

name	type	description
customerCount	Integer	inherited from: EnergyConsumer
pfixed	ActivePower	inherited from: EnergyConsumer
pfixedPct	PerCent	inherited from: EnergyConsumer
qfixed	ReactivePower	inherited from: EnergyConsumer
qfixedPct	PerCent	inherited from: EnergyConsumer
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 366 shows all association ends of NonConformLoad with other classes.

Table 366 – Association ends of LoadModel::NonConformLoad with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] LoadGroup	NonConformLoadGroup	Group of this ConformLoad
[0..*]	[0..1] LoadResponse	LoadResponseCharacteristic	inherited from: EnergyConsumer
[1..*]	[0..1] PowerCutZone	PowerCutZone	inherited from: EnergyConsumer
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

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6.1.9.11 NonConformLoadGroup

Loads that do not follow a daily and seasonal load variation pattern.

Table 367 shows all attributes of NonConformLoadGroup.

Table 367 – Attributes of LoadModel::NonConformLoadGroup

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 368 shows all association ends of NonConformLoadGroup with other classes.

Table 368 – Association ends of LoadModel::NonConformLoadGroup with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] EnergyConsumers	NonConformLoad	Conform loads assigned to this ConformLoadGroup
[1..1]	[1..*] NonConformLoadSchedules	NonConformLoadSchedule	The NonConformLoadSchedules in the NonConformLoadGroup
[1..*]	[1..1] SubLoadArea	SubLoadArea	inherited from: LoadGroup

6.1.9.12 NonConformLoadSchedule

An active power (Y1-axis) and reactive power (Y2-axis) schedule (curves) versus time (X-axis) for non-conforming loads, e.g., large industrial load or power station service (where modeled).

Table 369 shows all attributes of NonConformLoadSchedule.

Table 369 – Attributes of LoadModel::NonConformLoadSchedule

name	type	description
timeStep	Seconds	inherited from: RegularIntervalSchedule
endTime	AbsoluteDateTime	inherited from: RegularIntervalSchedule
startTime	AbsoluteDateTime	inherited from: BasicIntervalSchedule
value1Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
value2Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject

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name	type	description
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 370 shows all association ends of NonConformLoadSchedule with other classes.

Table 370 – Association ends of LoadModel::NonConformLoadSchedule with other classes

[mult from]	[mult to] name	type	description
[1..*]	[1..1] NonConformLoadGroup	NonConformLoadGroup	The NonConformLoadGroup where the NonConformLoadSchedule belongs
[0..*]	[0..1] DayType	DayType	inherited from: SeasonDayTypeSchedule
[0..*]	[0..1] Season	Season	inherited from: SeasonDayTypeSchedule
[1..1]	[1..*] TimePoints	RegularTimePoint	inherited from: RegularIntervalSchedule

6.1.9.13 PowerCutZone

An area or zone of the power system which is used for load shedding purposes.

Table 371 shows all attributes of PowerCutZone.

Table 371 – Attributes of LoadModel::PowerCutZone

name	type	description
cutLevel1	PerCent	First level (amount) of load to cut as a percentage of total zone load
cutLevel2	PerCent	Second level (amount) of load to cut as a percentage of total zone load
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 372 shows all association ends of PowerCutZone with other classes.

Table 372 – Association ends of LoadModel::PowerCutZone with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..*] EnergyConsumers	EnergyConsumer	An energy consumer is assigned to a power cut zone
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource

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[mult from]	[mult to] name	type	description
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.9.14 Season root class

A specified time period of the year, e.g. Spring, Summer, Fall, Winter.

Table 373 shows all attributes of Season.

Table 373 – Attributes of LoadModel::Season

name	type	description
name	SeasonName	Name of the Season
endDate	AbsoluteDateTime	Date season ends
startDate	AbsoluteDateTime	Date season starts

Table 374 shows all association ends of Season with other classes.

Table 374 – Association ends of LoadModel::Season with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..*] SeasonDayTypeSchedules	SeasonDayTypeSchedule	Schedules that use this Season.

6.1.9.15 SeasonDayTypeSchedule

The schedule specialize RegularIntervalSchedule with type curve data for a specific type of day and season. This means that curves of this type cover a 24 hour period.

Table 375 shows all attributes of SeasonDayTypeSchedule.

Table 375 – Attributes of LoadModel::SeasonDayTypeSchedule

name	type	description
timeStep	Seconds	inherited from: RegularIntervalSchedule
endTime	AbsoluteDateTime	inherited from: RegularIntervalSchedule
startTime	AbsoluteDateTime	inherited from: BasicIntervalSchedule
value1Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
value2Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 376 shows all association ends of SeasonDayTypeSchedule with other classes.

Table 376 – Association ends of LoadModel::SeasonDayTypeSchedule with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] DayType	DayType	DayType for the Schedule
[0..*]	[0..1] Season	Season	Season for the Schedule
[1..1]	[1..*] TimePoints	RegularTimePoint	inherited from: RegularIntervalSchedule

6.1.9.16 SeasonName enumeration

Name of season.

Table 377 shows all literals of SeasonName.

Table 377 – Literals of LoadModel::SeasonName

literal	description
winter	
spring	
summer	
fall	

6.1.9.17 StationSupply

Station supply with load derived from the station output.

Table 378 shows all attributes of StationSupply.

Table 378 – Attributes of LoadModel::StationSupply

name	type	description
customerCount	Integer	inherited from: EnergyConsumer
pfixed	ActivePower	inherited from: EnergyConsumer
pfixedPct	PerCent	inherited from: EnergyConsumer
qfixed	ReactivePower	inherited from: EnergyConsumer
qfixedPct	PerCent	inherited from: EnergyConsumer
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 379 shows all association ends of StationSupply with other classes.

Table 379 – Association ends of LoadModel::StationSupply with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] LoadResponse	LoadResponseCharacteristic	inherited from: EnergyConsumer
[1..*]	[0..1] PowerCutZone	PowerCutZone	inherited from: EnergyConsumer
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.9.18 SubLoadArea

The class is the second level in a hierarchical structure for grouping of loads for the purpose of load flow load scaling.

Table 380 shows all attributes of SubLoadArea.

Table 380 – Attributes of LoadModel::SubLoadArea

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 381 shows all association ends of SubLoadArea with other classes.

Table 381 – Association ends of LoadModel::SubLoadArea with other classes

[mult from]	[mult to] name	type	description
[1..1]	[1..*] LoadGroups	LoadGroup	The Loadgroups in the SubLoadArea
[1..*]	[1..1] LoadArea	LoadArea	The LoadArea where the SubLoadArea belongs
[0..1]	[0..1] ControlArea	ControlArea	inherited from: EnergyArea

6.1.10 Package Outage

6.1.10.1 General

An extension to the Core and Wires packages that models information on the current and planned network configuration. These entities are optional within typical network applications.

Figure 60 shows logical diagram Datatypes.

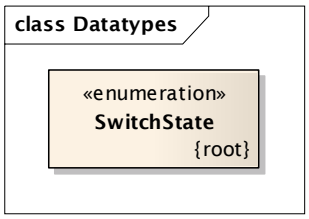

Figure 60 – Logical diagram Outage::Datatypes

This diagram shows the data types specific to the Outage package.

Figure 61 shows logical diagram Main.

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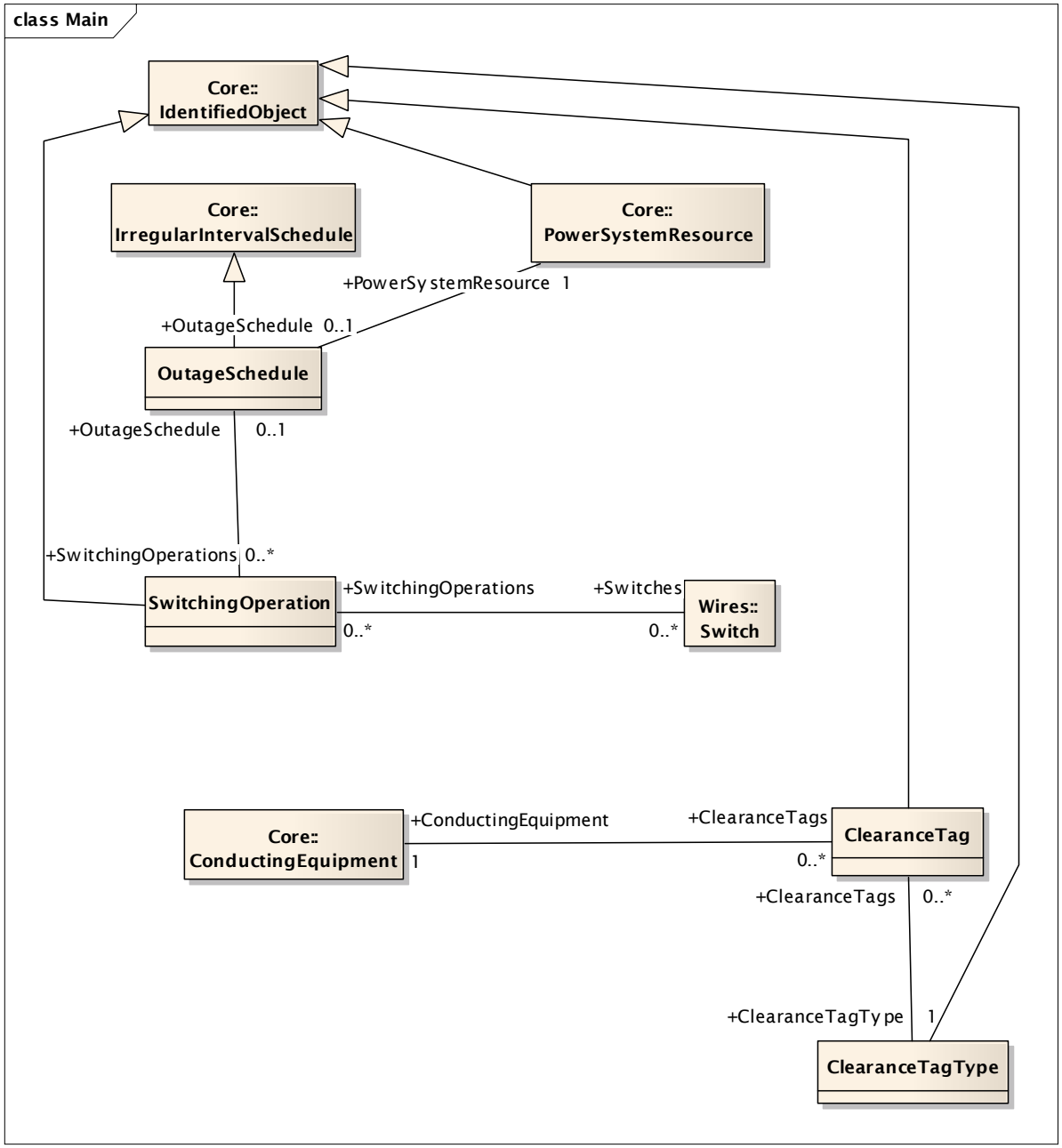

Figure 61 – Logical diagram Outage::Main

This diagram shows all classes included in the Outage package as well as the key external classes that have associations with Outage classes.

6.1.10.2 ClearanceTag

A clearance tag that is used to authorize and schedule work on conducting equipment in the field. Tagged equipment is not available for commercial service.

Table 382 shows all attributes of ClearanceTag.

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Table 382 – Attributes of Outage::ClearanceTag

name	type	description
authorityName	String	The name of the person who is authorized to issue the tag
deenergizeReqFlag	Boolean	Set true if equipment shall be deenergized
groundReqFlag	Boolean	Set true if equipment shall be grounded
phaseCheckReqFlag	Boolean	Set true if equipment phasing shall be checked
tagIssueTime	AbsoluteDateTime	The time at which the clearance tag was issued
workDescription	String	Description of the work to be performed
workEndTime	AbsoluteDateTime	The time at which the clearance tag is scheduled to be removed
workStartTime	AbsoluteDateTime	The time at which the clearance tag is scheduled to be set
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 383 shows all association ends of ClearanceTag with other classes.

Table 383 – Association ends of Outage::ClearanceTag with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] ConductingEquipment	ConductingEquipment	Conducting equipment may have multiple clearance tags for authorized field work
[0..*]	[1..1] ClearanceTagType	ClearanceTagType	The type of tag, depending on the purpose of the work to be performed and/or the type of supervisory control allowed

6.1.10.3 ClearanceTagType

Type of ClearanceTag. Could indicate the type of work to be performed and/or the type of supervisory control.

Table 384 shows all attributes of ClearanceTagType.

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Table 384 – Attributes of Outage::ClearanceTagType

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 385 shows all association ends of ClearanceTagType with other classes.

Table 385 – Association ends of Outage::ClearanceTagType with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] ClearanceTags	ClearanceTag	The ClearanceTags currently being defined for this type

6.1.10.4 OutageSchedule

The period of time that a piece of equipment is out of service, for example, for maintenance or testing; including the equipment's active power rating while under maintenance. The X-axis represents absolute time and the Y-axis represents the equipment's available rating while out of service.

Table 386 shows all attributes of OutageSchedule.

Table 386 – Attributes of Outage::OutageSchedule

name	type	description
startTime	AbsoluteDateTime	inherited from: BasicIntervalSchedule
value1Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
value2Unit	UnitSymbol	inherited from: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	inherited from: BasicIntervalSchedule
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 387 shows all association ends of OutageSchedule with other classes.

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Table 387 – Association ends of Outage::OutageSchedule with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] PowerSystemResource	PowerSystemResource	A power system resource may have an outage schedule
[0..1]	[0..*] SwitchingOperations	SwitchingOperation	An OutageSchedule may operate many switches
[1..1]	[1..*] TimePoints	IrregularTimePoint	inherited from: IrregularIntervalSchedule

6.1.10.5 SwitchingOperation

A SwitchingOperation is used to define individual switch operations for an OutageSchedule. This OutageSchedule may be associated with another item of Substation such as a Transformer, Line, or Generator; or with the Switch itself as a PowerSystemResource. A Switch may be referenced by many OutageSchedules.

Table 388 shows all attributes of SwitchingOperation.

Table 388 – Attributes of Outage::SwitchingOperation

name	type	description
operationTime	AbsoluteDateTime	Time of operation in same units as OutageSchedule.xAxixUnits
newState	SwitchState	The switch position that shall result from this SwitchingOperation
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 389 shows all association ends of SwitchingOperation with other classes.

Table 389 – Association ends of Outage::SwitchingOperation with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..*] Switches	Switch	A switch may be operated by many schedules
[0..*]	[0..1] OutageSchedule	OutageSchedule	An OutageSchedule may operate many switches

6.1.10.6 SwitchState enumeration

Possible states for a switch.

Table 390 shows all literals of SwitchState.

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Table 390 – Literals of Outage::SwitchState

literal	description
open	
close	

6.1.11 Package Protection

6.1.11.1 General

An extension to the Core and Wires packages that models information for protection equipment such as relays. These entities are used within training simulators and distribution network fault location applications.

Figure 62 shows logical diagram Main.

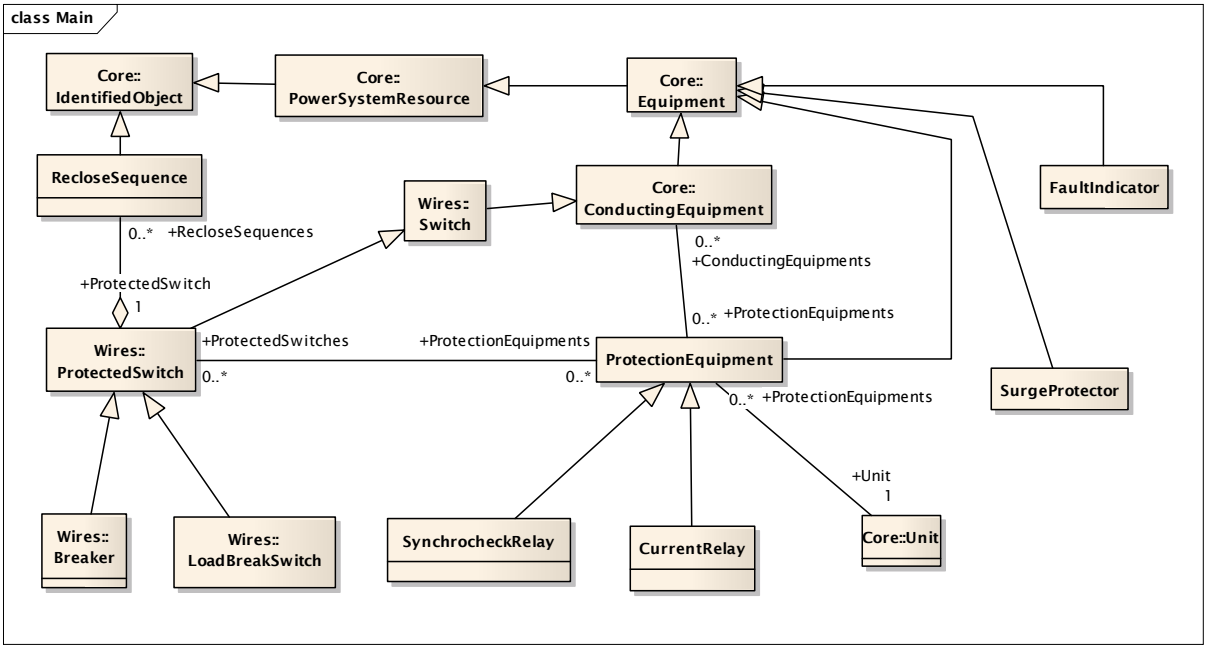

Figure 62 – Logical diagram Protection::Main

This diagram shows all classes included in the Protection package as well as the key external classes that have associations with Protection classes.

6.1.11.2 CurrentRelay

A device that checks current flow values in any direction or designated direction.

Table 391 shows all attributes of CurrentRelay.

Table 391 – Attributes of Protection::CurrentRelay

name	type	description
currentLimit1	CurrentFlow	Current limit #1 for inverse time pickup
currentLimit2	CurrentFlow	Current limit #2 for inverse time pickup
currentLimit3	CurrentFlow	Current limit #3 for inverse time pickup

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name	type	description
inverseTimeFlag	Boolean	Set true if the current relay has inverse time characteristic
timeDelay1	Seconds	Inverse time delay #1 for current limit #1
timeDelay2	Seconds	Inverse time delay #2 for current limit #2
timeDelay3	Seconds	Inverse time delay #3 for current limit #3
relayDelayTime	Seconds	inherited from: ProtectionEquipment
highLimit	Float	inherited from: ProtectionEquipment
lowLimit	Float	inherited from: ProtectionEquipment
powerDirectionFlag	Boolean	inherited from: ProtectionEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 392 shows all association ends of CurrentRelay with other classes.

Table 392 – Association ends of Protection::CurrentRelay with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Unit	Unit	inherited from: ProtectionEquipment
[0..*]	[0..*] ProtectedSwitches	ProtectedSwitch	inherited from: ProtectionEquipment
[0..*]	[0..*] ConductingEquipments	ConductingEquipment	inherited from: ProtectionEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.11.3 FaultIndicator

A FaultIndicator is typically only an indicator (which may or may not be remotely monitored), and not a piece of equipment that actually initiates a protection event. It is used for FLISR (Fault Location, Isolation and Restoration) purposes, assisting with the dispatch of crews to "most likely" part of the network (i.e. assists with determining circuit section where the fault most likely happened).

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Table 393 shows all attributes of FaultIndicator.

Table 393 – Attributes of Protection::FaultIndicator

name	type	description
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 394 shows all association ends of FaultIndicator with other classes.

Table 394 – Association ends of Protection::FaultIndicator with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.11.4 ProtectionEquipment

An electrical device designed to respond to input conditions in a prescribed manner and after specified conditions are met to cause contact operation or similar abrupt change in associated electric control circuits, or simply to display the detected condition. Protection equipment are associated with conducting equipment and usually operate circuit breakers.

Table 395 shows all attributes of ProtectionEquipment.

Table 395 – Attributes of Protection::ProtectionEquipment

name	type	description
relayDelayTime	Seconds	The time delay from detection of abnormal conditions to relay operation
highLimit	Float	The maximum allowable value
lowLimit	Float	The minimum allowable value
powerDirectionFlag	Boolean	Direction same as positive active power flow value

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name	type	description
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 396 shows all association ends of ProtectionEquipment with other classes.

Table 396 – Association ends of Protection::ProtectionEquipment with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Unit	Unit	The Unit for the Protection Equipment
[0..*]	[0..*] ProtectedSwitches	ProtectedSwitch	Protected switches operated by this ProtectionEquipment
[0..*]	[0..*] ConductingEquipments	ConductingEquipment	Protection equipment may be used to protect specific Conducting Equipment. Multiple equipment may be protected or monitored by multiple protection equipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.11.5 RecloseSequence

A reclose sequence (open and close) is defined for each possible reclosure of a breaker.

Table 397 shows all attributes of RecloseSequence.

Table 397 – Attributes of Protection::RecloseSequence

name	type	description
recloseDelay	Seconds	Indicates the time lapse before the reclose step will execute a reclose
recloseStep	Integer	Indicates the ordinal position of the reclose step relative to other steps in the sequence
mRID	String	inherited from: IdentifiedObject

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name	type	description
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 398 shows all association ends of RecloseSequence with other classes.

Table 398 – Association ends of Protection::RecloseSequence with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] ProtectedSwitch	ProtectedSwitch	A breaker may have zero or more automatic reclosures after a trip occurs

6.1.11.6 SurgeProtector

Shunt device, installed on the network, usually in the proximity of electrical equipment in order to protect the said equipment against transient voltage spikes caused by lightning or switching activity.

Table 399 shows all attributes of SurgeProtector.

Table 399 – Attributes of Protection::SurgeProtector

name	type	description
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 400 shows all association ends of SurgeProtector with other classes.

Table 400 – Association ends of Protection::SurgeProtector with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource

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[mult from]	[mult to] name	type	description
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.11.7 SynchrocheckRelay

A device that operates when two AC circuits are within the desired limits of frequency, phase angle, and voltage, to permit or to cause the paralleling of these two circuits. Used to prevent the paralleling of non-synchronous topological islands.

Table 401 shows all attributes of SynchrocheckRelay.

Table 401 – Attributes of Protection::SynchrocheckRelay

name	type	description
maxAngleDiff	AngleRadians	The maximum allowable voltage vector phase angle difference across the open device
maxFreqDiff	Frequency	The maximum allowable frequency difference across the open device
maxVoltDiff	Voltage	The maximum allowable difference voltage across the open device
relayDelayTime	Seconds	inherited from: ProtectionEquipment
highLimit	Float	inherited from: ProtectionEquipment
lowLimit	Float	inherited from: ProtectionEquipment
powerDirectionFlag	Boolean	inherited from: ProtectionEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 402 shows all association ends of SynchrocheckRelay with other classes.

Table 402 – Association ends of Protection::SynchrocheckRelay with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Unit	Unit	inherited from: ProtectionEquipment
[0..*]	[0..*] ProtectedSwitches	ProtectedSwitch	inherited from: ProtectionEquipment
[0..*]	[0..*] ConductingEquipments	ConductingEquipment	inherited from: ProtectionEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource

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[mult from]	[mult to] name	type	description
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.12 Package Equivalents

6.1.12.1 General

The equivalents package models equivalent networks.

Figure 63 shows logical diagram Main.

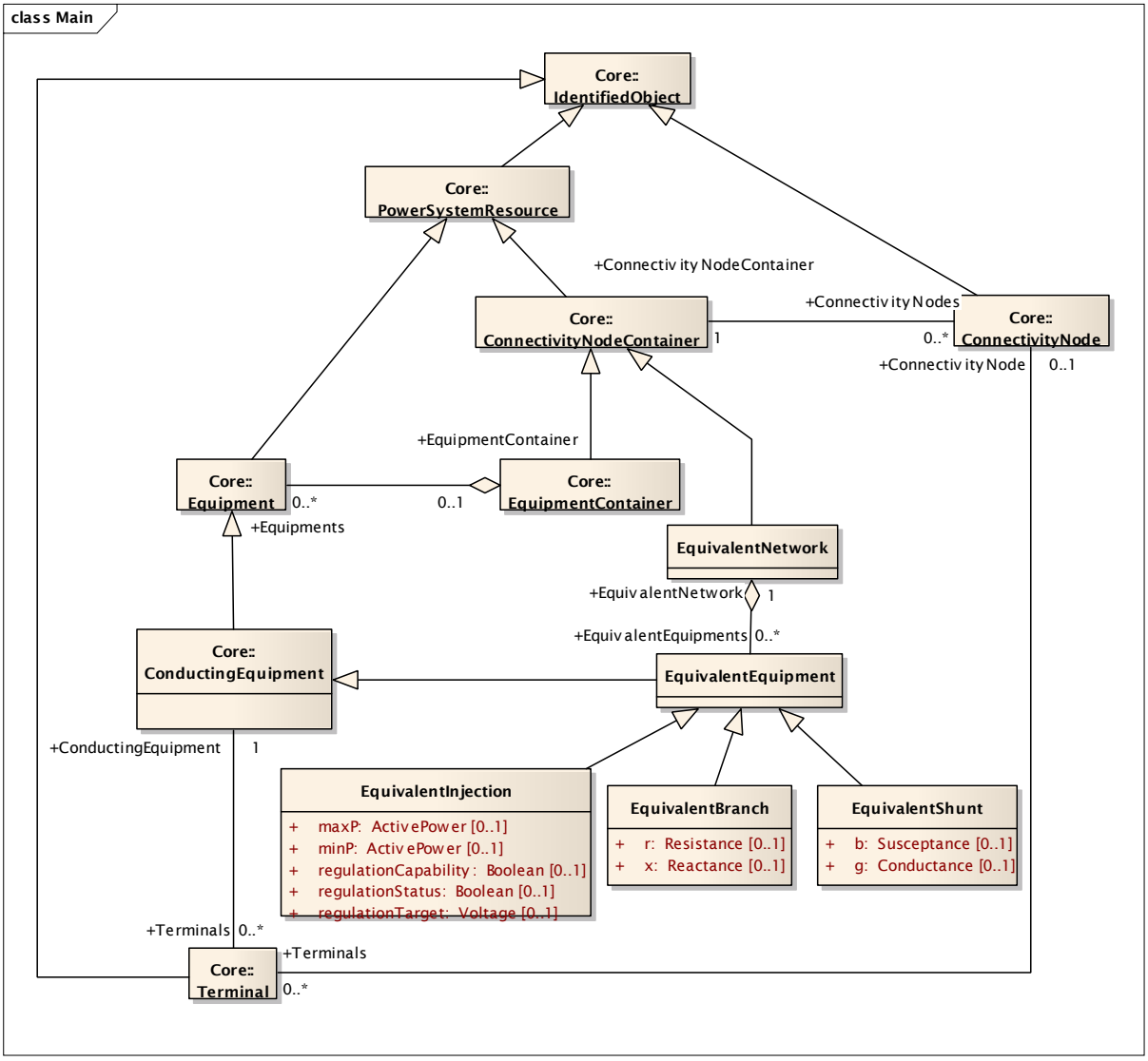

Figure 63 – Logical diagram Equivalents::Main

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6.1.12.2 EquivalentInjection

This class represents equivalent injections (generation or load). Voltage regulation is allowed only at the local connectivity node.

Table 403 shows all attributes of EquivalentInjection.

Table 403 – Attributes of Equivalents::EquivalentInjection

name	type	description
maxP	ActivePower	Minimum active power of the injection
minP	ActivePower	Maximum active power of the injection
regulationCapability	Boolean	Specifies whether or not the EquivalentInjection has the capability to regulate the local voltage
regulationStatus	Boolean	Specifies the default regulation status of the EquivalentInjection. True is regulating. False is not regulating
regulationTarget	Voltage	The target voltage for voltage regulation
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 404 shows all association ends of EquivalentInjection with other classes.

Table 404 – Association ends of Equivalents::EquivalentInjection with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] EquivalentNetwork	EquivalentNetwork	inherited from: EquivalentEquipment
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

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6.1.12.3 EquivalentBranch

The class represents equivalent branches.

Table 405 shows all attributes of EquivalentBranch.

Table 405 – Attributes of Equivalents::EquivalentBranch

name	type	description
r	Resistance	Positive sequence series resistance of the reduced branch
x	Reactance	Positive sequence series reactance of the reduced branch
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 406 shows all association ends of EquivalentBranch with other classes.

Table 406 – Association ends of Equivalents::EquivalentBranch with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] EquivalentNetwork	EquivalentNetwork	inherited from: EquivalentEquipment
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

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6.1.12.4 EquivalentEquipment

The class represents equivalent objects that are the result of a network reduction. The class is the base for equivalent objects of different types.

Table 407 shows all attributes of EquivalentEquipment.

Table 407 – Attributes of Equivalents::EquivalentEquipment

name	type	description
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 408 shows all association ends of EquivalentEquipment with other classes.

Table 408 – Association ends of Equivalents::EquivalentEquipment with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] EquivalentNetwork	EquivalentNetwork	The equivalent where the reduced model belongs
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.12.5 EquivalentNetwork

A class that represents an external meshed network that has been reduced to an electrically equivalent model. The ConnectivityNodes contained in the equivalent are intended to reflect

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internal nodes of the equivalent. The boundary Connectivity nodes where the equivalent connects outside itself are NOT contained by the equivalent.

Table 409 shows all attributes of EquivalentNetwork.

Table 409 – Attributes of Equivalents::EquivalentNetwork

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 410 shows all association ends of EquivalentNetwork with other classes.

Table 410 – Association ends of Equivalents::EquivalentNetwork with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] EquivalentEquipments	EquivalentEquipment	The associated reduced equivalents
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	inherited from: ConnectivityNodeContainer
[0..1]	[0..*] TopologicalNode	TopologicalNode	inherited from: ConnectivityNodeContainer
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.12.6 EquivalentShunt

The class represents equivalent shunts.

Table 411 shows all attributes of EquivalentShunt.

Table 411 – Attributes of Equivalents::EquivalentShunt

name	type	description
b	Susceptance	Positive sequence shunt susceptance
g	Conductance	Positive sequence shunt conductance
phases	PhaseCode	inherited from: ConductingEquipment
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject

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name	type	description
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 412 shows all association ends of EquivalentShunt with other classes.

Table 412 – Association ends of Equivalents::EquivalentShunt with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] EquivalentNetwork	EquivalentNetwork	inherited from: EquivalentEquipment
[0..*]	[0..1] BaseVoltage	BaseVoltage	inherited from: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	inherited from: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	inherited from: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	inherited from: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	inherited from: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.13 Package Meas

6.1.13.1 General

Contains entities that describe dynamic measurement data exchanged between applications.

Figure 64 shows logical diagram Datatypes.

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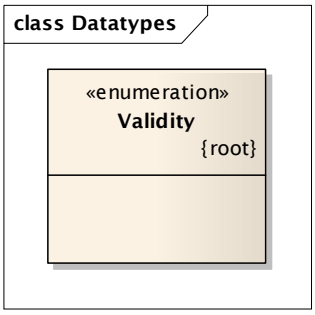

Figure 64 – Logical diagram Meas::Datatypes

Figure 65 shows logical diagram Meas.

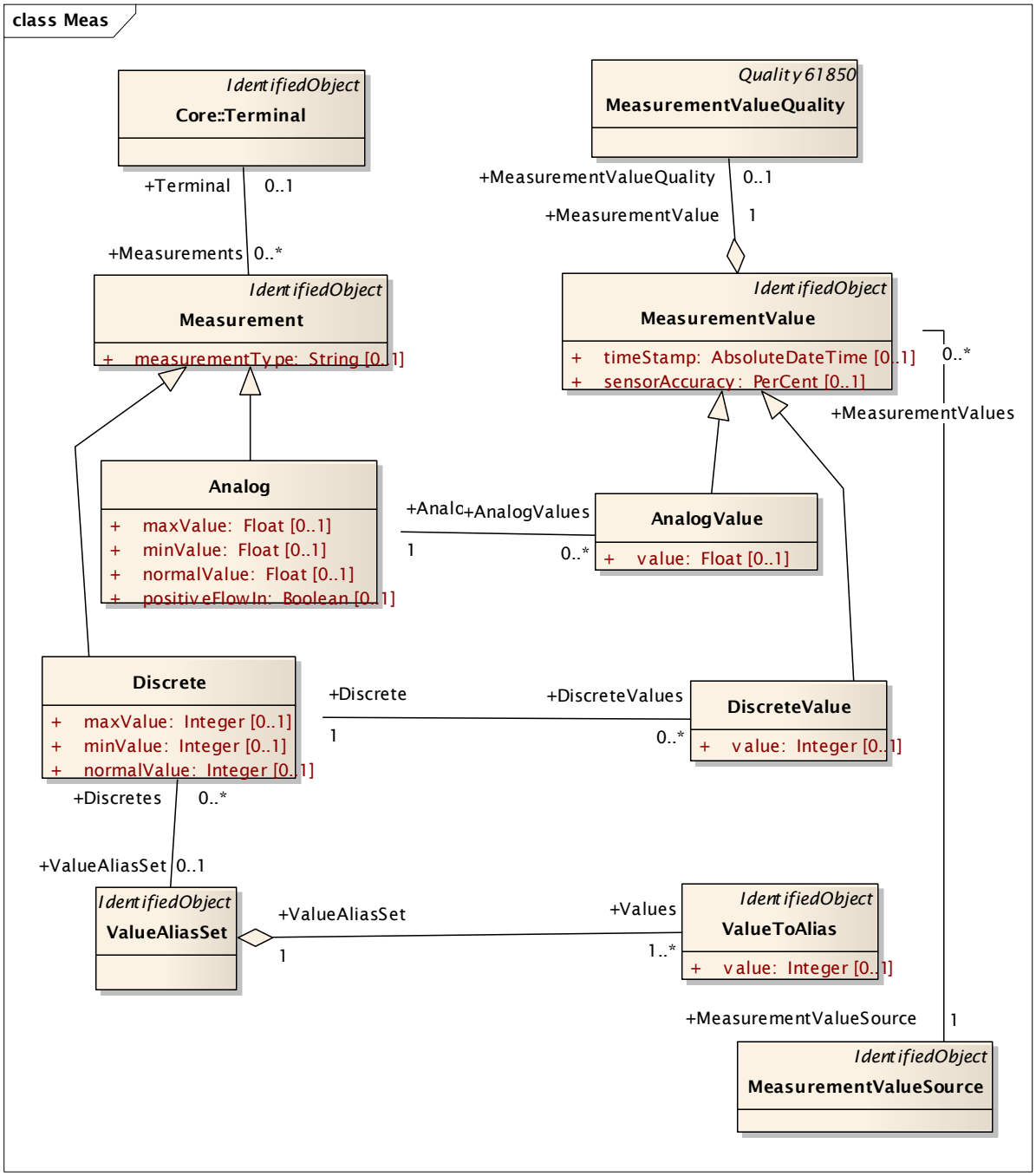

Figure 65 – Logical diagram Meas::Meas

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Figure 66 shows logical diagram Control.

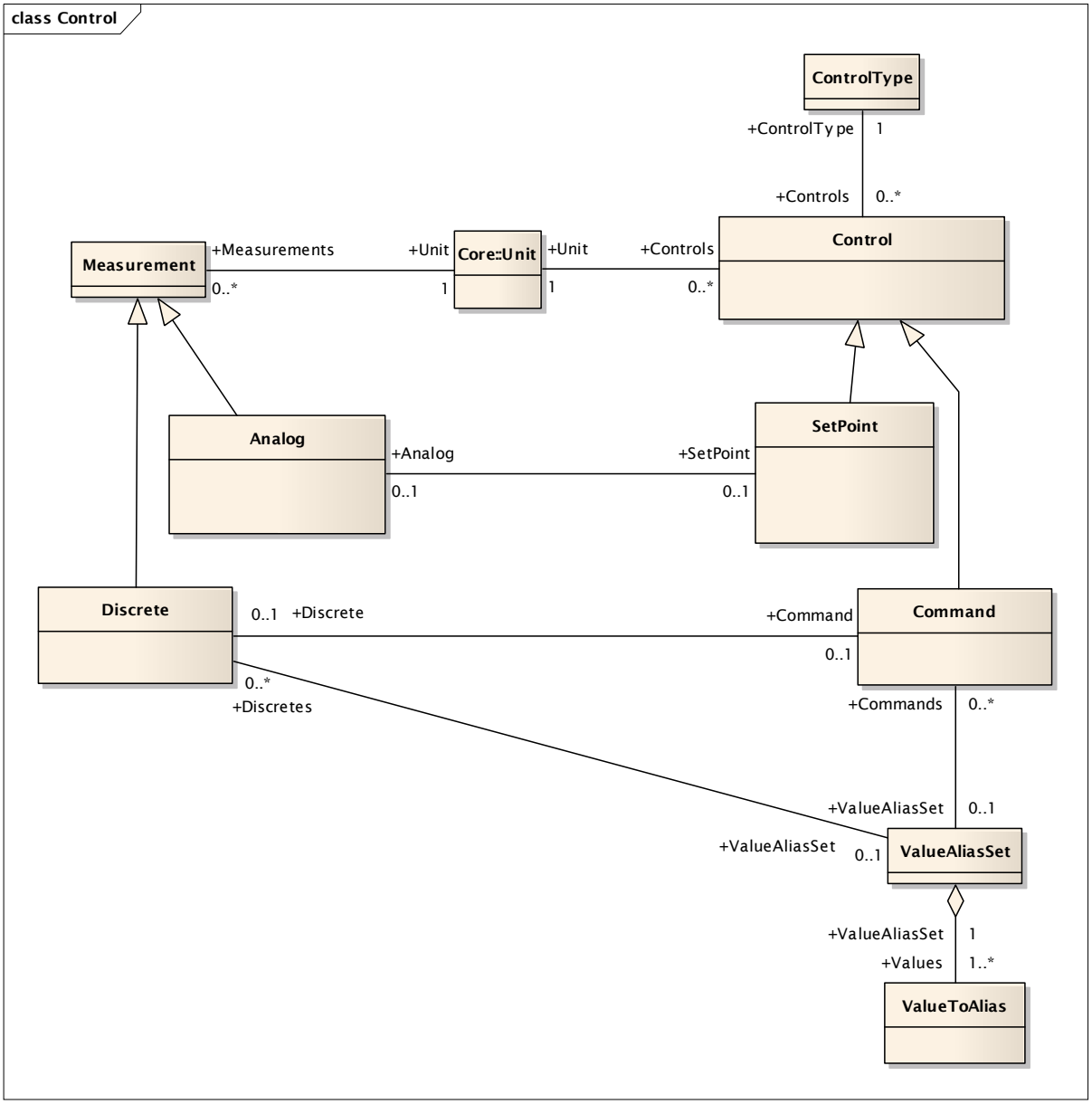

Figure 66 – Logical diagram Meas::Control

This diagram shows all classes included in the Meas package.

Figure 67 shows logical diagram InheritanceStructure.

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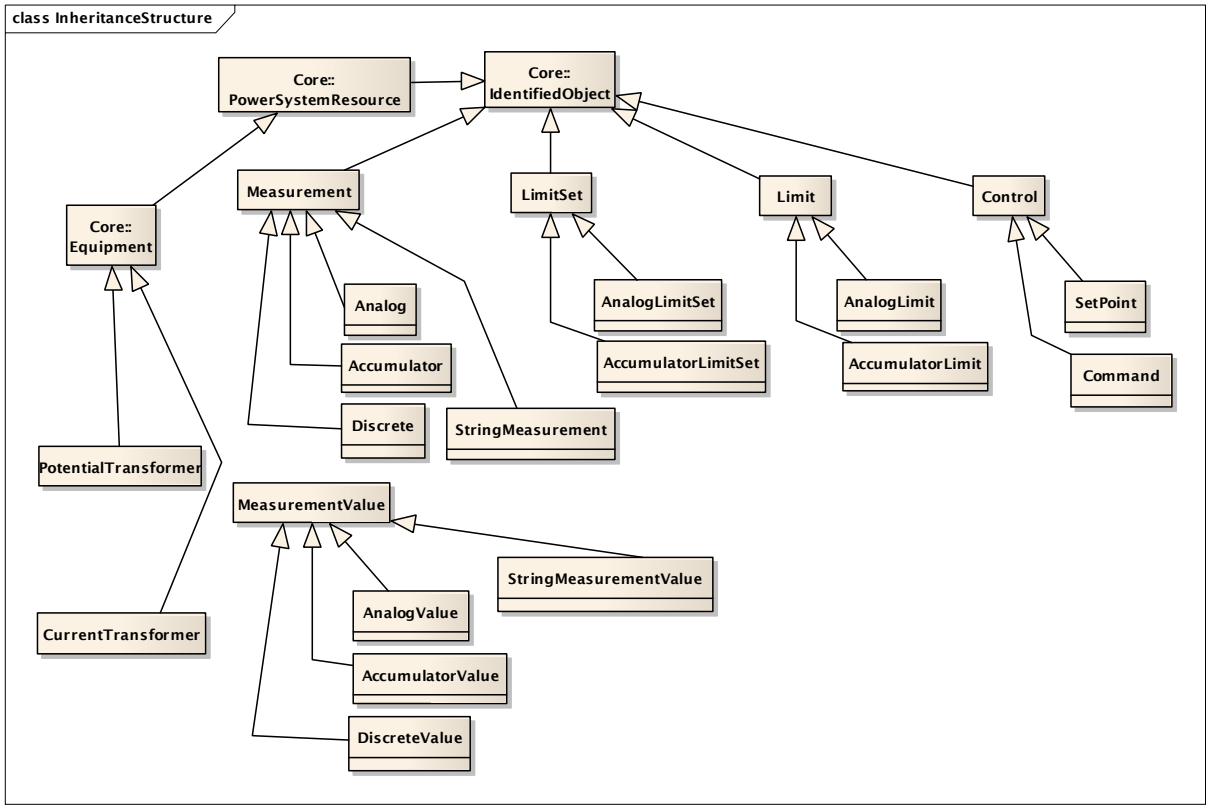

Figure 67 – Logical diagram Meas::InheritanceStructure

This diagram shows the measurement classes inherit basic classes.

Figure 68 shows logical diagram Measurement with limits.

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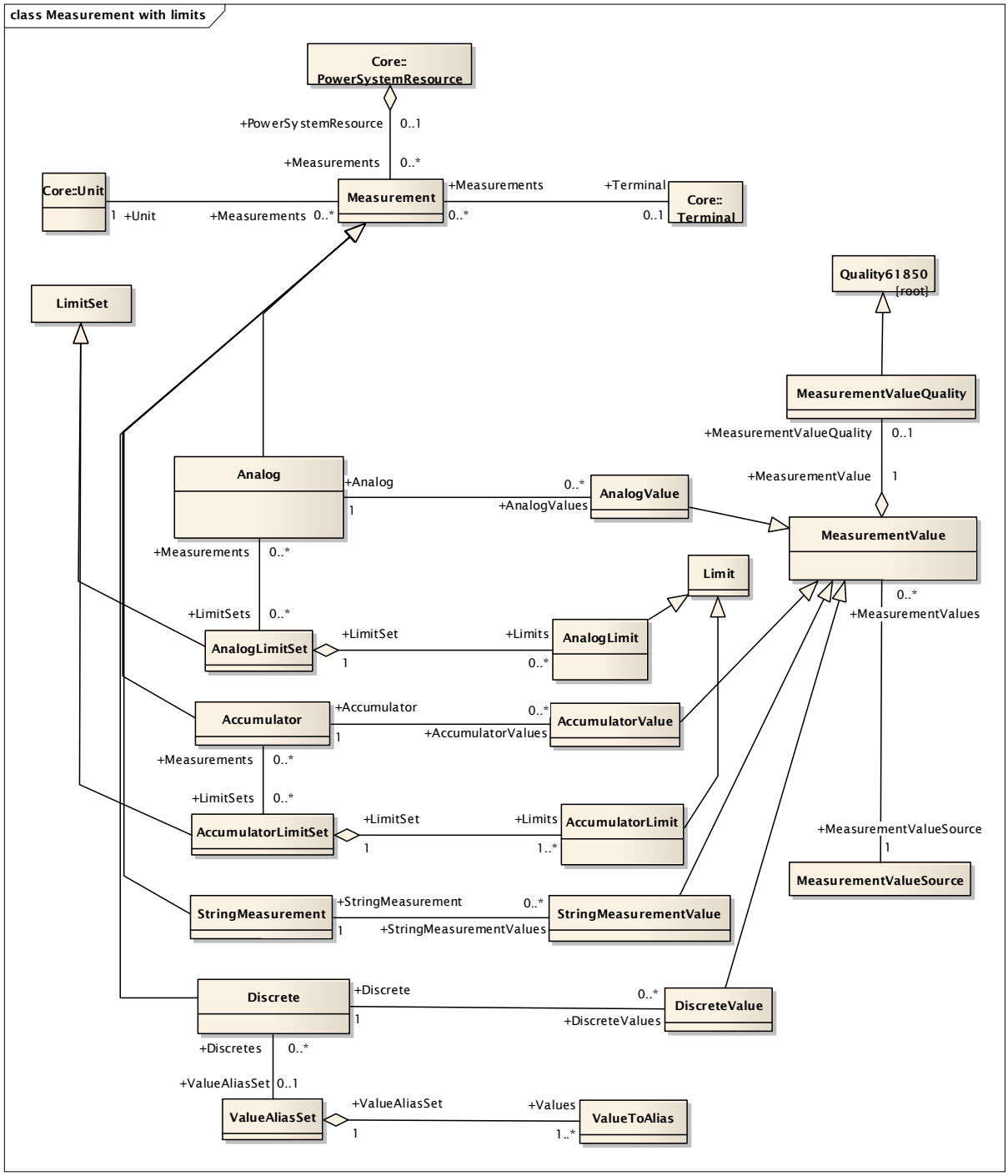

Figure 68 – Logical diagram Meas::Measurement with limits

This diagram shows classes central to the Measurement package and connections to some external classes.

Figure 69 shows logical diagram Quality.

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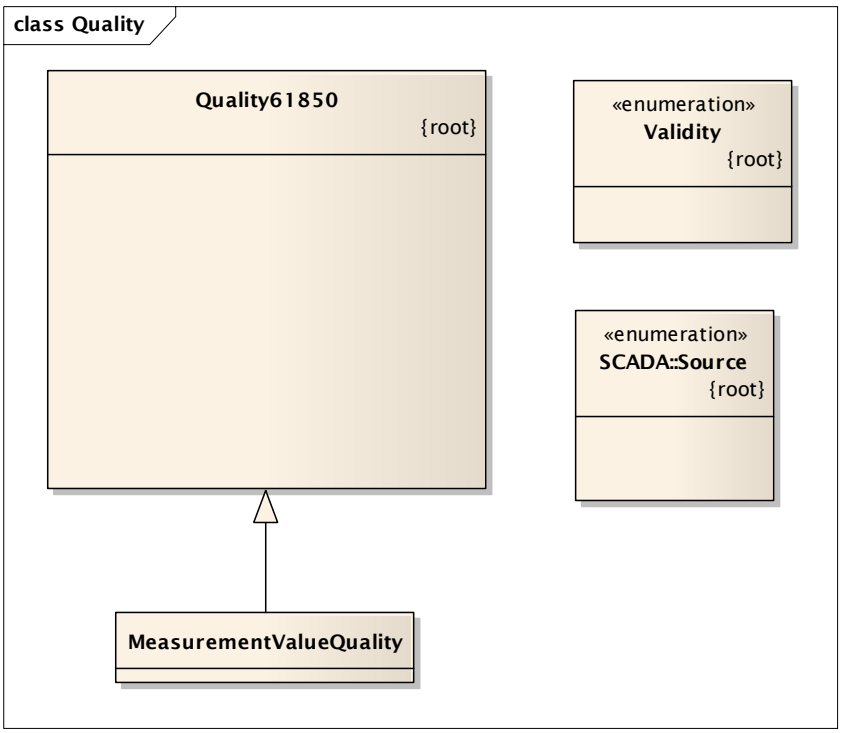

Figure 69 – Logical diagram Meas::Quality

This diagram shows the details of the quality codes. The quality flags can be used also in other packages not only specific to MeasurementValues. A generalized Quality class is added and inherited into MeasurementValueQuality.

6.1.13.2 Accumulator

Accumulator represents an accumulated (counted) Measurement, e.g. an energy value.

Table 413 shows all attributes of Accumulator.

Table 413 – Attributes of Meas::Accumulator

name	type	description
maxValue	Integer	Normal value range maximum for any of the MeasurementValue.values. Used for scaling, e.g. in bar graphs or of telemetered raw values
measurementType	String	inherited from: Measurement
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 414 shows all association ends of Accumulator with other classes.

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Table 414 – Association ends of Meas::Accumulator with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] AccumulatorValues	AccumulatorValue	The values connected to this measurement
[0..*]	[0..*] LimitSets	AccumulatorLimitSet	A measurement may have zero or more limit ranges defined for it
[0..*]	[1..1] Unit	Unit	inherited from: Measurement
[0..*]	[0..1] Terminal	Terminal	inherited from: Measurement
[0..*]	[0..1] PowerSystemResource	PowerSystemResource	inherited from: Measurement

6.1.13.3 AccumulatorLimit

Limit values for Accumulator measurements.

Table 415 shows all attributes of AccumulatorLimit.

Table 415 – Attributes of Meas::AccumulatorLimit

name	type	description
value	Integer	The value to supervise against. The value is positive
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 416 shows all association ends of AccumulatorLimit with other classes.

Table 416 – Association ends of Meas::AccumulatorLimit with other classes

[mult from]	[mult to] name	type	description
[1..*]	[1..1] LimitSet	AccumulatorLimitSet	The set of limits

6.1.13.4 AccumulatorLimitSet

An AccumulatorLimitSet specifies a set of Limits that are associated with an Accumulator measurement.

Table 417 shows all attributes of AccumulatorLimitSet.

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Table 417 – Attributes of Meas::AccumulatorLimitSet

name	type	description
isPercentageLimits	Boolean	inherited from: LimitSet
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 418 shows all association ends of AccumulatorLimitSet with other classes.

Table 418 – Association ends of Meas::AccumulatorLimitSet with other classes

[mult from]	[mult to] name	type	description
[1..1]	[1..*] Limits	AccumulatorLimit	The limit values used for supervision of Measurements
[0..*]	[0..*] Measurements	Accumulator	The Measurements using the LimitSet

6.1.13.5 AccumulatorValue

AccumulatorValue represents an accumulated (counted) MeasurementValue.

Table 419 shows all attributes of AccumulatorValue.

Table 419 – Attributes of Meas::AccumulatorValue

name	type	description
value	Integer	The value to supervise. The value is positive
timeStamp	AbsoluteDateTime	inherited from: MeasurementValue
sensorAccuracy	PerCent	inherited from: MeasurementValue
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 420 shows all association ends of AccumulatorValue with other classes.

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Table 420 – Association ends of Meas::AccumulatorValue with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Accumulator	Accumulator	Measurement to which this value is connected
[1..1]	[0..1] RemoteSource	RemoteSource	inherited from: MeasurementValue
[1..1]	[0..1] MeasurementValueQuality	MeasurementValueQuality	inherited from: MeasurementValue
[0..*]	[1..1] MeasurementValueSource	MeasurementValueSource	inherited from: MeasurementValue

6.1.13.6 Analog

Analog represents an analog Measurement.

Table 421 shows all attributes of Analog.

Table 421 – Attributes of Meas::Analog

name	type	description
maxValue	Float	Normal value range maximum for any of the MeasurementValue.values. Used for scaling, e.g. in bar graphs or of telemetered raw values
minValue	Float	Normal value range minimum for any of the MeasurementValue.values. Used for scaling, e.g. in bar graphs or of telemetered raw values
normalValue	Float	Normal measurement value, e.g., used for percentage calculations
positiveFlowIn	Boolean	If true then this measurement is an active power, reactive power or current with the convention that a positive value measured at the Terminal means power is flowing into the related PowerSystemResource
measurementType	String	inherited from: Measurement
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 422 shows all association ends of Analog with other classes.

Table 422 – Association ends of Meas::Analog with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] AnalogValues	AnalogValue	The values connected to this measurement
[0..*]	[0..*] LimitSets	AnalogLimitSet	A measurement may have zero or more limit ranges defined for it
[0..1]	[0..1] SetPoint	SetPoint	The Control variable associated with the Measurement

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[mult from]	[mult to] name	type	description
[0..*]	[1..1] Unit	Unit	inherited from: Measurement
[0..*]	[0..1] Terminal	Terminal	inherited from: Measurement
[0..*]	[0..1] PowerSystemResource	PowerSystemResource	inherited from: Measurement

6.1.13.7 AnalogLimit

Limit values for Analog measurements.

Table 423 shows all attributes of AnalogLimit.

Table 423 – Attributes of Meas::AnalogLimit

name	type	description
value	Float	The value to supervise against.
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 424 shows all association ends of AnalogLimit with other classes.

Table 424 – Association ends of Meas::AnalogLimit with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] LimitSet	AnalogLimitSet	The set of limits

6.1.13.8 AnalogLimitSet

An AnalogLimitSet specifies a set of Limits that are associated with an Analog measurement.

Table 425 shows all attributes of AnalogLimitSet.

Table 425 – Attributes of Meas::AnalogLimitSet

name	type	description
isPercentageLimits	Boolean	inherited from: LimitSet
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 426 shows all association ends of AnalogLimitSet with other classes.

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Table 426 – Association ends of Meas::AnalogLimitSet with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] Limits	AnalogLimit	The limit values used for supervision of Measurements
[0..*]	[0..*] Measurements	Analog	The Measurements using the LimitSet

6.1.13.9 AnalogValue

AnalogValue represents an analog MeasurementValue.

Table 427 shows all attributes of AnalogValue.

Table 427 – Attributes of Meas::AnalogValue

name	type	description
value	Float	The value to supervise
timeStamp	AbsoluteDateTime	inherited from: MeasurementValue
sensorAccuracy	PerCent	inherited from: MeasurementValue
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 428 shows all association ends of AnalogValue with other classes.

Table 428 – Association ends of Meas::AnalogValue with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Analog	Analog	Measurement to which this value is connected
[1..1]	[0..*] AltGeneratingUnit	AltGeneratingUnitMeas	The alternate generating unit for which this measurement value applies
[1..1]	[0..*] AltTieMeas	AltTieMeas	The usage of the measurement within the control area specification
[1..1]	[0..1] RemoteSource	RemoteSource	inherited from: MeasurementValue
[1..1]	[0..1] MeasurementValueQuality	MeasurementValueQuality	inherited from: MeasurementValue
[0..*]	[1..1] MeasurementValueSource	MeasurementValueSource	inherited from: MeasurementValue

6.1.13.10 Command

A Command is a discrete control used for supervisory control.

Table 429 shows all attributes of Command.

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Table 429 – Attributes of Meas::Command

name	type	description
value	Integer	The value representing the actuator output
normalValue	Integer	Normal value for Control.value e.g. used for percentage scaling
timeStamp	AbsoluteDateTime	inherited from: Control
operationInProgress	Boolean	inherited from: Control
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 430 shows all association ends of Command with other classes.

Table 430 – Association ends of Meas::Command with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] ValueAliasSet	ValueAliasSet	The Commands using the set for translation
[0..1]	[0..1] Discrete	Discrete	The Measurement variable used for control
[0..*]	[1..1] Unit	Unit	inherited from: Control
[1..1]	[0..1] RemoteControl	RemoteControl	inherited from: Control
[1..*]	[0..1] RegulatingCondEq	RegulatingCondEq	inherited from: Control
[0..*]	[1..1] ControlType	ControlType	inherited from: Control

6.1.13.11 Control

Control is used for supervisory/device control. It represents control outputs that are used to change the state in a process, e.g. close or open breaker, a set point value or a raise lower command.

Table 431 shows all attributes of Control.

Table 431 – Attributes of Meas::Control

name	type	description
timeStamp	AbsoluteDateTime	The last time a control output was sent
operationInProgress	Boolean	Indicates that a client is currently sending control commands that has not completed
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 432 shows all association ends of Control with other classes.

Table 432 – Association ends of Meas::Control with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Unit	Unit	The Unit for the Control
[1..1]	[0..1] RemoteControl	RemoteControl	The remote point controlling the physical actuator
[1..*]	[0..1] RegulatingCondEq	RegulatingCondEq	Regulating device governed by this control output
[0..*]	[1..1] ControlType	ControlType	The type of Control

6.1.13.12 ControlType

Specifies the type of Control, e.g. BreakerOn/Off, GeneratorVoltageSetPoint, TieLineFlow, etc. The ControlType.name shall be unique among all specified types and describe the type. The ControlType.aliasName is meant to be used for localization.

Table 433 shows all attributes of ControlType.

Table 433 – Attributes of Meas::ControlType

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 434 shows all association ends of ControlType with other classes.

Table 434 – Association ends of Meas::ControlType with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] Controls	Control	The Controls having the ControlType

6.1.13.13 CurrentTransformer

Instrument transformer used to measure electrical qualities of the circuit that is being protected and/or monitored. Typically used as current transducer for the purpose of metering or protection. A typical secondary current rating would be 5 A.

Table 435 shows all attributes of CurrentTransformer.

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Table 435 – Attributes of Meas::CurrentTransformer

name	type	description
ctClass	String	CT classification; i.e. class 10P
accuracyClass	String	CT accuracy classification
accuracyLimit	String	Percent of rated current for which the CT remains accurate within specified limits
maxRatio	Float	For multi-ratio CT's, the maximum permissable ratio attainable
coreCount	Integer	Number of cores
usage	String	Intended usage of the CT; i.e. metering, protection
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 436 shows all association ends of CurrentTransformer with other classes.

Table 436 – Association ends of Meas::CurrentTransformer with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.13.14 Discrete

Discrete represents a discrete Measurement, i.e. a Measurement representing discrete values, e.g. a Breaker position.

Table 437 shows all attributes of Discrete.

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Table 437 – Attributes of Meas::Discrete

name	type	description
maxValue	Integer	Normal value range maximum for any of the MeasurementValue.values. Used for scaling, e.g. in bar graphs or of telemetered raw values
minValue	Integer	Normal value range minimum for any of the MeasurementValue.values. Used for scaling, e.g. in bar graphs or of telemetered raw values
normalValue	Integer	Normal measurement value, e.g., used for percentage calculations
measurementType	String	inherited from: Measurement
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 438 shows all association ends of Discrete with other classes.

Table 438 – Association ends of Meas::Discrete with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..1] Command	Command	The Control variable associated with the Measurement
[1..1]	[0..*] DiscreteValues	DiscreteValue	The values connected to this measurement
[0..*]	[0..1] ValueAliasSet	ValueAliasSet	The ValueAliasSet used for translation of a MeasurementValue.value to a name
[0..*]	[1..1] Unit	Unit	inherited from: Measurement
[0..*]	[0..1] Terminal	Terminal	inherited from: Measurement
[0..*]	[0..1] PowerSystemResource	PowerSystemResource	inherited from: Measurement

6.1.13.15 DiscreteValue

DiscreteValue represents a discrete MeasurementValue.

Table 439 shows all attributes of DiscreteValue.

Table 439 – Attributes of Meas::DiscreteValue

name	type	description
value	Integer	The value to supervise
timeStamp	AbsoluteDateTime	inherited from: MeasurementValue
sensorAccuracy	PerCent	inherited from: MeasurementValue
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 440 shows all association ends of DiscreteValue with other classes.

Table 440 – Association ends of Meas::DiscreteValue with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Discrete	Discrete	Measurement to which this value is connected
[1..1]	[0..1] RemoteSource	RemoteSource	inherited from: MeasurementValue
[1..1]	[0..1] MeasurementValueQuality	MeasurementValueQuality	inherited from: MeasurementValue
[0..*]	[1..1] MeasurementValueSource	MeasurementValueSource	inherited from: MeasurementValue

6.1.13.16 Limit

Specifies one limit value for a Measurement. A Measurement typically has several limits that are kept together by the LimitSet class. The actual meaning and use of a Limit instance (i.e. if it is an alarm or warning limit or if it is a high or low limit) is not captured in the Limit class. However the name of a Limit instance may indicate both meaning and use.

Table 441 shows all attributes of Limit.

Table 441 – Attributes of Meas::Limit

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

6.1.13.17 LimitSet

Specifies a set of Limits that are associated with a Measurement. A Measurement may have several LimitSets corresponding to seasonal or other changing conditions. The condition is captured in the name and description attributes. The same LimitSet may be used for several Measurements. In particular percentage limits are used this way.

Table 442 shows all attributes of LimitSet.

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Table 442 – Attributes of Meas::LimitSet

name	type	description
isPercentageLimits	Boolean	Tells if the limit values are in percentage of normalValue or the specified Unit for Measurements and Controls
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

6.1.13.18 Measurement

A Measurement represents any measured, calculated or non-measured non-calculated quantity. Any piece of equipment may contain Measurements, e.g. a substation may have temperature measurements and door open indications, a transformer may have oil temperature and tank pressure measurements, a bay may contain a number of power flow measurements and a Breaker may contain a switch status measurement.

The PSR-Measurement association is intended to capture this use of Measurement and is included in the naming hierarchy based on EquipmentContainer. The naming hierarchy typically has Measurements as leafs, e.g. Substation-VoltageLevel-Bay-Switch-Measurement.

Some Measurements represent quantities related to a particular sensor location in the network, e.g. a voltage transformer (PT) at a busbar or a current transformer (CT) at the bar between a breaker and an isolator. The sensing position is not captured in the PSR - Measurement association. Instead it is captured by the Measurement - Terminal association that is used to define the sensing location in the network topology. The location is defined by the connection of the Terminal to ConductingEquipment.

Two possible paths exist:

a) Measurement-Terminal- ConnectivityNode-Terminal-ConductingEquipment

b) Measurement-Terminal-ConductingEquipment

Alternative b) is the only allowed use.

When the sensor location is needed both Measurement-PSR and Measurement-Terminal are used. The Measurement-Terminal association is never used alone.

Table 443 shows all attributes of Measurement.

Table 443 – Attributes of Meas::Measurement

name	type	description
measurementType	String	Specifies the type of Measurement, e.g. IndoorTemperature, OutDoorTemperature, BusVoltage, GeneratorVoltage, LineFlow etc.
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

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Table 444 shows all association ends of Measurement with other classes.

Table 444 – Association ends of Meas::Measurement with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Unit	Unit	The Unit for the Measurement
[0..*]	[0..1] Terminal	Terminal	One or more measurements may be associated with a terminal in the network
[0..*]	[0..1] PowerSystemResource	PowerSystemResource	The PowerSystemResource that contains the Measurement in the naming hierarchy

6.1.13.19 MeasurementValue

The current state for a measurement. A state value is an instance of a measurement from a specific source. Measurements can be associated with many state values, each representing a different source for the measurement.

Table 445 shows all attributes of MeasurementValue.

Table 445 – Attributes of Meas::MeasurementValue

name	type	description
timeStamp	AbsoluteDateTime	The time when the value was last updated
sensorAccuracy	PerCent	The limit, expressed as a percentage of the sensor maximum, that errors will not exceed when the sensor is used under reference conditions
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 446 shows all association ends of MeasurementValue with other classes.

Table 446 – Association ends of Meas::MeasurementValue with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..1] RemoteSource	RemoteSource	Link to the physical telemetered point associated with this measurement
[1..1]	[0..1] MeasurementValueQuality	MeasurementValueQuality	A MeasurementValue has a MeasurementValueQuality associated with it
[0..*]	[1..1] MeasurementValueSource	MeasurementValueSource	A reference to the type of source that updates the MeasurementValue, e.g. SCADA, CCLink, manual, etc. User conventions for the names of sources are contained in the introduction to IEC 61970-301.

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6.1.13.20 MeasurementValueQuality

Measurement quality flags. Bits 0-10 are defined for substation automation in IEC 61850-7-3. Bits 11-15 are reserved for future expansion by that document. Bits 16-31 are reserved for EMS applications.

Table 447 shows all attributes of MeasurementValueQuality.

Table 447 – Attributes of Meas::MeasurementValueQuality

name	type	description
badReference	Boolean	inherited from: Quality61850
estimatorReplaced	Boolean	inherited from: Quality61850
failure	Boolean	inherited from: Quality61850
oldData	Boolean	inherited from: Quality61850
operatorBlocked	Boolean	inherited from: Quality61850
oscillatory	Boolean	inherited from: Quality61850
outOfRange	Boolean	inherited from: Quality61850
overFlow	Boolean	inherited from: Quality61850
source	Source	inherited from: Quality61850
suspect	Boolean	inherited from: Quality61850
test	Boolean	inherited from: Quality61850
validity	Validity	inherited from: Quality61850

Table 448 shows all association ends of MeasurementValueQuality with other classes.

Table 448 – Association ends of Meas::MeasurementValueQuality with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] MeasurementValue	MeasurementValue	A MeasurementValue has a MeasurementValueQuality associated with it

6.1.13.21 MeasurementValueSource

MeasurementValueSource describes the alternative sources updating a MeasurementValue. User conventions for how to use the MeasurementValueSource attributes are described in the introduction to this standard.

Table 449 shows all attributes of MeasurementValueSource.

Table 449 – Attributes of Meas::MeasurementValueSource

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject

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name	type	description
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 450 shows all association ends of MeasurementValueSource with other classes.

Table 450 – Association ends of Meas::MeasurementValueSource with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] MeasurementValues	MeasurementValue	The MeasurementValues updated by the source

6.1.13.22 PotentialTransformer

Instrument transformer (also known as Voltage Transformer) used to measure electrical qualities of the circuit that is being protected and/or monitored. Typically used as voltage transducer for the purpose of metering, protection, or sometimes auxiliary substation supply. A typical secondary voltage rating would be 120 V.

Table 451 shows all attributes of PotentialTransformer.

Table 451 – Attributes of Meas::PotentialTransformer

name	type	description
ptClass	String	PT classification
accuracyClass	String	PT accuracy classification
nominalRatio	Float	Nominal ratio between the primary and secondary voltage
normallyInService	Boolean	inherited from: Equipment
aggregate	Boolean	inherited from: Equipment
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 452 shows all association ends of PotentialTransformer with other classes.

Table 452 – Association ends of Meas::PotentialTransformer with other classes

[mult from]	[mult to] name	type	description
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	inherited from: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	inherited from: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	inherited from: Equipment

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[mult from]	[mult to] name	type	description
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.13.23 Quality61850 root class

Quality flags in this class are as defined in IEC 61850-7-3:2010, except for estimatorReplaced, which has been included in this class for convenience.

Table 453 shows all attributes of Quality61850.

Table 453 – Attributes of Meas::Quality61850

name	type	description
badReference	Boolean	Measurement value may be incorrect due to a reference being out of calibration
estimatorReplaced	Boolean	Value has been replaced by State Estimator. estimatorReplaced is not an IEC61850 quality bit but has been put in this class for convenience
failure	Boolean	This identifier indicates that a supervision function has detected an internal or external failure, e.g. communication failure
oldData	Boolean	Measurement value is old and possibly invalid, as it has not been successfully updated during a specified time interval
operatorBlocked	Boolean	Measurement value is blocked and hence unavailable for transmission
oscillatory	Boolean	To prevent some overload of the communication it is sensible to detect and suppress oscillating (fast changing) binary inputs. If a signal changes in a defined time (tosc) twice in the same direction (from 0 to 1 or from 1 to 0) then oscillation is detected and the detail quality identifier "oscillatory" is set. If it is detected a configured numbers of transient changes could be passed by. In this time the validity status "questionable" is set. If after this defined numbers of changes the signal is still in the oscillating state the value shall be set either to the opposite state of the previous stable value or to a defined default value. In this case the validity status "questionable" is reset and "invalid" is set as long as the signal is oscillating. If it is configured such that no transient changes should be passed by then the validity status "invalid" is set immediately in addition to the detail quality identifier "oscillatory" (used for status information only)
outOfRange	Boolean	Measurement value is beyond a predefined range of value
overFlow	Boolean	Measurement value is beyond the capability of being represented properly. For example, a counter value overflows from maximum count back to a value of zero
source	Source	Source gives information related to the origin of a value. The value may be acquired from the process, defaulted or substituted
suspect	Boolean	A correlation function has detected that the value is not consistent with other values. Typically set by a network State Estimator
test	Boolean	Measurement value is transmitted for test purposes
validity	Validity	Validity of the measurement value

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6.1.13.24 SetPoint

A SetPoint is an analog control used for supervisory control.

Table 454 shows all attributes of SetPoint.

Table 454 – Attributes of Meas::SetPoint

name	type	description
value	Float	The value representing the actuator output
maxValue	Float	Normal value range maximum for any of the Control.value. Used for scaling, e.g. in bar graphs
minValue	Float	Normal value range minimum for any of the Control.value. Used for scaling, e.g. in bar graphs
normalValue	Float	Normal value for Control.value e.g. used for percentage scaling
timeStamp	AbsoluteDateTime	inherited from: Control
operationInProgress	Boolean	inherited from: Control
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 455 shows all association ends of SetPoint with other classes.

Table 455 – Association ends of Meas::SetPoint with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..1] Analog	Analog	The Measurement variable used for control
[0..*]	[1..1] Unit	Unit	inherited from: Control
[1..1]	[0..1] RemoteControl	RemoteControl	inherited from: Control
[1..*]	[0..1] RegulatingCondEq	RegulatingCondEq	inherited from: Control
[0..*]	[1..1] ControlType	ControlType	inherited from: Control

6.1.13.25 StringMeasurement

StringMeasurement represents a measurement with values of type string.

Table 456 shows all attributes of StringMeasurement.

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Table 456 – Attributes of Meas::StringMeasurement

name	type	description
measurementType	String	inherited from: Measurement
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 457 shows all association ends of StringMeasurement with other classes.

Table 457 – Association ends of Meas::StringMeasurement with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] StringMeasurementValues	StringMeasurementValue	The values connected to this measurement
[0..*]	[1..1] Unit	Unit	inherited from: Measurement
[0..*]	[0..1] Terminal	Terminal	inherited from: Measurement
[0..*]	[0..1] PowerSystemResource	PowerSystemResource	inherited from: Measurement

6.1.13.26 StringMeasurementValue

StringMeasurementValue represents a measurement value of type string.

Table 458 shows all attributes of StringMeasurementValue.

Table 458 – Attributes of Meas::StringMeasurementValue

name	type	description
value	String	The value to supervise
timeStamp	AbsoluteDateTime	inherited from: MeasurementValue
sensorAccuracy	PerCent	inherited from: MeasurementValue
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 459 shows all association ends of StringMeasurementValue with other classes.

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Table 459 – Association ends of Meas::StringMeasurementValue with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] StringMeasurement	StringMeasurement	Measurement to which this value is connected
[1..1]	[0..1] RemoteSource	RemoteSource	inherited from: MeasurementValue
[1..1]	[0..1] MeasurementValueQuality	MeasurementValueQuality	inherited from: MeasurementValue
[0..*]	[1..1] MeasurementValueSource	MeasurementValueSource	inherited from: MeasurementValue

6.1.13.27 Validity enumeration

Validity for MeasurementValue.

Table 460 shows all literals of Validity.

Table 460 – Literals of Meas::Validity

literal	description
GOOD	The value is marked good if no abnormal condition of the acquisition function or the information source is detected
QUESTIONABLE	The value is marked questionable if a supervision function detects an abnormal behaviour, however the value could still be valid. The client is responsible for determining whether or not values marked "questionable" should be used
INVALID	The value is marked invalid when a supervision function recognizes abnormal conditions of the acquisition function or the information source (missing or non-operating updating devices). The value is not defined under this condition. The mark invalid is used to indicate to the client that the value may be incorrect and shall not be used

6.1.13.28 ValueAliasSet

Describes the translation of a set of values into a name and is intended to facilitate custom translations. Each ValueAliasSet has a name, description etc. A specific Measurement may represent a discrete state like Open, Closed, Intermediate etc. This requires a translation from the MeasurementValue.value number to a string, e.g. 0="Invalid", 1="Open", 2="Closed", 3="Intermediate". Each ValueToAlias member in ValueAliasSet.Value describes a mapping for one particular value to a name.

Table 461 shows all attributes of ValueAliasSet.

Table 461 – Attributes of Meas::ValueAliasSet

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 462 shows all association ends of ValueAliasSet with other classes.

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Table 462 – Association ends of Meas::ValueAliasSet with other classes

[mult from]	[mult to] name	type	description
[1..1]	[1..*] Values	ValueToAlias	The ValueToAlias mappings included in the set
[0..1]	[0..*] Discretes	Discrete	The Measurements using the set for translation
[0..1]	[0..*] Commands	Command	The ValueAliasSet used for translation of a Control value to a name

6.1.13.29 ValueToAlias

Describes the translation of one particular value into a name, e.g. 1="Open".

Table 463 shows all attributes of ValueToAlias.

Table 463 – Attributes of Meas::ValueToAlias

name	type	description
value	Integer	The value that is mapped
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 464 shows all association ends of ValueToAlias with other classes.

Table 464 – Association ends of Meas::ValueToAlias with other classes

[mult from]	[mult to] name	type	description
[1..*]	[1..1] ValueAliasSet	ValueAliasSet	The ValueAliasSet having the ValueToAlias mappings

6.1.14 Package SCADA

6.1.14.1 General

Contains entities to model information used by Supervisory Control and Data Acquisition (SCADA) applications. Supervisory control supports operator control of equipment, such as opening or closing a breaker. Data acquisition gathers telemetered data from various sources. The subtypes of the Telemetry entity deliberately match the UCA and IEC 61850 definitions.

This package also supports alarm presentation but it is not expected to be used by other applications.

Figure 70 shows logical diagram Datatypes.

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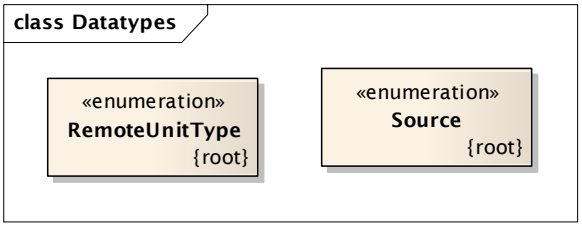

Figure 70 – Logical diagram SCADA::Datatypes

Figure 71 shows logical diagram Main.

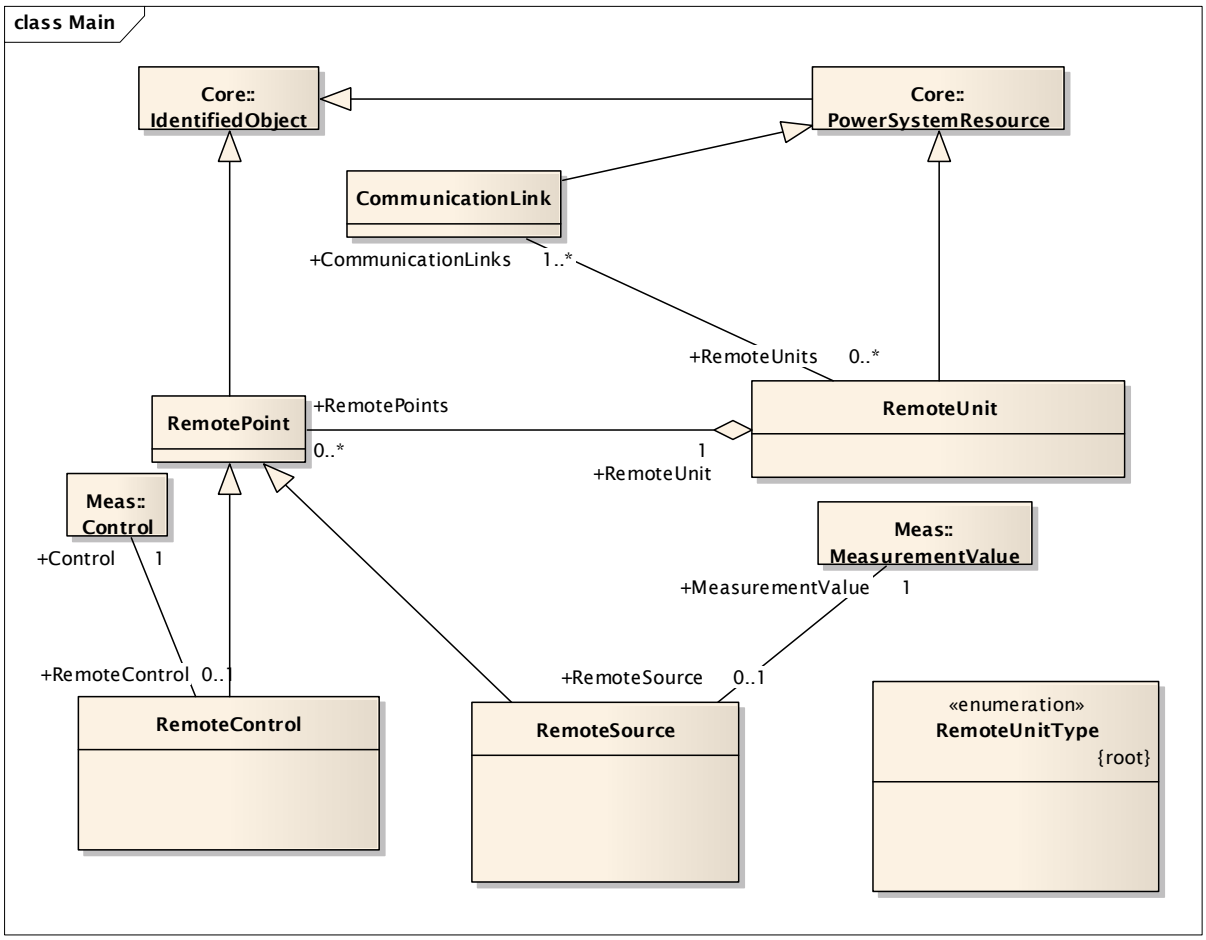

Figure 71 – Logical diagram SCADA::Main

This diagram shows all classes included in the SCADA package as well as the key external classes that have associations with SCADA classes.

6.1.14.2 CommunicationLink

The connection to remote units is through one or more communication links. Reduntant links may exist. The CommunicationLink class inherit PowerSystemResource. The intention is to allow CommunicationLinks to have Measurements. These Measurements can be used to model link status as operational, out of service, unit failure, etc.

Table 465 shows all attributes of CommunicationLink.

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Table 465 – Attributes of SCADA::CommunicationLink

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 466 shows all association ends of CommunicationLink with other classes.

Table 466 – Association ends of SCADA::CommunicationLink with other classes

[mult from]	[mult to] name	type	description
[1..*]	[0..*] RemoteUnits	RemoteUnit	RTUs may be attached to communication links
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.14.3 RemoteControl

Remote controls are outputs that are sent by the remote unit to actuators in the process.

Table 467 shows all attributes of RemoteControl.

Table 467 – Attributes of SCADA::RemoteControl

name	type	description
remoteControlled	Boolean	Set to true if the actuator is remotely controlled
actuatorMaximum	Float	The maximum set point value accepted by the remote control point
actuatorMinimum	Float	The minimum set point value accepted by the remote control point
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 468 shows all association ends of RemoteControl with other classes.

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Table 468 – Association ends of SCADA::RemoteControl with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] Control	Control	The Control for the RemoteControl point
[0..*]	[1..1] RemoteUnit	RemoteUnit	inherited from: RemotePoint

6.1.14.4 RemotePoint

For an RTU remote points correspond to telemetered values or control outputs. Other units (e.g. control centers) usually also contain calculated values.

Table 469 shows all attributes of RemotePoint.

Table 469 – Attributes of SCADA::RemotePoint

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 470 shows all association ends of RemotePoint with other classes.

Table 470 – Association ends of SCADA::RemotePoint with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] RemoteUnit	RemoteUnit	Remote unit this point belongs to

6.1.14.5 RemoteSource

Remote sources are state variables that are telemetered or calculated within the remote unit.

Table 471 shows all attributes of RemoteSource.

Table 471 – Attributes of SCADA::RemoteSource

name	type	description
sensorMaximum	Float	The maximum value the telemetry item can return
sensorMinimum	Float	The minimum value the telemetry item can return
scanInterval	Seconds	The time interval between scans
deadband	Float	The smallest change in value to be reported
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject

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name	type	description
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 472 shows all association ends of RemoteSource with other classes.

Table 472 – Association ends of SCADA::RemoteSource with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] MeasurementValue	MeasurementValue	Link to the physical telemetered point associated with this measurement
[0..*]	[1..1] RemoteUnit	RemoteUnit	inherited from: RemotePoint

6.1.14.6 RemoteUnit

A remote unit can be a RTU, IED, substation control system, control center etc. The communication with the remote unit can be through various standard protocols (e.g. IEC 61850) or non standard protocols (e.g. DNP, RP570, etc.). A remote unit contain remote data points that might be telemetered, collected or calculated. The RemoteUnit class inherit PowerSystemResource. The intention is to allow RemotUnits to have Measurements. These Measurements can be used to model unit status as operational, out of service, unit failure etc.

Table 473 shows all attributes of RemoteUnit.

Table 473 – Attributes of SCADA::RemoteUnit

name	type	description
remoteUnitType	RemoteUnitType	Type of remote unit
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 474 shows all association ends of RemoteUnit with other classes.

Table 474 – Association ends of SCADA::RemoteUnit with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..*] CommunicationLinks	CommunicationLink	RTUs may be attached to communication links
[1..1]	[0..*] RemotePoints	RemotePoint	Remote points this Remote unit contains
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource

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[mult from]	[mult to] name	type	description
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.14.7 RemoteUnitType enumeration

Type of remote unit.

Table 475 shows all literals of RemoteUnitType.

Table 475 – Literals of SCADA::RemoteUnitType

literal	description
RTU	
SubstationControlSystem	
ControlCenter	
IED	

6.1.14.8 Source enumeration

Source gives information related to the origin of a value.

Table 476 shows all literals of Source.

Table 476 – Literals of SCADA::Source

literal	description
PROCESS	The value is provided by input from the process I/O or being calculated from some function
DEFAULTED	The value contains a default value
SUBSTITUTED	The value is provided by input of an operator or by an automatic source

6.1.15 Package ControlArea

6.1.15.1 General

The ControlArea package models area specifications which can be used for a variety of purposes. The package as a whole models potentially overlapping control area specifications for the purpose of actual generation control, load forecast area load capture, or powerflow based analysis.

Figure 72 shows logical diagram ControlArea.

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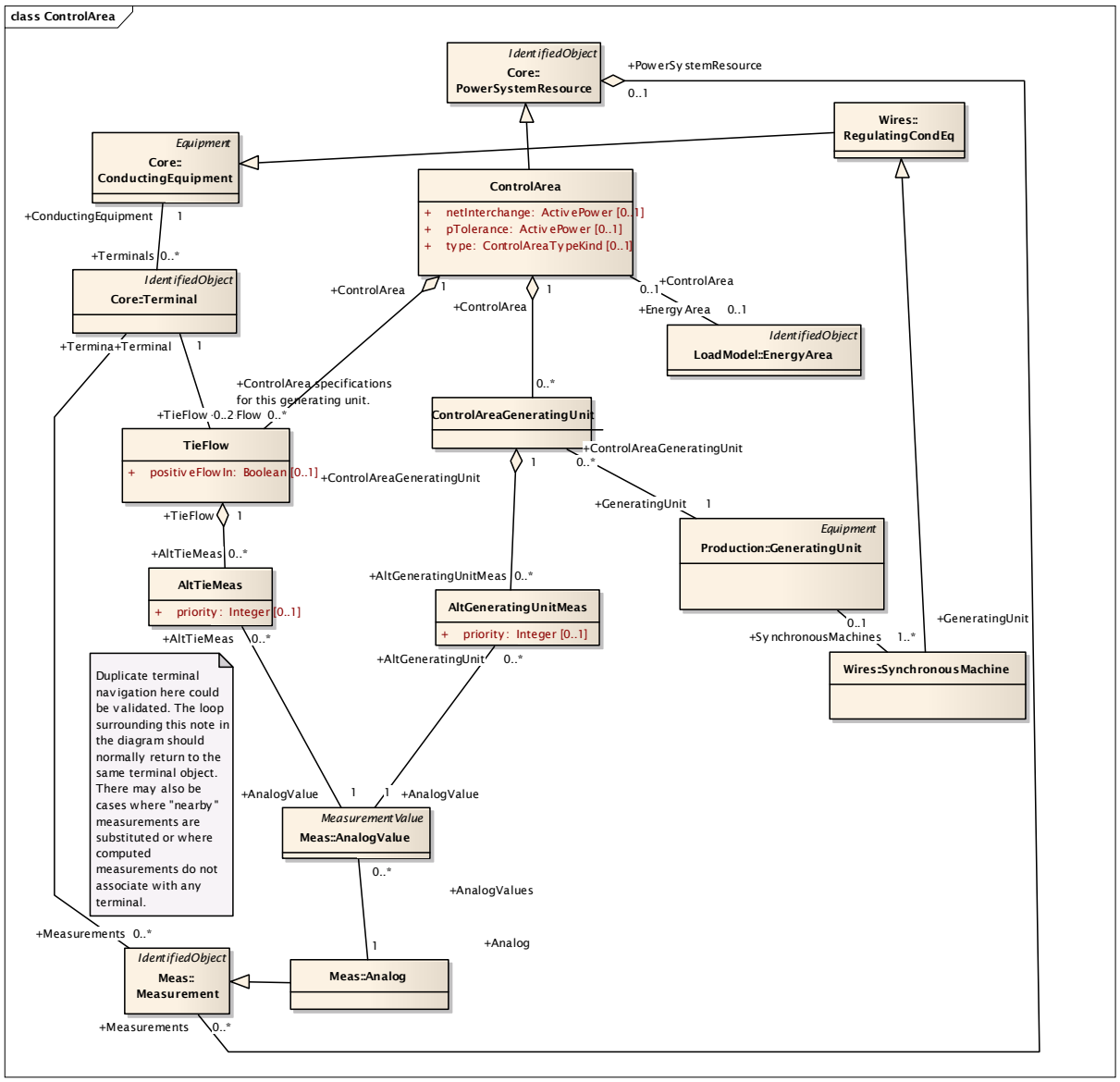

Figure 72 – Logical diagram ControlArea::ControlArea

This diagram shows control area specification and some related classes. The Terminal to AnalogValue linkages are shown for clarity in understanding the control area specificition. The GeneratingUnit to Terminal linkages are also shown to illustrate how generation flows are specifically tied to the network.

Figure 73 shows logical diagram ControlAreaInheritance.

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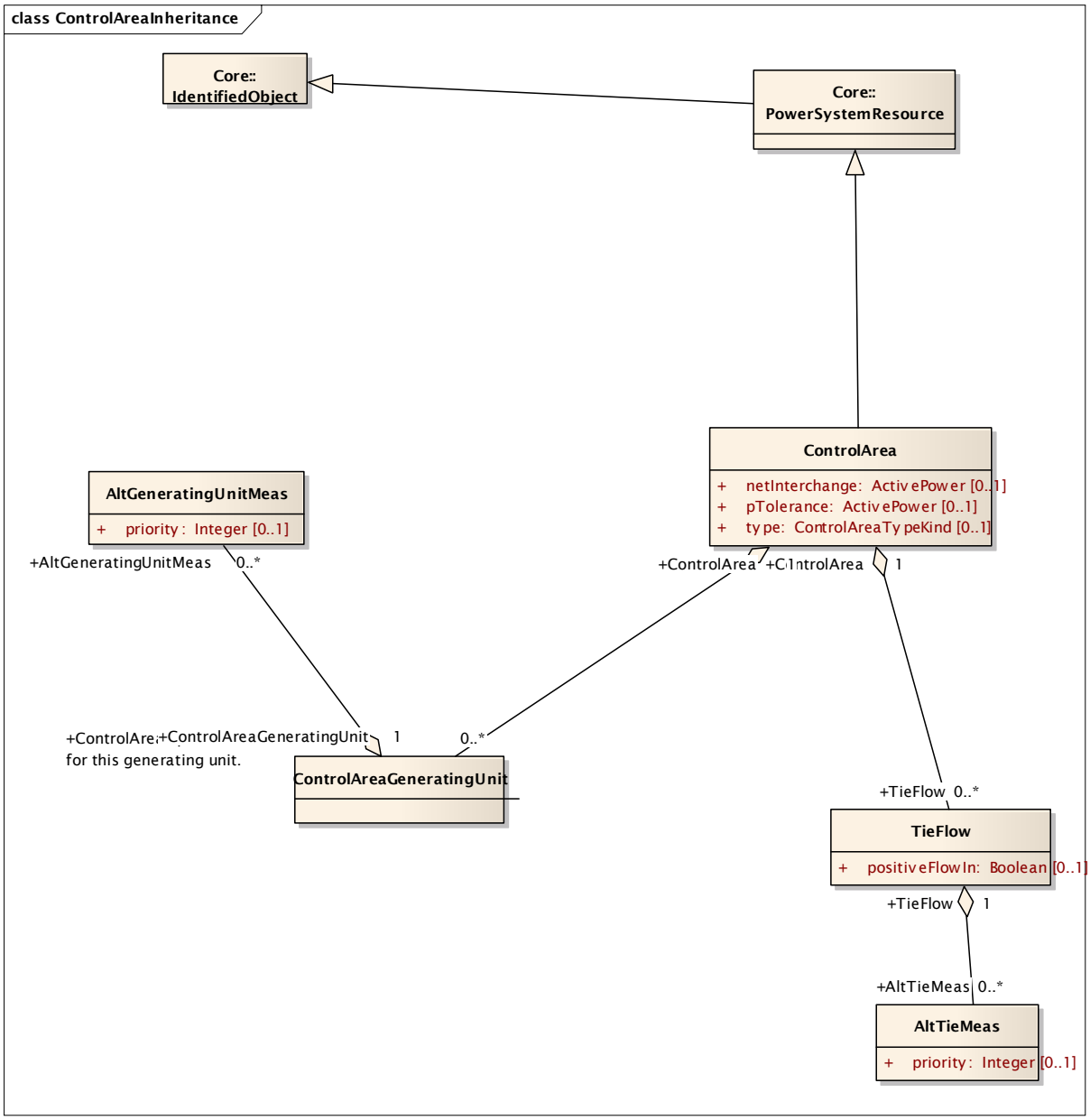

Figure 73 – Logical diagram ControlArea::ControlAreaInheritance

Shows the inheritance of classes in this package.

Figure 74 shows logical diagram Datatypes.

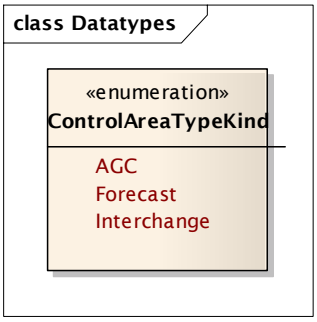

Figure 74 – Logical diagram ControlArea::Datatypes

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6.1.15.2 AltGeneratingUnitMeas root class

A prioritized measurement to be used for the generating unit in the control area specification.

Table 477 shows all attributes of AltGeneratingUnitMeas.

Table 477 – Attributes of ControlArea::AltGeneratingUnitMeas

name	type	description
priority	Integer	Priority of a measurement usage. Lower numbers have first priority

Table 478 shows all association ends of AltGeneratingUnitMeas with other classes.

Table 478 – Association ends of ControlArea::AltGeneratingUnitMeas with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] ControlAreaGeneratingUnit	ControlAreaGeneratingUnit	The control area generating unit to which the prioritized measurement assignment is applied
[0..*]	[1..1] AnalogValue	AnalogValue	The specific analog value used as a source

6.1.15.3 AltTieMeas root class

A prioritized measurement to be used for the tie flow as part of the control area specification.

Table 479 shows all attributes of AltTieMeas.

Table 479 – Attributes of ControlArea::AltTieMeas

name	type	description
priority	Integer	Priority of a measurement usage. Lower numbers have first priority

Table 480 shows all association ends of AltTieMeas with other classes.

Table 480 – Association ends of ControlArea::AltTieMeas with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] TieFlow	TieFlow	The tie flow of the alternate measurements
[0..*]	[1..1] AnalogValue	AnalogValue	The specific analog value used as a source

6.1.15.4 ControlArea

A control area is a grouping of generating units and/or loads and a cutset of tie lines (as terminals) which may be used for a variety of purposes including automatic generation control, powerflow solution area interchange control specification, and input to load

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forecasting. Note that any number of overlapping control area specifications can be superimposed on the physical model.

Table 481 shows all attributes of ControlArea.

Table 481 – Attributes of ControlArea::ControlArea

name	type	description
netInterchange	ActivePower	The specified positive net interchange into the control area
pTolerance	ActivePower	Active power net interchange tolerance
type	ControlAreaTypeKind	The type of control area definition used to determine if this is used for automatic generation control, for planning interchange control, or other purposes
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 482 shows all association ends of ControlArea with other classes.

Table 482 – Association ends of ControlArea::ControlArea with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..1] EnergyArea	EnergyArea	The energy area that is forecast from this control area specification
[1..1]	[0..*] ControlArea specifications for this generating unit.	ControlAreaGeneratingUnit	ControlArea specifications for this generating unit
[1..1]	[0..*] TieFlow	TieFlow	The tie flows associated with the control area
[0..*]	[0..1] PSRType	PSRType	inherited from: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	inherited from: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	inherited from: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	inherited from: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	inherited from: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	inherited from: PowerSystemResource
[0..*]	[0..1] Location	Location	inherited from: PowerSystemResource

6.1.15.5 ControlAreaGeneratingUnit root class

A control area generating unit. This class is needed so that alternate control area definitions may include the same generating unit. Note only one instance within a control area should reference a specific generating unit.

Table 483 shows all association ends of ControlAreaGeneratingUnit with other classes.

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Table 483 – Association ends of ControlArea::ControlAreaGeneratingUnit with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] GeneratingUnit	GeneratingUnit	The generating unit specified for this control area. Note that a control area should include a GeneratingUnit only once
[0..*]	[1..1] ControlArea	ControlArea	The parent control area for the generating unit specifications
[1..1]	[0..*] AltGeneratingUnitMeas	AltGeneratingUnitMeas	The link to prioritized measurements for this GeneratingUnit

6.1.15.6 ControlAreaTypeKind enumeration

The type of control area.

Table 484 shows all literals of ControlAreaTypeKind.

Table 484 – Literals of ControlArea::ControlAreaTypeKind

literal	description
AGC	Used for automatic generation control
Forecast	Used for load forecast
Interchange	Used for interchange specification or control

6.1.15.7 TieFlow root class

A flow specification in terms of location and direction for a control area.

Table 485 shows all attributes of TieFlow.

Table 485 – Attributes of ControlArea::TieFlow

name	type	description
positiveFlowIn	Boolean	The flow is positive into the terminal. A flow is positive if it is an import into the control area

Table 486 shows all association ends of TieFlow with other classes.

Table 486 – Association ends of ControlArea::TieFlow with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] ControlArea	ControlArea	The control area of the tie flows
[0..2]	[1..1] Terminal	Terminal	The terminal to which this tie flow belongs
[1..1]	[0..*] AltTieMeas	AltTieMeas	The primary and alternate tie flow measurements associated with the tie flow

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6.1.16 Package Contingency

6.1.16.1 General

Contingencies to be studied.

Figure 75 shows logical diagram Contingency.

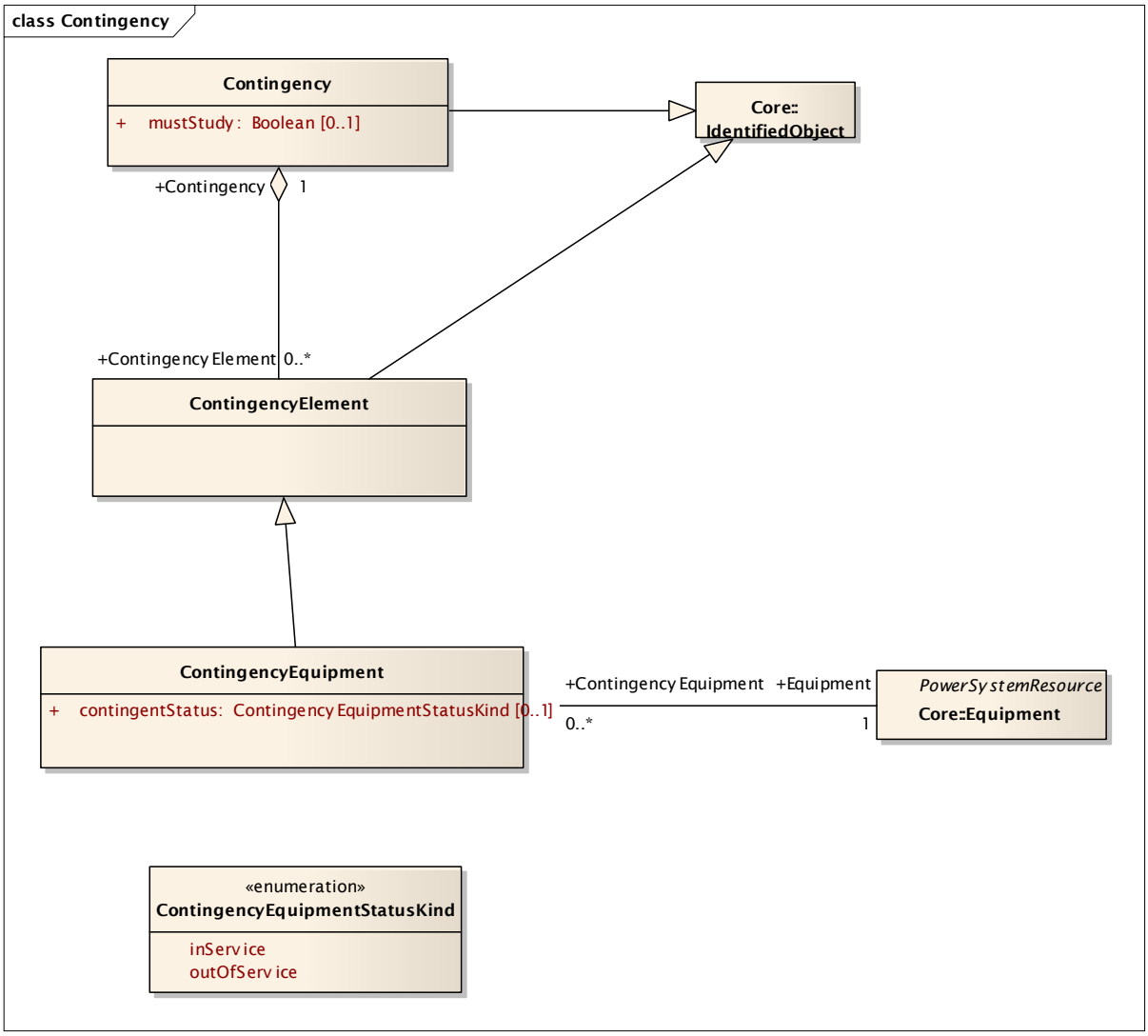

Figure 75 – Logical diagram Contingency::Contingency

6.1.16.2 ContingencyEquipment

Equipment to which the in service status is to change such as a power transformer or AC line segment.

Table 487 shows all attributes of ContingencyEquipment.

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Table 487 – Attributes of Contingency::ContingencyEquipment

name	type	description
contingentStatus	ContingencyEquipmentStatusKind	The status for the associated equipment when in the contingency state. This status is independent of the case to which the contingency is originally applied, but defines the equipment status when the contingency is applied
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 488 shows all association ends of ContingencyEquipment with other classes.

Table 488 – Association ends of Contingency::ContingencyEquipment with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Equipment	Equipment	The single piece of equipment to which to apply the contingency
[0..*]	[1..1] Contingency	Contingency	inherited from: ContingencyElement

6.1.16.3 ContingencyEquipmentStatusKind enumeration

Indicates the state which the contingency equipment is to be in when the contingency is applied.

Table 489 shows all literals of ContingencyEquipmentStatusKind.

Table 489 – Literals of Contingency::ContingencyEquipmentStatusKind

literal	description
inService	The equipment is in service
outOfService	The equipment is to be taken out of service

6.1.16.4 Contingency

An event threatening system reliability, consisting of one or more contingency elements.

Table 490 shows all attributes of Contingency.

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Table 490 – Attributes of Contingency::Contingency

name	type	description
mustStudy	Boolean	Set true if must study this contingency
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 491 shows all association ends of Contingency with other classes.

Table 491 – Association ends of Contingency::Contingency with other classes

[mult from]	[mult to] name	type	description
[1..1]	[0..*] ContingencyElement	ContingencyElement	A contingency can have any number of contingency elements

6.1.16.5 ContingencyElement

An element of a system event to be studied by contingency analysis, representing a change in status of a single piece of equipment.

Table 492 shows all attributes of ContingencyElement.

Table 492 – Attributes of Contingency::ContingencyElement

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 493 shows all association ends of ContingencyElement with other classes.

Table 493 – Association ends of Contingency::ContingencyElement with other classes

[mult from]	[mult to] name	type	description
[0..*]	[1..1] Contingency	Contingency	A contingency element belongs to one contingency

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6.1.17 Package StateVariables

6.1.17.1 General

State variables for analysis solutions such as powerflow.

Figure 76 shows logical diagram StateVariables.

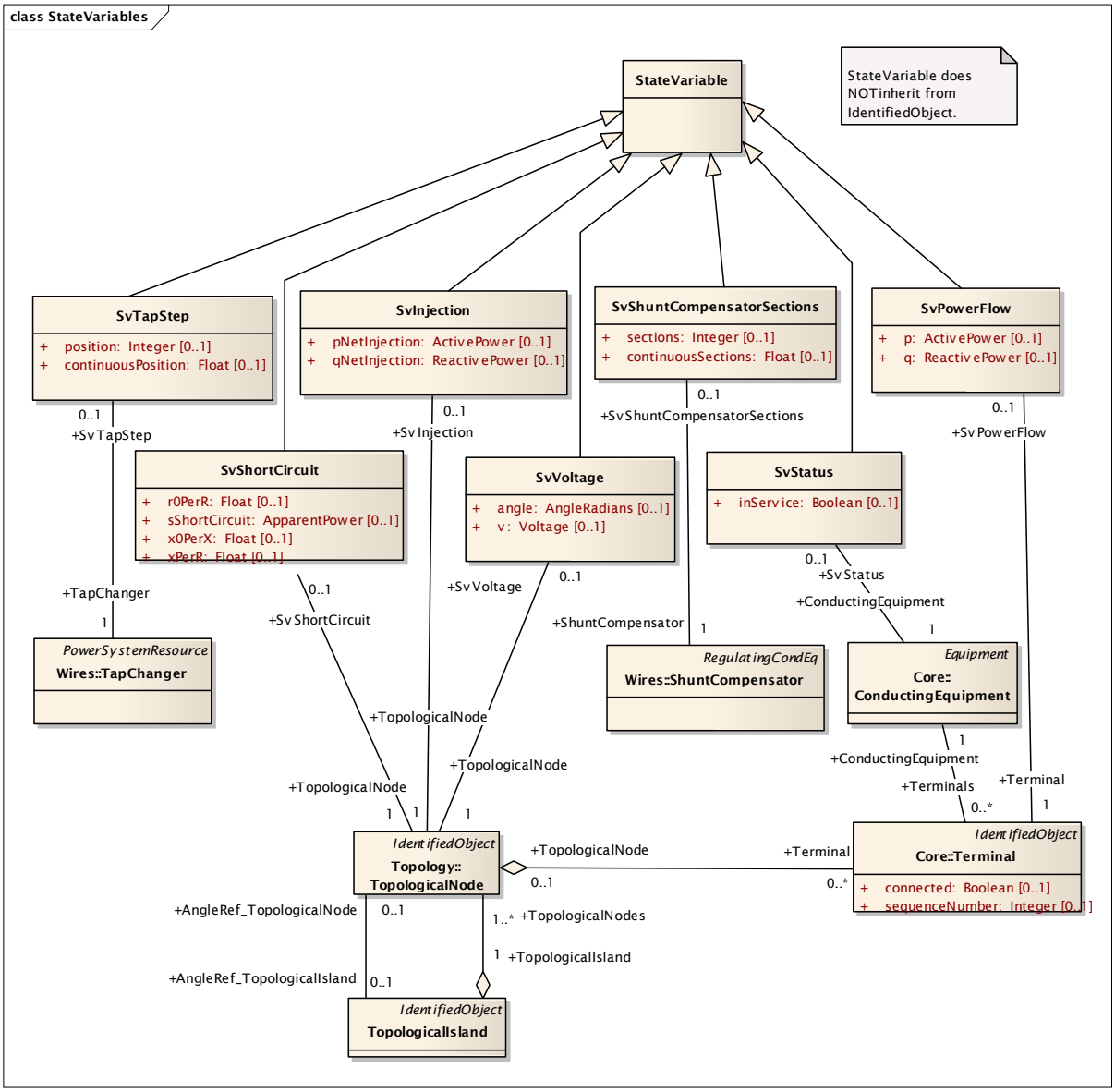

Figure 76 – Logical diagram StateVariables::StateVariables

The state solution variables as derived from base StateVariable class. Note that specialized state variables will be associated with objects derived from IdentifiedObject, but StateVariable does not derive from IdentifiedObject.

6.1.17.2 SvShortCircuit

State variable for short circuit.

Table 494 shows all attributes of SvShortCircuit.

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Table 494 – Attributes of StateVariables::SvShortCircuit

name	type	description
r0PerR	Float	The ratio of zero sequence resistance to positive sequence resistance
sShortCircuit	ApparentPower	The short circuit apparent power drawn at this node when faulted
x0PerX	Float	The ratio of zero sequence reactance per positive sequence reactance
xPerR	Float	Ratio of positive sequence reactance per postive sequence resistance

Table 495 shows all association ends of SvShortCircuit with other classes.

Table 495 – Association ends of StateVariables::SvShortCircuit with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] TopologicalNode	TopologicalNode	The topological node associated with the short circuit state

6.1.17.3 StateVariable root class

An abstract class for state variables.

6.1.17.4 SvInjection

Injection state variable.

Table 496 shows all attributes of SvInjection.

Table 496 – Attributes of StateVariables::SvInjection

name	type	description
pNetInjection	ActivePower	The active power injected into the bus at this location. Positive sign means injection into the bus
qNetInjection	ReactivePower	The reactive power injected into the bus at this location. Positive sign means injection into the bus

Table 497 shows all association ends of SvInjection with other classes.

Table 497 – Association ends of StateVariables::SvInjection with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] TopologicalNode	TopologicalNode	The topological node associated with the state injection

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6.1.17.5 SvPowerFlow

State variable for power flow.

Table 498 shows all attributes of SvPowerFlow.

Table 498 – Attributes of StateVariables::SvPowerFlow

name	type	description
p	ActivePower	The active power flow into the terminal
q	ReactivePower	The reactive power flow into the terminal

Table 499 shows all association ends of SvPowerFlow with other classes.

Table 499 – Association ends of StateVariables::SvPowerFlow with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] Terminal	Terminal	The terminal associated with the power flow state

6.1.17.6 SvShuntCompensatorSections

State variable for the number of sections in service for a shunt compensator.

Table 500 shows all attributes of SvShuntCompensatorSections.

Table 500 – Attributes of StateVariables::SvShuntCompensatorSections

name	type	description
sections	Integer	The number of sections in service
continuousSections	Float	The number of sections in service as a continous variable

Table 501 shows all association ends of SvShuntCompensatorSections with other classes.

Table 501 – Association ends of StateVariables::SvShuntCompensatorSections with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] ShuntCompensator	ShuntCompensator	The shunt compensator for which the state applies

6.1.17.7 SvStatus

State variable for status.

Table 502 shows all attributes of SvStatus.

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Table 502 – Attributes of StateVariables::SvStatus

name	type	description
inService	Boolean	The in service status as a result of topology processing

Table 503 shows all association ends of SvStatus with other classes.

Table 503 – Association ends of StateVariables::SvStatus with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] ConductingEquipment	ConductingEquipment	The conducting equipment associated with the status state

6.1.17.8 SvTapStep

State variable for transformer tap step. This class is to be used for taps of LTC (load tap changing) transformers, not fixed tap transformers. Normally a profile specifies only one of the attributes "position"or "tapRatio".

Table 504 shows all attributes of SvTapStep.

Table 504 – Attributes of StateVariables::SvTapStep

name	type	description
position	Integer	The integer tap position
continuousPosition	Float	The floating point tap position

Table 505 shows all association ends of SvTapStep with other classes.

Table 505 – Association ends of StateVariables::SvTapStep with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] TapChanger	TapChanger	The tap changer associated with the tap step state.

6.1.17.9 SvVoltage

State variable for voltage.

Table 506 shows all attributes of SvVoltage.

Table 506 – Attributes of StateVariables::SvVoltage

name	type	description
angle	AngleRadians	The voltage angle in radians of the topological node
v	Voltage	The voltage magnitude of the topological node

Table 507 shows all association ends of SvVoltage with other classes.

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Table 507 – Association ends of StateVariables::SvVoltage with other classes

[mult from]	[mult to] name	type	description
[0..1]	[1..1] TopologicalNode	TopologicalNode	The topological node associated with the voltage state

6.1.17.10 TopologicalIsland

An electrically connected subset of the network. Topological islands can change as the current network state changes (i.e. switch or Terminal.connected status changes).

Table 508 shows all attributes of TopologicalIsland.

Table 508 – Attributes of StateVariables::TopologicalIsland

name	type	description
mRID	String	inherited from: IdentifiedObject
name	String	inherited from: IdentifiedObject
localName	String	inherited from: IdentifiedObject
pathName	String	inherited from: IdentifiedObject
aliasName	String	inherited from: IdentifiedObject
description	String	inherited from: IdentifiedObject

Table 509 shows all association ends of TopologicalIsland with other classes.

Table 509 – Association ends of StateVariables::TopologicalIsland with other classes

[mult from]	[mult to] name	type	description
[0..1]	[0..1] AngleRef_TopologicalNode	TopologicalNode	The angle reference for the island. Normally there is one TopologicalNode that is selected as the angle reference for each island. Other reference schemes exist, so the association is optional
[1..1]	[1..*] TopologicalNodes	TopologicalNode	A topological node belongs to a topological island

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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INTERFACE DE PROGRAMMATION D'APPLICATION POUR SYSTÈME DE GESTION D'ÉNERGIE (EMS-API) –

Partie 301: Base de modèle d'information commun (CIM)

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La Norme internationale CEI 61970-301 a été établie par le comité d´études 57 de la CEI: Gestion des systèmes de puissance et échanges d'informations associés.

Cette quatrième édition annule et remplace la troisième édition, parue en 2011. Cette quatrième édition constitue une révision technique.

Les principales modifications par rapport à la troisième édition sont les suivantes:

- extensions ajoutées pour prendre en charge l'échange UCTE;
- déplacement de plusieurs classes de la CEI 61970 vers le paquetage Assets ("Biens") dans la CEI 61968;
- modification et extension du modèle de régulation des transformateurs afin de prendre en charge les modèles de transformateurs de déphasage dont a besoin l'ENTSO-E;
- ajout des termes "impédance homopolaire" et "impédance inverse" aux endroits où ils étaient absents;

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- ajout d'un nouveau paquetage StateVariables afin de prendre en charge l'échange de solutions de modèles de réseau à partir du calcul de répartition, de l'estimation d'état, etc.;
- ajout de classes complémentaires comprenant:
  - PhaseTapChanger
  - RatioTapChanger
  - ImpedanceVariationCurve
  - RatioVariationCurve
  - TapSchedule
  - SwitchSchedule
  - PhaseVariationCurve
  - Ajout de EquivalentInjection au paquetage Equivalents
  - Ajout de WindGeneratingUnit et de NuclearGeneratingUnit comme sous-types de GeneratingUnit
- les classes qui ont été supprimées comprenaient:
  - Company
  - HeatExchanger
  - MeasurementType, remplacée par l'attribut Measurement.measurementType
  - Les Datatypes (types de données) ShortLength et LongLength ont été éliminés et remplacés par Length.
  - Load, CustomerLoad et InductionMotorLoad.
  - Sous-types de ConformLoad et NonConFormLoad
- divers changements éditoriaux pour mettre au net le modèle UML.

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
57/1331/FDIS	57/1349/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

Cette publication a été rédigée selon les Directives ISO/CEI, Partie 2.

Une liste de toutes les parties de la série CEI 61970, sous le titre général: *Interface de programmation d'application pour système de gestion d'énergie (EMS-API),* peut être consultée sur le site web de la CEI.

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INTRODUCTION

Cette norme est l'une des différentes parties de la série de normes CEI 61970 qui définissent une interface de programmation d'application (API) pour un système de gestion d'énergie (EMS, c'est-à-dire energy management system). La présente partie de la CEI 61970 a été initialement fondée sur les travaux réalisés dans le cadre du projet de recherche (RP-3654-1) sur les API de centres de conduite (CCAPI) de l'EPRI. Le projet CCAPI de l'EPRI avait principalement pour objet de:

- réduire les coûts et le temps nécessaires à l'ajout de nouvelles applications à un EMS;
- protéger l'investissement dans les applications existantes qui fonctionnent efficacement dans un EMS.

Le principal but de la série de normes CEI 61970 est de produire les normes destinées à faciliter l'intégration d'applications EMS développées de façon indépendante par différents fournisseurs, entre des systèmes EMS complets développés de façon indépendante ou entre un système EMS et d'autres systèmes concernés par différents aspects de l'exploitation d'un système électrique, tels que les systèmes de gestion de la distribution (DMS, c'est-à-dire Distribution Management System) ou de la production. Cela s'effectue par la définition d'interfaces de programmation d'applications (API) normalisées pour permettre à ces applications ou systèmes d'accéder aux données publiques et d'échanger des informations indépendamment de la représentation interne de ces informations.

Le modèle d'information commun (CIM) spécifie la sémantique de cette API. Les spécifications des composants d'interface (CIS pour l'anglais "component interface specifications", qui sont contenues dans d'autres parties des normes CEI 61970, précisent le contenu des messages échangés.

Le CIM est un modèle abstrait représentant tous les objets principaux d'une entreprise de distribution d'électricité habituellement nécessaires pour modéliser les opérations d'une entreprise d'électricité. Ce modèle inclut les classes et les attributs publics de ces objets, ainsi que les relations entre eux.

Les objets représentés dans le CIM sont de nature abstraite et peuvent être utilisés dans une large gamme d'applications. L'utilisation du CIM n'est pas limitée à son application dans un EMS. Il convient que cette norme soit comprise comme un outil permettant l'intégration dans tout domaine où un modèle commun de réseau est nécessaire pour faciliter l'interopérabilité et la compatibilité de connexion entre des applications et des systèmes indépendants de toute mise en œuvre particulière.

La présente norme définit la Base du modèle d'information commun (CIM) constituée d'un ensemble de paquetages qui offrent une vue logique des aspects fonctionnels d'un système de gestion de l'énergie (EMS, c'est-à-dire energy management system) incluant SCADA (Supervisory Control And Data Acquisition).D'autres domaines fonctionnels sont normalisés dans des documents CEI distincts qui augmentent et référencent la présente norme CIM de base. Par exemple, la CEI 61968-11 traite des modèles de distribution et référence la présente norme CIM de base. Alors qu'il existe plusieurs normes de la CEI qui traitent des différentes parties du CIM, un seul modèle d'information unifié comprenant le CIM est derrière tous ces documents normatifs individuels.

La Commission Électrotechnique Internationale (CEI) attire l'attention sur le fait qu'il est déclaré que la conformité avec les dispositions du présent document peut impliquer l'utilisation d'un brevet concernant une mise en œuvre gérée par ordinateur d'un modèle de système de puissance orienté objet dans une base de données relationnelle. À ce titre, elle n'est en conflit avec le développement d'aucun modèle logique de système de puissance incluant le Modèle d'information commun (CIM), lorsque la mise en œuvre du modèle n'est pas définie.

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INTERFACE DE PROGRAMMATION D'APPLICATION POUR SYSTÈME DE GESTION D'ÉNERGIE (EMS-API) –

Partie 301: Base de modèle d'information commun (CIM)

1 Domaine d'application

La présente partie de la CEI 61970 traite du modèle d'information commun (CIM), un modèle abstrait qui représente tous les objets principaux d'une entreprise de service public de distribution d'électricité habituellement impliqués dans les opérations de l'entreprise.

Les classes d'objets représentées dans le CIM sont de nature abstraite et peuvent être utilisées dans une large gamme d'applications. L'utilisation du CIM n'est pas limitée à son application dans un EMS. Il convient que cette norme soit comprise comme un outil permettant l'intégration dans tout domaine où un modèle commun de réseau est nécessaire pour faciliter l'interopérabilité et la compatibilité de connexion entre des applications et des systèmes indépendants de toute mise en œuvre particulière.

En fournissant une façon normalisée de représenter des ressources de réseaux électriques comme classes et attributs d'objets ainsi que leurs relations, le CIM facilite l'intégration des applications de système de gestion de l'énergie (EMS) développées de façon indépendante par différents fournisseurs, entre des systèmes EMS complets développés de façon indépendante ou entre un système EMS et d'autres systèmes concernés par différents aspects des opérations d'un réseau électrique tels que la gestion de la production ou de la distribution. Le système SCADA (supervisory control and data acquisition) est modélisé dans toute la mesure nécessaire pour prendre en charge la simulation des systèmes énergétiques et la communication entre des centres de commande. Le CIM facilite l'intégration en définissant un langage commun (une sémantique) fondé sur le modèle CIM pour permettre à ces applications ou systèmes d'accéder aux données publiques et d'échanger des informations indépendamment de la représentation interne de ces informations.

À cause de la taille du CIM complet, les classes objet qui le composent sont regroupées en un certain nombre de Paquetages logiques, qui représentent chacun une certaine partie du système électrique modélisé. Les collections de ces Paquetages sont fournies progressivement sous forme de Normes internationales distinctes. La présente Norme internationale particulière spécifie un ensemble de Base de paquetages qui offrent une vue logique sur les aspects fonctionnels des informations relatives à un Système de Gestion de l'Énergie (EMS) d'une entreprise de service public de distribution d'électricité qui sont partagées par toutes les applications. D'autres normes spécifient des aspects plus spécifiques du modèle qui ne sont nécessaires qu'à certaines applications. Le Paragraphe 4.2 ci-dessous définit le découpage actuel des paquetages dans les documents normatifs.

2 Références normatives

Les documents suivants sont cités en référence de manière normative, en intégralité ou en partie, dans le 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).

CEI 61850-7-4, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes* (disponible en anglais seulement)

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CEI 61970-2, *Energy management system application program interface (EMS-API) – Part 2: Glossary* (disponible en anglais seulement)

ISO 8601, *Éléments de données et formats d'échange – Échange d'information – Représentation de la date et de l'heure*

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions donnés dans la CEI 61970-2 ainsi que les suivants s'appliquent.

NOTE Se référer à la CEI 60050, Vocabulaire Électrotechnique International, pour les définitions du glossaire général.

3.1
système de gestion d'énergie
EMS (en anglais, *energy management system*)
système informatique comprenant une plateforme logicielle offrant les services de support de base et un ensemble d'applications offrant les fonctionnalités requises pour le bon fonctionnement des installations de production et de transport d'électricité afin d'assurer la sécurité adéquate d'approvisionnement énergétique à un coût minimal

3.2
interface de programmation d'application
API (en anglais, *application program interface*)
ensemble des fonctions publiques qu'offre un composant exécutable d'application pour être utilisées par d'autres composants exécutables d'application

4 Spécification CIM

4.1 Notation de modélisation du CIM

Le CIM est défini en utilisant des techniques de modélisation orientées objet. Plus précisément, la spécification du CIM utilise la notation du Langage de modélisation unifié (UML) qui définit le CIM comme un groupe de paquetages.

Chaque paquetage du CIM contient un ou plusieurs diagrammes de classe montrant sous forme graphique toutes les classes de ce paquetage et leurs relations. Chaque classe est ensuite définie de façon textuelle en mettant l'accent sur ses attributs et ses relations avec d'autres classes.

La notation UML est décrite dans les documents de l'Object Management Group (OMG) et dans plusieurs autres manuels édités.

4.2 Paquetages CIM

Le CIM est fractionné en un ensemble de paquetages. Un paquetage est un moyen général permettant de grouper des éléments liés à un modèle. Les paquetages ont été choisis pour simplifier la conception, la compréhension et la révision du modèle. Le CIM se compose de l'ensemble complet de paquetages. Des entités peuvent avoir des associations dépassant les limites de plusieurs paquetages. Chaque application utilisera des informations représentées dans plusieurs paquetages.

Le CIM complet est fractionné en groupes de paquetages afin de les gérer et maintenir commodément. Ces groupes sont affectés à des groupes de travail différents au sein de la CEI.

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Le paquetage CIMde la CEI 61970-301 (le présent document) est sous la responsabilité du même groupe de travail qui traite les cas suivants:

- Domain (domaine)
- Core (cœur)
- OperationalLimits (limites opérationnelles)
- Topology (topologie)
- Wires (Fils)
- Generation (production)
- Generation.GenerationDynamics
- Generation.Production
- LoadModel (modèle de charge)
- Outage (interruption de service)
- Protection
- Equivalents
- Meas (mesures)
- SCADA
- ControlArea (zone de contrôle)
- Contingency (contingence)
- StateVariables (variables d'état)

Les paquetages compris dans la série de normes CEI 61968 décrivent des parties supplémentaires du CIM qui traitent d'autres vues logiques des opérations d'une entreprise de service public, y compris la gestion du patrimoine, des emplacements, des activités, des clients, de la documentation et des travaux, et des modèles de réseau spécifiques à la distribution.

Noter que les limites du paquetage n'impliquent pas de limites pour une application. Une application peut utiliser des entités CIM de différents paquetages. Il est également prévu que des paquetages du CIM en dehors de ceux du présent document auront des dépendances avec certains des paquetages décrits dans le présent document, et en particulier les paquetages Domain et Core, même si d'autres dépendances existeront aussi.

La Figure 1 représente les paquetages définis pour la Base de CIM de la CEI 61970-301 et leurs relations de dépendance. Les lignes en pointillé indiquent une relation de dépendance, la flèche allant du paquetage dépendant vers le paquetage dont il dépend.

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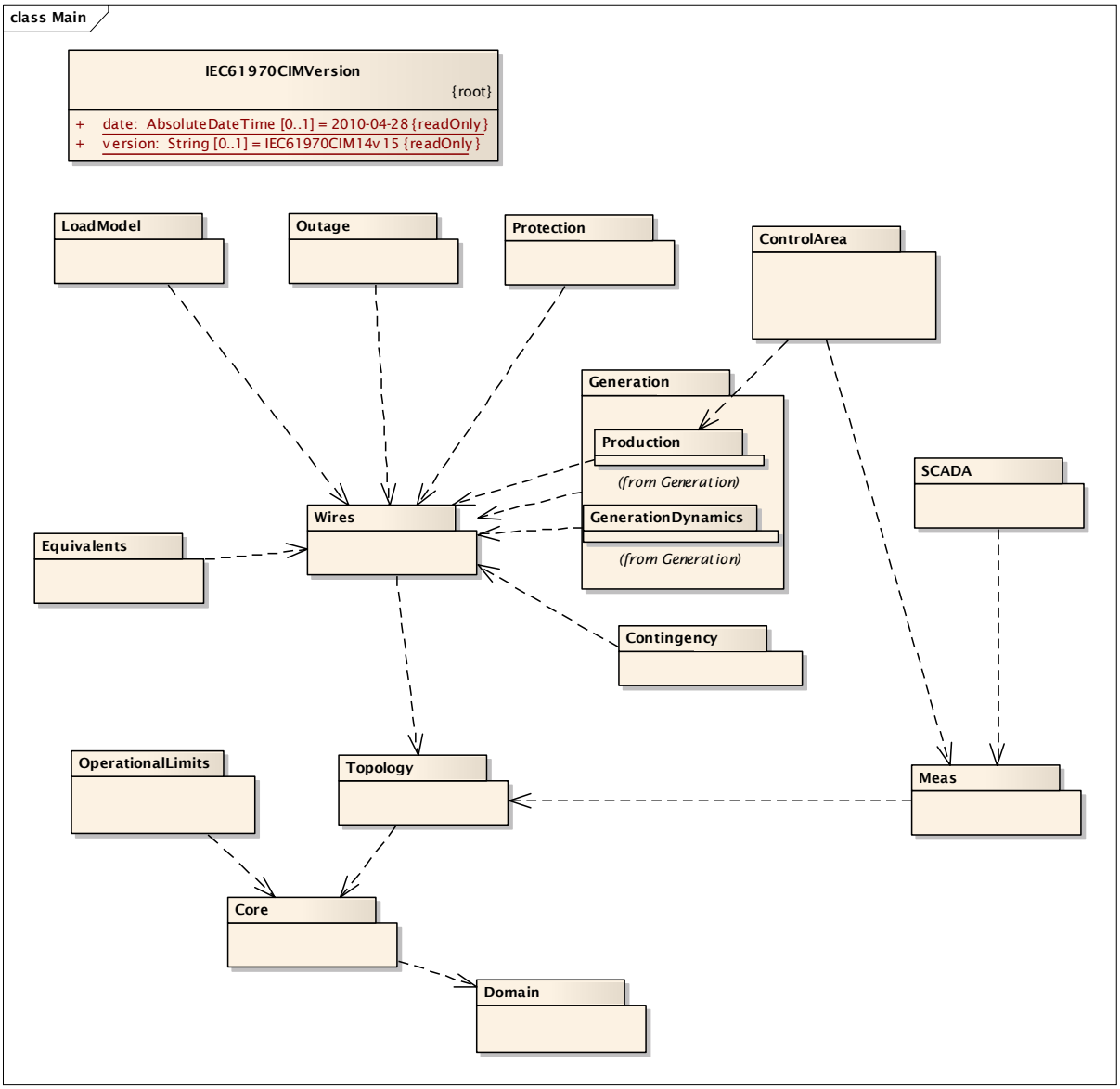

Figure 1 – Diagramme du paquetage CIM IEC 61970-301

L'Article 6 contient la spécification pour chacun des paquetages du CIM.

NOTE Le contenu du CIM défini dans la présente spécification a été créé automatiquement à partir de la version IEC61970CIM14v15 du modèle électronique UML du CIM, qui est disponible auprès du groupe des utilisateurs du CIM (CIM Users Group).

4.3 Classes CIM et relations

4.3.1 Classes

Le ou les diagrammes de classe de chaque paquetage CIM représentent toutes les classes du paquetage et leurs relations. Lorsque des relations existent avec des classes dans d'autres paquetages, ces classes sont également représentées.

Les classes et les objets modélisent ce qui se trouve dans un réseau électrique et qui doit être représenté de la même façon pour les applications EMS. Une classe est une description d'un objet réel, tel qu'un transformateur électrique, un générateur ou une charge, qui doit être représenté comme faisant partie du modèle complet de réseau électrique dans un EMS. Parmi les autres types d'objets figurent des éléments tels que les programmes et les mesures que des applications EMS doivent également traiter, analyser et enregistrer. De tels objets

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nécessitent une représentation commune pour atteindre les objectifs de compatibilité de connexion et d'interopérabilité de la norme EMS-API. Un objet particulier dans un réseau électrique ayant une identité unique est modélisé comme une instance de la classe à laquelle il appartient.

Il convient également de noter que le CIM est défini pour faciliter l'échange de données. Comme défini dans le présent document, les entités du CIM n'ont pas de comportement. Pour une interface spécifique, un profil est défini et consiste en des sous-ensembles de classes, attributs et associations du CIM. Un profil définit la charge utile de message pour une interface.

Les classes comportent des attributs qui décrivent les caractéristiques des objets. Chaque classe du CIM contient les attributs décrivant et identifiant une instance spécifique de la classe. Seuls les attributs d'intérêt public pour les applications EMS sont inclus dans les descriptions de classes.

Chaque attribut possède un type qui identifie le type d'attribut dont il s'agit. Les attributs typiques sont de type Integer (nombre entier), Float (flottant), Boolean (booléen), String (chaîne) et Enumeration (énumération), qui sont appelés types primitifs. Cependant, de nombreux types supplémentaires sont définis comme partie intégrante de la spécification CIM. Par exemple, ShuntCompensator a un attribut "maxU" du type Voltage (tension). La définition des types de données est contenue dans le Paquetage Domain décrit en 4.2. Les stéréotypes Primitive, enumeration et Datatype de l'UML sont ajoutés aux classes utilisées comme types. Le stéréotype Datatype est utilisé avec une sémantique spécifique du CIM pour un triplet d'attributs {value, unit, multiplier}, qui implique une mise en correspondance personnalisée avec des artéfacts de sérialisation tels que RDFS, OWL et XSD. Les classes ayant ces stéréotypes ne participent pas à des relations de généralisation ou d'association et sont simplement utilisées comme types pour des attributs.

Tous les attributs du CIM sont implicitement facultatifs en ce sens que les profils utilisant le CIM peuvent les éliminer tous.

Les relations entre les classes révèlent la façon dont elles sont structurées l'une par rapport à l'autre. Les classes CIM sont reliées de différentes façons, comme décrit en 4.3.2, 4.3.3 et 4.3.4.

4.3.2 Generalization

Une generalization (généralisation) est une relation entre une classe générale et une classe plus spécifique. La classe la plus spécifique ne peut contenir que des informations supplémentaires. Par exemple, un PowerTransformer (transformateur de puissance) est un type spécifique de Equipment (d'équipement). L'association de type Generalization permet à une classe spécifique d'hériter d'attributs et de relations de toutes les classes plus générales situées au-dessus d'elle.

La Figure 2 est un exemple de generalization. Dans cet exemple tiré du paquetage Wires, un Breaker (disjoncteur) est un type plus spécifique de ProtectedSwitch (commutateur protégé), qui à son tour est un type plus spécifique de Switch (commutateur), qui est un type plus spécifique de ConductingEquipment (équipement conducteur), etc. Un PowerTransformer (transformateur de puissance) est un autre type plus spécifique de Equipment. Noter que PowerSystemResource hérite de la classe IdentifiedObject (objet identifié) qui n'est pas sur le diagramme.

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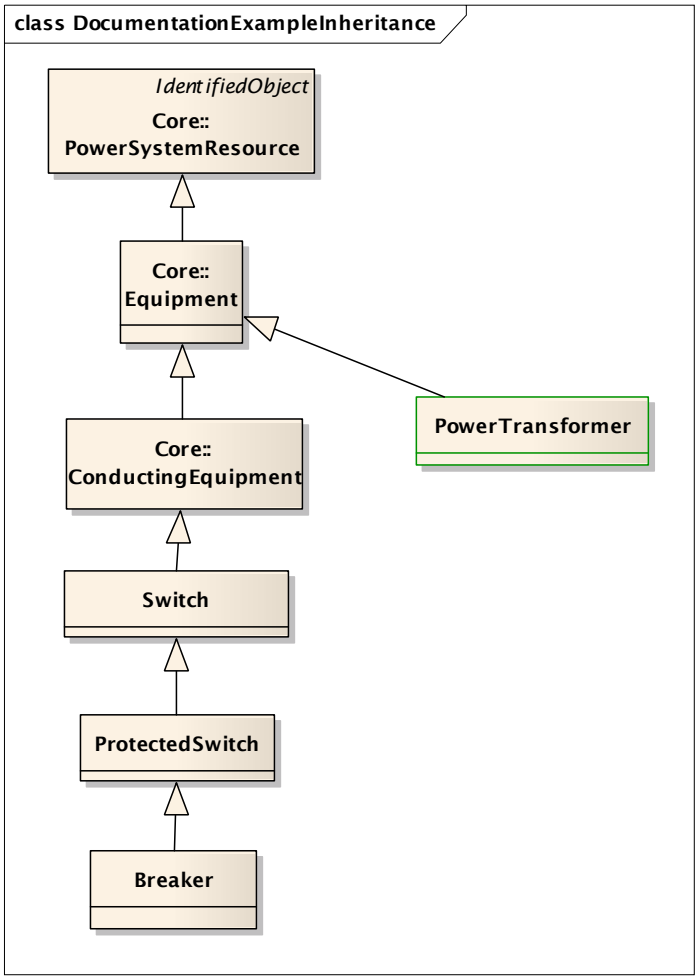

Figure 2 – Exemple de généralisation

4.3.3 Simple association

Une association est une connexion conceptuelle entre des classes. Chaque association a deux “extrémités d'association”. Les “extrémités d'association” étaient appelées “rôles” avant la spécification UML 2.0. Chaque extrémité d'association décrit le rôle que la classe cible (la classe *vers* laquelle l'extrémité d'association part) a en relation avec la classe source (la classe *à partir de* laquelle l'extrémité d'association part). La coutume est d'attribuer aux extrémités d'association le nom de la classe cible avec ou sans un qualifieur. Chaque extrémité d'association possède aussi une cardinalité/multiplicité, qui est une indication du nombre d'objets qui peuvent prendre part à la relation décrite. Dans le CIM, les associations ne sont pas nommées, seules les extrémités d'association sont nommées. Par exemple dans le CIM, il existe une association entre un BaseVoltage et un VoltageLevel (voir la Figure 3 qui vient du paquetage Wires). La multiplicité est montrée aux deux extrémités de l'association. Dans cet exemple, un objet VoltageLevel (niveau de tension) peut faire référence à 1 BaseVoltage (tension de base), et une BaseVoltage peut être référencée par 0 ou plus d'objets VoltageLevel.

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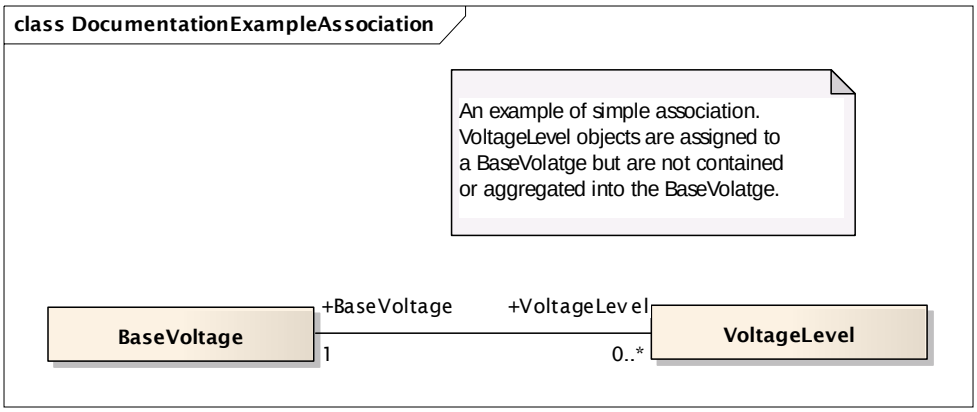


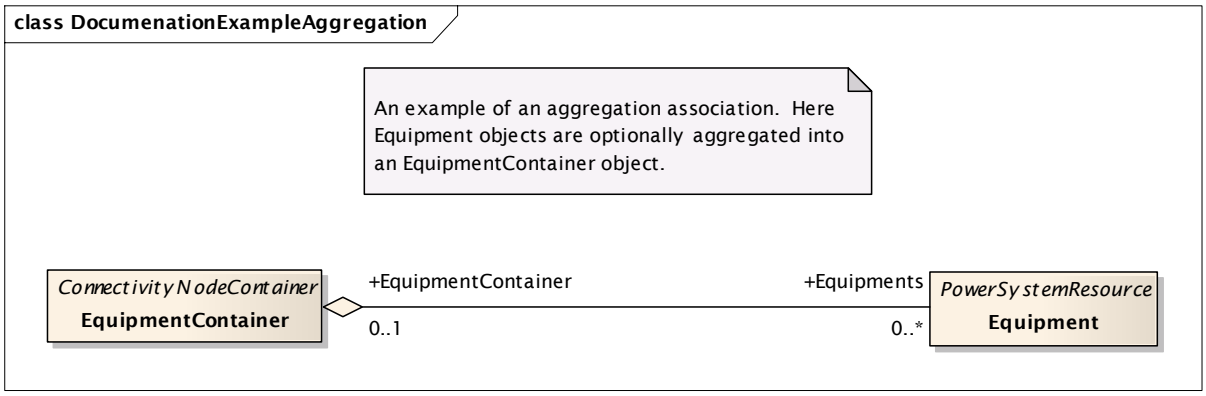
Légende

Anglais	Français
An example of a simple association. VoltageLevel objects are assigned to a BaseVoltage but are not contained or aggregated into the BaseVoltage.	Un exemple d'association simple. Des objets VoltageLevel sont affectés à une BaseVoltage, mais ne sont ni contenus ni agrégés dans la BaseVoltage.

Figure 3 – Exemple d'association simple

4.3.4 Aggregation

Aggregation (agrégation) est un cas spécial d'association. L'agrégation indique que la relation entre les classes est une sorte de relation classe entière/classe partielle où la classe entière "consists of" (se compose de) ou "contains" (contient) la classe partielle, et cette classe partielle est une "part of" (partie de) la classe entière. La classe partielle n'hérite pas de la classe entière comme dans la généralisation. La Figure 4 représente une agrégation entre la classe EquipmentContainer (Conteneur d'équipements) et la classe Equipment, qui provient du paquetage Core. Comme montré, un Equipment peut être membre de zéro ou d'un seul objet EquipmentContainer, mais un objet EquipmentContainer peut contenir n'importe quel nombre d'objets Equipment.



Légende

Anglais	Français
An example of an aggregation association. Here Equipment objects are optionally aggregated into an EquipmentContainer object.	Un exemple d'association d'agrégation. Ici, des objets Equipment sont facultativement agrégés en un objet EquipmentContainer.

Figure 4 – Exemple d'agrégation

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4.4 Concepts du modèle CIM et exemples

4.4.1 Concepts

Les classes, les attributs, les types et les relations du CIM sont spécifiés dans les Articles 5 et 6. L'Article 6 comprend une description complète du modèle de la Base du CIM de la CEI 61970-301. Afin d'aider à comprendre comment interpréter le CIM, certains concepts-clés de modèle utilisés dans le CIM sont présentés et décrits en 4.4.2 à 4.4.8.

4.4.2 Hiérarchies d'emboîtement, d'équipements et dénomination

4.4.2.1 Structure de l'emboîtement

La Figure 5 montre le concept d'EquipmentContainer (conteneurs d'équipement) pour former des hiérarchies dans le CIM. Les conteneurs d'équipement sont un moyen de regrouper et de nommer des équipements se trouvant, typiquement, dans un poste (substation). Comme on peut le constater *de visu*, les conteneurs offrent une certaine souplesse d'utilisation pour se plier aux différents usages internationaux, ainsi qu'aux différences trouvées habituellement entre les postes de transport et de distribution. Bay (une cellule), VoltageLevel (un niveau de tension), Substation (un poste), Line (une ligne) et Plant (une centrale) sont tous des types de EquipmentContainers. En général, une Bay est contenue dans un VoltageLevel spécifique, qui à son tour est contenu dans un Substation. Les Substations et les Lines peuvent être contenus dans des SubGeographicRegion (des sous-régions géographiques) et GeographicRegion (des régions géographiques).

Une hiérarchie d'emboîtement est utilisée avec la classe IdentifiedObject pour créer une désignation hiérarchique destinée à décrire la consommation humaine. Une hiérarchie est utilisée spécifiquement pour nommer les équipements selon leur fonction dans le système électrique. Il s'agit de la hiérarchie de dénomination fonctionnelle. Outre les noms fonctionnels, d'autres identifications communes sont les numéros de série des biens. Le nom fonctionnel diffère d'un numéro de série en ce qu'il renvoie à la fonction d'une position ou localisation particulière d'un équipement dans le système électrique. Quel que soit l'élément spécifique d'équipement physique qui est placé en un endroit, le nom fonctionnel est le même, mais le numéro de série varie en fonction de l'équipement physique actuellement utilisé.

4.4.2.2 Classe IdentifiedObject

La classe IdentifiedObject contenu dans le paquetage Core est héritée par tous les objets PowerSystemResource et de nombreuses autres classes. Cette classe contient six attributs à utiliser pour nommer tous les objets PowerSystemRessource. L'objectif est qu'il convient d'assigner des valeurs à chacun des attributs d'une manière cohérente avec la définition des attributs.

Les éléments qui suivent sont des définitions et conventions concernant les modalités d'utilisation des attributs IdentifiedObject pour nommer les objets PowerSystemResource (pour plus de détails, se référer à la documentation concernant IdentifiedObject et ses attributs à l'Article 6):

- name: Un nom en texte libre.
- localName: Un nom court local de l'instance. Les objets qui sont structurés en une hiérarchie de dénomination fonctionnelle gardent ce nom local à tous les niveaux de la hiérarchie. Le nom doit être unique pour les objets contenus par le même parent.
- pathName: Les objets qui sont structurés en une hiérarchie de dénomination fonctionnelle ont un pathName (chemin d'accès) qui contient tous les IdentifiedObject.localName (nom local d'objet identifié) allant de l'objet à la racine. Le pathName est alors une concaténation de tous ces noms en remontant de l'objet feuille à la racine de la hiérarchie d'emboîtement, de manière semblable à un chemin d'accès pour un fichier. Par exemple, si le node (nœud) "A" contient le node "B" qui contient le node "C", alors le pathName pour le node "C" peut apparaître comme étant "A.B.C". Le type des caractères de

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délimitation utilisés entre les localName (noms locaux) n'est pas spécifié, mais est du ressort de la mise en œuvre locale.

- aliasName (pseudonyme): Un nom en texte libre de l'instance. Cet attribut peut aussi être utilisé pour la localisation.
- description: Une description en format libre de l'instance.
- mRID (Master Resource ID): Un identificateur lisible par une machine et unique au niveau global pour une instance d'objet.

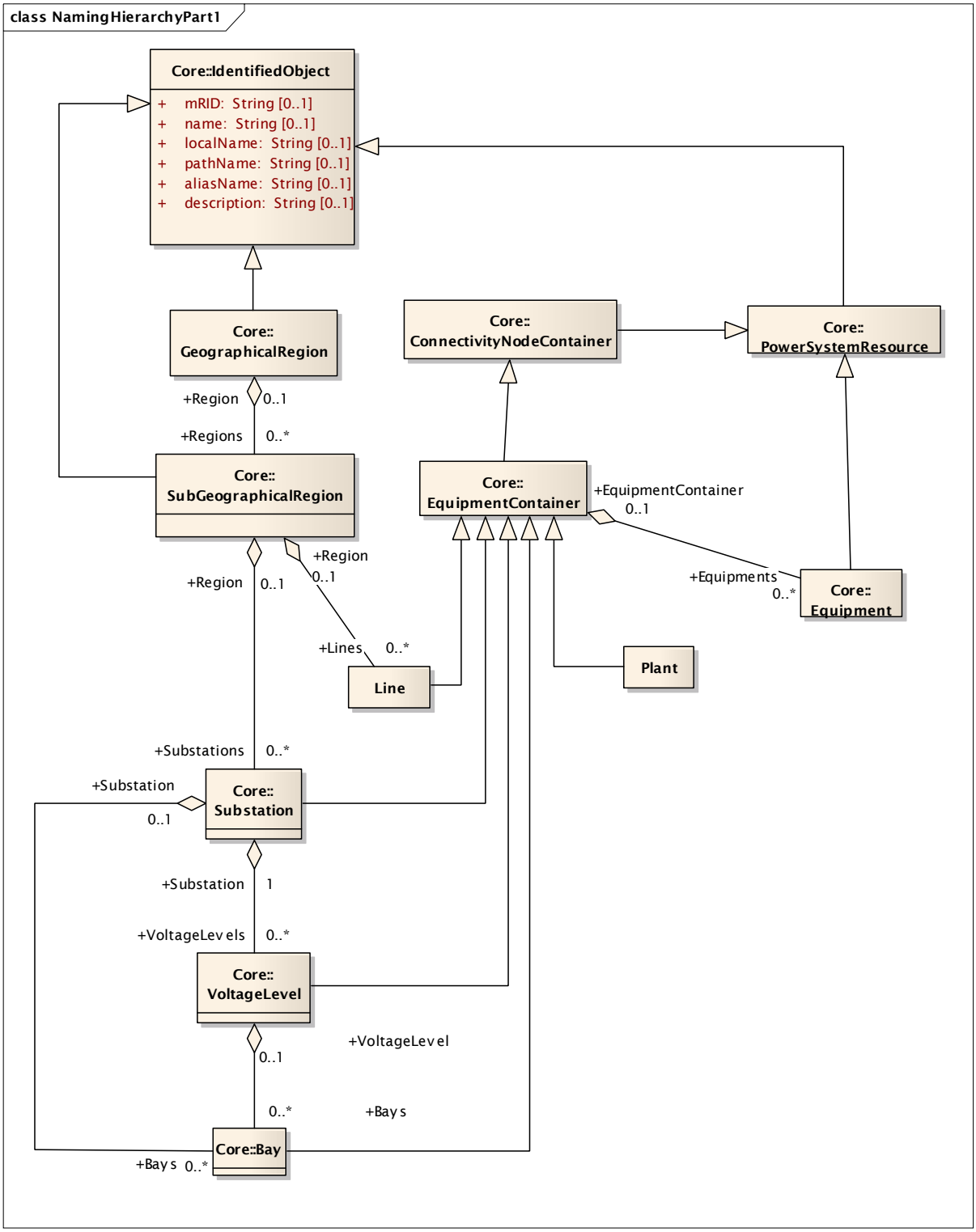

Figure 5 – EquipmentContainers

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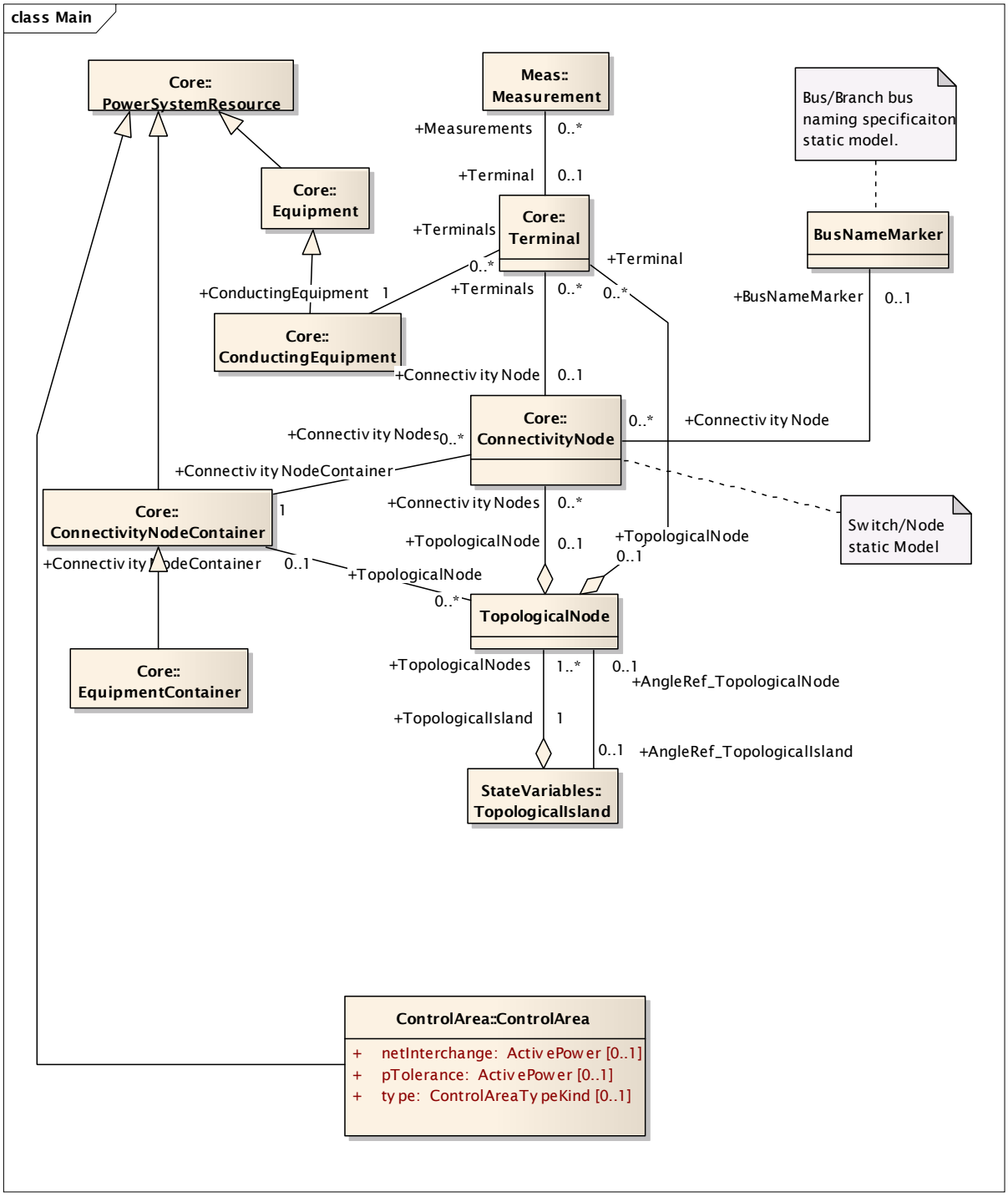
Les diagrammes NamingHierarchyPart1 (Partie 1 de la hiérarchie de dénomination) et NamingHierarchyPart2 (Partie 2 de la hiérarchie de dénomination) dans les paquetages Wires montrent la hiérarchie de dénomination fonctionnelle (pour les détails, se référer à la documentation du paquetage Wires donnée à l'Article 6).

4.4.3 Modèle de connectivité

4.4.3.1 Description de la connectivité

La Figure 6 montre le diagramme de classe Topology qui modélise la connectivité entre différents types de ConductingEquipment. Elle inclut également une partie du diagramme de classe du paquetage Meas traitant des mesures pour illustrer la façon dont les mesures sont associées aux équipements conducteurs.



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Légende

Anglais	Français
Bus/Branch bus naming specification static model.	Modèle statique de spécification de dénomination de topologie nodale
Switch/Node static model	Modèle statique Commutateur/Nœud

Figure 6 – Modèle de connectivité

Pour modéliser la connectivité, les classes Terminal (borne) et ConnectivityNode (nœud de connectivité) ont été définies. Une Terminal appartient à un ConductingEquipment, mais un ConductingEquipment peut avoir un nombre quelconque de Terminals. Chaque Terminal peut être connectée à un ConnectivityNode qui est un point où les bornes des équipements conducteurs sont connectées ensemble avec une impédance nulle. Un ConnectivityNode peut avoir un nombre quelconque de bornes connectées et peut être membre d'un TopologicalNode (nœud topologique) (à savoir un bus) qui est membre d'un TopologicalIsland (îlot topologique). Les TopologicalNode et TopologicalIsland sont créés comme résultat d'un programme qui prend en compte la topologie existante et les positions réelles des Switch (commutateurs).

Il est possible d'échanger des messages impliquant directement TopologicalNode et contournant les détails de ConnectivityNode en utilisant l'association TopologicalNode à Terminal. Cela est souvent utile pour les échanges impliquant des modèles de topologie nodale qui ne contiennent pas typiquement des détails relatifs aux commutateurs.

Les EquipmentContainers, qui sont une spécialisation d'un ConnectivityNodeContainer (Conteneur de nœud de connectivité), peuvent avoir zéro à plusieurs de ConnectivityNodes. Les associations ConductingEquipment–Terminal et Terminal–ConnectivityNode permettent de représenter la topologie d'un réseau électrique réel. Pour chaque Terminal connecté à un ConnectivityNode, les associations des autres Terminal(s) connectées au même ConnectivityNode identifient le ou les objets ConductingEquipment qui sont connectés électriquement. Une connectivité similaire, au niveau de détail “topologie nodale”, peut être exprimée à l'aide de TopologicalNode au lieu du ConnectivityNode. La classe BusNameMarker, qui a une association à ConnectivityNode, est utilisée pour contenir les noms de bus utilisateur devant être appliqués aux TopologicalNodes. Les TopologicalNodes sont créés à partir de ConnectivityNodes comme résultat d'un traitement de topologie.

Pour modéliser les valeurs analogiques telles que la tension et la puissance, chaque Terminal a une association avec une classe Measurement du paquetage Meas. Bien que Figure 6 ne le montre pas la, un objet Measurement est associé à au moins un objet MeasurementValue (valeur de mesure). Chaque MeasurementValue est une instance de mesure d'une source spécifique, par exemple une mesure télémétrée.

L'Article 6 contient une description complète de chaque classe de la Figure 6 avec la définition de tous les attributs et de toutes les relations pris en charge dans chaque classe.

4.4.3.2 Exemple de connectivité et d'emboîtement

Pour illustrer comment le modèle de connectivité et le modèle d'emboîtement peuvent être représentés comme des objets, un petit exemple est présenté à la Figure 7. L'exemple montre une ligne de transport avec une jonction en T entre deux postes et un poste avec deux niveaux de tension et un transformateur entre eux. La ligne de transport contient deux câbles différents. Un des niveaux de tension est montré avec un tronçon de jeux de barres contenant un seul jeu de barres et deux baies de commutation très simples connectées au jeu de barres.

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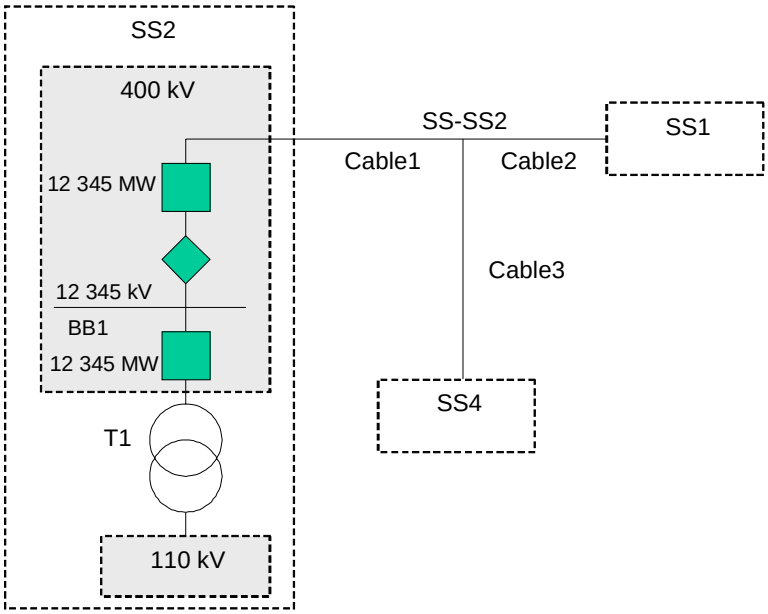

Figure 7 – Exemple de réseau simple

La Figure 8 montre comment la connectivité est modélisée dans le CIM ainsi qu'une façon (mais pas nécessairement la seule) dont l'emboîtement est modélisé pour le diagramme de la Figure 8. Les carrés ombrés représentent les EquipmentContainers, et les carrés blancs les ConductingEquipments. Un ombrage plus sombre indique que l'EquipmentContainer est plus haut dans la hiérarchie d'emboîtement (à savoir, Substation est le plus haut, VoltageLevel vient ensuite, etc.). Les cercles blancs représentent les ConnectivityNodes, et les petits cercles noirs les Terminals. Un Terminal appartient à un ConductingEquipment, et un ConnectivityNode appartient à un EquipmentContainer. Cela signifie que les frontières (ou points de contact) entre ConductingEquipments sont leurs Terminals interconnectées via les ConnectivityNodes.

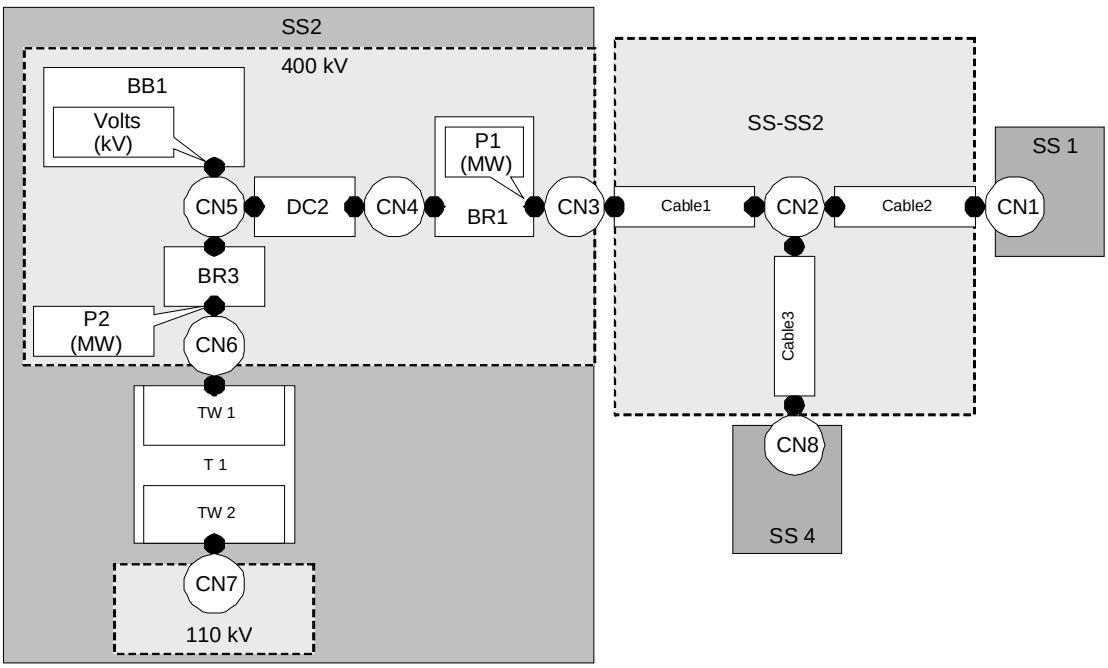

Figure 8 – Connectivité d'un réseau simple modélisé avec la topologie du CIM

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La Line (ligne) SS1-SS2 contient trois ACLineSegments (Cable1, Cable2, et Cable3) et le ConnectivityNode (CN2) associé pour modéliser une jonction en T, qui assure une connexion à SS4. Cela n'est qu'une façon dont cette configuration pourrait être modélisée. Chaque ACLineSegment a deux Terminal. Cable1 est connecté à CN3 et CN2 via ces Terminal. CN3 est contenu par VoltageLevel 400 kV. Le Breaker (disjoncteur) BR1 a deux bornes dont l'une est connectée à CN3.

Les Measurements sont représentées par des bulles carrées où les flèches pointent vers un Terminal. P1 est connecté au Terminal de droite appartenant au Breaker BR1. Noter que P1 est tracé dans la boîte représentant BR1. C'est parce qu'une Measurement peut appartenir à une PowerSystemResource (PSR), comme c'est le cas avec BR1. P2 est tracé dans le VoltageLevel 400 kV, ce qui signifie qu'il appartient au VoltageLevel 400 kV et non à BR3.

4.4.4 Hiérarchie des héritages

La Figure 9 montre une vue générale de la hiérarchie des héritages modélisée dans le CIM. Cette vue générale qui est incluse comme l'un des diagrammes du paquetage Wires couvre en fait la plupart des paquetages du CIM.

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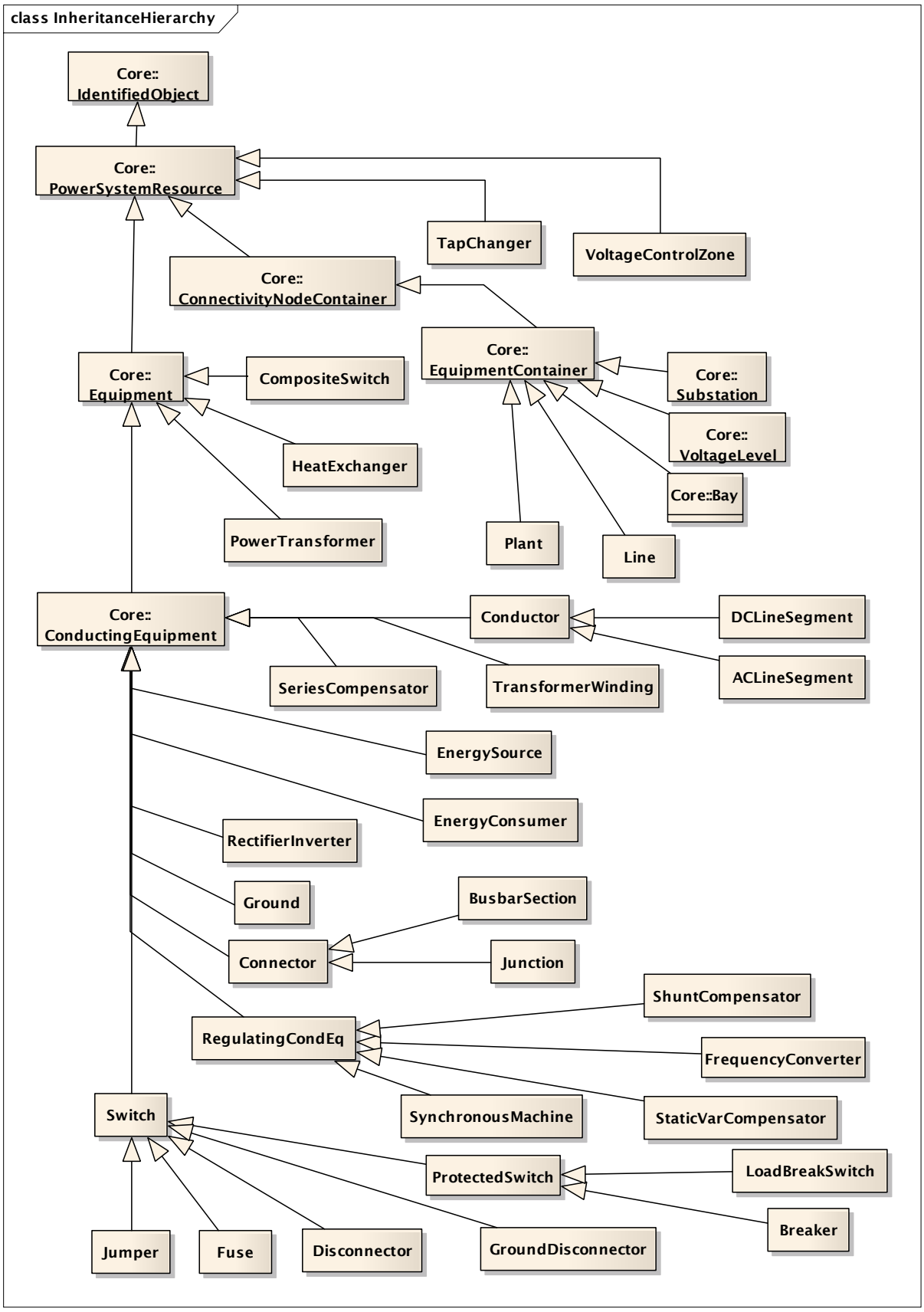

Figure 9 – Hiérarchie des héritages de l'Equipment

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4.4.5 Modèle de transformateur

La Figure 10 montre une partie du diagramme de classe Wires qui modélise un dispositif PowerTransformer (Transformateur de puissance).

Comme le montre la Figure 10, un PowerTransformer est une classe spécialisée d'Equipment, elle-même classe spécialisée de PowerSystemResource. C'est ce que montre l'utilisation de la relation de type généralisation qui utilise une flèche pour indiquer la classe générale et permet au PowerTransformer d'hériter d'attributs à la fois de Equipment et de PowerSystemResource.

Un PowerTransformer a également une relation au TransformerWinding (enroulement de transformateur) qui est modélisé par une relation de type agrégation utilisant un symbole en forme de losange pour montrer la relation de la classe partielle à la classe entière. Comme le montre la Figure 10, un PowerTransformer peut avoir (ou contenir) un ou plusieurs TransformerWindings, mais un TransformerWinding ne peut appartenir qu'à (ou être membre de) un seul PowerTransformer.

Le TransformerWinding a également d'autres relations:

- une relation de generalization avec le ConductingEquipment;
- deux relations d'association avec la classe WindingTest, faisant qu'un objet TransformerWinding peut être de ("from") 0, 1 ou plusieurs objets WindingTest et vers ("to") 0, 1 ou plusieurs objets WindingTest;
- des relations d'aggregation avec les classes PhaseTapChanger et RatioTapChanger, faisant qu'un objet TransformerWinding peut avoir 0 ou 1 objet PhaseTapChanger et 0 ou 1 objet RatioTapChanger qui lui sont associés.

L'Article 6 contient une description complète de chaque classe de la Figure 10 avec la définition de tous les attributs et de toutes les relations pris en charge dans chaque classe.

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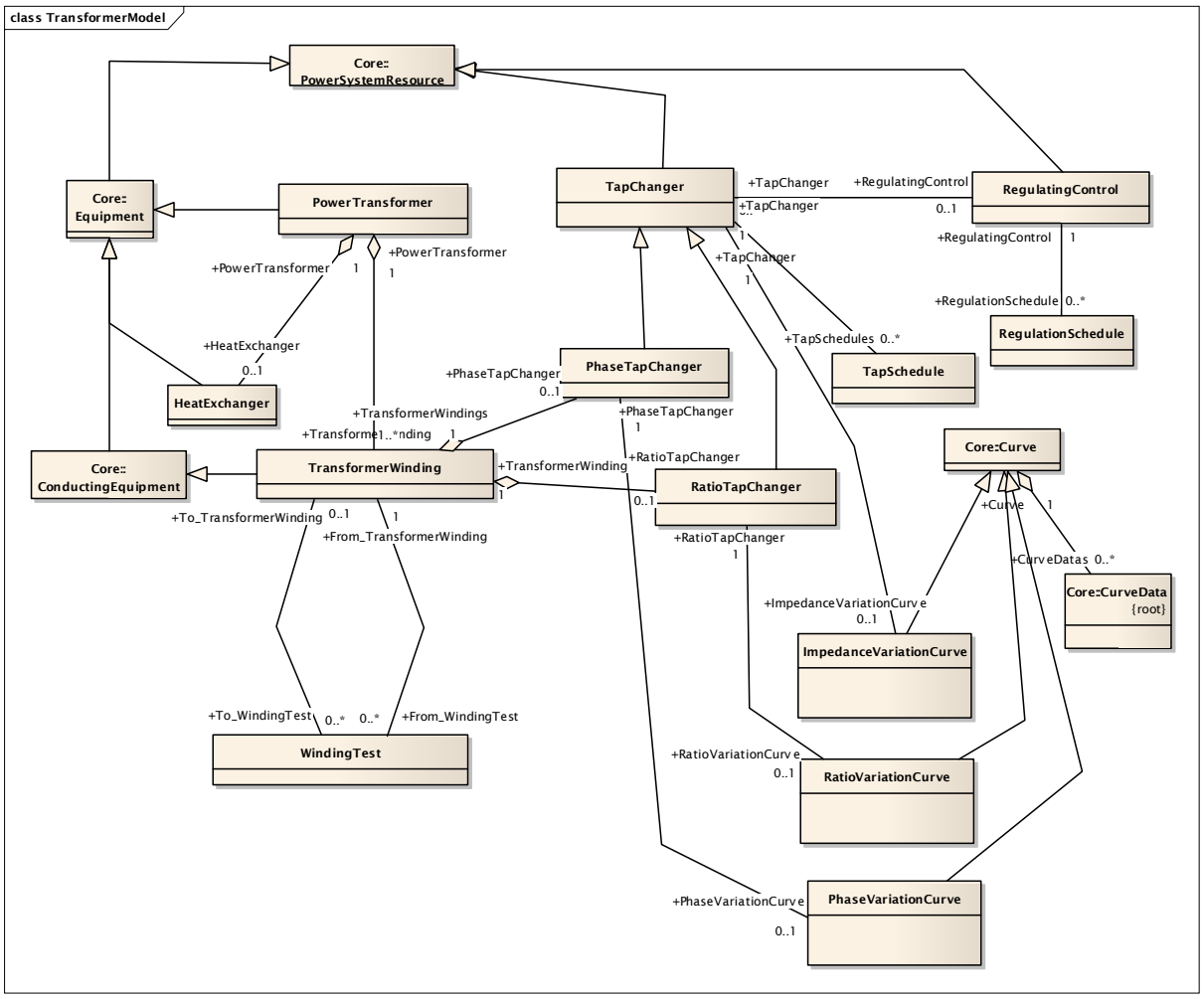

Figure 10 – Modèle de transformateur

4.4.6 Modélisation d'un transformateur de réglage

4.4.6.1 Vue d'ensemble de la modélisation d'un transformateur de réglage

Plusieurs types de transformateurs de réglage sont pris en charge par le modèle CIM. En fonction des capacités de régulation, les effets du mouvement de la prise seront définis en utilisant la classe RatioTapChanger ou la classe PhaseTapChanger. Toutes ces deux classes sont des sous-types de la classe TapChanger. Pour tous les RatioTapChangers et PhaseTapChangers, les attributs suivants sont requis et ont la même signification.

TapChanger.highStep
TapChanger.lowStep
TapChanger.ltcFlag
TapChanger.neutralStep
TapChanger.neutralU
TapChanger.normalStep
TapChanger.regulationStatus

D'autres attributs sont requis et peuvent avoir une signification légèrement différente selon le type de transformateur.

4.4.6.2 Modélisation d'un transformateur de tension

La classe RatioTapChanger est utilisée pour définir un transformateur qui change le rapport de tensions sans avoir d'impact sur l'angle de phase à travers le transformateur. Les attributs requis supplémentaires pour un RatioTapChanger sont:

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TapChanger.stepVoltageIncrement
RatioTapChanger.tculControlMode

4.4.6.3 Modélisation d'un transformateur déphaseur linéaire

Un transformateur déphaseur est linéaire si l'incrément (accroissement) de déphasage par échelon de prise est uniforme sur toute la plage du changeur de prise. Un déphaseur linéaire est modélisé en utilisant la classe PhaseTapChanger. Les attributs supplémentaires requis pour un transformateur déphaseur linéaire sont:

PhaseTapChanger.stepPhaseShiftIncrement

4.4.6.4 Modélisation d'un déphaseur symétrique

Une construction de déphaseur symétrique rend constants le rapport des nombres de spires et la transformation de l'amplitude de la tension alors que la phase de la tension est décalée. Les variations de l'amplitude et de la phase de la tension sur toute la plage des échelons des prises pour un déphaseur symétrique sont montrées à la Figure 11 ci-dessous.

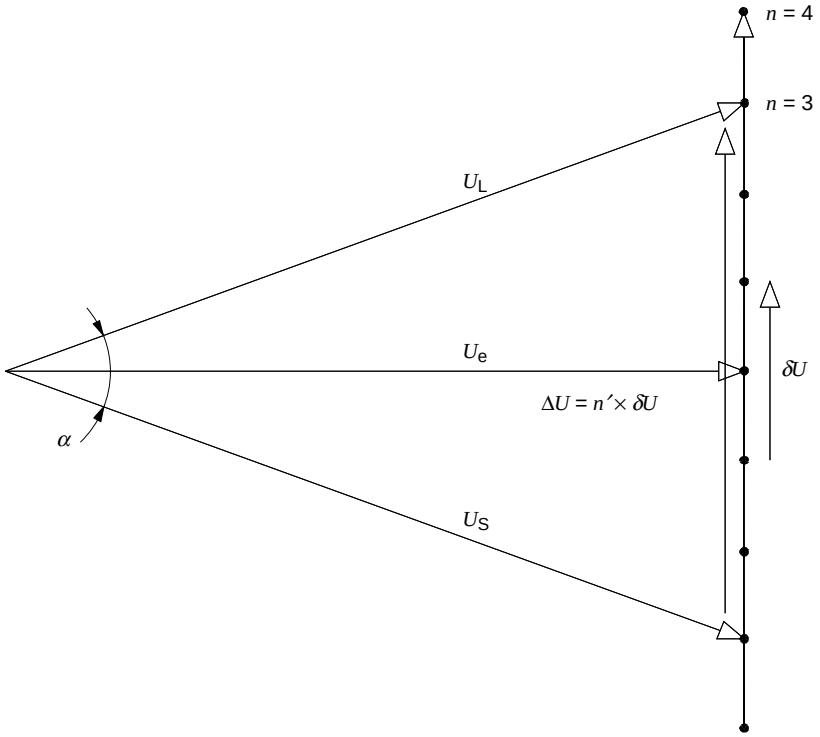

Figure 11 – Déphaseur symétrique

L'angle de déphasage peut être représenté comme étant:

$$\alpha \quad 2\arctan\frac{n'\Delta U}{2U_e} \quad 2\arctan\frac{n'\delta U}{2}$$

$$\rho = 1$$

où

α est l'angle de déphasage;

n' est la position de prise courante;

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ΔU est la variation de tension;

U_e est la tension à la prise neutre;

δU est la variation de la tension PU;

ρ est le rapport de transformation.

Pour un déphaseur symétrique, l'attribut PhaseTapChanger.phaseTapChangerType doit être mis à “symmetrical” ("symétrique"). Le PhaseTapChanger.windingConnectionAngle doit être égal soit à +90°, soit à –90°. Avec +90°, il y a un accroissement d'angle de phase positif à mesure que la position de la prise augmente. Avec –90°, l'angle de phase devient un angle d'autant plus négatif que la position de la prise augmente. Les attributs supplémentaires requis pour un transformateur déphaseur symétrique sont:

TapChanger.stepVoltageIncrement
PhaseTapChanger.phaseTapChangerType
PhaseTapChanger.stepPhaseShiftIncrement
PhaseTapChanger.windingConnectionAngle
PhaseTapChanger.xStepMax
PhaseTapChanger.xStepMin

4.4.6.5 Modélisation d'un déphaseur asymétrique

Un déphaseur asymétrique amène le rapport de tensions à varier à mesure que le déphasage varie. Les variations de l'amplitude et de la phase de la tension sur toute la plage des échelons des prises pour un déphaseur asymétrique sont montrées à la Figure 12 ci-dessous.

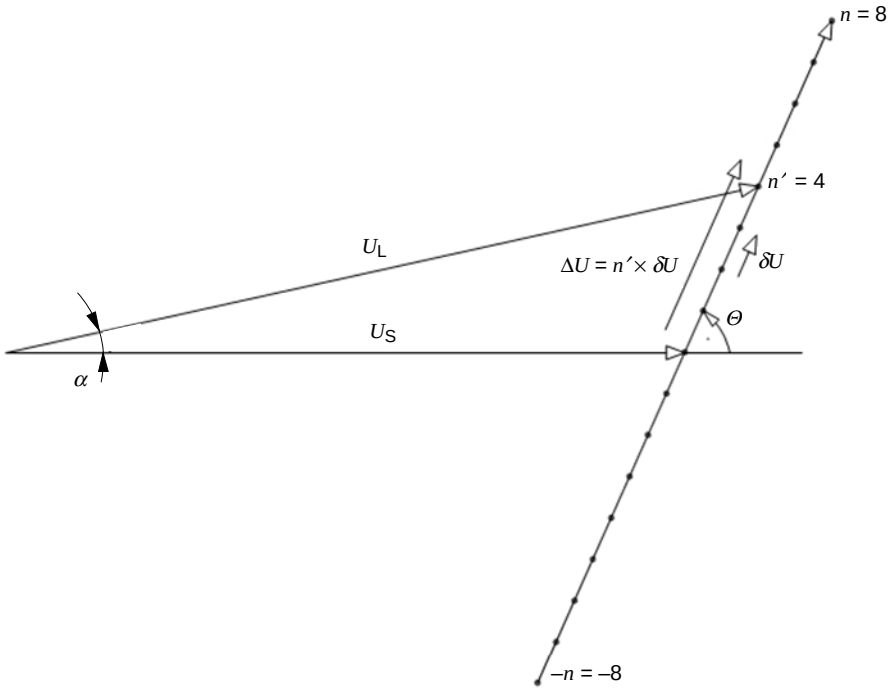

Figure 12 – Déphaseur asymétrique

L'angle de déphasage peut être représenté comme étant:

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$$\alpha \quad \arctan\left(\frac{n'\,\delta U \sin\Theta}{1 \quad n'\,\delta U \cos\Theta}\right)$$

$$\rho \quad \frac{1}{\sqrt{n'\,\delta u \sin\Theta^{\,2} \quad 1 \quad n'\,\delta U \cos\Theta}}$$

où

α est l'angle de déphasage;

n' est la position de prise courante;

δU est la variation de la tension PU;

Θ est l'angle de connexion d'enroulements;

ρ est le rapport de transformation.

Pour un déphaseur asymétrique, l'attribut PhaseTapChanger.phaseTapChangerType doit être mis à “asymmetrical” ("asymétrique"). Le PhaseTapChanger.windingConnectionAngle doit être un multiple de 30°: –90°, –60°, –30°, 30°, 60°, 90°, etc.). Un déphaseur asymétrique avec un angle de connexion d'enroulements de 90° n'est pas identique à un déphaseur symétrique. Les attributs supplémentaires requis pour un transformateur déphaseur asymétrique sont:

TapChanger.stepVoltageIncrement
PhaseTapChanger.phaseTapChangerType
PhaseTapChanger.stepPhaseShiftIncrement
PhaseTapChanger.windingConnectionAngle
PhaseTapChanger.xStepMax
PhaseTapChanger.xStepMin

4.4.7 Mesures et commande

4.4.7.1 Vue générale des mesures

Les Measurements (mesures) sont utilisées pour représenter les variables d'état qui peuvent être rencontrées dans des processus industriels. Chaque processus industriel a ses types spécifiques de mesures. Un système de puissance a typiquement des flux de puissance, des tensions, des positions (par exemple, disjoncteurs, sectionneurs), des indicateurs de défauts (pression atmosphérique, pression d'huile, surchauffe, etc.), des compteurs (par exemple, énergie), etc.

Le nom "Measurement" semblerait indiquer que toutes les variables d'état seraient mesurées. Tel n'est pas toujours strictement le cas, car de nombreuses mesures sont calculées par des fonctions SCADA ou EMS/DMS, comme les State Estimator (estimateur d'état) et Power Flow (calcul de répartition), par exemple. Par conséquent, une mesure peut avoir un certain nombre de valeurs alternatives (par exemple, fournies manuellement, télémétrées, estimées par état, optimisées, etc.). Cela est pris en charge par les modèles Measurement et MeasurementValue dans le paquetage Meas. Les classes dans le paquetage StateVariable ont été ajoutées au modèle CIM, et ce, spécifiquement pour le besoin de prendre en charge l'échange de valeurs calculées par des fonctions telles que State Estimator et Power Flow.

4.4.7.2 Vue générale des commandes

Les commandes sont utilisées pour représenter les variables de commande. Les variables de commande du système de puissance sont typiquement des points de consigne, des commandes de montée-descente, des commandes de sélection avant exécution et des commandes marche/arrêt, etc. Le paquetage Meas prend en charge les variables de commande avec le modèle Control (Commande).

4.4.7.3 Utilisation des classes liées à la classe Measurement

Une PowerSystemResource (PSR) peut avoir zéro à plusieurs mesures qui lui sont associées en contenant une ou plusieurs mesures. Chaque Measurement peut contenir une ou plusieurs

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valeurs de mesure. Le respect des conseils suivants permettra aux applications de naviguer et de retrouver les valeurs de mesure requises de manière cohérente (voir Figure 13).

a) Les Measurements d'une PowerSystemResource sont classées par l'attribut measurementType (type de mesure). Les valeurs devant être utilisées pour Measurement.measurementType sont spécifiées dans le Tableau 1.

b) Les MeasurementValues (valeurs de mesure) d'une Measurement sont classées par MeasurementValueSource (source de valeur de mesure).

c) MeasurementValueSource hérite d'IdentifiedObject. Les valeurs à utiliser pour MeasurementValueSource.name et MeasurementValueSource.description sont données au Tableau 2. Ce tableau donne un certain nombre de noms de source qui doivent être utilisés lorsque cela est possible. Cependant, les noms exacts devant être utilisés pour des applications spécifiques sont définis dans les spécifications des composants d'interface (CIS, component interface specifications) correspondants de la CEI 61970.

d) Les tableaux peuvent être étendus pour des besoins propriétaires. Les noms ajoutés doivent commencer par un nom unique (par exemple, le nom de la compagnie) et un trait de soulignement (underscore). Exemple: xyz_AverageTemperature.

e) ValueAliasSet (ensemble de pseudonymes de valeurs) est utilisé pour les mesures discrètes et décrit les correspondances ("mapping") de valeurs à des noms symboliques, tels que les libellés enumeration ayant des valeurs entières spécifiques Des protocoles de communication différents (par exemple pour les RTUs (Remote Terminal Unit, à savoir terminal à distance) et pour les centres de conduite tels que ICCP (Intelligent Customer Contact Platform, à savoir plate-forme intelligente de relations avec l'abonné) ou ELCOM) utilisent des codages de données différents. Un système peut avoir une mise en correspondance à l'échelle du système pour toutes les valeurs Discrete (discrètes) ou regrouper les valeurs Discrete et effectuer la mise en correspondance par groupe. La création d'une seule mise en correspondance à l'échelle du système qui couvrirait des protocoles de communication existants ne relève pas du domaine d'application de la présente spécification.

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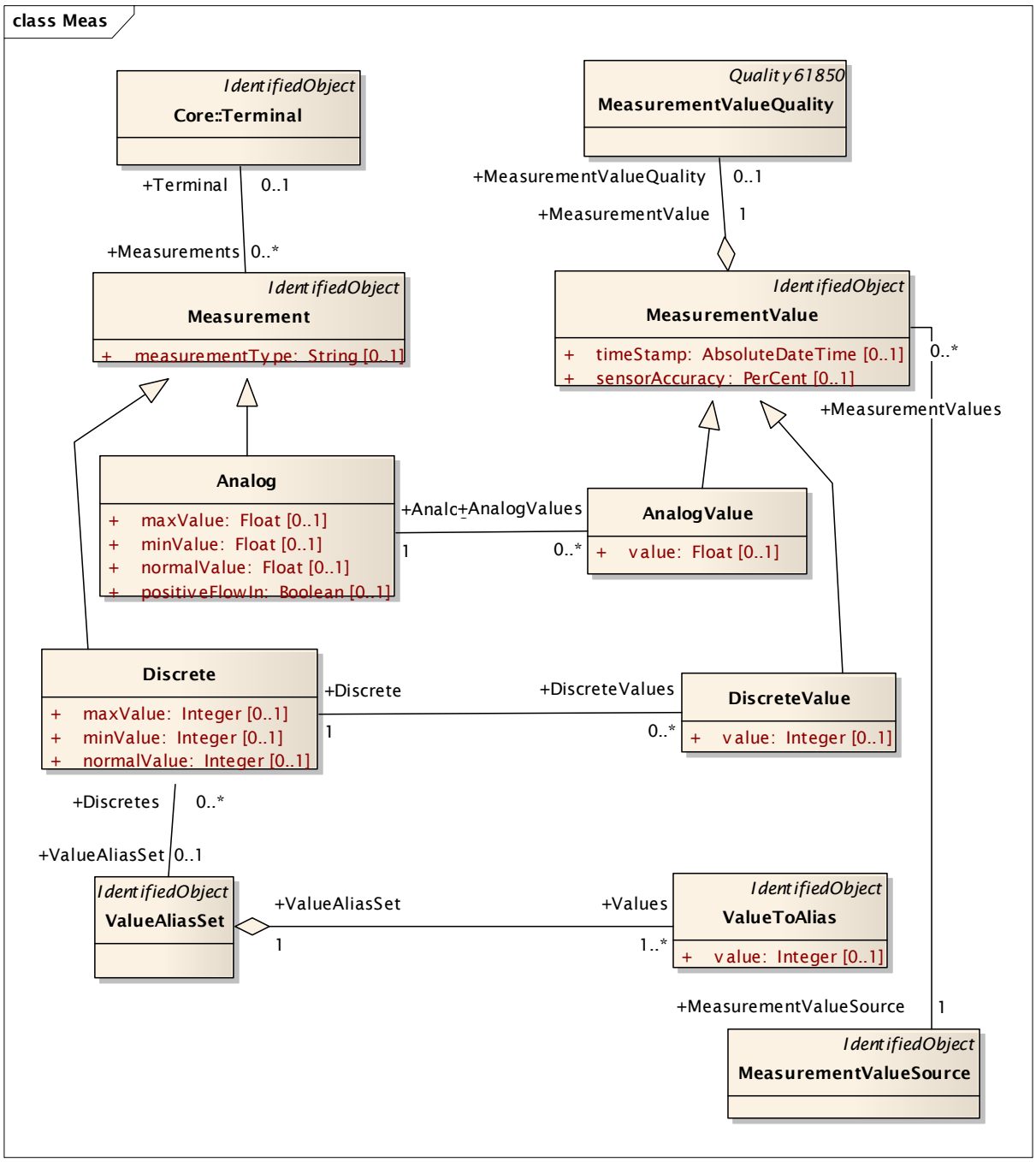

Figure 13 – Navigation de PSR à MeasurementValue

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Tableau 1 – Conventions de dénomination de measurementType

measurementType	61850 Name	description
Courant	Amp	Courant (efficace) d'un circuit non triphasé
ThreePhaseCurrent	AvAmps	Courant total (efficace) dans un circuit triphasé
PhaseCurrent	A	Courant de phase mesuré
Frequency	Hz	Fréquence
PowerFactor	PwrFact	Facteur de puissance non alloué à une phase
ThreePhasePowerFactor	TotPF	Facteur de puissance moyen dans un circuit triphasé
ThreePhaseApparentPower	TotVA	Puissance apparente totale dans un circuit triphasé
ThreePhaseReactivePower	TotVAr	Puissance réactive totale dans un circuit triphasé
ThreePhaseActivePower	TotW	Puissance réelle totale dans un circuit triphasé
ApparentPower	VoltAmp	Puissance apparente dans un circuit non triphasé
ReactivePower	VoltAmpr	Puissance réactive dans un circuit non triphasé
Voltage	Vol	Tension (efficace) non allouée à une phase
ActivePower	Watt	Puissance réelle dans un circuit non triphasé
Pressure	Pres	Pression
Temperature	Tmp	Température
Angle	Ang	Angle entre la tension et le courant
ApparentEnergy	TotVAh	Énergie apparente
ReactiveEnergy	TotVArh	Énergie réactive
ActiveEnergy	TotWh	Énergie réelle
Automatic	Auto	Fonctionnement automatique (non manuel)
LocalOperation	Loc	Fonctionnement local (non à distance)
SwitchPosition	Pos	Position du commutateur [2bits= intermediate, open, closed, ignore]
TapPosition	TapPos	Position de la prise d'un transformateur de puissance ou d'un déphaseur
Operation Count	OperCnt	Opération de comptage – en général pour les commutations

Le Tableau 1 décrit divers types de mesures également définies dans la CEI 61850-7-4. Les colonnes du Tableau 1 ont les significations suivantes:

- measurementType (Measurement.measurementType) est le nom du type de mesure selon la CEI 61970;
- 61850 Name ("Nom 61850") est le nom attribué à la donnée dans la CEI 61850 (se référer à l'Article 6 de la CEI 61850-7-4:2010, sémantique du nom d'objet de donnée);
- description de la donnée.

Il doit être noté que le Tableau 1 est une liste non exhaustive et que la correspondance entre mesures telles que définies dans un centre de conduite et un poste n'est pas triviale.

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Tableau 2 – Conventions de dénomination de MeasurementValueSource (source de valeur de mesure)

nom	description
SCADA	Valeurs télémesurées reçues d'un système SCADA local
CCLink	Valeur reçue d'un centre de conduite distant par l'intermédiaire de TASE.2 ou autre protocole
Operator	Valeur entrée par un opérateur (toujours maintenu manuellement, le PSR n'est pas connecté à une “RTU” (unité terminale distante))
Estimated	Valeur mise à jour par un estimateur d'état
PowerFlow	Valeur mise à jour par un Powerflow (calcul de répartition)
Forecasted	Valeur qui est planifiée ou prévisionnelle
Calculated	Valeur calculée à partir d'autres valeurs de mesure (par exemple, une somme)
Allocated	Valeur calculée par un allocateur de charge

En respectant ces conventions:

- chaque instance de Measurement représente une grandeur technique d'une PowerSystemResource;
- chaque MeasurementValue d'un Measurement représente une valeur pour la grandeur technique, fournie par une source unique;
- l'attribut source de MeasurementValueQuality indique alors si la source a vraiment fourni la valeur courante ou bien si elle est une valeur de substitution ou une valeur par défaut.

4.4.7.4 Rattachement des Measurement

Comme mentionné en 4.4.7.3 et comme montré à la Figure 13, les Measurement sont contenues par une PowerSystemResource. Cela est suffisant pour des Measurement qui ne sont pas reliées à la connectivité, par exemple la température, le poids, la taille.

Pour spécifier l'emplacement d'une Measurement dans le réseau, il est utilisé une association à Terminal. Des exemples sont les flux de puissance, les tensions et les courants. Les Voltages (tensions) n'ont pas de sens et peuvent être attachées en fonction de l'emplacement du capteur. Les flux ont un sens et doivent être attachés de façon à ce que le sens du flux soit évident d'après le placement.

La Figure 14 montre deux exemples de placement de Measurements.

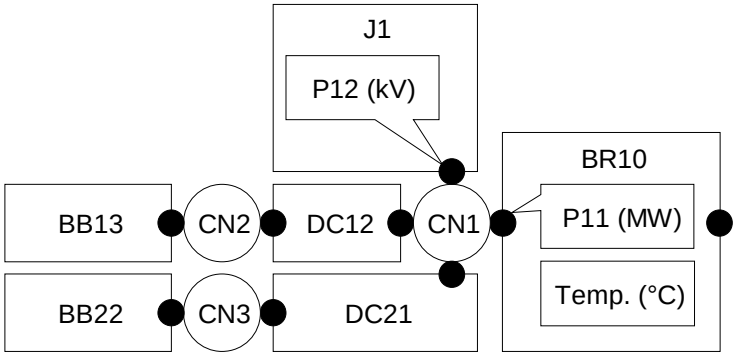

Figure 14 – Placement de Measurement

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P12 est une Measurement de tension qui mesure la tension à la jonction J1. P12 est topologiquement relié au ConnectivityNode CN1 via la Terminal de la jonction J1. P11 est une Measurement qui mesure le flux traversant le Breaker BR10 du côté connecté au ConnectivityNode CN1. P11 est topologiquement relié au ConnectivityNode CN1 via la Terminal gauche du disjoncteur BR10. Temp est une Measurement qui mesure la température du disjoncteur. Comme la température n'est pas reliée à la connectivité, elle n'a pas de relation avec une Terminal - elle appartient seulement au Breaker BR10.

4.4.8 Modèle de commande de régulation

La commande de régulation, telle qu'une commande de tension automatique dans des générateurs ou une commande de prise de tension dans des transformateurs, est modélisée en utilisant une classe nommée RegulationControl (commande de régulation). La classe RegulatingControl fournit la fonctionnalité permettant de modéliser de multiples équipements participant à un plan de régulation. Ces plans de régulation peuvent être physiques ou mis en œuvre manuellement dans le fonctionnement réel du système d'énergie, mais ils sont reflétés dans les modèles utilisés à des fins d'analyse des systèmes de puissance. La Figure 15 montre comment les classes RegulatingCondEq et TapChanger peuvent participer à la régulation.

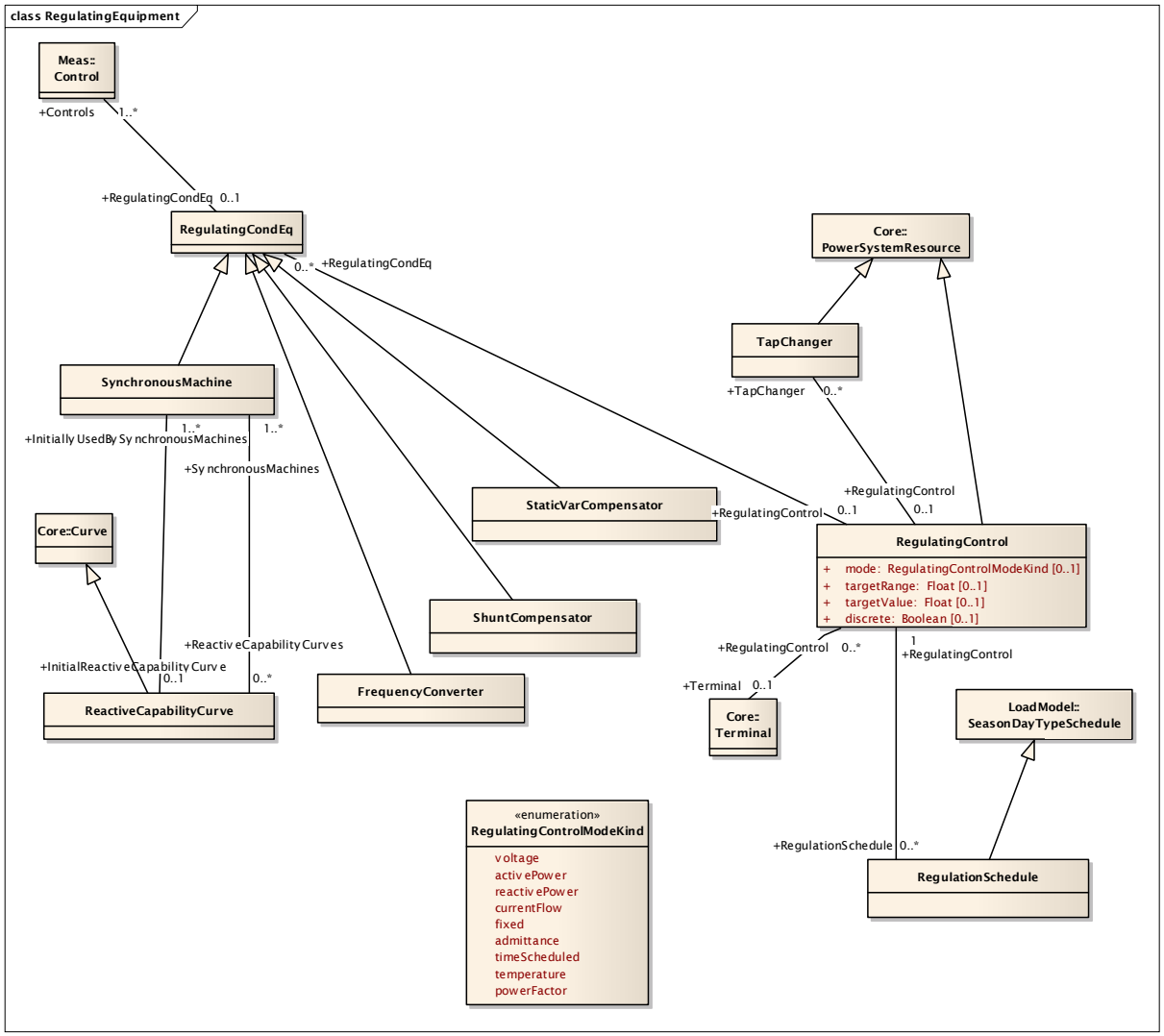

Figure 15 – Modèles de commande de régulation

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4.5 Conseils de modélisation

4.5.1 Modélisation pour modifications

Les paragraphes 4.5.2 à 4.5.5 proposent des conseils sur la façon de maintenir et étendre le CIM.

Le CIM est destiné à contenir les classes et les attributs qui seront échangés sur des interfaces publiques entre des applications principales. L'objectif est de ne conserver, autant que possible, que les caractéristiques génériques à partir desquelles une mise en œuvre détaillée peut être extraite. Il est, en général, plus facile de modifier la valeur ou le domaine d'un attribut que de modifier une définition de classe. Cela rend le modèle plus solide, car il peut supporter une plus large classe d'exigences, et plus stable, car il peut être possible de gérer de nouvelles exigences sans avoir à modifier le modèle.

4.5.2 Processus pour les amendements au CIM

Il peut être souhaitable d'amender le CIM pour réviser le modèle ou pour étendre le CIM afin de modéliser des éléments supplémentaires d'un système électrique. Le processus recommandé pour ces amendements est le suivant.

a) Préparer un Use Case (cas d'utilisation) qui décrit les changements souhaités. Il convient que cela inclue les changements proposés aux diagrammes de classes concernés avec illustration des classes, attributs et associations nouveaux ou révisés.

b) Les cas d'utilisation sont ensuite examinés par le Groupe de Travail approprié de la CEI, qui va décider s'il convient que les changements demandés soient traités en tant que révisions de la norme CIM courante, ou s'il convient qu'ils soient traités comme des amendements privés sans nécessiter de changement pour la norme.

c) Les propositions d'amendements acceptés par le groupe de travail seront ajoutées à la liste des sujets majeurs et le moment venu, une nouvelle version du modèle CIM sera préparée et une mise à jour de la spécification CIM appropriée sera faite.

4.5.3 Modifications apportées au modèle UML du CIM

Du point de vue de la modélisation, lorsque le CIM est étendu, l'approche consiste à partir du modèle UML de CIM existant. Les extensions peuvent être ajoutées de plusieurs façons disponibles avec UML, mais dans tous les cas, la bonne approche est d'examiner le modèle courant et de déterminer la meilleure extension à partir des diagrammes de classes existants. Les extensions peuvent prendre une des formes suivantes, de la plus simple à la plus complexe:

- ajouter des attributs ou associations supplémentaires à des classes préexistantes;
- ajouter de nouvelles classes qui sont des spécialisations classes préexistantes;
- ajouter de nouvelles classes à l'aide d'associations avec des classes préexistantes.

L'objectif principal est de réutiliser au maximum le CIM. Du point de vue des paquetages, il convient que les extensions soient faites aux paquetages existants chaque fois que cela est possible. Si les extensions comprennent un nouveau domaine d'application, il convient d'envisager de créer un nouveau paquetage pour les additions, mais en créant toujours les nécessaires associations au paquetage préexistant, en gardant à l'esprit que bien qu'un nouveau paquetage soit créé, le CIM continue d'être un seul modèle.

4.5.4 Modifications apportées aux documents normatifs du CIM

D'un point de vue documentaire, lorsque le CIM est étendu, une décision doit être prise quant à la question de savoir si les changements constituent des mises à jour de documents normatifs sur le CIM ou si une nouvelle CEI 61970-3xx spécifique est nécessaire. Dans les deux cas, les extensions deviendront une partie de la norme CEI sur le CIM.

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4.5.5 Profils CIM

Une mise en œuvre du CIM peut ne pas inclure toutes les classes, attributs et associations de la norme CIM et être tout de même conforme à la norme CIM. Des profils peuvent être définis pour spécifier quels éléments doivent être inclus (à savoir éléments obligatoires) pour une utilisation particulière du CIM, ainsi que ceux qui sont facultatifs. Ces profils sont définis dans la série de normes IEC 61970-4xx.

Un exemple est le profil pour échanger des modèles de système de puissance. Ce profil spécifie comment le CIM doit être utilisé pour échanger des modèles de système de puissance en XML et il spécifie aussi les classes, attributs et associations, obligatoires et facultatifs, devant être pris en charge pour cette utilisation du CIM. Les profils peuvent être maintenus à l'aide d'outils tels que des outils listés dans le groupe MTEI MTEI-wiki disponible à l'adresse <http://cimug.ucaiug.org>.

4.6 Outils de modélisation

Les éditions précédentes du CIM avaient été créées et maintenues à l'aide de Rational® ROSE[1] d'IBM®, mais la présente version a été construite à l'aide du produit Enterprise Architect[2] de Sparx Systems. Le modèle UML du CIM complet existe sous la forme d'un fichier de projet Enterprise Architect et peut être visualisé avec cet outil, y compris les diagrammes de classe et les descriptions des classes, des attributs, des types et des relations. La visualisation du CIM de cette façon offre une interface de navigation graphique qui permet de visualiser toutes les données de spécification du CIM par simple pointer-cliquer sur le diagramme de classe dans chaque paquetage. Une visionneuse gratuite est disponible auprès de Sparx Systems.

Idéalement, le modèle d'informations du CIM est indépendant de tout outil UML spécifique, bien que l'expérience ait montré que les échanges entre des outils différents soient souvent loin d'être parfaits. En attendant la réalité de l'interopérabilité des outils, les futures modifications apportées à la spécification du CIM, débouchant sur de nouvelles versions de la présente norme, seront incorporées en premier lieu dans la description du projet Enterprise Architect pour garantir une source unique pour les données de modèle CIM.

L'Article 6 du présent document a été généré automatiquement en utilisant un outil accessible au public appelé jCleanCim qui utilise les interfaces d'automatisation de Microsoft Word™[3] et d'Enterprise Architect et en utilisant le format et les styles normalisés de la CEI.

4.7 Conventions de mise en œuvre pour les utilisateurs

Ce paragraphe 4.7 propose des conventions d'utilisateur recommandées pour l'utilisation du CIM dans la mise en œuvre des systèmes réels.

Les ConductingEquipments (équipements conducteurs) suivants ont deux bornes: ACLineSegment, DCLineSegment, Jumper (cavalier), Fuse (coupe-circuit à fusibles), Breaker, Disconnector (sectionneur), LoadBreakSwitch (commutateur à coupure en charge), SeriesCompensator (compensateur série). Toutes les autres classes feuilles ConductingEquipment ont une seule borne.

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4.8 Exemples de modélisation CIM

Des modèles de systèmes électriques ont été créés de plusieurs façons à partir du modèle UML du CIM. Le premier exemple est une version du schéma RDF (Resource Description Framework, cadre général pour la description des ressources) du CIM, qui utilise XML (eXtensible Markup Language) pour décrire un modèle de réseau de système de puissance. La CEI 61970-501 et d'autres normes de profil en développement sont utilisées pour spécifier le format d'échange de modèles. Des versions de schémas RDF du CIM ont été utilisées pour créer les fichiers de modèles XML de réseaux réels pour des tests d'interopérabilité. Une version de schéma RDF du CIM est générée à partir du fichier de modèle UML du CIM en utilisant des outils logiciels basés sur une spécification de schéma RDF du CIM.

Il convient de noter qu'une version de schéma RDF du CIM est du niveau métadonnées plutôt qu'une instanciation d'un réseau réel. Cependant, des fichiers de modélisation complets de réseaux avec tous les éléments du réseau ainsi que leurs connexions électriques peuvent être générés par des fournisseurs utilisant des outils d'exportation propriétaires, puis importés ensuite par d'autres systèmes avec un outil similaire, qui est utilisé pour remplir une base de données technique locale sur le réseau. Des exemples de ces modèles XML du CIM sont notamment les fichiers Siemens 100 bus model, Areva 60 bus model et ABB 40 bus model[4] utilisés pour des essais d'interopérabilité XML du CIM.

5 Modèle détaillé

5.1 Vue d'ensemble

Le Modèle d'information commun (CIM) représente une vue logique complète des informations d'un Système de gestion de l'énergie. Cette définition inclut les classes et les attributs publics ainsi que leurs relations. Le paragraphe 5.2 décrit comment l'Article 6 est structuré. L'Article 6 est généré automatiquement à partir du modèle CIM maintenu avec les outils décrits en 4.6.

5.2 Contexte

Le CIM est fractionné en sous-paquetages. Le paquetage Domain définit des types de données (datatypes) utilisés par les autres paquetages. Le paquetage Generation est subdivisé en deux paquetages: Production et GenerationDynamics. Les classes au sein des paquetages sont énumérées alphabétiquement. Les attributs natifs d'une classe sont énumérés en premier, suivis des attributs hérités, dans l'ordre de profondeur d'héritage, puis suivis du nom d'attribut. Les associations natives sont énumérées en premier pour chaque classe, suivies, dans l'ordre de profondeur d'héritage, des associations héritées, suivies, dans l'ordre alphabétique, du nom de classe, suivi, dans l'ordre alphabétique, du nom d'extrémité d'association. Les associations sont décrites selon le rôle de chaque classe participant à l'association. Les extrémités d'association sont énumérées dans la classe à chaque extrémité d'une association.

La Figure 16 montre les paquetages de haut niveau inclus dans le présent document.

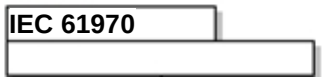

Figure 16 – Paquetages de haut niveau du CIM

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4 Siemens100 bus model, Areva 60 bus model et ABB 40 bus model sont les appellations commerciales de produits distribués par Siemens, Areva et ABB. Cette information est donnée à l´intention des utilisateurs de la présente Norme internationale et ne signifie nullement que la CEI approuve ou recommande l´emploi exclusif du produit ainsi désigné.Des produits équivalents peuvent être utilisés s'il est démontré qu'ils conduisent aux mêmes résultats.

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Pour chaque paquetage, le modèle d'information de chaque classe est entièrement décrit. Les informations relatives aux attributs et extrémités d'association pour les attributs natifs et hérités sont énumérées comme ci-dessous. Pour tous les éventuels attributs ou extrémités d'association hérités, la colonne "description" contiendra le texte indiquant que les attributs sont hérités d'une classe spécifique. La colonne "description" pour les attributs natifs et extrémités d'associations contient la description réelle.

Tableau 3 – Attributs

nom	type	description
native1	Float	Un attribut natif virgule flottante de la classe est décrit ici
native2	ActivePower	Documentation pour un autre attribut natif du type ActivePower
Name	Float	Hérité de la classe IdentifiedObject

Dans le Tableau 3, dans certains cas, un attribut est une constante, auquel cas l'expression "(const)" est ajoutée dans la colonne nom du tableau d'attributs. Dans ces cas, l'attribut a normalement une valeur initiale aussi qui est précédée du signal "égal" et accolée au nom d'attribut.

Tableau 4 – Extrémités d'association

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] PSRType	PSRType	PSRType (classification personnalisée) pour cette PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	Les Measurements qui sont incluses dans la hiérarchie de dénomination où le PSR est l'élément conteneur
[1..1]	[0..*] OperatingShare	OperatingShare	Le lien à n'importe quel nombre d'objets de quote-part d'opérateur
[0..*]	[0..*] PsrLists	PsrList	
[1..1]	[0..1] OutageSchedule	OutageSchedule	Une ressource de réseau électrique peut avoir un programme d'indisponibilité.
[0..*]	[0..*] ReportingGroup	ReportingGroup	Groupes de reporting auxquels appartient cette PSR

Dans le Tableau 4, la première colonne décrit la multiplicité à l'autre extrémité de l'association (c'est-à-dire, la multiplicité de la classe pour laquelle des extrémités d'association sont décrites). La multiplicité de l'extrémité d'association elle-même est incluse entre crochets. Le nom de l'extrémité d'association est énuméré en texte en clair. La classe à l'autre extrémité de l'association est énumérée dans la colonne "type". Une multiplicité zéro indique une association facultative. Une multiplicité "*" indique que n'importe quel nombre est autorisé. Par exemple, une multiplicité [1..*] indique qu'une plage allant de 1 à n'importe quel nombre plus grand est autorisée.

Lorsqu'une classe est enumeration (une énumération), le Tableau 3 est remplacé par le Tableau 5 comme montré ci-dessous, car les libellés enumeration n'ont pas de type. Il n'y a pas de libellés enumeration hérités pour une classe enumeration.

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Tableau 5 – Enums

libellé	description
native1	Il s'agit de la première valeur enumeration native
native2	Il s'agit de la deuxième valeur enumeration native
native3	Il n'y a typiquement pas d'attributs hérités pour les énumérations

6 Architecture des paquetages

6.1 Paquetage de haut niveau (Top package) IEC61970

6.1.1 Généralités

La Figure 17 montre le diagramme logique Main.

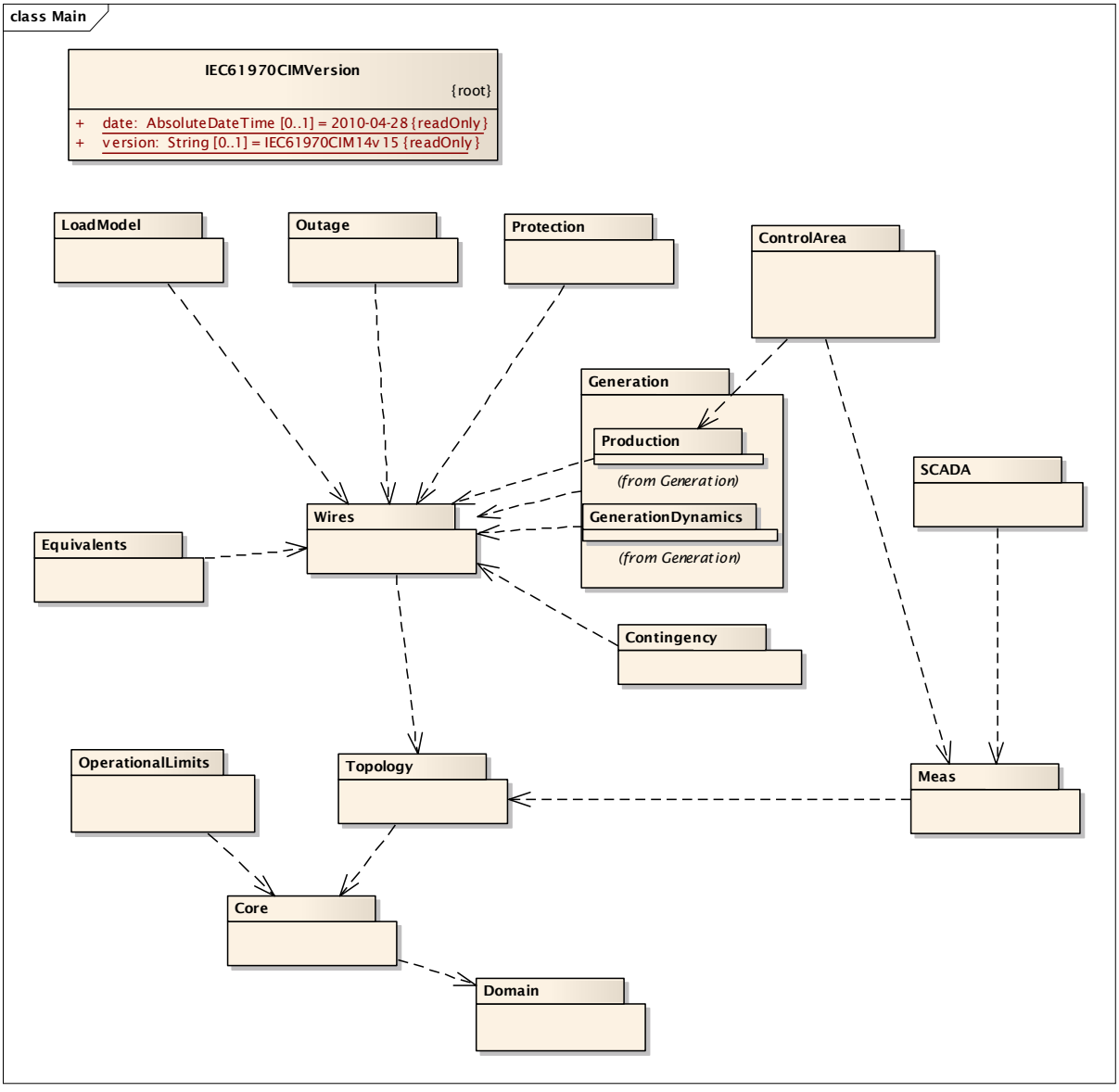

Figure 17 – Diagramme logique IEC61970::Main

Ce diagramme montre tous les paquetages de la CEI 61970 et leurs dépendances logiques.

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6.1.2 Classe racine IEC61970CIMVersion

Il s'agit du numéro de version CIM de la CEI 61970 assigné à ce fichier de modèle UML.

Le Tableau 6 montre tous les attributs de IEC61970CIMVersion.

Tableau 6 – Attributs de IEC61970::IEC61970CIMVersion

nom	type	description
date=2010-04-28 (const)	AbsoluteDateTime	La forme est AAAA-MM-JJ par exemple le 5 janvier 2009 est 2009-01-05
version=IEC61970CIM14v15 (const)	String	La forme est IEC61970CIMXXvYY où XX est la version principale du paquetage CIM et YY la version secondaire. Par exemple: IEC61970CIM13v18

6.1.3 Paquetage Domain

6.1.3.1 Généralités

Le paquetage Domain est une bibliothèque de données regroupant les grandeurs et les unités qui définissent les types de données des attributs (propriétés) pouvant être repris par n'importe quelle classe dans n'importe quel autre paquetage.

Ce paquetage définit les types de données essentiels, comprenant les unités de mesures et les valeurs autorisées. Chaque type de données comporte un attribut de valeur et une unité de mesure facultative, précisée comme étant une variable fixe initialisée d'après la description textuelle de l'unité de mesure. Les valeurs des "units" (unités) sous forme de chaîne de caractères peuvent être spécifiques à un pays ou à un client. Des valeurs types sont données. Les valeurs autorisées pour les énumérations sont énumérées entre accolades dans la documentation de l'attribut utilisant la syntaxe de la contrainte UML. Les longueurs de chaînes de caractère (string lengths) sont énumérées dans le texte descriptif à l'endroit requis.

La Figure 18 montre le diagramme logique CombinedDatatypes.

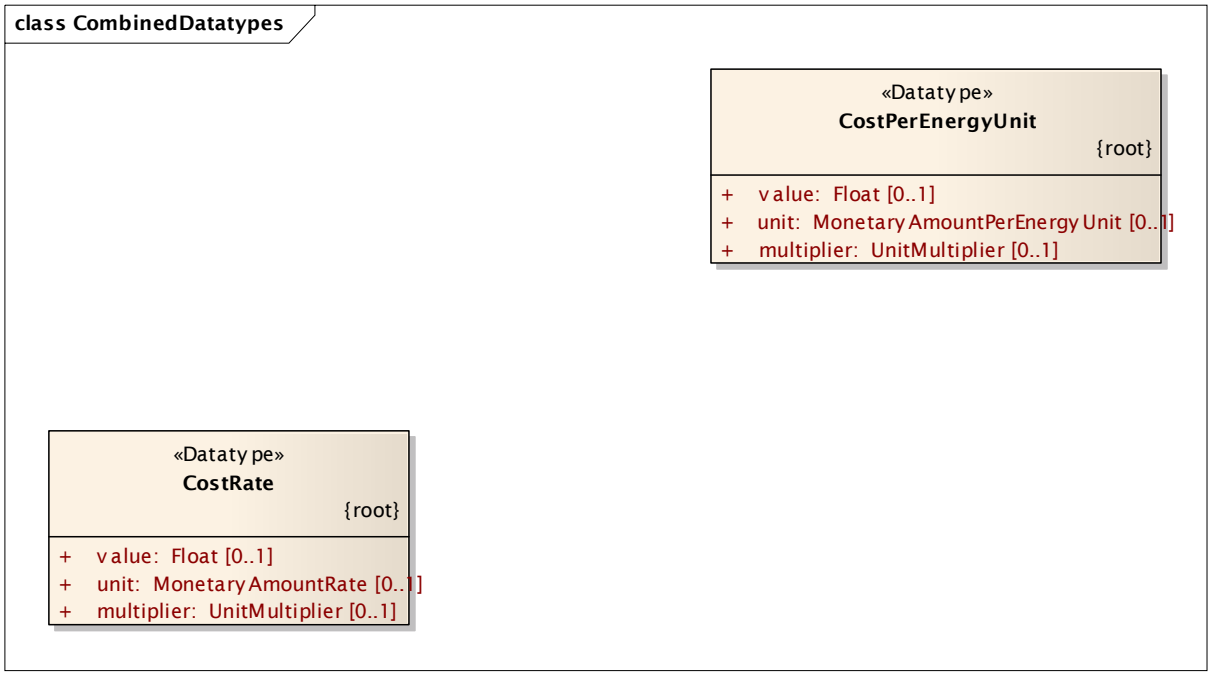

Figure 18 – Diagramme logique Domain::CombinedDatatypes

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Ce diagramme comprend les types de données qui sont combinés à d'autres types de données dans d'autres diagrammes.

La Figure 19 montre le diagramme logique BasicDatatypes.

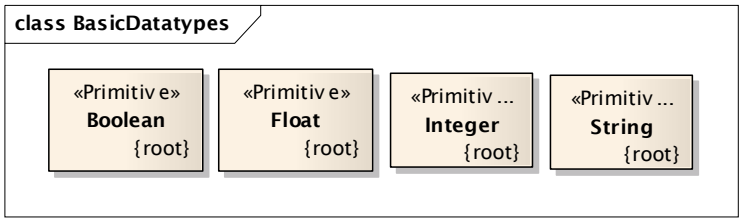

Figure 19 – Diagramme logique Domain::BasicDatatypes

Ce diagramme montre les types de données fondamentaux qui sont la base de tous les autres types de données.

La Figure 20 montre le diagramme logique ElectricityDatatypes.

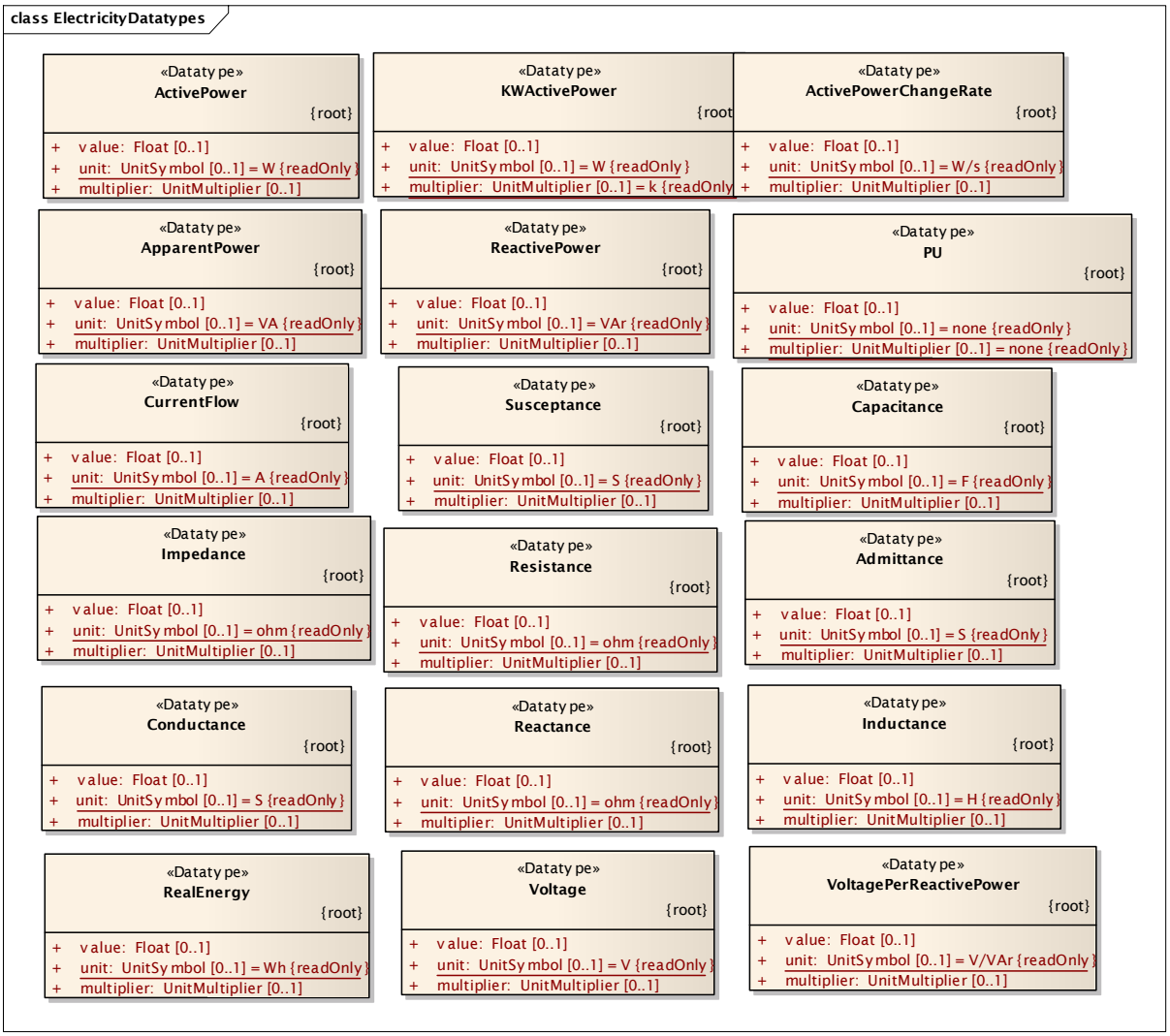

Figure 20 – Diagramme logique Domain::ElectricityDatatypes

Ce diagramme montre les types de données liés à l'électricité.

La Figure 21 montre le diagramme logique EnumeratedUnitDatatypes.

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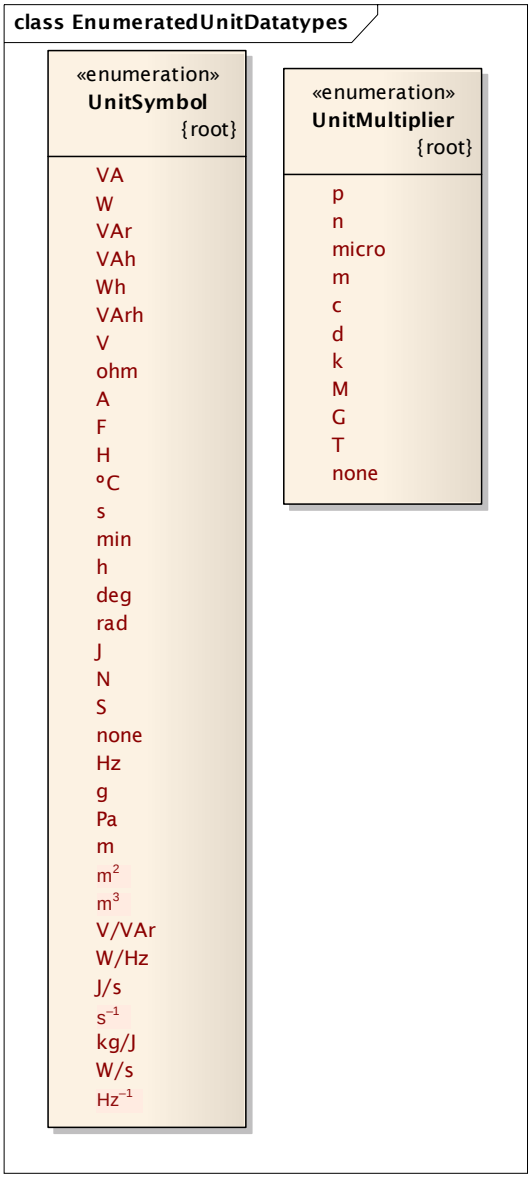

Figure 21 – Diagramme logique Domain::EnumeratedUnitDatatypes

Ce diagramme montre les types de données énumérés liés au système d'unités SI.

La Figure 22 montre le diagramme logique GeneralDatatypes.

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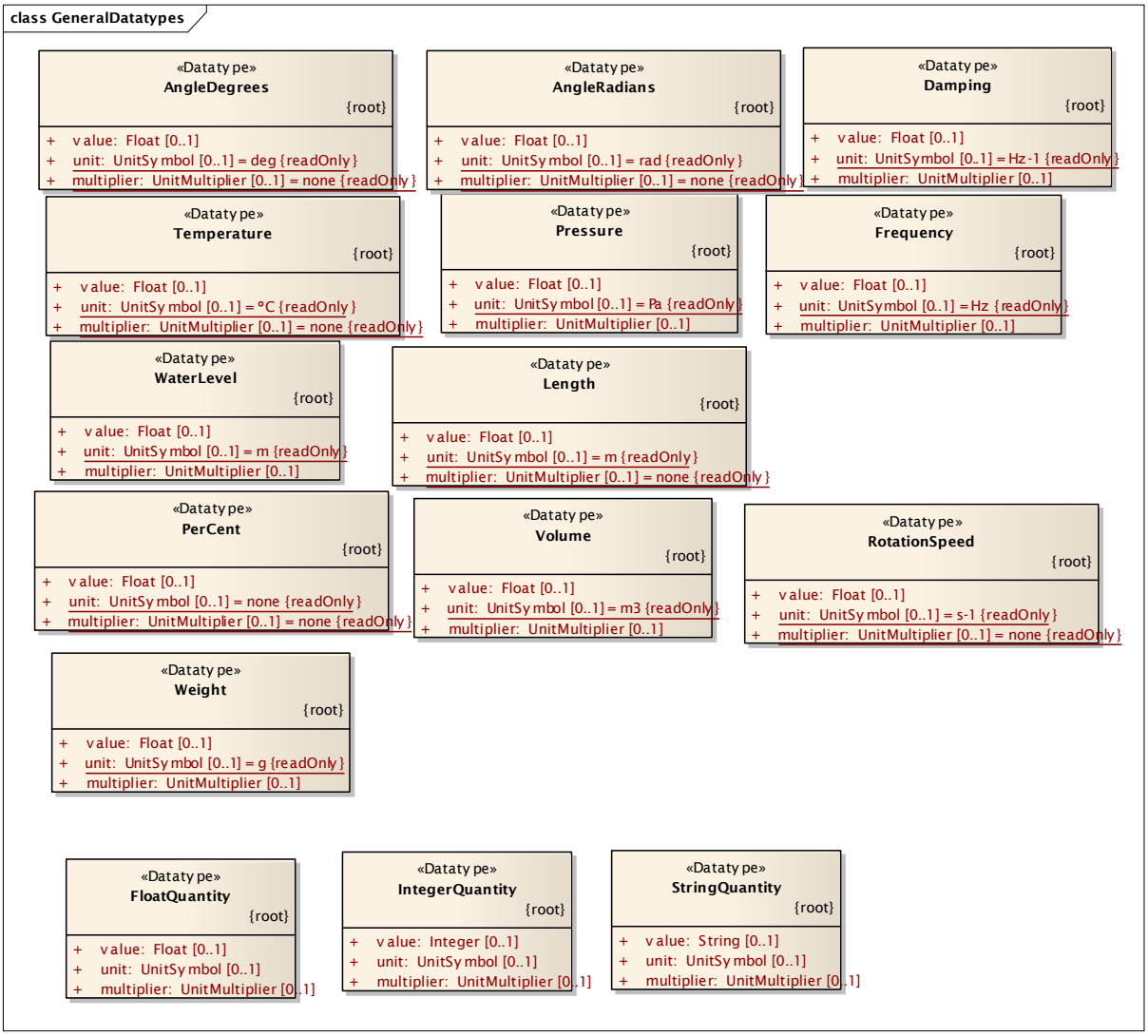

Figure 22 – Diagramme logique Domain::GeneralDatatypes

Ce diagramme montre des types de données liés aux généralités.

La Figure 23 montre le diagramme logique MonetaryDatatypes.

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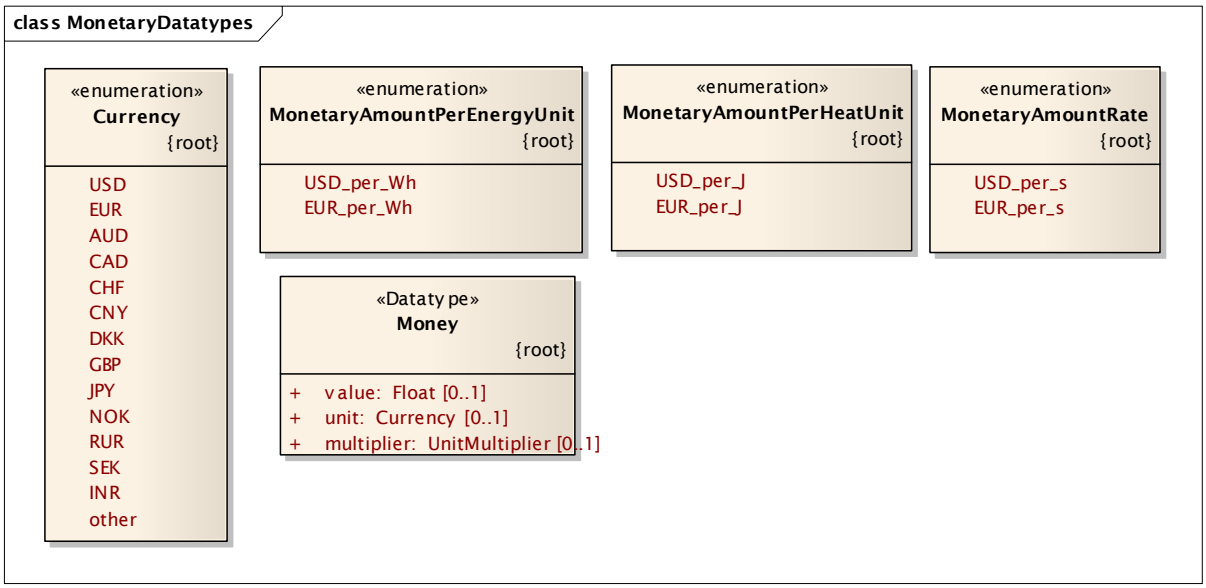

Figure 23 – Diagramme logique Domain::MonetaryDatatypes

Ce diagramme montre les types de données liés à la monnaie.

La Figure 24 montre le diagramme logique TimeDatatypes.

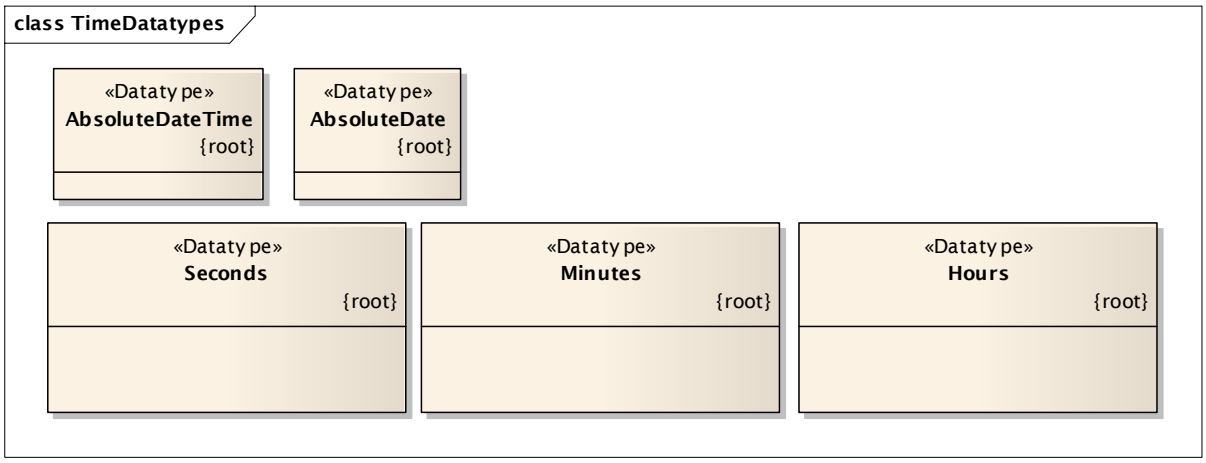

Figure 24 – Diagramme logique Domain::TimeDatatypes

Ce diagramme montre les types de données liés au temps.

6.1.3.2 Type de données AbsoluteDate

Date et heure sous la forme "aaaa-mm-jj", qui est conforme à l'ISO 8601. Le fuseau horaire TUC est spécifié comme étant "aaaa-mm-jj".

Le Tableau 7 montre tous les attributs de AbsoluteDate.

Tableau 7 – Attributs de Domain::AbsoluteDate

nom	type	description
value	String	Représentation de la date en chaîne de caractères, se référer à la description de la classe

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6.1.3.3 Type de données AbsoluteDateTime

Date et heure sous la forme "aaaa-mm-jjThh:mm:ss.sss", qui est conforme à l'ISO 8601. Le fuseau horaire TUC est spécifié sous la forme "aaaa-mm-jjThh:mm:ss.sssZ". Un temps TUC par rapport à un fuseau horaire local est spécifié sous la forme "aaaa-mm-jjThh:mm:ss.sss-hh:mm".

AbsoluteDateTime peut être utilisé aussi bien pour le temps de calendrier (par exemple 2007-02-07T10:30) que pour le temps relatif (par exemple 10:30).

Le Tableau 8 montre tous les attributs de AbsoluteDateTime.

Tableau 8 – Attributs de Domain::AbsoluteDateTime

nom	type	description
value	String	Représentation de la date et de l'heure en chaîne de caractères, se référer à la description de la classe

6.1.3.4 Type de données ActivePower

Produit de la valeur RMS (valeur efficace) de la tension et de la valeur RMS de l'élément en phase du courant.

Le Tableau 9 montre tous les attributs de ActivePower.

Tableau 9 – Attributs de Domain::ActivePower

nom	type	description
value	Float	
unit=W (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.5 Type de données ActivePowerChangeRate

Le Tableau 10 montre tous les attributs de ActivePowerChangeRate.

Tableau 10 – Attributs de Domain::ActivePowerChangeRate

nom	type	description
value	Float	
unit=W/s (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.6 Type de données Admittance

Rapport courant/tension.

Le Tableau 11 montre tous les attributs de Admittance.

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Tableau 11 – Attributs de Domain::Admittance

nom	type	description
value	Float	
unit=S (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.7 Type de données AngleDegrees

Mesure d'angle en degrés.

Le Tableau 12 montre tous les attributs de AngleDegrees.

Tableau 12 – Attributs de Domain::AngleDegrees

nom	type	description
value	Float	
unit=deg (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.8 Type de données AngleRadians

Angle de phase en radians.

Le Tableau 13 montre tous les attributs de AngleRadians.

Tableau 13 – Attributs de Domain::AngleRadians

nom	type	description
value	Float	
unit=rad (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.9 Type de données ApparentPower

Produit de la valeur RMS (moyenne quadratique) de la tension et de la valeur RMS du courant.

Le Tableau 14 montre tous les attributs de ApparentPower.

Tableau 14 – Attributs de Domain::ApparentPower

nom	type	description
value	Float	
unit=VA (const)	UnitSymbol	
multiplier	UnitMultiplier	

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6.1.3.10 Primitive Boolean

Un type avec l'espace de valeurs "true" (vrai) et "false" (faux).

6.1.3.11 Type de données Capacitance

Un Farad, l'unité type, est la capacité d'un condensateur pour lequel une charge de 1 Coulomb produit une différence de potentiel de 1 Volt entre ses bornes.

Le Tableau 15 montre tous les attributs de Capacitance.

Tableau 15 – Attributs de Domain::Capacitance

nom	type	description
value	Float	
unit=F (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.12 Type de données Conductance

Facteur par lequel doit être multipliée la tension pour obtenir la puissance correspondante perdue dans un circuit. Partie réelle de l'admittance.

Le Tableau 16 montre tous les attributs de Conductance.

Tableau 16 – Attributs de Domain::Conductance

nom	type	description
value	Float	
unit=S (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.13 Type de données CostPerEnergyUnit

Coût, en unités monétaires, par quantité d'énergie électrique produite.

Le Tableau 17 montre tous les attributs de CostPerEnergyUnit.

Tableau 17 – Attributs de Domain::CostPerEnergyUnit

nom	type	description
value	Float	
unit	MonetaryAmountPerEnergyUnit	
multiplier	UnitMultiplier	

6.1.3.14 Type de données CostRate

Coût par heure de temps écoulé, en unités monétaires.

Le Tableau 18 montre tous les attributs de CostRate.

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Tableau 18 – Attributs de Domain::CostRate

nom	type	description
value	Float	
unit	MonetaryAmountRate	
multiplier	UnitMultiplier	

6.1.3.15 Enumération Currency

Devises monétaires. Excuses pour cette liste non exhaustive.

Le Tableau 19 montre tous les libellés de Currency.

Tableau 19 – Libellés de Domain::Currency

libellé	description
USD	Dollar US
EUR	Euro européen
AUD	Dollar australien
CAD	Dollar canadien
CHF	Franc suisse
CNY	Yuan renminbi chinois
DKK	Couronne danoise
GBP	Livre britannique
JPY	Yen japonais
NOK	Couronne norvégienne
RUR	Rouble russe
SEK	Couronne suédoise
INR	Roupie indienne
other	Autre type de devise

6.1.3.16 Type de données CurrentFlow

Intensité de courant électrique (positif dans le sens ConductingEquipement vers ConnectivityNode).

Le Tableau 20 montre tous les attributs de CurrentFlow.

Tableau 20 – Attributs de Domain::CurrentFlow

nom	type	description
value	Float	
unit=A (const)	UnitSymbol	
multiplier	UnitMultiplier	

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6.1.3.17 Type de données Damping

Variation de puissance active par unité avec une fréquence par unité référencée dans la base de puissance apparente du système. Valeurs types comprises entre 1,0 et 2,0.

Le Tableau 21 montre tous les attributs de Damping.

Tableau 21 – Attributs de Domain::Damping

nom	type	description
value	Float	
unit=Hz^{-1} (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.18 Primitive Float

Un nombre à virgule flottante. La plage est indéterminée et n'est pas limitée.

6.1.3.19 Type de données FloatQuantity

Grandeur avec valeur float (flottante) et informations associées relatives aux unités.

Le Tableau 22 montre tous les attributs de FloatQuantity.

Tableau 22 – Attributs de Domain::FloatQuantity

nom	type	description
value	Float	
unit	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.20 Type de données Frequency

Cycles par seconde.

Le Tableau 23 montre tous les attributs de Frequency.

Tableau 23 – Attributs de Domain::Frequency

nom	type	description
value	Float	
unit=Hz (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.21 Type de données Hours

Temps, en heures.

Le Tableau 24 montre tous les attributs de Hours.

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Tableau 24 – Attributs de Domain::Hours

nom	type	description
value	Float	
unit=h (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.22 Type de données Impedance

Rapport tension/courant.

Le Tableau 25 montre tous les attributs de Impedance.

Tableau 25 – Attributs de Domain::Impedance

nom	type	description
value	Float	
unit=ohm (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.23 Type de données Inductance

Inductance.

Le Tableau 26 montre tous les attributs de Inductance.

Tableau 26 – Attributs de Domain::Inductance

nom	type	description
value	Float	
unit=H (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.24 Primitive Integer

Un nombre entier. La plage est indéterminée et n'est pas limitée.

6.1.3.25 Type de données IntegerQuantity

Grandeur avec valeur integer (entière) et informations associées relatives aux unités.

Le Tableau 27 montre tous les attributs de IntegerQuantity.

Tableau 27 – Attributs de Domain::IntegerQuantity

nom	type	description
value	Integer	
unit	UnitSymbol	
multiplier	UnitMultiplier	

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6.1.3.26 Type de données KWActivePower

Puissance active, en kilowatts.

Le Tableau 28 montre tous les attributs de KWActivePower.

Tableau 28 – Attributs de Domain::KWActivePower

nom	type	description
value	Float	
unit=W (const)	UnitSymbol	
multiplier=k (const)	UnitMultiplier	

6.1.3.27 Type de données Length

Unité de longueur.

Le Tableau 29 montre tous les attributs de Length.

Tableau 29 – Attributs de Domain::Length

nom	type	description
value	Float	
unit=m (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.28 Type de données Minutes

Temps en minutes.

Le Tableau 30 montre tous les attributs de Minutes.

Tableau 30 – Attributs de Domain::Minutes

nom	type	description
value	Float	
unit=min (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.29 Enumération MonetaryAmountPerEnergyUnit

Montant monétaire par unité d'énergie.

Le Tableau 31 montre tous les libellés de MonetaryAmountPerEnergyUnit.

Tableau 31 – Libellés de Domain::MonetaryAmountPerEnergyUnit

libellé	description
USD_per_Wh	
EUR_per_Wh	

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6.1.3.30 Enumération MonetaryAmountPerHeatUnit

Montant monétaire par joule.

Le Tableau 32 montre tous les libellés de MonetaryAmountPerHeatUnit.

Tableau 32 – Libellés de Domain::MonetaryAmountPerHeatUnit

libellé	description
USD_per_J	
EUR_per_J	

6.1.3.31 Enumération MonetaryAmountRate

Montant monétaire par seconde.

Le Tableau 33 montre tous les libellés de MonetaryAmountRate.

Tableau 33 – Libellés de Domain::MonetaryAmountRate

libellé	description
USD_per_s	
EUR_per_s	

6.1.3.32 Type de données Money

Quantité d'argent.

Le Tableau 34 montre tous les attributs de Money.

Tableau 34 – Attributs de Domain::Money

nom	type	description
value	Float	
unit	Currency	
multiplier	UnitMultiplier	

6.1.3.33 Type de données PerCent

Normalement 0 à 100 sur une base définie.

Le Tableau 35 montre tous les attributs de PerCent.

Tableau 35 – Attributs de Domain::PerCent

nom	type	description
value	Float	Normalement 0 à 100 sur une base définie
unit=none (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

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6.1.3.34 Type de données Pressure

Pression en Pascals.

Le Tableau 36 montre tous les attributs de Pressure.

Tableau 36 – Attributs de Domain::Pressure

nom	type	description
value	Float	
unit=Pa (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.35 Type de données PU

Par unité - valeur négative ou positive se référant à une base définie. Valeurs généralement comprises entre –10 et +10.

Le Tableau 37 montre tous les attributs de PU.

Tableau 37 – Attributs de Domain::PU

nom	type	description
value	Float	
unit=none (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.36 Type de données Reactance

Réactance (partie imaginaire de l'impédance), à une fréquence assignée.

Le Tableau 38 montre tous les attributs de Reactance.

Tableau 38 – Attributs de Domain::Reactance

nom	type	description
value	Float	
unit=ohm (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.37 Type de données ReactivePower

Produit de la valeur RMS (valeur efficace de la tension et de la valeur RMS de la composante en quadrature du courant.

Le Tableau 39 montre tous les attributs de ReactivePower.

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Tableau 39 – Attributs de Domain::ReactivePower

nom	type	description
value	Float	
unit=VAr (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.38 Type de données RealEnergy

Énergie électrique réelle.

Le Tableau 40 montre tous les attributs de RealEnergy.

Tableau 40 – Attributs de Domain::RealEnergy

nom	type	description
value	Float	
unit=Wh (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.39 Type de données Resistance

Résistance (partie réelle de l'impédance).

Le Tableau 41 montre tous les attributs de Resistance.

Tableau 41 – Attributs de Domain::Resistance

nom	type	description
value	Float	
unit=ohm (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.40 Type de données RotationSpeed

Nombre de tours par seconde.

Le Tableau 42 montre tous les attributs de RotationSpeed.

Tableau 42 – Attributs de Domain::RotationSpeed

nom	type	description
value	Float	
unit=s^{-1} (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.41 Type de données Seconds

Temps, en secondes.

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Le Tableau 43 montre tous les attributs de Seconds.

Tableau 43 – Attributs de Domain::Seconds

nom	type	description
value	Float	Temps, en secondes
unit=s (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.3.42 Primitive String

Une chaîne constituée d'une séquence de caractères 8 bits. Le codage de caractères est UTF-8. La longueur de la chaîne est indéterminée et illimitée.

6.1.3.43 Type de données StringQuantity

Grandeur avec valeur chaîne de caractères (lorsqu'il importe peu qu'il s'agisse d'un entier ou d'un nombre à virgule flottante) et les informations associées relatives aux unités

Le Tableau 44 montre tous les attributs de StringQuantity.

Tableau 44 – Attributs de Domain::StringQuantity

nom	type	description
value	String	
unit	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.44 Type de données Susceptance

Partie imaginaire de l'admittance.

Le Tableau 45 montre tous les attributs de Susceptance.

Tableau 45 – Attributs de Domain::Susceptance

nom	type	description
value	Float	
unit=S (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.45 Type de données Temperature

Valeur de température en degrés Celsius.

Le Tableau 46 montre tous les attributs de Temperature.

Tableau 46 – Attributs de Domain::Temperature

nom	type	description
value	Float	
unit=ºC (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

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6.1.3.46 Enumération UnitMultiplier

Les multiplicateurs d'unité définis pour le CIM.

Le Tableau 47 montre tous les libellés de UnitMultiplier.

Tableau 47 – Libellés de Domain::UnitMultiplier

libellé	description
p	Pico 10**-12
n	Nano 10**-9
micro	Micro 10**-6
m	Milli 10**-3
c	Centi 10**-2
d	Déci 10**-1
k	Kilo 10**3
M	Méga 10**6
G	Giga 10**9
T	Téra 10**12
none	

6.1.3.47 Enumération UnitSymbol

Les unités définies en vue de leur utilisation dans le CIM.

Le Tableau 48 montre tous les libellés de UnitSymbol.

Tableau 48 – Libellés de Domain::UnitSymbol

libellé	description
VA	Puissance apparente en volts ampères
W	Puissance active en watts
VAr	Puissance réactive en volts ampères réactifs
VAh	Énergie apparente en volts ampères heures
Wh	Énergie réelle en wattheures
VArh	Énergie réactive en volts ampères réactifs heures
V	Tension en volts
ohm	Résistance en ohms
A	Courant en ampères
F	Capacité en farads
H	Inductance en henrys
°C	Température relative en degrés Celsius
s	Temps en secondes
min	Temps en minutes
h	Temps en heures
deg	Angle plan en degrés
rad	Angle plan en radians

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libellé	description
J	Énergie en joules
N	Force en newtons
S	Conductance en siemens
none	Grandeur sans dimension, par exemple: compte, par unité, etc.
Hz	Fréquence en hertz
g	Masse en grammes
Pa	Pression en pascals (N/m^2)
m	Longueur en mètres
m^2	Surface en mètres carrés
m^3	Volume en mètres cubes
V/VAr	Volts par vols2t ampère réactif
W/Hz	Watts par hertz
J/s	Joules par seconde
s^{-1}	par seconde
kg/J	Masse par énergie
W/s	Watts par seconde
Hz^{-1}	par Hertz

6.1.3.48 Type de données Voltage

Tension électrique.

Le Tableau 49 montre tous les attributs de Voltage.

Tableau 49 – Attributs de Domain::Voltage

nom	type	description
value	Float	
unit=V (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.49 Type de données VoltagePerReactivePower

Variation de la tension avec la puissance réactive.

Le Tableau 50 montre tous les attributs de VoltagePerReactivePower.

Tableau 50 – Attributs de Domain::VoltagePerReactivePower

nom	type	description
value	Float	
unit=V/VAr (const)	UnitSymbol	
multiplier	UnitMultiplier	

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6.1.3.50 Type de données Volume

Volume.

Le Tableau 51 montre tous les attributs de Volume.

Tableau 51 – Attributs de Domain::Volume

nom	type	description
value	Float	
unit=m^3 (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.51 Type de données WaterLevel

Niveau d'eau présente dans le réservoir par rapport à une référence de type niveau moyen de la mer.

Le Tableau 52 montre tous les attributs de WaterLevel.

Tableau 52 – Attributs de Domain::WaterLevel

nom	type	description
value	Float	
unit=m (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.3.52 Type de données Weight

Le poids d'un objet.

Le Tableau 53 montre tous les attributs de Weight.

Tableau 53 – Attributs de Domain::Weight

nom	type	description
value	Float	
unit=g (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.4 Paquetage Core

6.1.4.1 Généralités

Contient les entités centrales PowerSystemResource (ressource du réseau électrique) et ConductingEquipment (équipement conducteur) partagées par toutes les applications plus les collections communes de ces entités. Toutes les applications ne nécessitent pas toutes les entités Core. Ce paquetage ne dépend d'aucun autre paquetage (à l'exception du paquetage Domain), mais en revanche, la plupart des autres paquetages ont des associations et des generalizations qui dépendent de ce paquetage.

La Figure 25 montre le diagramme logique Reporting.

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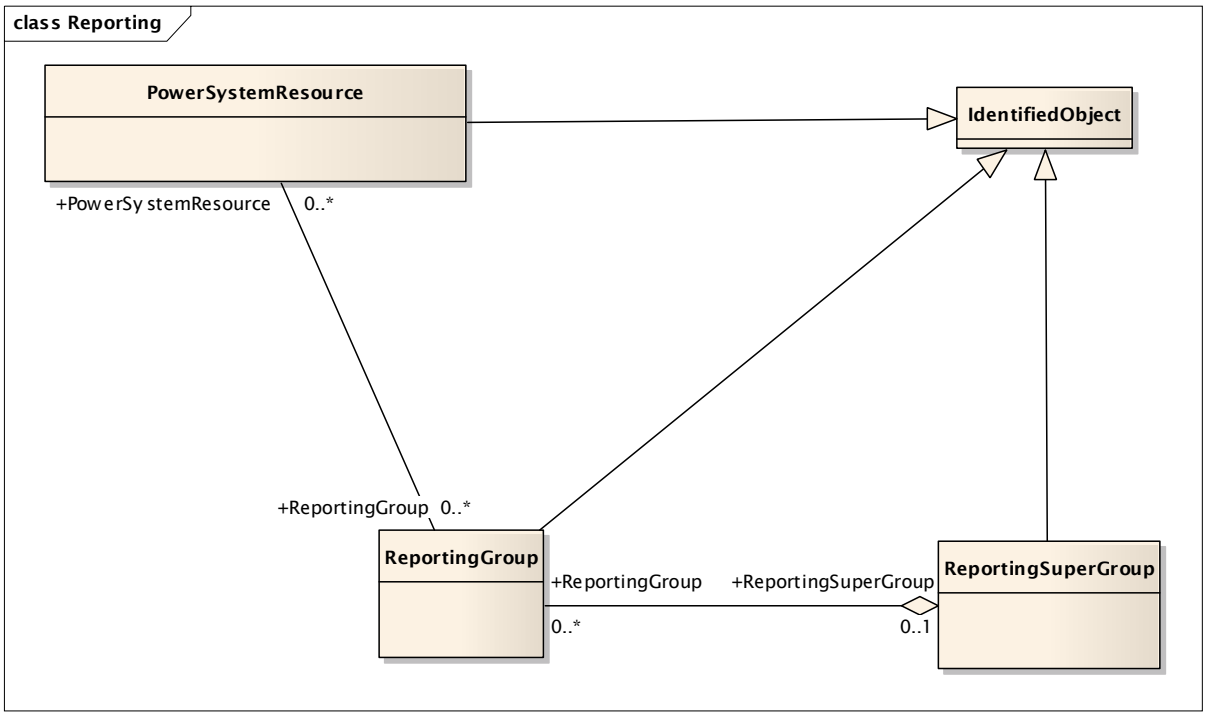

Figure 25 – Diagramme logique Core::Reporting

La Figure 26 montre le diagramme logique Main.

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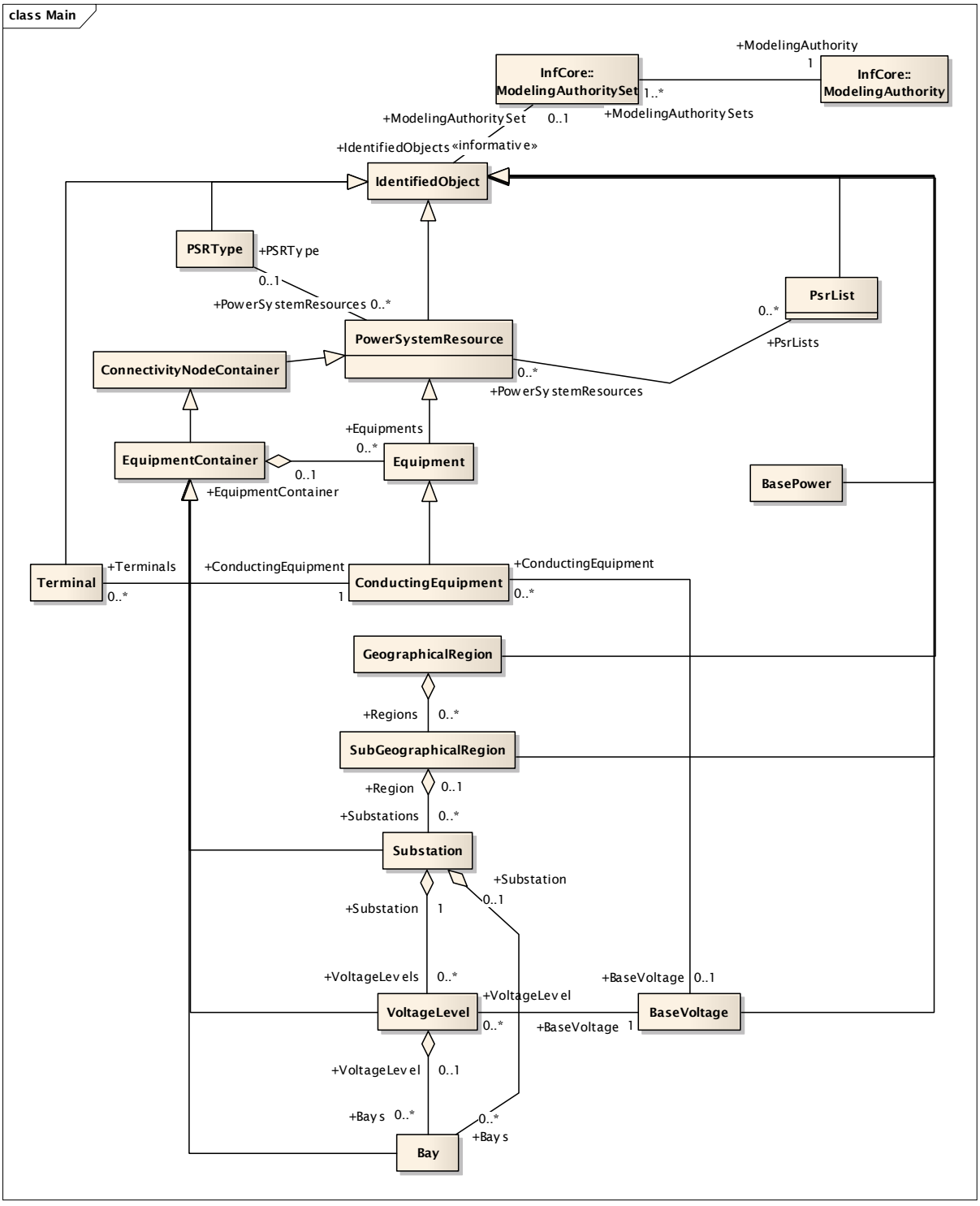

Figure 26 – Diagramme logique Core::Main

Ce diagramme est conçu pour montrer toutes les classes nécessaires à toute application du CIM pour modéliser des systèmes de transport ou de production.

La Figure 27 montre le diagramme logique CurveSchedule.

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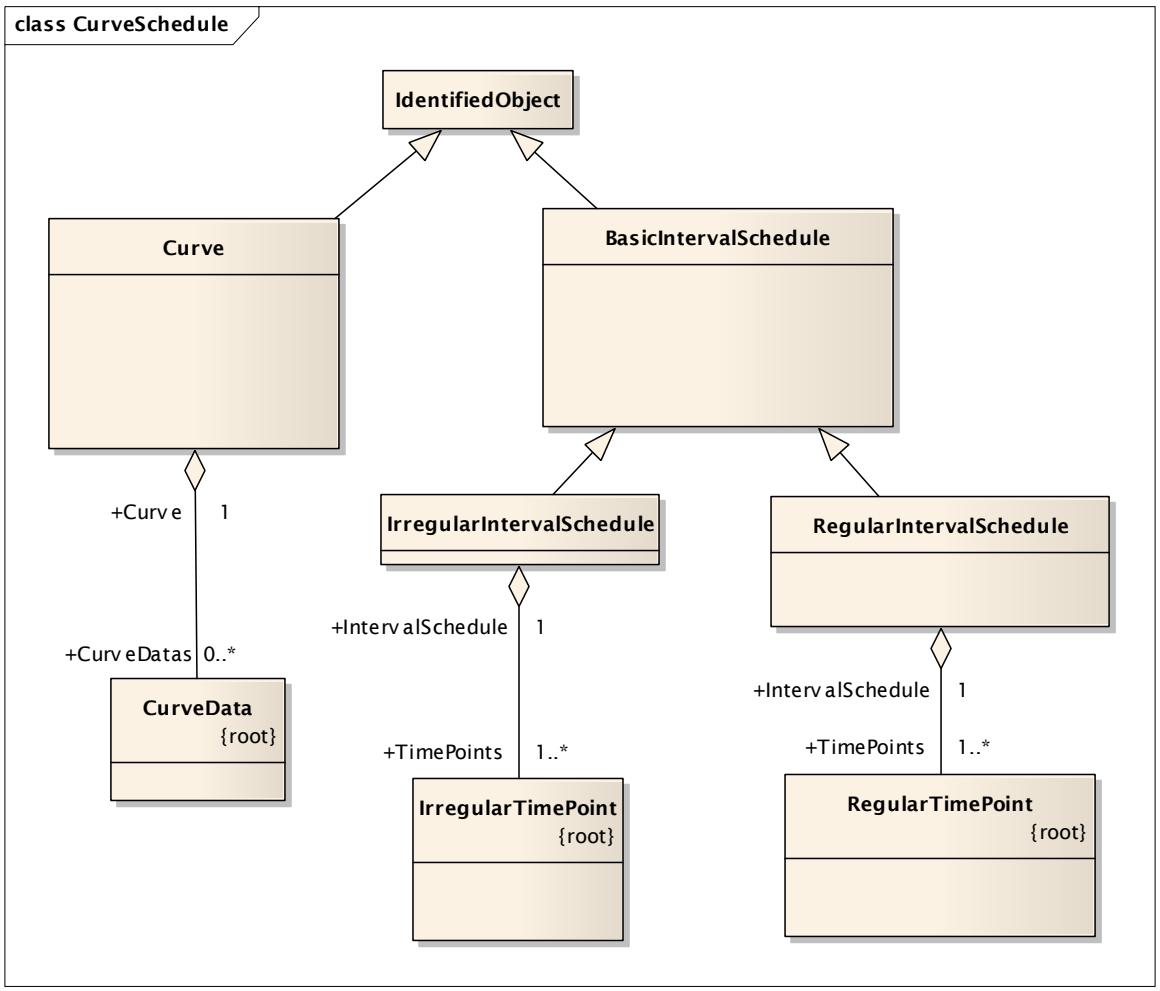

Figure 27 – Diagramme logique Core::CurveSchedule

La Figure 28 montre le diagramme logique Datatypes.

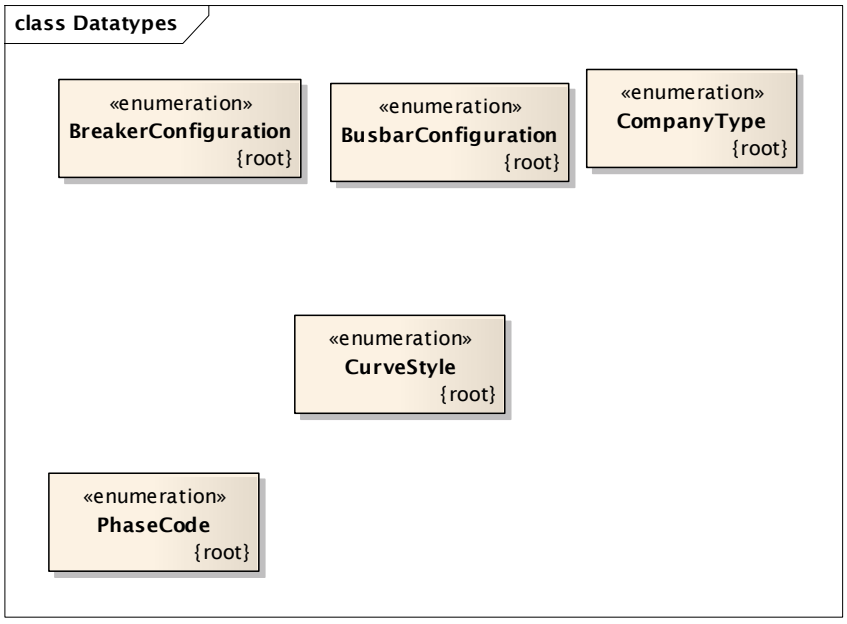

Figure 28 – Diagramme logique Core::Datatypes

Ce diagramme montre les types de données spécifiques au paquetage Core.

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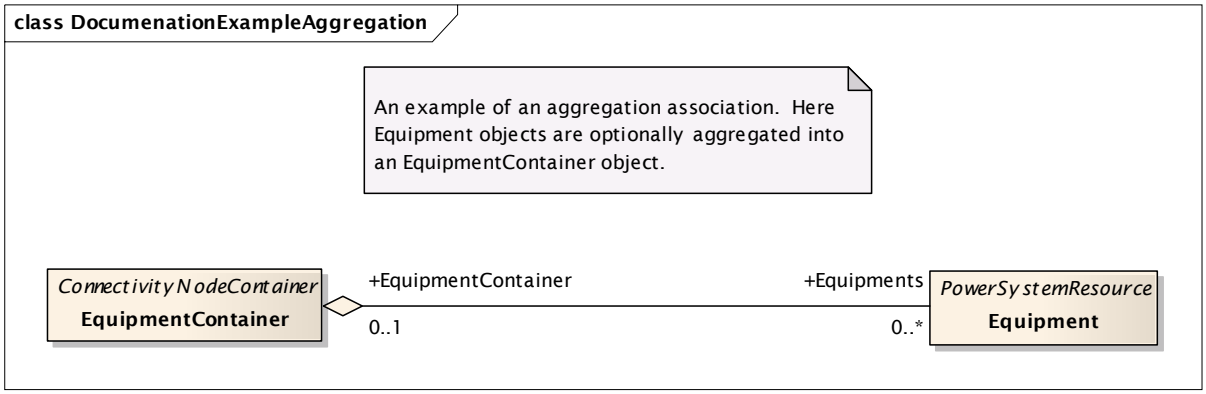
La Figure 29 montre le diagramme logique DocumenationExampleAggregation.

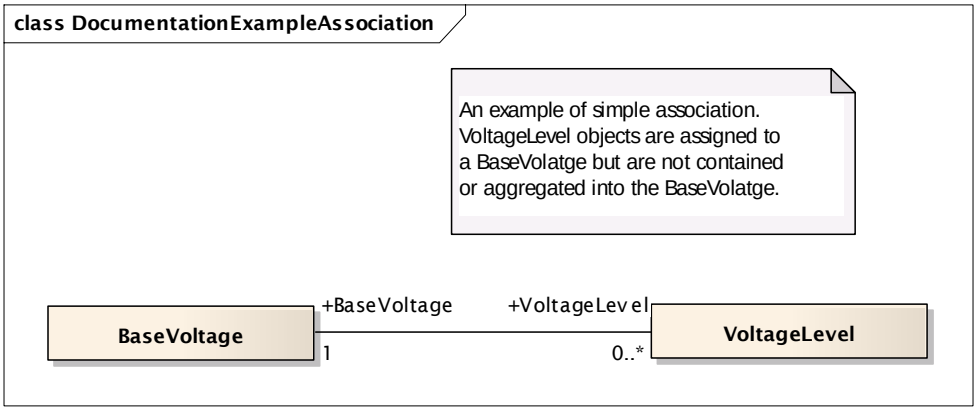


Légende

Anglais	Français
An example of an aggregation association. Here Equipment objects are optionally aggregated into an EquipmentContainer object.	Un exemple d'association d'agrégation. Ici, des objets Equipment sont facultativement agrégés dans un objet EquipmentContainer.

Figure 29 – Diagramme logique Core::DocumentationExampleAggregation

La Figure 30 montre le diagramme logique DocumentationExampleAssociation.



Légende

Anglais	Français
An example of a simple association. VoltageLevel objects are assigned to a BaseVoltage but are not contained or aggregated into the BaseVoltage.	Un exemple d'association simple. Des objets VoltageLevel sont affectés à une BaseVoltage mais ne sont ni contenus ni agrégés dans la BaseVoltage.

Figure 30 – Diagramme logique Core::DocumentationExampleAssociation

Ce diagramme est un exemple utilisé à des fins de documentation. Il montre comment une association simple et une association d'agrégation sont exprimées dans les diagrammes UML.

La Figure 31 montre le diagramme logique Ownership.

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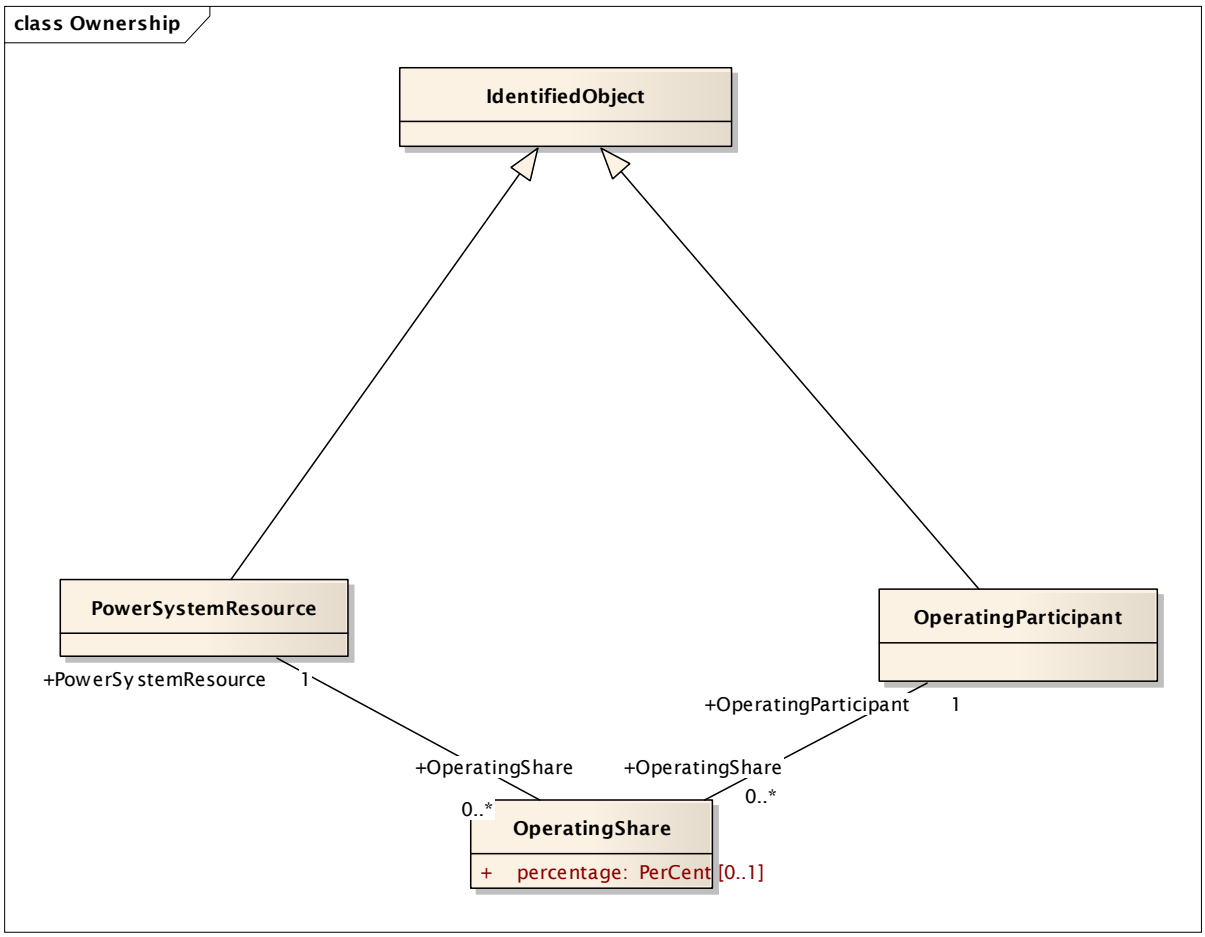

Figure 31 – Diagramme logique Core::Ownership

6.1.4.2 ReportingGroup

Un groupe de reporting est utilisé pour divers groupements ad hoc utilisés pour la production de rapports.

Le Tableau 54 montre tous les attributs de ReportingGroup.

Tableau 54 – Attributs de Core::ReportingGroup

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 55 montre toutes les extrémités d'association de ReportingGroup avec d'autres classes.

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Tableau 55 – Extrémités d'association de Core::ReportingGroup avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] ReportingSuperGroup	ReportingSuperGroup	Supergroupe de reporting auquel ce groupe de reporting appartient
[0..*]	[0..*] PowerSystemResource	PowerSystemResource	Les PSR qui appartiennent à ce groupe de reporting
[0..1]	[0..*] BusNameMarker	BusNameMarker	Les BusNameMarkers qui appartiennent à ce groupe de reporting
[0..1]	[0..*] TopologicalNode	TopologicalNode	Les TopologicalNode (nœuds topologiques) qui appartiennent à ce groupe de reporting

6.1.4.3 ReportingSuperGroup

Un supergroupe de reporting regroupe des groupes de reporting pour un rapport de niveau plus haut.

Le Tableau 56 montre tous les attributs de ReportingSuperGroup.

Tableau 56 – Attributs de Core::ReportingSuperGroup

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 57 montre toutes les extrémités d'association de ReportingSuperGroup avec d'autres classes.

Tableau 57 – Extrémités d'association de Core::ReportingSuperGroup avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] ReportingGroup	ReportingGroup	Groupes de reporting qui sont regroupés sous ce groupe de groupes

6.1.4.4 BasePower

La classe BasePower définit la puissance de base dans les calculs par unité.

Le Tableau 58 montre tous les attributs de BasePower.

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Tableau 58 – Attributs de Core::BasePower

nom	type	description
basePower	ApparentPower	Définition de la puissance de base
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

6.1.4.5 BaseVoltage

Définit une tension de base nominale qui est référencée dans le système.

Le Tableau 59 montre tous les attributs de BaseVoltage.

Tableau 59 – Attributs de Core::BaseVoltage

nom	type	description
isDC	Boolean	Si true (vrai), il s'agit d'une tension de base en courant continu et les éléments affectés à cette tension de base sont aussi associés à des fonctionnalités en courant continu. False (faux) indique le courant alternatif
nominalVoltage	Voltage	Tension de base de la PowerSystemResource
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 60 montre toutes les extrémités d'association de BaseVoltage avec d'autres classes.

Tableau 60 – Extrémités d'association de Core::BaseVoltage avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] ConductingEquipment	ConductingEquipment	Utiliser l'association à un Conducting Equipment seulement dans le cas où un conteneur VoltageLevel n'est pas utilisé
[1..1]	[0..*] VoltageLevel	VoltageLevel	Les VoltageLevel (les niveaux de tension) ont ce BaseVoltage (cette tension de base)
[0..1]	[0..*] TopologicalNode	TopologicalNode	Les nœuds topologiques à la tension de base

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6.1.4.6 BasicIntervalSchedule

Programme de valeurs à des instants donnés.

Le Tableau 61 montre tous les attributs de BasicIntervalSchedule.

Tableau 61 – Attributs de Core::BasicIntervalSchedule

nom	type	description
startTime	AbsoluteDateTime	L'heure pour le premier TimePoint
value1Unit	UnitSymbol	Unités de mesure pour value1
value1Multiplier	UnitMultiplier	Multiplicateur pour value1
value2Unit	UnitSymbol	Unités de mesure pour value2
value2Multiplier	UnitMultiplier	Multiplicateur pour value2
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

6.1.4.7 Bay

Collection de ressources du réseau électrique (au sein d'un poste donné) comprenant équipement conducteur, relais de protection, mesures et télémétrie.

Le Tableau 62 montre tous les attributs de Bay.

Tableau 62 – Attributs de Core::Bay

nom	type	description
bayEnergyMeasFlag	Boolean	Indique la présence/l'absence de mesures d'énergie
bayPowerMeasFlag	Boolean	Indique la présence/l'absence de mesures de puissance active/réactive
breakerConfiguration	BreakerConfiguration	Configuration de l'organe de coupure
busBarConfiguration	BusbarConfiguration	Configuration du jeu de barres
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 63 montre toutes les extrémités d'association de Bay avec d'autres classes.

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Tableau 63 – Extrémités d'association de Core::Bay avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] Substation	Substation	L'association est utilisée dans la hiérarchie de dénomination
[0..*]	[0..1] VoltageLevel	VoltageLevel	L'association est utilisée dans la hiérarchie de dénomination
[0..1]	[0..*] Equipments	Equipment	hérité de: EquipmentContainer
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	hérité de: ConnectivityNodeContainer
[0..1]	[0..*] TopologicalNode	TopologicalNode	hérité de: ConnectivityNodeContainer
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.4.8 Enumération BreakerConfiguration

Disposition de commutation pour Bay.

Le Tableau 64 montre tous les libellés de BreakerConfiguration.

Tableau 64 – Libellés de Core::BreakerConfiguration

libellé	description
singleBreaker	
breakerAndAHalf	
doubleBreaker	
noBreaker	

6.1.4.9 Enumération BusbarConfiguration

Disposition du jeu de barres pour Bay.

Le Tableau 65 montre tous les libellés de BusbarConfiguration.

Tableau 65 – Libellés de Core::BusbarConfiguration

libellé	description
singleBus	
doubleBus	
mainWithTransfer	
ringBus	

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6.1.4.10 Enumération CompanyType

Type d'entreprise.

Le Tableau 66 montre tous les libellés de CompanyType.

Tableau 66 – Libellés de Core::CompanyType

libellé	description
pool	
municipal	
isPrivate	

6.1.4.11 ConductingEquipment

Parties de composant de réseau électrique conçues pour transporter du courant ou connectées de façon à assurer la conduction. Un ConductingEquipment (équipement conducteur) est contenu dans un EquipmentContainer (conteneur d'équipement) qui peut être un Substation (poste), ou un VoltageLevel ou une Bay dans un poste.

Le Tableau 67 montre tous les attributs de ConductingEquipment.

Tableau 67 – Attributs de Core::ConductingEquipment

nom	type	description
phases	PhaseCode	Décrit les phases supportées par un équipement conducteur
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 68 montre toutes les extrémités d'association de ConductingEquipment avec d'autres classes.

Tableau 68 – Extrémités d'association de Core::ConductingEquipment avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	Utiliser l'association à un Conducting Equipment seulement dans le cas où un conteneur VoltageLevel n'est pas utilisé
[1..1]	[0..*] Terminals	Terminal	ConductingEquipment a 1 ou 2 bornes qui peuvent être connectées à d'autres bornes de Conducting Equipment via des ConnectivityNode (nœuds de

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[mult à partir de]	[mult vers] nom	type	description
			connectivité)
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	Le dispositif de protection peut être utilisé pour protéger un équipement conducteur spécifique. De multiples équipements peuvent être protégés ou supervisés par plusieurs dispositifs de protection
[1..1]	[0..*] ClearanceTags	ClearanceTag	L'équipement conducteur peut comporter plusieurs marqueurs de consignation pour la tâche autorisée sur le terrain
[1..1]	[0..1] SvStatus	SvStatus	L'état statut associé à l'équipement conducteur
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.4.12 ConnectivityNode

Les Connectivity nodes (nœuds de connectivité) sont des points où les bornes d'un équipement conducteur sont connectées avec une impédance nulle.

Le Tableau 69 montre tous les attributs de ConnectivityNode.

Tableau 69 – Attributs de Core::ConnectivityNode

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 70 montre toutes les extrémités d'association de ConnectivityNode avec d'autres classes.

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Tableau 70 – Extrémités d'association de Core::ConnectivityNode avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] ConnectivityNodeContainer	ConnectivityNodeContainer	Conteneur de ce noeud de connectivité
[0..*]	[0..1] TopologicalNode	TopologicalNode	Plusieurs ConnectivityNode(s) peuvent s'associer pour ne former qu'un seul TopologicalNode, selon l'état actuel du réseau
[0..*]	[0..1] BusNameMarker	BusNameMarker	Le nom associé du noeud topologique (TopologicalNode) contenant le ConnectivityNode est calculé par un algorithme qui utilise le marqueur de nom de bus
[0..1]	[0..*] Terminals	Terminal	Les bornes s'interconnectent avec une impédance nulle à un nœud. Les Measurements sur un nœud s'appliquent à toutes ses bornes

6.1.4.13 ConnectivityNodeContainer

Une classe de base pour tous les objets qui peuvent contenir des ConnectivityNode ou des TopologicalNode.

Le Tableau 71 montre tous les attributs de ConnectivityNodeContainer.

Tableau 71 – Attributs de Core::ConnectivityNodeContainer

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 72 montre toutes les extrémités d'association de ConnectivityNodeContainer avec d'autres classes.

Tableau 72 – Extrémités d'association de Core:: ConnectivityNodeContainer avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	Nœuds de connectivité contenus dans ce conteneur
[0..1]	[0..*] TopologicalNode	TopologicalNode	Les nœuds topologiques qui appartiennent à ce conteneur de nœuds de connectivité
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource

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[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.4.14 Curve

Courbe d'usage général ou relation fonctionnelle entre une variable indépendante (axe X) et des variables dépendantes (axe Y).

Le Tableau 73 montre tous les attributs de Curve.

Tableau 73 – Attributs de Core::Curve

nom	type	description
curveStyle	CurveStyle	Style ou forme de la courbe
xMultiplier	UnitMultiplier	Multiplicateur pour l'axe X
xUnit	UnitSymbol	Unités de mesure de l'axe X
y1Multiplier	UnitMultiplier	Multiplicateur pour l'axe Y1
y1Unit	UnitSymbol	Unités de mesure de l'axe Y1
y2Multiplier	UnitMultiplier	Multiplicateur pour l'axe Y2
y2Unit	UnitSymbol	Unités de mesure de l'axe Y2
y3Multiplier	UnitMultiplier	Multiplicateur pour l'axe Y3
y3Unit	UnitSymbol	Unités de mesure de l'axe Y3
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 74 montre toutes les extrémités d'association de Curve avec d'autres classes.

Tableau 74 – Extrémités d'association de Core::Curve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] CurveDatas	CurveData	Valeurs de données du point définissant une courbe

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6.1.4.15 Classe racine CurveData

Points de données d'usage général pour définir une courbe.

Le Tableau 75 montre tous les attributs de CurveData.

Tableau 75 – Attributs de Core::CurveData

nom	type	description
xvalue	Float	La valeur de données de la variable de l'axe X, en fonction des unités de l'axe X
y1value	Float	La valeur de données de la première variable de l'axe Y, en fonction des unités de l'axe Y
y2value	Float	La valeur de données de la deuxième variable de l'axe Y (s'il y en a une), en fonction des unités de l'axe Y
y3value	Float	La valeur de données de la troisième variable de l'axe Y (s'il y en a une), en fonction des unités de l'axe Y

Le Tableau 76 montre toutes les extrémités d'association de CurveData avec d'autres classes.

Tableau 76 – Extrémités d'association de Core::CurveData avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Curve	Curve	La courbe Curve définie par ces CurveData (ces données de courbe)

6.1.4.16 Enumération CurveStyle

Style ou forme de la courbe

Le Tableau 77 montre tous les libellés de CurveStyle.

Tableau 77 – Libellés de Core::CurveStyle

libellé	description
constantYValue	
straightLineYValues	
rampYValue	
formula	

6.1.4.17 Equipment

Les éléments d'une ressource de réseau électrique qui sont des dispositifs matériels, électroniques ou mécaniques.

Le Tableau 78 montre tous les attributs de Equipment.

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Tableau 78 – Attributs de Core::Equipment

nom	type	description
normallyInService	Boolean	L'équipement est normalement en service.
aggregate	Boolean	L'instance unique de l'équipement représente plusieurs éléments d'équipement qui ont été modélisés ensemble comme un agrégat. Des exemples seraient des PowerTransformers ou des SychronousMachines fonctionnant en parallèle modélisés comme étant un PowerTransformer agrégé unique ou une SynchronousMachine agrégée unique. Cela ne doit pas être utilisé pour indiquer un équipement qui est partie intégrante d'un groupe d'équipements interdépendants produits par un programme de production de réseau
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 79 montre toutes les extrémités d'association de Equipment avec d'autres classes.

Tableau 79 – Extrémités d'association de Core::Equipment avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	L'association est utilisée dans la hiérarchie de dénomination
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	Les jeux de limites d'équipement associés à l'équipement
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	L'élément de contingence associé à l'équipement
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.4.18 EquipmentContainer

Un élément de modélisation pour proposer une classe racine qui regroupe des équippements.

Le Tableau 80 montre tous les attributs de EquipmentContainer.

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Tableau 80 – Attributs de Core::EquipmentContainer

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 81 montre toutes les extrémités d'association de EquipmentContainer avec d'autres classes.

Tableau 81 – Extrémités d'association de Core::EquipmentContainer avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] Equipments	Equipment	L'association est utilisée dans la hiérarchie de dénomination
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	hérité de: ConnectivityNodeContainer
[0..1]	[0..*] TopologicalNode	TopologicalNode	hérité de: ConnectivityNodeContainer
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.4.19 GeographicalRegion

Une région géographique d'un modèle de réseau de système de puissance.

Le Tableau 82 montre tous les attributs de GeographicalRegion.

Tableau 82 – Attributs de Core::GeographicalRegion

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 83 montre toutes les extrémités d'association de GeographicalRegion avec d'autres classes.

Tableau 83 – Extrémités d'association de Core::GeographicalRegion avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] Regions	SubGeographicalRegion	L'association est utilisée dans la hiérarchie de dénomination

6.1.4.20 Classe racine IdentifiedObject

Il s'agit d'une classe racine qui offre des attributs de dénomination communs à toutes les classes nécessitant des attributs de dénomination.

Le Tableau 84 montre tous les attributs de IdentifiedObject.

Tableau 84 – Attributs de Core::IdentifiedObject

nom	type	description
mRID	String	Un Modeling Authority (une autorité de modélisation) émet des mRID. Sachant que chaque Modeling Authority a un identificateur unique et que cet identificateur fait partie du mRID, donc le mRID est unique au niveau global
name	String	Le name (nom) est un nom en texte libre de l'objet lisible par l'homme. Il peut ne pas être unique et peut ne pas se corréler à une hiérarchie de dénomination
localName	String	Le localName (nom local) est un nom de l'objet lisible par l'homme. Il est utilisé uniquement avec des objets organisés en hiérarchie de dénomination. La hiérarchie de dénomination la plus simple comporte juste un seul parent (la racine), ce qui correspond à une hiérarchie de dénomination plate. Cependant, la hiérarchie de dénomination comporte en général plusieurs niveaux, par exemple Substation, VoltageLevel, Equipment, etc. Les enfants de même parent ont des noms qui sont uniques entre eux. Si l'exigence d'unicité ne peut pas être satisfaite, IdentifiedObject.localName ne doit pas être utilisé, utiliser plutôt IdentifiedObject.name
pathName	String	Le pathName (chemin d'accès) est un nom unique dans le système composé de tous les IdentifiedObject.localName dans un chemin de hiérarchie de dénomination allant de l'objet jusqu'à la racine
aliasName	String	L'aliasName est un nom de l'objet en texte libre lisible par l'homme en remplacement de IdentifiedObject.name. Il peut ne pas être unique et peut ne pas se corréler à une hiérarchie de dénomination
description	String	La description est un texte libre lisible par l'homme décrivant ou nommant l'objet. Il peut ne pas être unique et peut ne pas se corréler à une hiérarchie de dénomination

6.1.4.21 IrregularIntervalSchedule

Le programme comporte plusieurs TimePoint où le temps entre eux varie.

Le Tableau 85 montre tous les attributs de IrregularIntervalSchedule.

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Tableau 85 – Attributs de Core::IrregularIntervalSchedule

nom	type	description
startTime	AbsoluteDateTime	hérité de: BasicIntervalSchedule
value1Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
value2Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 86 montre toutes les extrémités d'association de IrregularIntervalSchedule avec d'autres classes.

Tableau 86 – Extrémités d'association de Core::IrregularIntervalSchedule avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[1..*] TimePoints	IrregularTimePoint	Valeurs de données du point définissant une courbe

6.1.4.22 Classe racine IrregularTimePoint

Des TimePoints pour un programme où le temps entre les points varie.

Le Tableau 87 montre tous les attributs de IrregularTimePoint.

Tableau 87 – Attributs de Core::IrregularTimePoint

nom	type	description
Temps	Seconds	Le temps est rapporté au BasicTimeSchedule.startTime
value1	Float	La première valeur au temps indiqué. La signification de la valeur est définie par la classe héritant du IrregularIntervalSchedule
value2	Float	La deuxième valeur au temps indiqué. La signification de la valeur est définie par la classe héritant du IrregularIntervalSchedule

Le Tableau 88 montre toutes les extrémités d'association de IrregularTimePoint avec d'autres classes.

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Tableau 88 – Extrémités d'association de Core::IrregularTimePoint avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..*]	[1..1] IntervalSchedule	IrregularIntervalSchedule	Un IrregularTimePoint appartient à un IrregularIntervalSchedule

6.1.4.23 OperatingParticipant

Un opérateur de multiples objets PowerSystemResource. Plusieurs OperatingParticipant peuvent exploiter le même objet PowerSystemResource. Cela peut être utilisé pour modéliser des unités détenues en copropriété où chaque propriétaire agit selon une quote-part contractuelle.

Le Tableau 89 montre tous les attributs de OperatingParticipant.

Tableau 89 – Attributs de Core::OperatingParticipant

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 90 montre toutes les extrémités d'association de OperatingParticipant avec d'autres classes.

Tableau 90 – Extrémités d'association de Core::OperatingParticipant avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] OperatingShare	OperatingShare	Les quotes-parts d'exploitation d'un participant opérateur. Un participant opérateur peut être réutilisé pour un nombre quelconque de PSR

6.1.4.24 Classe racine OperatingShare

Spécifie la relation contractuelle entre une PowerSystemResource et un participant au contrat.

Le Tableau 91 montre tous les attributs de OperatingShare.

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Tableau 91 – Attributs de Core::OperatingShare

nom	type	description
percentage	PerCent	Propriété en pourcentage pour ce dispositif. Le pourcentage indique la part de possession en pourcentage du PSROwner (c'est-à-dire, le propriétaire de PSR) dans la PowerSystemResource. Il convient que la possession totale en pourcentage d'une PowerSystemResource soit égale à 100 %

Le Tableau 92 montre toutes les extrémités d'association de OperatingShare avec d'autres classes.

Tableau 92 – Extrémités d'association de Core::OperatingShare avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] OperatingParticipant	OperatingParticipant	Le lien à un propriétaire et ses attributs de liaison comme possession en pourcentage. Il convient que le pourcentage de possession soit de 100 % au total pour tous les propriétaires d'une PowerSystemResource, mais un PSROwner peut posséder n'importe quel pourcentage de n'importe quel nombre d'objets PowerSystemResource
[0..*]	[1..1] PowerSystemResource	PowerSystemResource	La PowerSystemResource à laquelle les attributs s'appliquent. Il convient que la possession totale en pourcentage de tous les propriétaires d'une PowerSystemResource soit égale à 100 %

6.1.4.25 Enumération PhaseCode

Énumération des identificateurs de phase.

Le Tableau 93 montre tous les libellés de PhaseCode.

Tableau 93 – Libellés de Core::PhaseCode

libellé	description
ABCN	
ABC	
ABN	
ACN	
BCN	
AB	
AC	
BC	
AN	
BN	
CN	

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libellé	description
A	
B	
C	
N	
splitSecondary1N	Phase secondaire divisée 1 et Neutre
splitSecondary2N	Phase secondaire divisée 2 et Neutre
splitSecondary12N	Phases secondaires divisées 1 et 2, avec Neutre

6.1.4.26 PowerSystemResource

Une ressource du réseau électrique peut être un élément d'équipement tel qu'un Switch (organe de coupure), un EquipmentContainer (conteneur d'équipements) contenant beaucoup d'éléments d'équipements individuels tel qu'un Substation (poste), ou une entité opérationnelle telle qu'une Company (entreprise) ou une SubControlArea (sous-zone de contrôle). Cela permet l'imbrication de collections de PowerSystemResources à l'intérieur d'autres PowerSystemResources. Par exemple un Switch peut être membre d'un Substation et un Substation peut être membre d'une division d'une Company.

Le Tableau 94 montre tous les attributs de PowerSystemResource.

Tableau 94 – Attributs de Core::PowerSystemResource

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 95 montre toutes les extrémités d'association de PowerSystemResource avec d'autres classes.

Tableau 95 – Extrémités d'association de Core::PowerSystemResource avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] PSRType	PSRType	PSRType (classification personnalisée) pour cette PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	Les Measurements qui sont incluses dans la hiérarchie de dénomination où le PSR est l'élément conteneur
[1..1]	[0..*] OperatingShare	OperatingShare	Le lien à n'importe quel nombre d'objets de quote-part d'opérateur
[0..*]	[0..*] PsrLists	PsrList	
[1..1]	[0..1] OutageSchedule	OutageSchedule	Une ressource de réseau électrique peut avoir un programme d'indisponibilité

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[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] ReportingGroup	ReportingGroup	Groupes de reporting auxquels appartient ce PSR
[0..*]	[0..1] Location	Location	Emplacement de cette ressource de réseau électrique

6.1.4.27 PsrList

Liste arbitraire de PowerSystemResources. Peut être utilisée à diverses fins, y compris le regroupement pour la génération de rapports.

Le Tableau 96 montre tous les attributs de PsrList.

Tableau 96 – Attributs de Core::PsrList

nom	type	description
typePSRList	String	Type de ressources de réseau électrique (Power System Ressource) contenues dans cette liste
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 97 montre toutes les extrémités d'association de PsrList avec d'autres classes.

Tableau 97 – Extrémités d'association de Core::PsrList avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] PowerSystemResources	PowerSystemResource	

6.1.4.28 PSRType

Instances de classification de la même classe, par exemple ACLineSegments (segments de ligne en courant alternatif) aériens et souterrains. Ce mécanisme de classification est destiné à procurer de la flexibilité au-delà du domaine de la présente norme, à apporter une personnalisation qui n'est pas dans la norme.

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Le Tableau 98 montre tous les attributs de PSRType.

Tableau 98 – Attributs de Core::PSRType

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 99 montre toutes les extrémités d'association de PSRType avec d'autres classes.

Tableau 99 – Extrémités d'association de Core::PSRType avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] PowerSystemResources	PowerSystemResource	Ressources de réseau électrique classées avec ce PSRType

6.1.4.29 RegularIntervalSchedule

Le programme comporte plusieurs TimePoints pour lesquels le temps entre eux est constant.

Le Tableau 100 montre tous les attributs de RegularIntervalSchedule.

Tableau 100 – Attributs de Core::RegularIntervalSchedule

nom	type	description
timeStep	Seconds	Le temps entre chaque paire de RegularTimePoints consécutifs
endTime	AbsoluteDateTime	L'heure pour le dernier instant (Time Point)
startTime	AbsoluteDateTime	hérité de: BasicIntervalSchedule
value1Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
value2Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 101 montre toutes les extrémités d'association de RegularIntervalSchedule avec d'autres classes.

Tableau 101 – Extrémités d'association de Core::RegularIntervalSchedule avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[1..*] TimePoints	RegularTimePoint	Valeurs de données du point définissant une courbe

6.1.4.30 Classe racine RegularTimePoint

Des TimePoint pour un programme où le temps entre les points est constant.

Le Tableau 102 montre tous les attributs de RegularTimePoint.

Tableau 102 – Attributs de Core::RegularTimePoint

nom	type	description
sequenceNumber	Integer	La position du RegularTimePoint dans la séquence. Noter que les Time Point ne doivent pas nécessairement être séquentiels, que des Time Point peuvent être omis. Le temps réel pour un RegularTimePoint est calculé en multipliant le RegularIntervalSchedule.timeStep avec le RegularTimePoint.sequenceNumber et en ajoutant le BasicIntervalSchedule.startTime
value1	Float	La première valeur au temps indiqué. La signification de la valeur est définie par la classe héritant du RegularIntervalSchedule
value2	Float	La deuxième valeur au temps indiqué. La signification de la valeur est définie par la classe héritant du RegularIntervalSchedule

Le Tableau 103 montre toutes les extrémités d'association de RegularTimePoint avec d'autres classes.

Tableau 103 – Extrémités d'association de Core::RegularTimePoint avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..*]	[1..1] IntervalSchedule	RegularIntervalSchedule	Un RegularTimePoint appartient à un RegularIntervalSchedule

6.1.4.31 SubGeographicalRegion

Un sous-ensemble d'une région géographique d'un modèle de réseau de système de puissance.

Le Tableau 104 montre tous les attributs de SubGeographicalRegion.

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Tableau 104 – Attributs de Core::SubGeographicalRegion

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 105 montre toutes les extrémités d'association de SubGeographicalRegion avec d'autres classes.

Tableau 105 – Extrémités d'association de Core::SubGeographicalRegion avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] Substations	Substation	L'association est utilisée dans la hiérarchie de dénomination
[0..1]	[0..*] Lines	Line	Une Line (ligne) peut être contenue par une SubGeographical Region
[0..*]	[0..1] Region	GeographicalRegion	L'association est utilisée dans la hiérarchie de dénomination

6.1.4.32 Substation

Collection d'équipements dans d'autres buts que la production ou l'utilisation, à travers lesquels passe de l'énergie électrique en vrac dans le but de commuter ou de modifier ses caractéristiques.

Le Tableau 106 montre tous les attributs de Substation.

Tableau 106 – Attributs de Core::Substation

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 107 montre toutes les extrémités d'association de Substation avec d'autres classes.

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Tableau 107 – Extrémités d'association de Core::Substation avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] VoltageLevels	VoltageLevel	L'association est utilisée dans la hiérarchie de dénomination
[0..*]	[0..1] Region	SubGeographicalRegion	L'association est utilisée dans la hiérarchie de dénomination
[0..1]	[0..*] Bays	Bay	L'association est utilisée dans la hiérarchie de dénomination
[0..1]	[0..*] Equipments	Equipment	hérité de: EquipmentContainer
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	hérité de: ConnectivityNodeContainer
[0..1]	[0..*] TopologicalNode	TopologicalNode	hérité de: ConnectivityNodeContainer
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.4.33 Terminal

Point de connexion électrique à une partie d'un équipement conducteur. Les Terminals (bornes) sont connectées sur des points de connexion physiques appelés "connectivity nodes" (nœuds de connectivité).

Le Tableau 108 montre tous les attributs de Terminal.

Tableau 108 – Attributs de Core::Terminal

nom	type	description
connected	Boolean	Le statut "connected" (connecté) est relatif à un modèle de topologie nodale et à la relation TopologicalNode-Terminal. "True" implique que le Terminal est connecté au TopologicalNode connexe et "false" implique qu'elle ne l'est pas. Dans un modèle de topologie nodale, le statut "connected" est utilisé pour indiqué si l'équipement est déconnecté sans devoir changer la connectivité décrite par la relation TopologicalNode-Terminal. Un cas valide est celui où le ConductingEquipment peut être connecté en une extrémité et ouvert en l'autre. En particulier pour un ACLineSegment où la charge peut être significative, cela constitue un cas pertinent
sequenceNumber	Integer	L'orientation des connexions de bornes pour un équipement conducteur à plusieurs bornes. La numérotation séquentielle commence à 1 et il convient que les bornes supplémentaires suivent l'ordre croissant. La première borne est le "point de départ" d'une branche à deux bornes. Dans le cas de la classe TransformerWinding, une seule borne est utilisée et donc son sequenceNumber doit être 1
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject

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nom	type	description
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 109 montre toutes les extrémités d'association de Terminal avec d'autres classes.

Tableau 109 – Extrémités d'association de Core::Terminal avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] ConductingEquipment	ConductingEquipment	ConductingEquipment a 1 ou 2 bornes qui peuvent être connectées à d'autres bornes de Conducting Equipment via des ConnectivityNode (nœuds de connectivité)
[0..1]	[0..*] RegulatingControl	RegulatingControl	La borne est régulée par une commande
[0..*]	[0..1] ConnectivityNode	ConnectivityNode	Les bornes s'interconnectent avec une impédance nulle à un nœud. Les Measurement sur un nœud s'appliquent à toutes ses bornes
[0..*]	[0..1] TopologicalNode	TopologicalNode	Le nœud topologique associé à la borne. Il peut être utilisé comme remplacement d'un chemin de nœuds de connectivité allant jusqu'au nœud topologique, éliminant donc la nécessité de modéliser les nœuds de connectivité dans certains cas. Noter que si les nœuds de connectivité sont présents dans le modèle, cette association ne serait probablement pas utilisée
[1..1]	[0..*] BranchGroupTerminal	BranchGroupTerminal	Les BranchGroupTerminals orientées pour lesquelles la borne est surveillée
[0..1]	[0..*] Measurements	Measurement	Une ou plusieurs Measurements peuvent être associées à une borne du réseau. L'association Measurement-Terminal définit l'endroit où la mesure est placée dans la topologie de réseau. Certaines Measurement représentent des grandeurs relatives à la position particulière d'un capteur, par exemple un transformateur de tension (PT) sur un jeu de barres ou un transformateur de courant (CT) sur une barre entre un disjoncteur et un sectionneur. La position de captage est capturée par l'association Measurement - Terminal qui permet de placer la position de captage en un emplacement bien défini. L'emplacement est défini par le point de connexion entre la Terminal (la borne) et le ConductingEquipment (l'équipement conducteur)
[1..1]	[0..2] TieFlow	TieFlow	Les flux d'interconnexion de zone de commande auxquels cette borne est associée
[0..1]	[0..*] OperationalLimitSet	OperationalLimitSet	Les ensembles de limites opérationnelles qui s'appliquent spécifiquement à cette borne. D'autres ensembles de limites opérationnelles peuvent s'appliquer à cette borne par le truchement d'une association à Equipment

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[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] HasSecond_MutualCoupling	MutualCoupling	Couplages mutuels avec la branche associée comme première branche
[1..1]	[0..*] HasFirst_MutualCoupling	MutualCoupling	Couplages mutuels associés avec la branche comme première branche
[1..1]	[0..1] SvPowerFlow	SvPowerFlow	L'état de flux de puissance associé à la borne

6.1.4.34 Unit

Grandeur étant mesurée. Le Unit.name doit être unique parmi toutes les grandeurs spécifiées et décrire la grandeur. Le Unit.aliasName est prévu pour des particularisations locales.

Le Tableau 110 montre tous les attributs de Unit.

Tableau 110 – Attributs de Core::Unit

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 111 montre toutes les extrémités d'association de Unit avec d'autres classes.

Tableau 111 – Extrémités d'association de Core::Unit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] Controls	Control	Les Controls (commandes) ayant l'Unit
[1..1]	[0..*] ProtectionEquipments	ProtectionEquipment	Les Protection Equipments (équipements de protection) ayant l'Unit
[1..1]	[0..*] Measurements	Measurement	Les mesures Measurements ayant l'Unit

6.1.4.35 VoltageLevel

Ensemble d'équipements à un même niveau de tension, constituant un ensemble de commutation. L'équipement consiste typiquement en disjoncteurs, jeux de barre, dispositifs d'instrumentation, de contrôle, de régulation et de protection, de même que des regroupements de ce type de constituants.

Le Tableau 112 montre tous les attributs de VoltageLevel.

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Tableau 112 – Attributs de Core::VoltageLevel

nom	type	description
highVoltageLimit	Voltage	La tension limite haute du jeu de barres
lowVoltageLimit	Voltage	La tension limite basse du jeu de barres
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 113 montre toutes les extrémités d'association de VoltageLevel avec d'autres classes.

Tableau 113 – Extrémités d'association de Core::VoltageLevel avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] Bays	Bay	L'association est utilisée dans la hiérarchie de dénomination
[0..*]	[1..1] BaseVoltage	BaseVoltage	La tension de base utilisée pour tous les équipements dans le VoltageLevel
[0..*]	[1..1] Substation	Substation	L'association est utilisée dans la hiérarchie de dénomination
[0..1]	[0..*] Equipments	Equipment	hérité de: EquipmentContainer
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	hérité de: ConnectivityNodeContainer
[0..1]	[0..*] TopologicalNode	TopologicalNode	hérité de: ConnectivityNodeContainer
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.5 Paquetage OperationalLimits

6.1.5.1 Généralités

Le paquetage OperationalLimits modélise une spécification des limites associées à des entités d'équipement et autres entités opérationnelles.

La Figure 32 montre le diagramme logique OperationalLimits.

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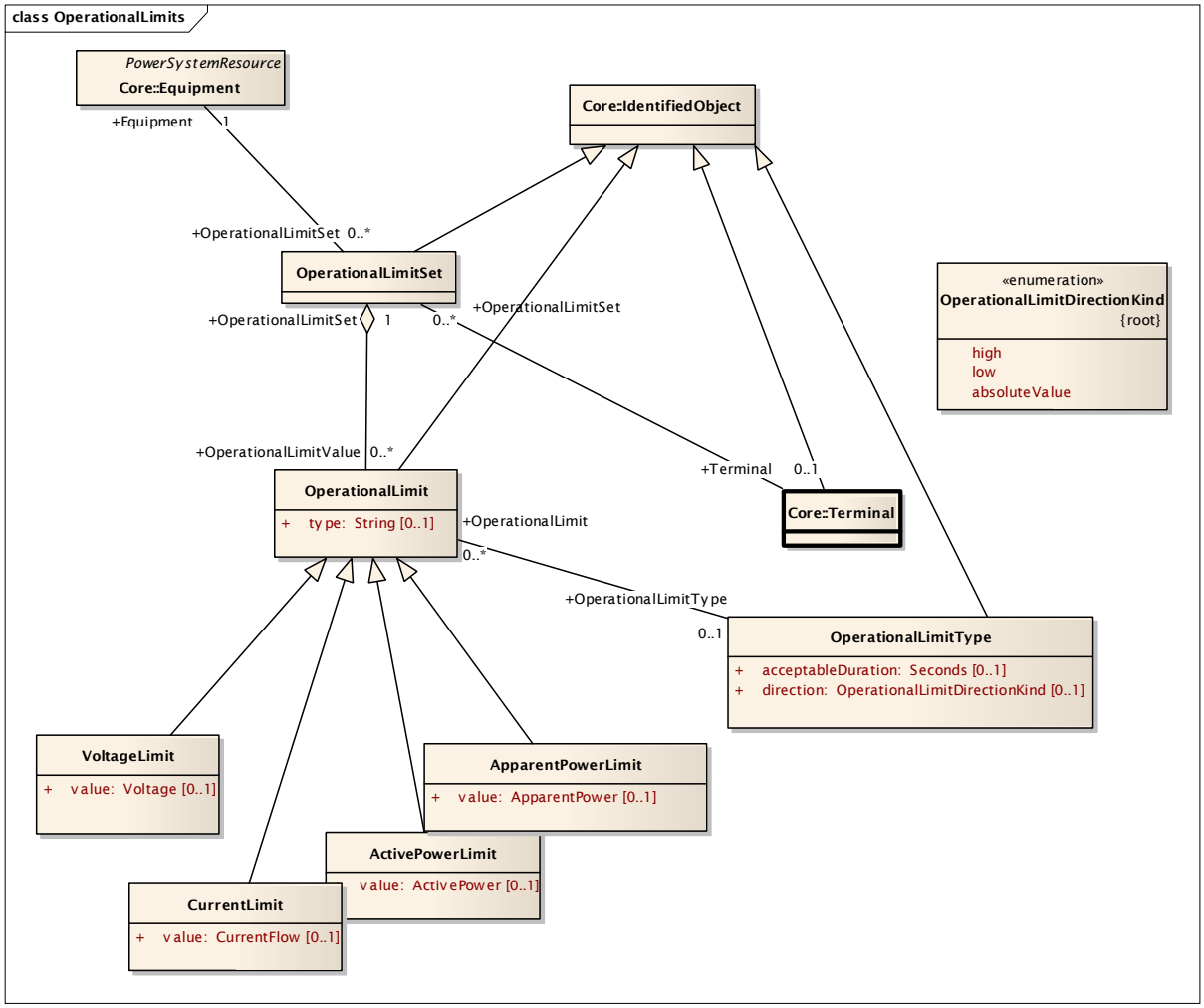

Figure 32 – Diagramme logique OperationalLimits::OperationalLimits

Limites opérationnelles telles qu'elles se rattachent dans le modèle central.

La Figure 33 montre le diagramme logique BranchGroup.

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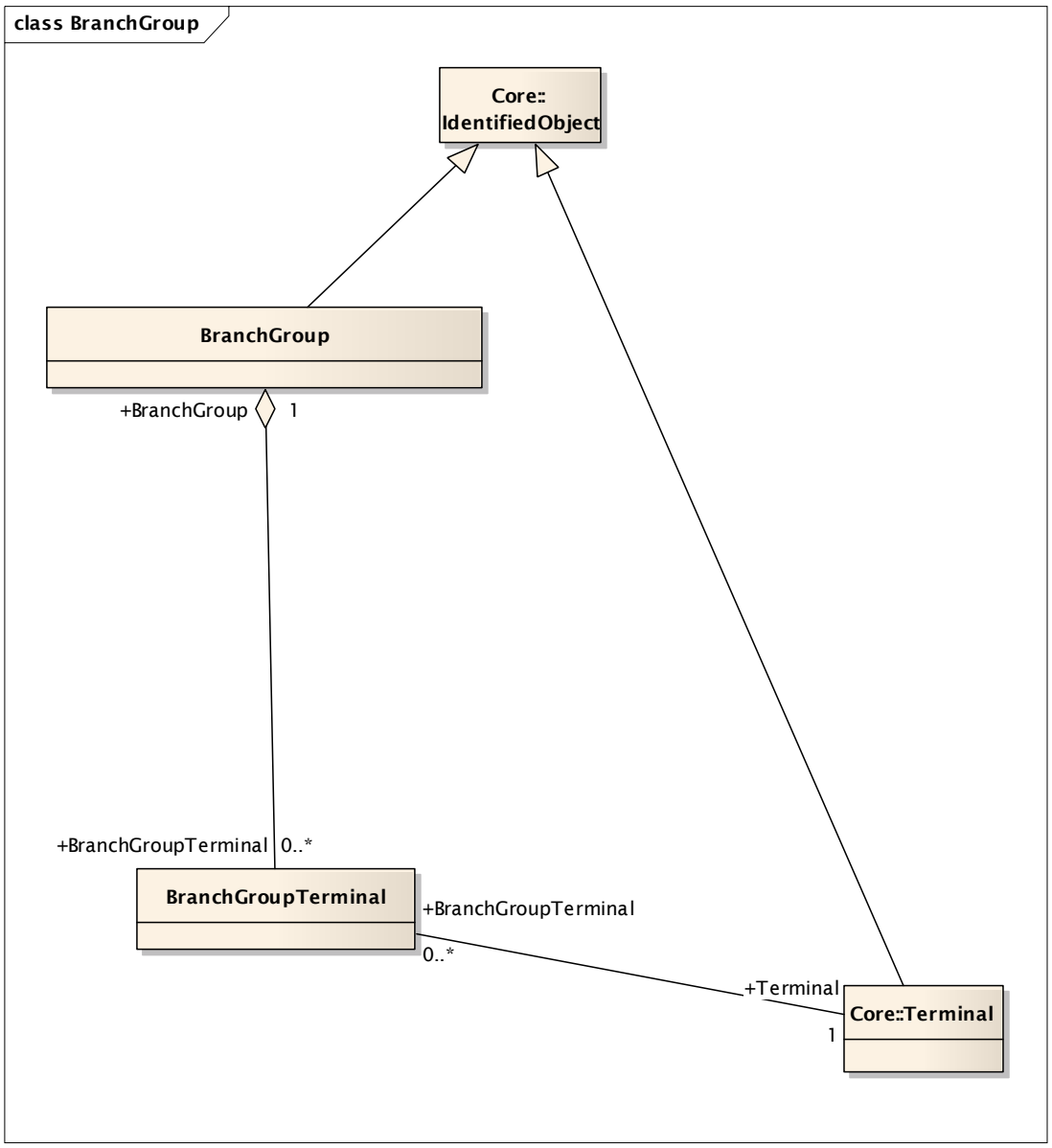

Figure 33 – Diagramme logique OperationalLimits::BranchGroup

6.1.5.2 Enumération OperationalLimitDirectionKind

Le sens d'une limite opérationnelle.

Le Tableau 114 montre tous les libellés de OperationalLimitDirectionKind.

Tableau 114 – Libellés de OperationalLimits::OperationalLimitDirectionKind

libellé	description
high	La limite est une limite haute. Si elle est appliquée au flux d'une borne, le sens positif est celui pénétrant dans la borne
low	La limite est une limite basse. Si elle est appliquée au flux d'une borne, le sens positif est celui pénétrant dans la borne
absoluteValue	Si la valeur absolue de la valeur surveillée est supérieure à la valeur limite, la limite est violée. En fait, la limite est une limite haute et, en même temps, sa valeur négative une limite basse

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6.1.5.3 OperationalLimitType

Un type de limite. La signification d'une limite spécifique est décrite dans cette classe.

Le Tableau 115 montre tous les attributs de OperationalLimitType.

Tableau 115 – Attributs de OperationalLimits::OperationalLimitType

nom	type	description
acceptableDuration	Seconds	La durée acceptable nominale de la limite. Les limites sont communément exprimées en termes de limites temporelles pour lesquelles la limite est normalement acceptable. La durée acceptable réelle d'une limite spécifique peut dépendre d'autres facteurs locaux tels que la température ou la vitesse du vent
direction	OperationalLimitDirectionKind	Le sens de la limite
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 116 montre toutes les extrémités d'association de OperationalLimitType avec d'autres classes.

Tableau 116 – Extrémités d'association de OperationalLimits::OperationalLimitType avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] OperationalLimit	OperationalLimit	Les limites opérationnelles associées à ce type de limite

6.1.5.4 ActivePowerLimit

Limite sur le flux de puissance active.

Le Tableau 117 montre tous les attributs de ActivePowerLimit.

Tableau 117 – Attributs de OperationalLimits::ActivePowerLimit

nom	type	description
value	ActivePower	Valeur de la limite de puissance active
type	String	hérité de: OperationalLimit
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 118 montre toutes les extrémités d'association de ActivePowerLimit avec d'autres classes.

Tableau 118 – Extrémités d'association de OperationalLimits::ActivePowerLimit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] OperationalLimitSet	OperationalLimitSet	hérité de: OperationalLimit
[0..*]	[0..1] OperationalLimitType	OperationalLimitType	hérité de: OperationalLimit

6.1.5.5 ApparentPowerLimit

Limite de puissance apparente.

Le Tableau 119 montre tous les attributs de ApparentPowerLimit.

Tableau 119 – Attributs de OperationalLimits::ApparentPowerLimit

nom	type	description
value	ApparentPower	La limite de puissance apparente
type	String	hérité de: OperationalLimit
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 120 montre toutes les extrémités d'association de ApparentPowerLimit avec d'autres classes.

Tableau 120 – Extrémités d'association de OperationalLimits::ApparentPowerLimit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] OperationalLimitSet	OperationalLimitSet	hérité de: OperationalLimit
[0..*]	[0..1] OperationalLimitType	OperationalLimitType	hérité de: OperationalLimit

6.1.5.6 BranchGroup

Un groupe de bornes de branches dont la sommation des flux orientés doit être surveillée. Un groupe de branches peut ne pas former un ensemble de coupure du réseau.

Le Tableau 121 montre tous les attributs de BranchGroup.

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Tableau 121 – Attributs de OperationalLimits::BranchGroup

nom	type	description
maximumActivePower	ActivePower	Le flux maximal de puissance active
maximumReactivePower	ReactivePower	Le flux maximal de puissance réactive
minimumActivePower	ActivePower	Le flux minimal de puissance active
minimumReactivePower	ReactivePower	Le flux minimal de puissance réactive
monitorActivePower	Boolean	Surveiller le flux de puissance active
monitorReactivePower	Boolean	Surveiller le flux de puissance réactive.
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 122 montre toutes les extrémités d'association de BranchGroup avec d'autres classes.

Tableau 122 – Extrémités d'association de OperationalLimits::BranchGroup avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] BranchGroupTerminal	BranchGroupTerminal	Les bornes de BranchGroups orientées devant être sommées

6.1.5.7 Classe racine BranchGroupTerminal

Un flux spécifique de bornes orienté pour un groupe de branches.

Le Tableau 123 montre tous les attributs de BranchGroupTerminal.

Tableau 123 – Attributs de OperationalLimits::BranchGroupTerminal

nom	type	description
positiveFlowIn	Boolean	S'il est mis à true (vrai), le flux pénétrant dans la borne est sommé. S'il est mis à false (faux), le flux sortant de la borne est sommé

Le Tableau 124 montre toutes les extrémités d'association de BranchGroupTerminal avec d'autres classes.

Tableau 124 – Extrémités d'association de OperationalLimits::BranchGroupTerminal avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description

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[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Terminal	Terminal	La borne devant être sommée
[0..*]	[1..1] BranchGroup	BranchGroup	Le BranchGroup auquel appartiennent les bornes de groupe de branches orientées

6.1.5.8 CurrentLimit

Limite opérationnelle sur le courant.

Le Tableau 125 montre tous les attributs de CurrentLimit.

Tableau 125 – Attributs de OperationalLimits::CurrentLimit

nom	type	description
value	CurrentFlow	Limite sur le flux de courant
type	String	hérité de: OperationalLimit
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 126 montre toutes les extrémités d'association de CurrentLimit avec d'autres classes.

Tableau 126 – Extrémités d'association de OperationalLimits::CurrentLimit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] OperationalLimitSet	OperationalLimitSet	hérité de: OperationalLimit
[0..*]	[0..1] OperationalLimitType	OperationalLimitType	hérité de: OperationalLimit

6.1.5.9 OperationalLimit

Une valeur associée à une sorte spécifique de limite.

Le Tableau 127 montre tous les attributs de OperationalLimit.

Tableau 127 – Attributs de OperationalLimits::OperationalLimit

nom	type	description
type	String	Utilisé pour spécifier les niveaux high/low (haut/bas) et les niveaux limites

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nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 128 montre toutes les extrémités d'association de OperationalLimit avec d'autres classes.

Tableau 128 – Extrémités d'association de OperationalLimits::OperationalLimit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] OperationalLimitSet	OperationalLimitSet	Jeu de limites auquel les valeurs limites appartiennent
[0..*]	[0..1] OperationalLimitType	OperationalLimitType	Le type de limite associé à cette limite

6.1.5.10 OperationalLimitSet

Jeu de limites associées à un équipement. Les jeux de limites pourraient s'appliquer à une température spécifique, ou à une saison par exemple. Un jeu de limites peut contenir de nombreuses sévérités différentes pour les niveaux limites qui s'appliqueraient au même équipement. Le jeu peut contenir des limites de types différents telles que limites de puissance apparente et limites de courant ou bien limites de tension haute et basse qui sont logiquement appliquées ensemble comme un jeu.

Le Tableau 129 montre tous les attributs de OperationalLimitSet.

Tableau 129 – Attributs de OperationalLimits::OperationalLimitSet

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 130 montre toutes les extrémités d'association de OperationalLimitSet avec d'autres classes.

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Tableau 130 – Extrémités d'association de OperationalLimits::OperationalLimitSet avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Equipment	Equipment	L'équipement auquel le jeu de limites s'applique
[0..*]	[0..1] Terminal	Terminal	La borne spécifiquement associée à ce jeu de limites opérationnelles. Si aucune borne n'est associée, toutes les bornes de l'équipement sont sous-entendues
[1..1]	[0..*] OperationalLimitValue	OperationalLimit	Valeurs des limites opérationnelles

6.1.5.11 VoltageLimit

La limite opérationnelle appliquée à la tension.

Le Tableau 131 montre tous les attributs de VoltageLimit.

Tableau 131 – Attributs de OperationalLimits::VoltageLimit

nom	type	description
value	Voltage	Limite sur la tension. La limite haute ou basse dépend du OperatoinalLimit.limitKind
type	String	hérité de: OperationalLimit
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 132 montre toutes les extrémités d'association de VoltageLimit avec d'autres classes.

Tableau 132 – Extrémités d'association de OperationalLimits::VoltageLimit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] OperationalLimitSet	OperationalLimitSet	hérité de: OperationalLimit
[0..*]	[0..1] OperationalLimitType	OperationalLimitType	hérité de: OperationalLimit

6.1.6 Paquetage Topology

6.1.6.1 Généralités

Extension du paquetage Core qui, associé à la classe Terminal (borne), modélise la Connectivity (connectivité), à savoir la définition physique de la façon dont les équipements

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sont connectés ensemble. De plus, il modélise la Topology, à savoir la définition logique de la façon dont un équipement est connecté via des organes de coupure fermés. La définition de Topology est indépendante des autres caractéristiques électriques.

La Figure 34 montre le diagramme logique TopologicalNodeTerminal.

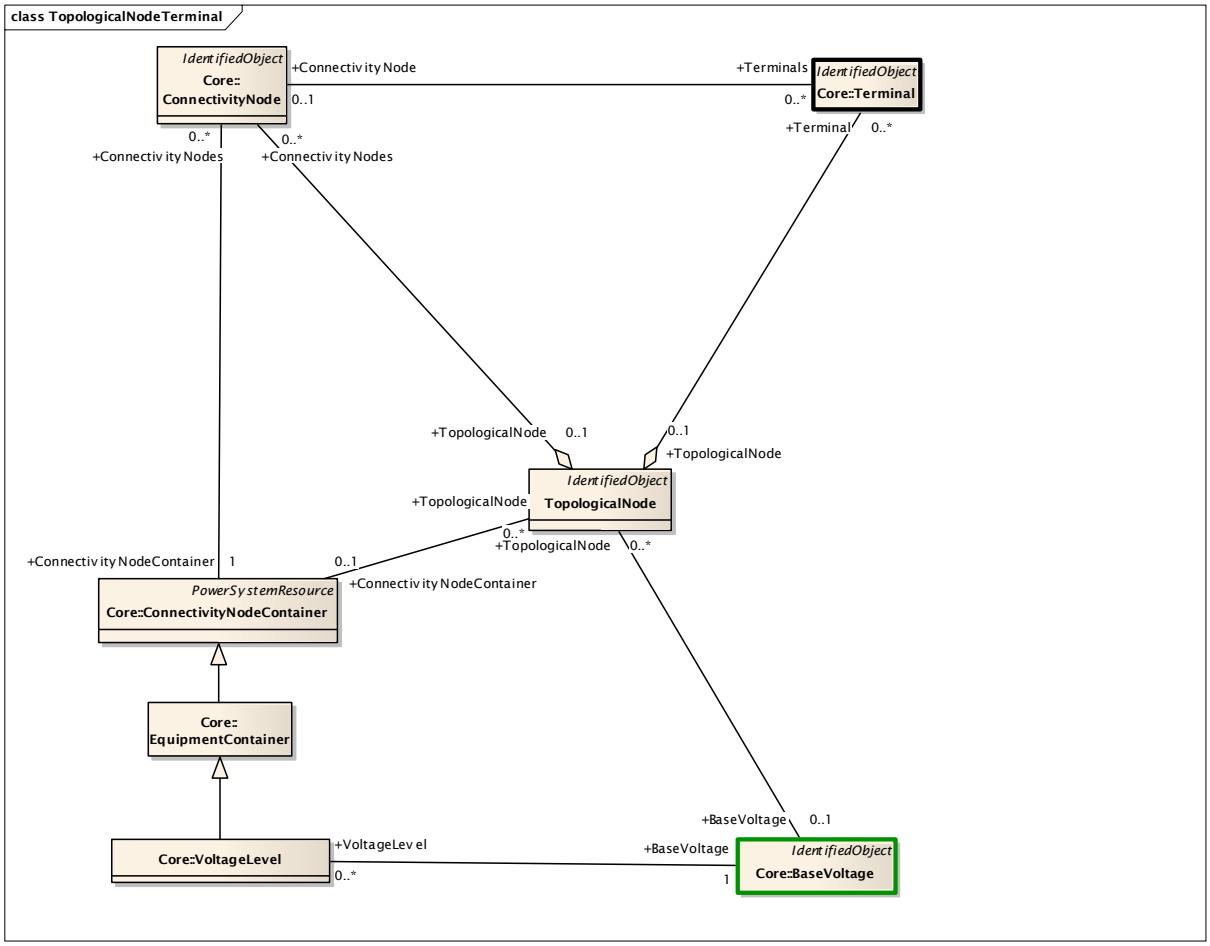

Figure 34 – Diagramme logique Topology::TopologicalNodeTerminal

La Figure 35 montre le diagramme logique Topology.

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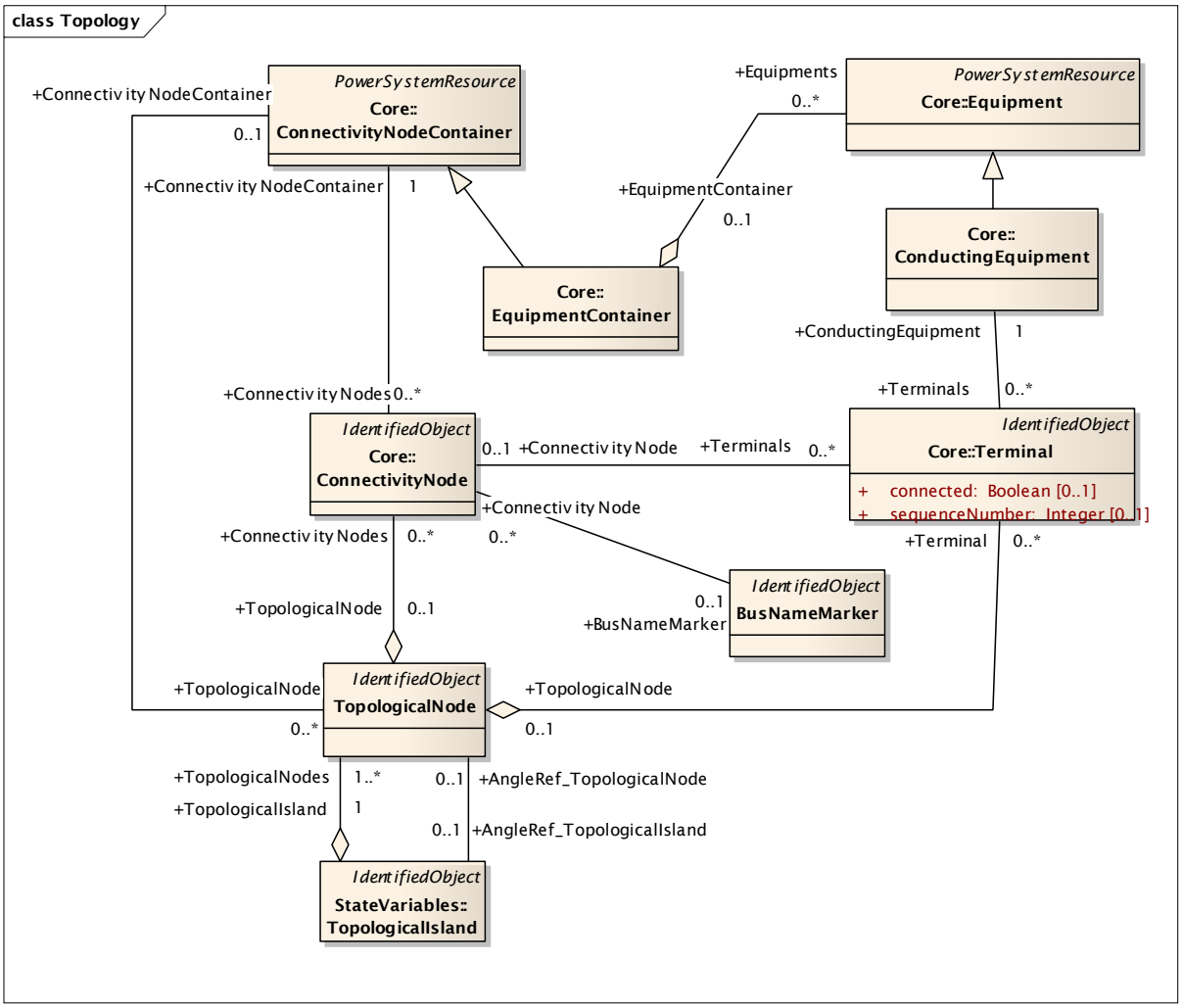

Figure 35 – Diagramme logique Topology::Topology

La Figure 36 montre le diagramme logique TopologyMeasRelations.

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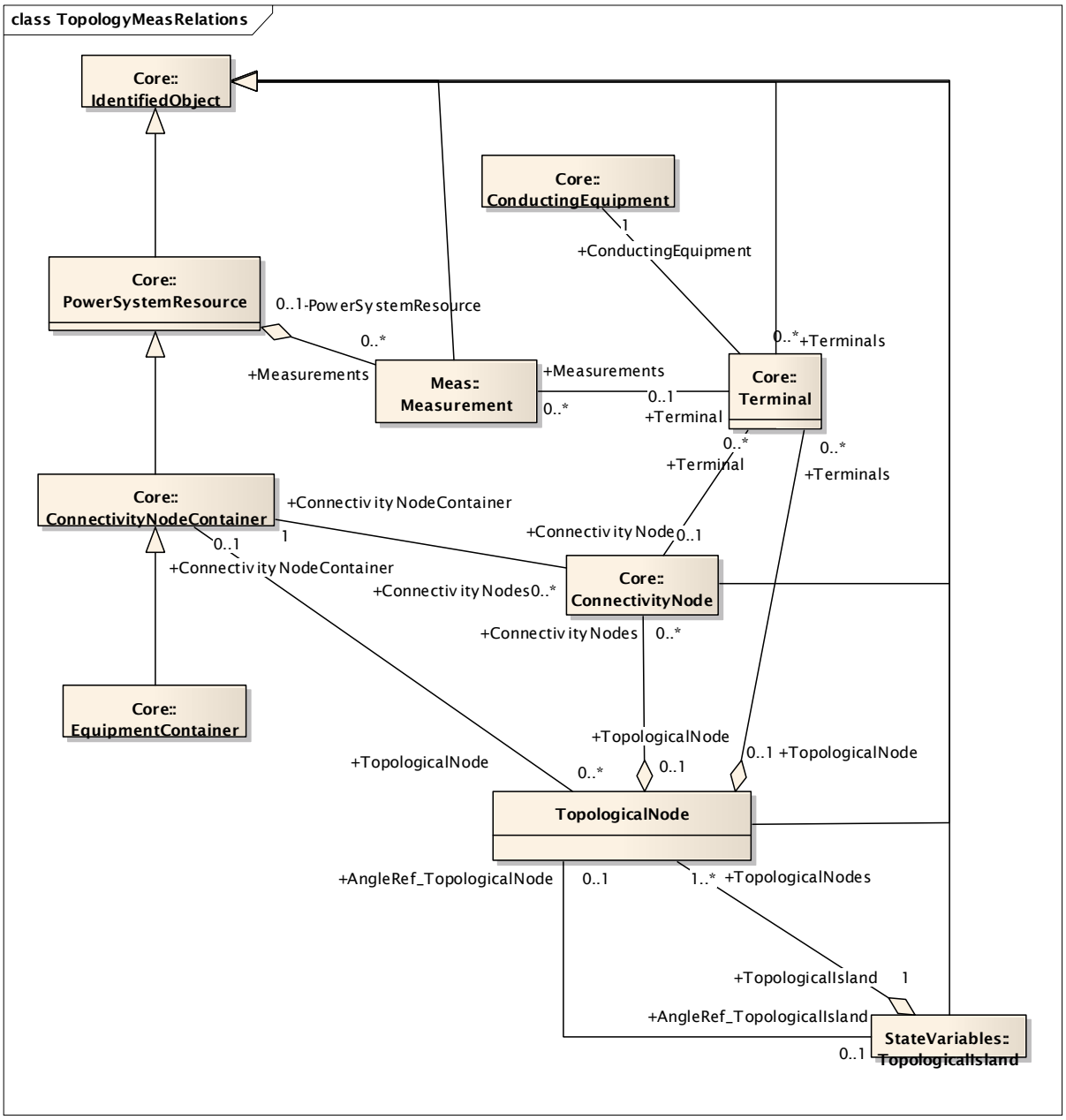

Figure 36 – Diagramme logique Topology::TopologyMeasRelations

La Figure 37 montre le diagramme logique TopologyReporting.

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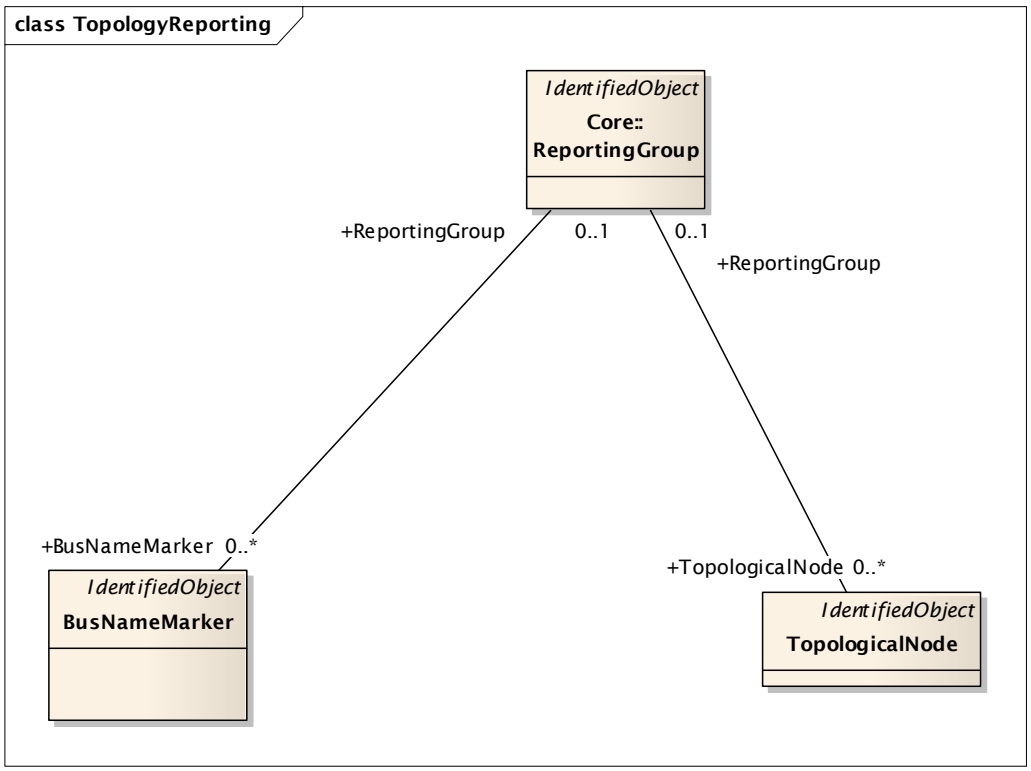

Figure 37 – Diagramme logique Topology::TopologyReporting

La Figure 38 montre le diagramme logique Main.

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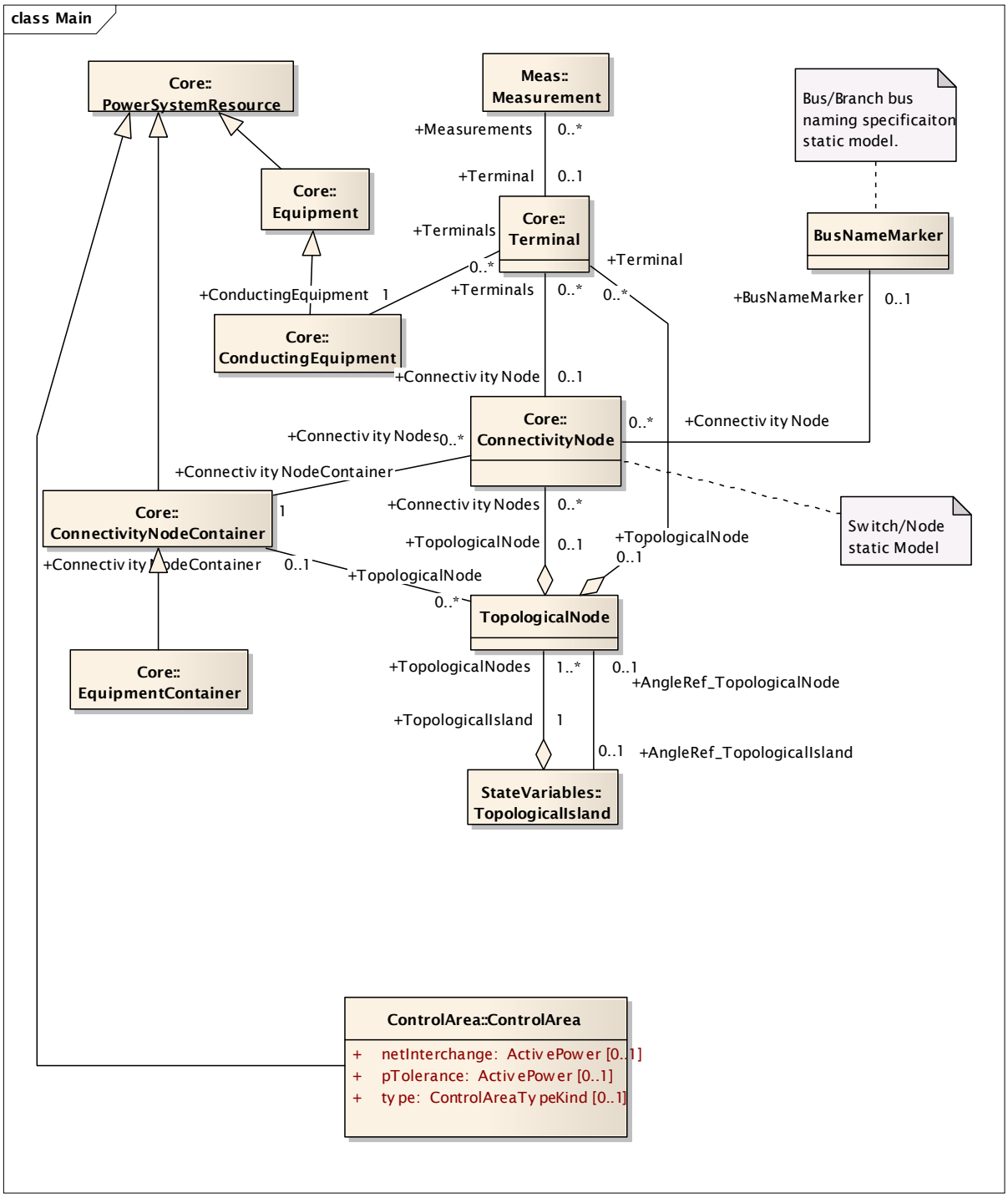

Légende

Anglais	Français
Bus/Branch bus naming specificatIon static model.	Modèle statique de spécification de dénomination de topologie nodale
Switch/Node static model	Modèle statique Commutateur/Nœud

Figure 38 – Diagramme logique Topology::Main

Ce diagramme montre toutes les classes incluses dans le paquetage Topology de même que les classes-clés externes, qui ont des associations avec des classes Topology.

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6.1.6.2 BusNameMarker

Utilisé pour appliquer les noms normalisés d'utilisateur à des bus de topologie. Typiquement utilisé pour la génération de cas "topologie nodale". Associé à un ou plusieurs ConnectivityNode qui sont normalement une partie du nom du bus. Les ConnectivityNode associés doivent être reliés par des commutateurs sans retenue. Pour une configuration de poste en réseau bouclé, tous les nœuds de connectivité de jeux de barres dans l'anneau sont typiquement associés. Pour un disjoncteur et un demi-schéma, les deux jeux de barres seraient associés. Pour un réseau bouclé, tous les jeux de barres seraient associés. Pour une configuration "rectiligne" de jeux de barres, seul le nœud de connectivité au niveau du jeu de barres serait associé.

Le Tableau 133 montre tous les attributs de BusNameMarker.

Tableau 133 – Attributs de Topology::BusNameMarker

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 134 montre toutes les extrémités d'association de BusNameMarker avec d'autres classes.

Tableau 134 – Extrémités d'association de Topology::BusNameMarker avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] ConnectivityNode	ConnectivityNode	La liste des nœuds qui ont le même nom de bus dans la topologie normale. Noter qu'il convient que cette liste de ConnectivityNode soit reliée par des objets dérivés de Switch qui sont normalement fermés
[0..*]	[0..1] ReportingGroup	ReportingGroup	Le groupe de reporting auquel ce BusNameMarker appartient

6.1.6.3 TopologicalNode

Pour un modèle de poste détaillé, un TopologicalNode est un ensemble de noeuds de connectivité qui, dans l'état courant du réseau, sont reliés ensemble par n'importe quelle sorte de commutateurs fermés, y compris des cavaliers. Les nœuds topologiques changent en même temps que l'état du réseau change (que des organes de coupure, des disjoncteurs, etc. changent l'état).

Pour un modèle de planification, les états d'organe de coupure ne sont pas utilisés pour former des TopologicalNodes. Au contraire, ils sont créés ou supprimés manuellement dans un outil constructeur de modèle. Les TopologialNodes maintenus de cette manière sont également appelés "bus".

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Le Tableau 135 montre tous les attributs de TopologicalNode.

Tableau 135 – Attributs de Topology::TopologicalNode

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 136 montre toutes les extrémités d'association de TopologicalNode avec d'autres classes.

Tableau 136 – Extrémités d'association de Topology::TopologicalNode avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..*]	[1..1] TopologicalIsland	TopologicalIsland	Un nœud topologique appartient à un îlot topologique
[0..*]	[0..1] ReportingGroup	ReportingGroup	Le groupe de reporting auquel le nœud topologique appartient
[0..*]	[0..1] ConnectivityNodeContainer	ConnectivityNodeContainer	Le conteneur de nœuds de connectivité auquel le nœud topologique appartient
[0..*]	[0..1] BaseVoltage	BaseVoltage	La tension de base du nœud topologique
[0..1]	[0..*] ConnectivityNodes	ConnectivityNode	Plusieurs ConnectivityNode(s) peuvent s'associer pour ne former qu'un seul TopologicalNode, selon l'état actuel du réseau
[0..1]	[0..1] AngleRef_TopologicalIsland	TopologicalIsland	L'îlot pour lequel le nœud est une référence angulaire. Normalement, il y a un nœud référence angulaire pour chaque îlot
[0..1]	[0..*] Terminal	Terminal	Les bornes associées au nœud topologique. Il peut être utilisé à la place d'un chemin de nœuds de connectivité allant jusqu'à la borne, éliminant donc la nécessité de modéliser les nœuds de connectivité dans certains cas. Noter que si les nœuds de connectivité sont présents dans le modèle, cette association ne serait probablement pas utilisée
[1..1]	[0..1] SvVoltage	SvVoltage	L'état de tension associé au nœud topologique
[1..1]	[0..1] SvInjection	SvInjection	L'état d'injection associé au nœud topologique
[1..1]	[0..1] SvShortCircuit	SvShortCircuit	L'état de court-circuit associé au nœud topologique

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6.1.7 Paquetage Wires

6.1.7.1 Généralités

Extension des paquetages Core et Topology qui modélise les informations des caractéristiques électriques des réseaux Transport et Distribution. Ce paquetage est utilisé par des applications de réseau telles que State Estimation, Load Flow et Optimal Power Flow.

La Figure 39 montre le diagramme logique DocumentationExampleInheritance.

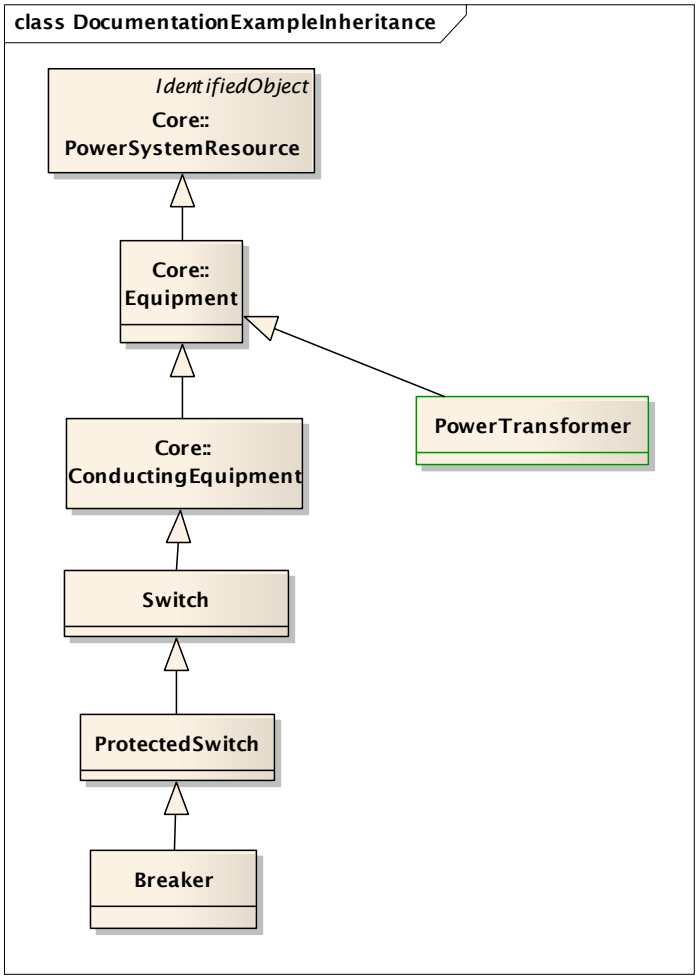

Figure 39 – Diagramme logique Wires::DocumentationExampleInheritance

Ce diagramme un exemple de relations d'héritage dans UML. Ce diagramme sert seulement à venir à l'appui de figures dans la documentation.

La Figure 40 montre le diagramme logique MutualCoupling.

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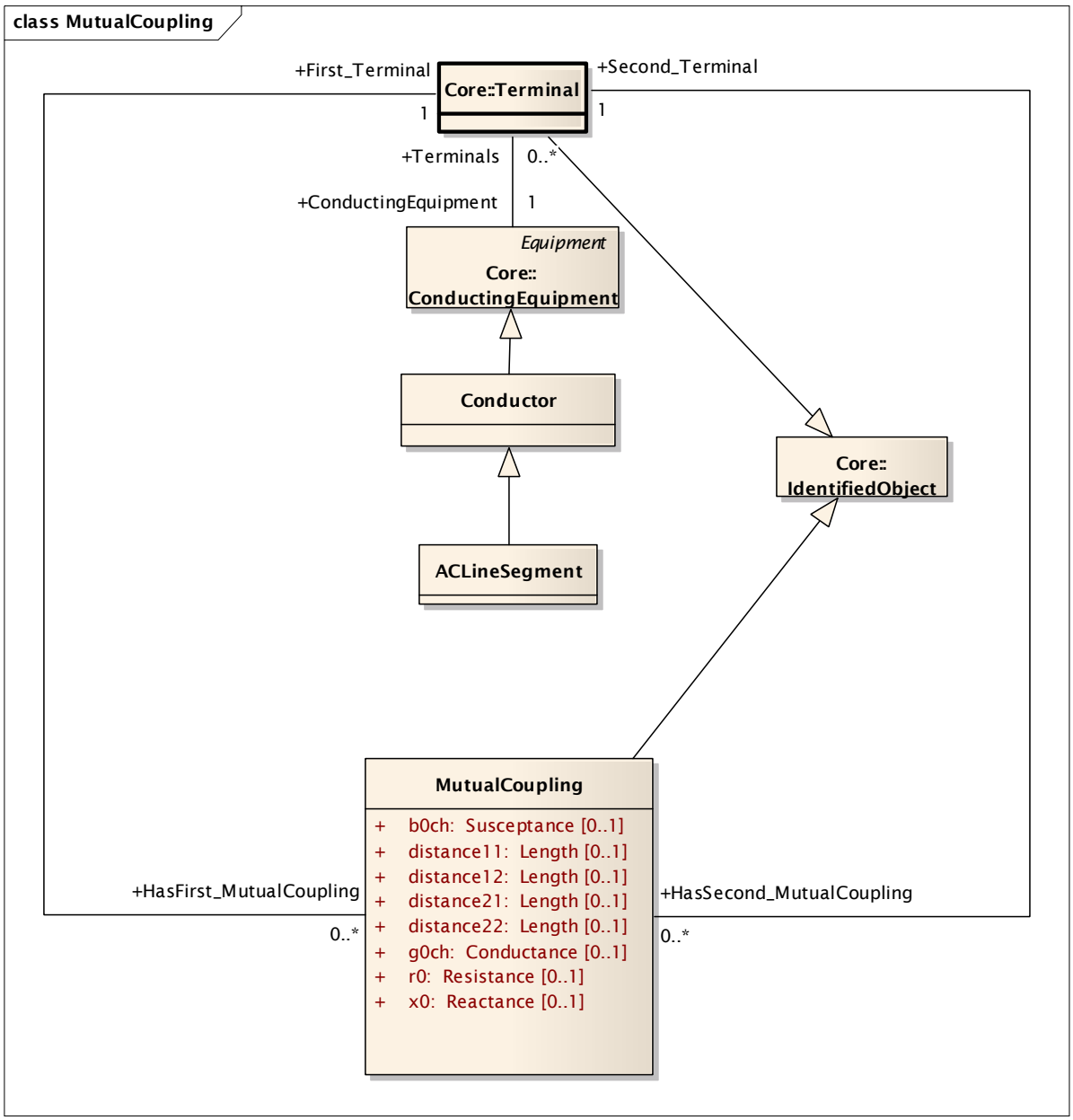

Figure 40 – Diagramme logique Wires::MutualCoupling

La Figure 41 montre le diagramme logique Schedules.

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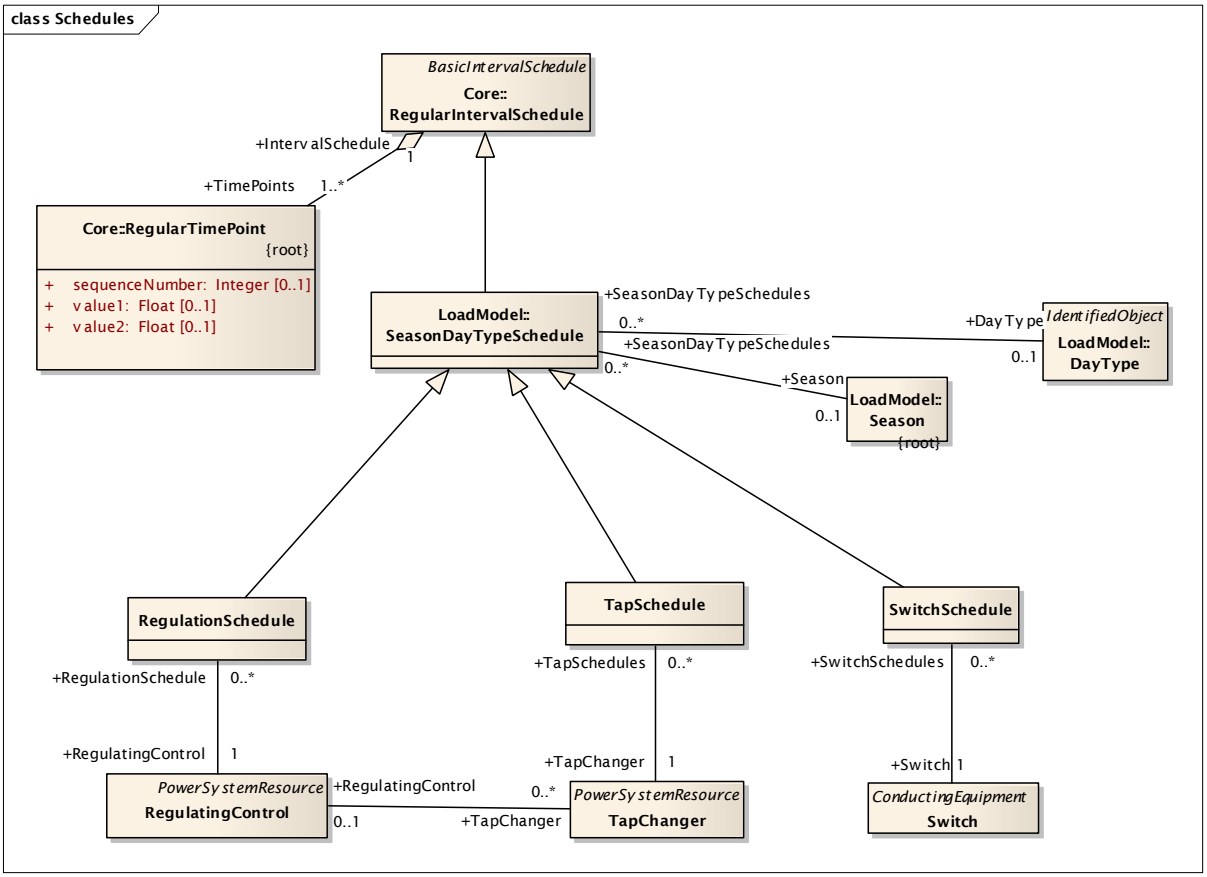

Figure 41 – Diagramme logique Wires::Schedules

La Figure 42 montre le diagramme logique Datatypes.

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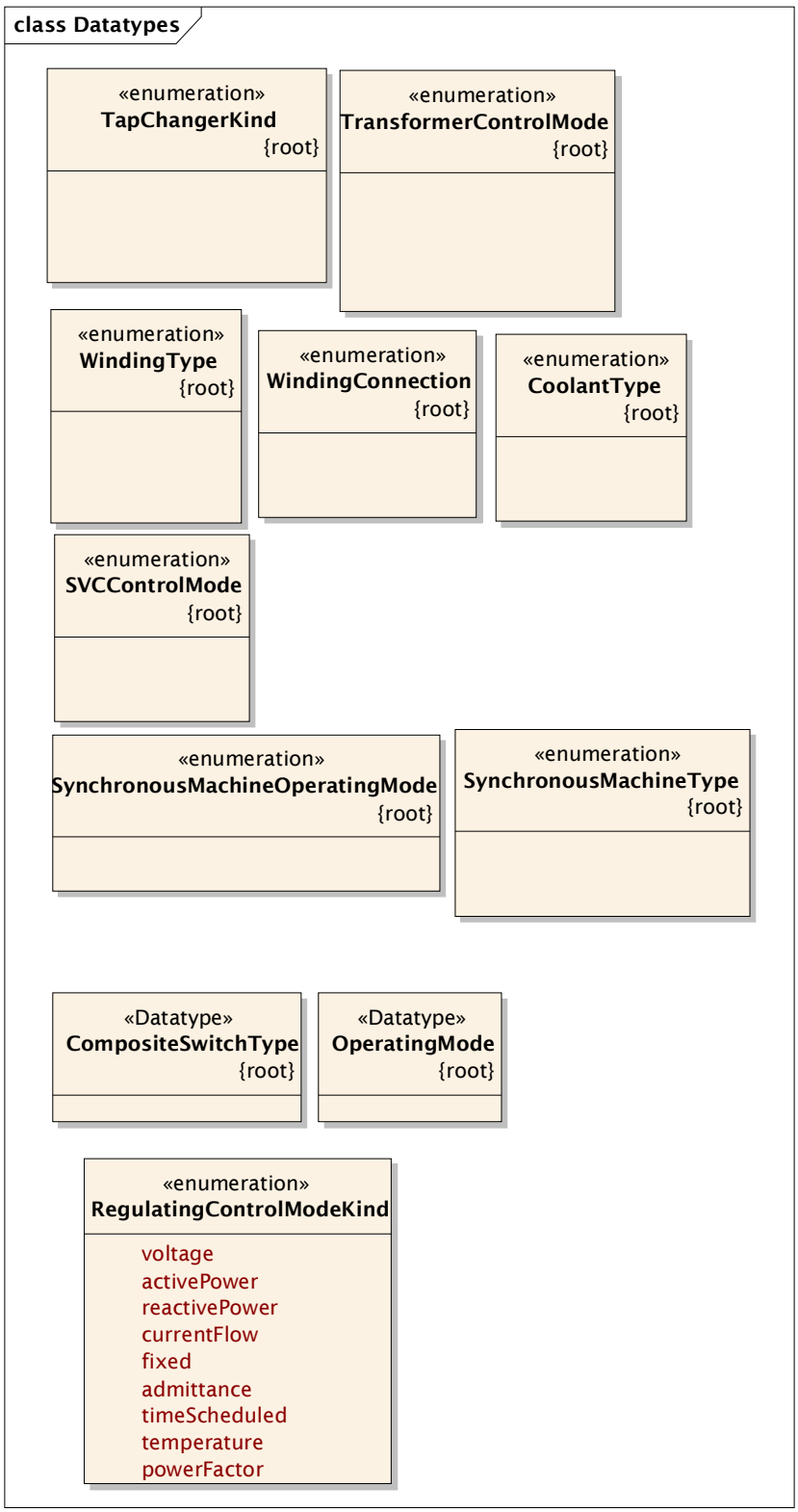

Figure 42 – Diagramme logique Wires::Datatypes

Ce diagramme montre les types de données spécifiques au paquetage Wires.

La Figure 43 montre le diagramme logique InheritanceHierarchy.

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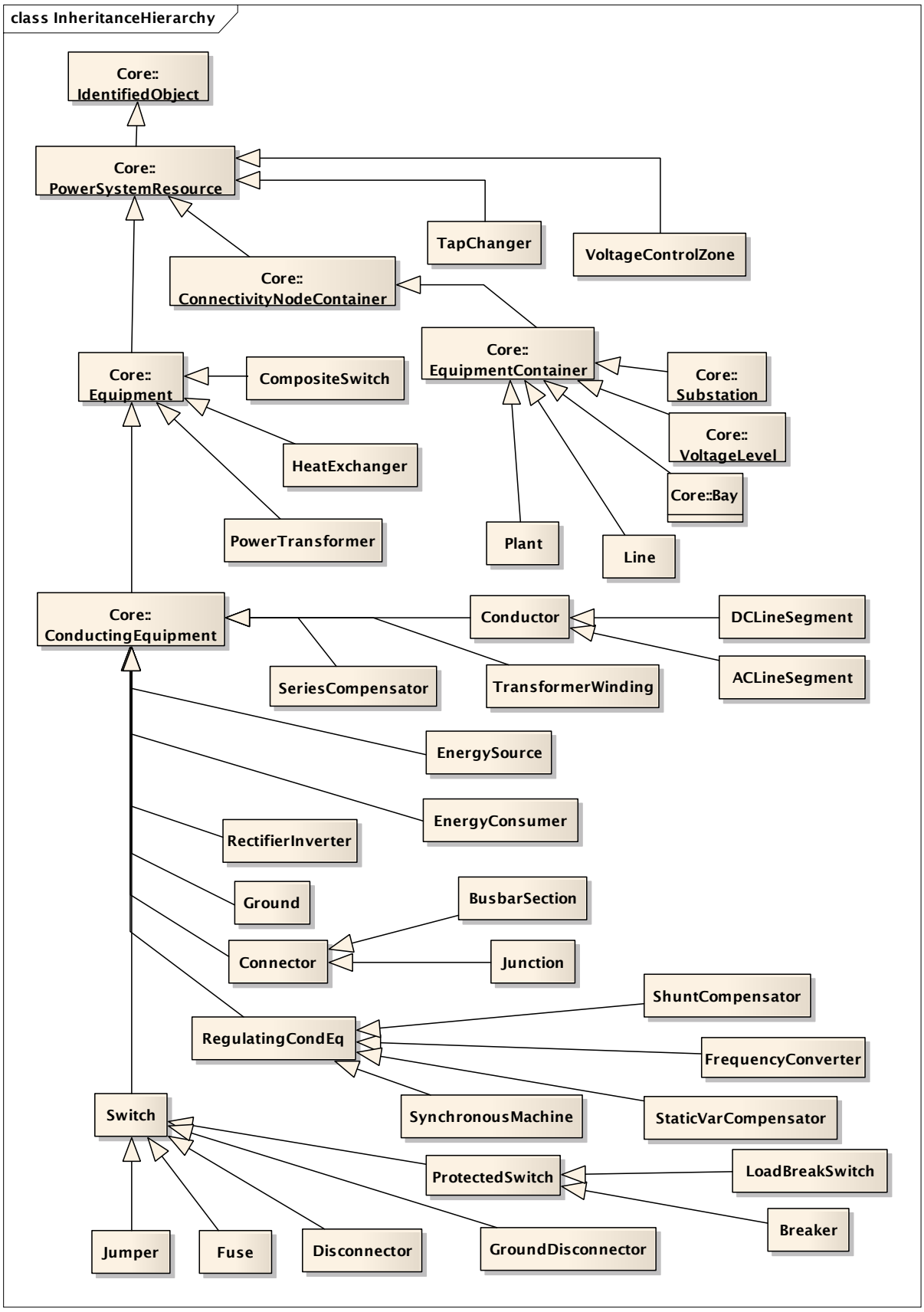

Figure 43 – Diagramme logique Wires::InheritanceHierarchy

Ce diagramme décrit les relations d'héritage entre des classes du paquetage Wires ou liées à celui-ci.

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La Figure 44 montre le diagramme logique LineModel.

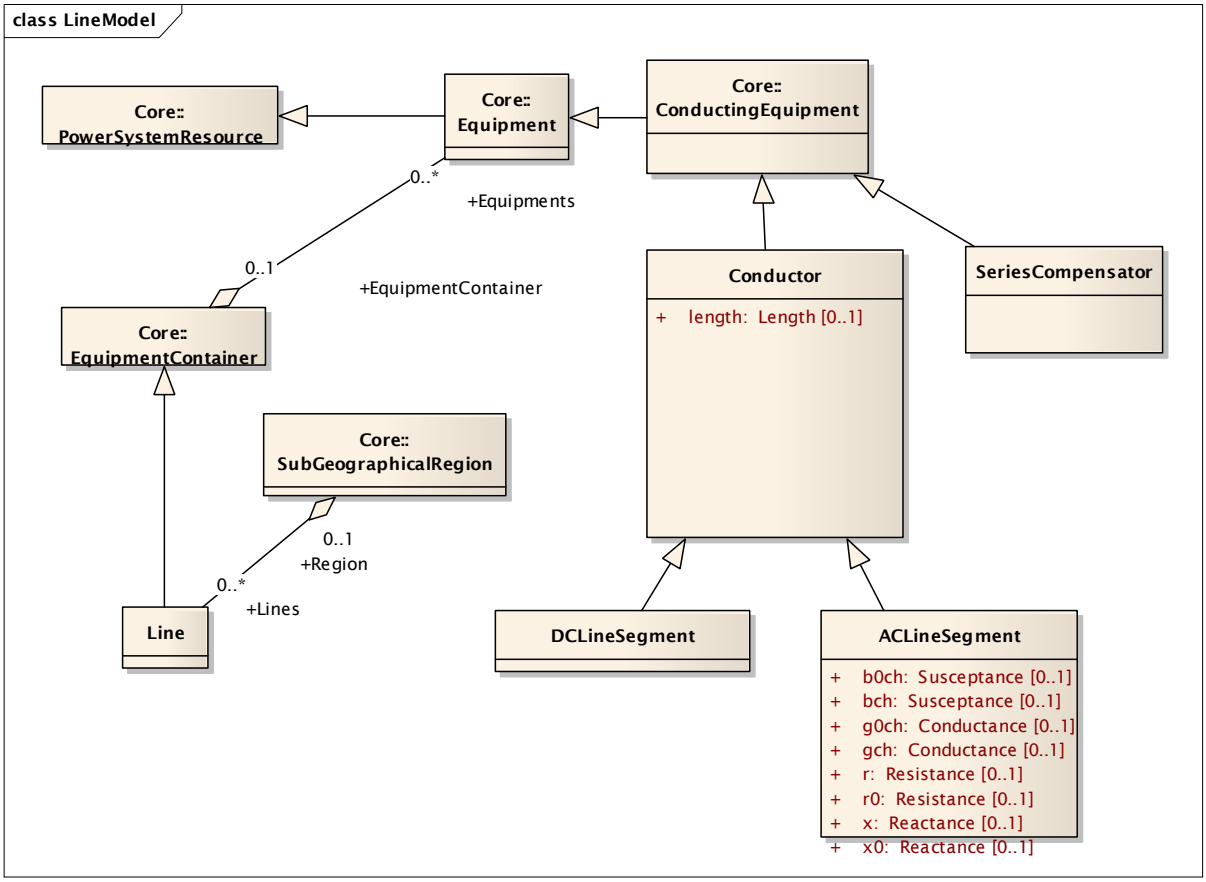

Figure 44 – Diagramme logique Wires::LineModel

Ce diagramme montre toutes les classes liées au modèle de lignes de transport.

La Figure 45 montre le diagramme logique NamingHierarchyPart1.

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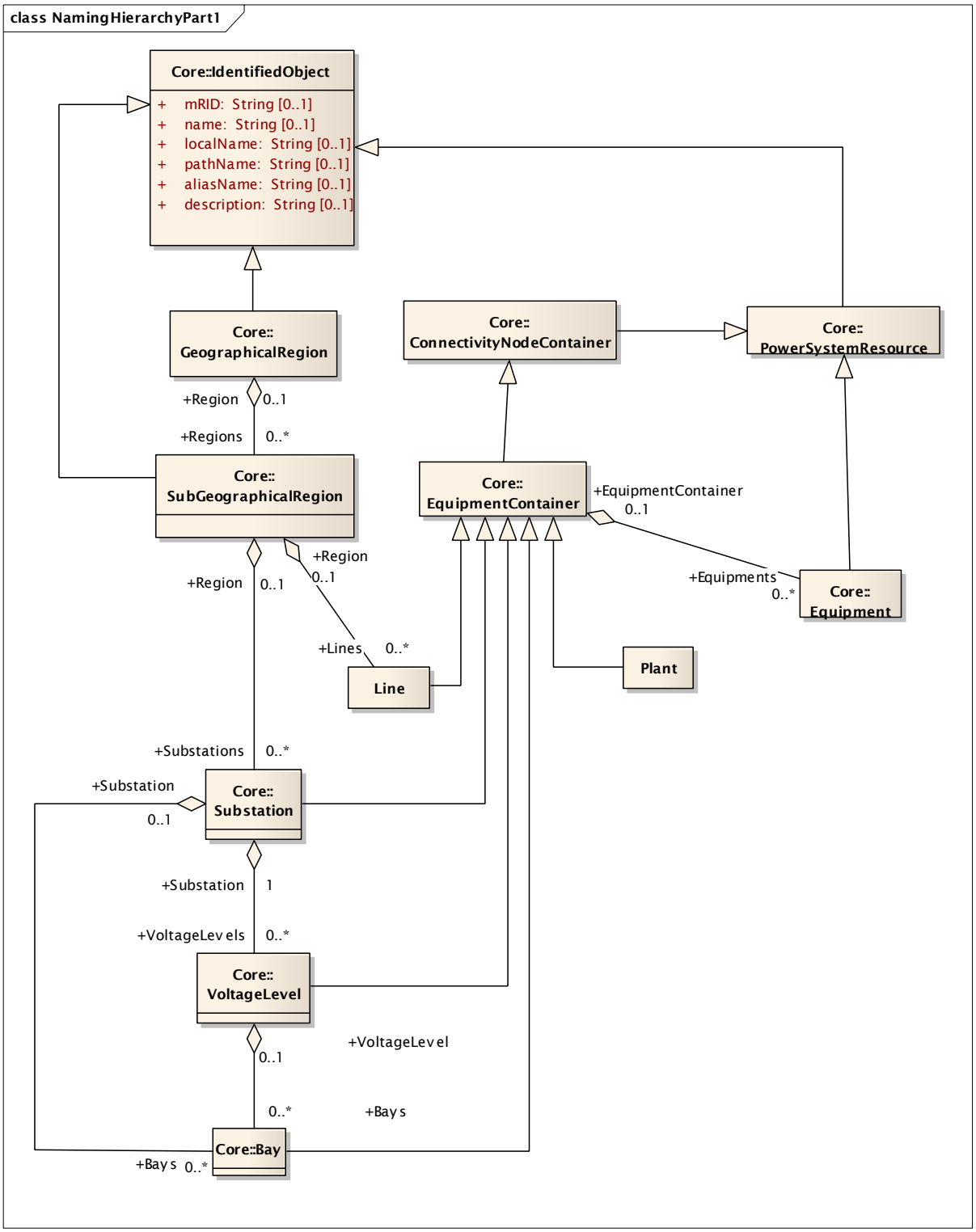

Figure 45 – Diagramme logique Wires::NamingHierarchyPart1

Ce diagramme montre la partie supérieure de la hiérarchie de dénomination. La hiérarchie est une façon d'organiser et de nommer l'équipement. Par conséquent, elle est intimement liée à l'IdentifiedObject et à ses attributs. La classe Equipment est en outre spécialisée en de nombreux sous-types qui sont tous contenus par les sous-classes de EquipmentContainer.

La Figure 46 montre le diagramme logique NamingHierarchyPart2.

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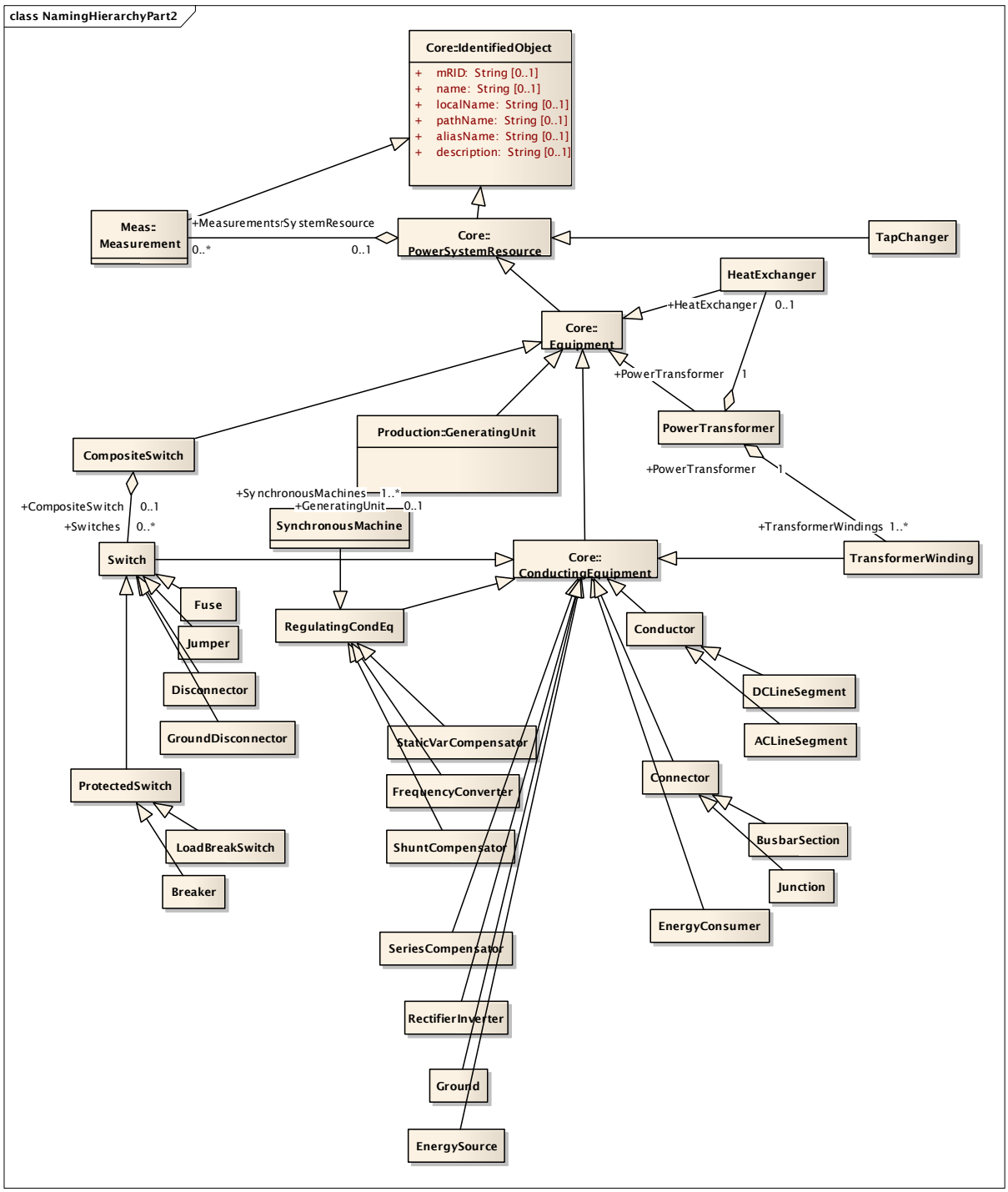

Figure 46 – Diagramme logique Wires::NamingHierarchyPart2

Le diagramme montre la partie inférieure de la hiérarchie de dénomination. Il montre comment la classe Equipment est en outre spécialisée en de nombreux sous-types qui sont tous contenus par les sous-classes de EquipmentContainer. Pour les sous-classes du conteneur d'équipement, se référer à la partie 1 du diagramme.

La Figure 47 montre le diagramme logique RegulatingEquipment.

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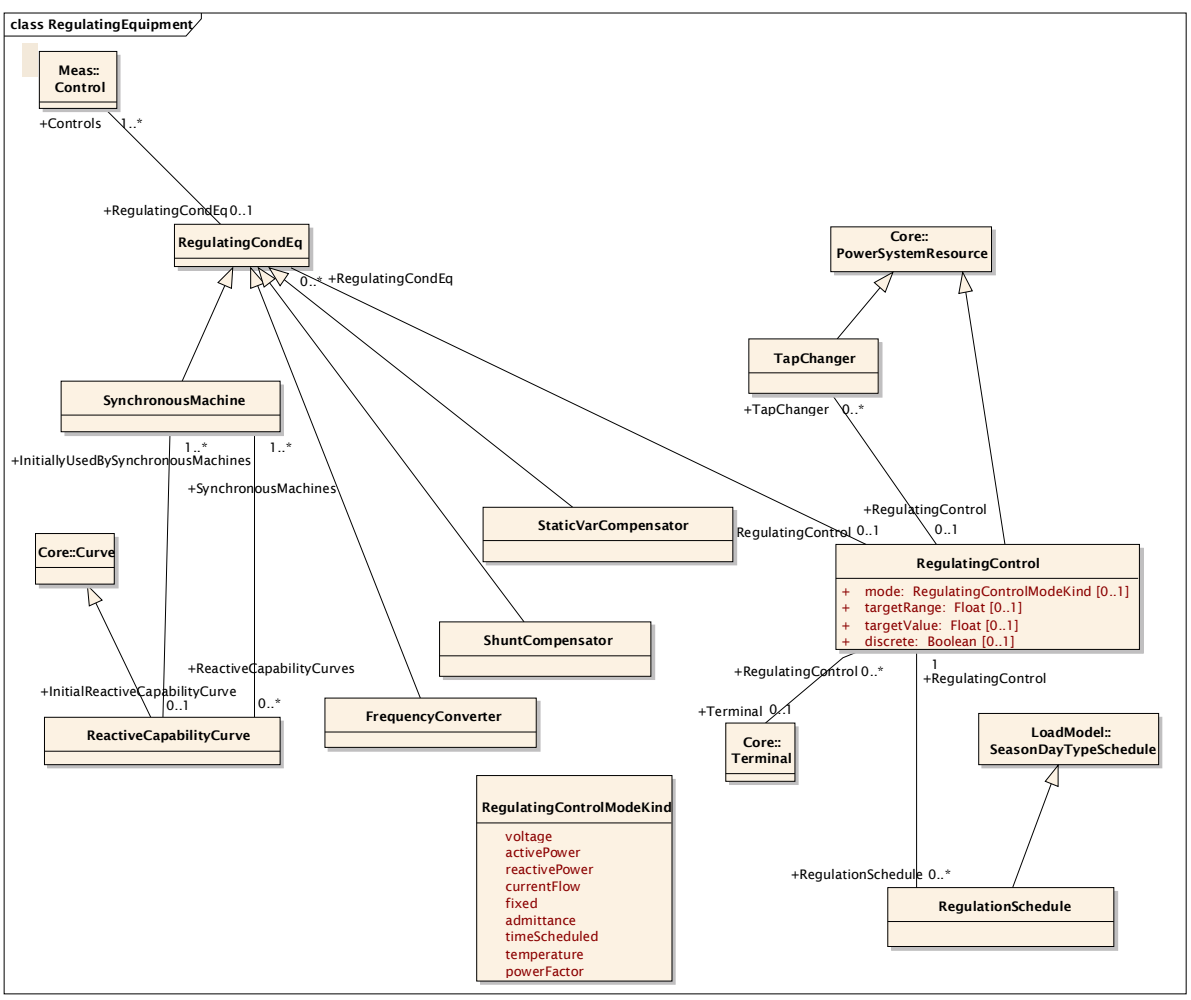

Figure 47 – Diagramme logique Wires::RegulatingEquipment

Le diagramme montre toutes les classes liées à l'équipement de régulation et à la compensation de puissance réactive.

La Figure 48 montre le diagramme logique TransformerModel.

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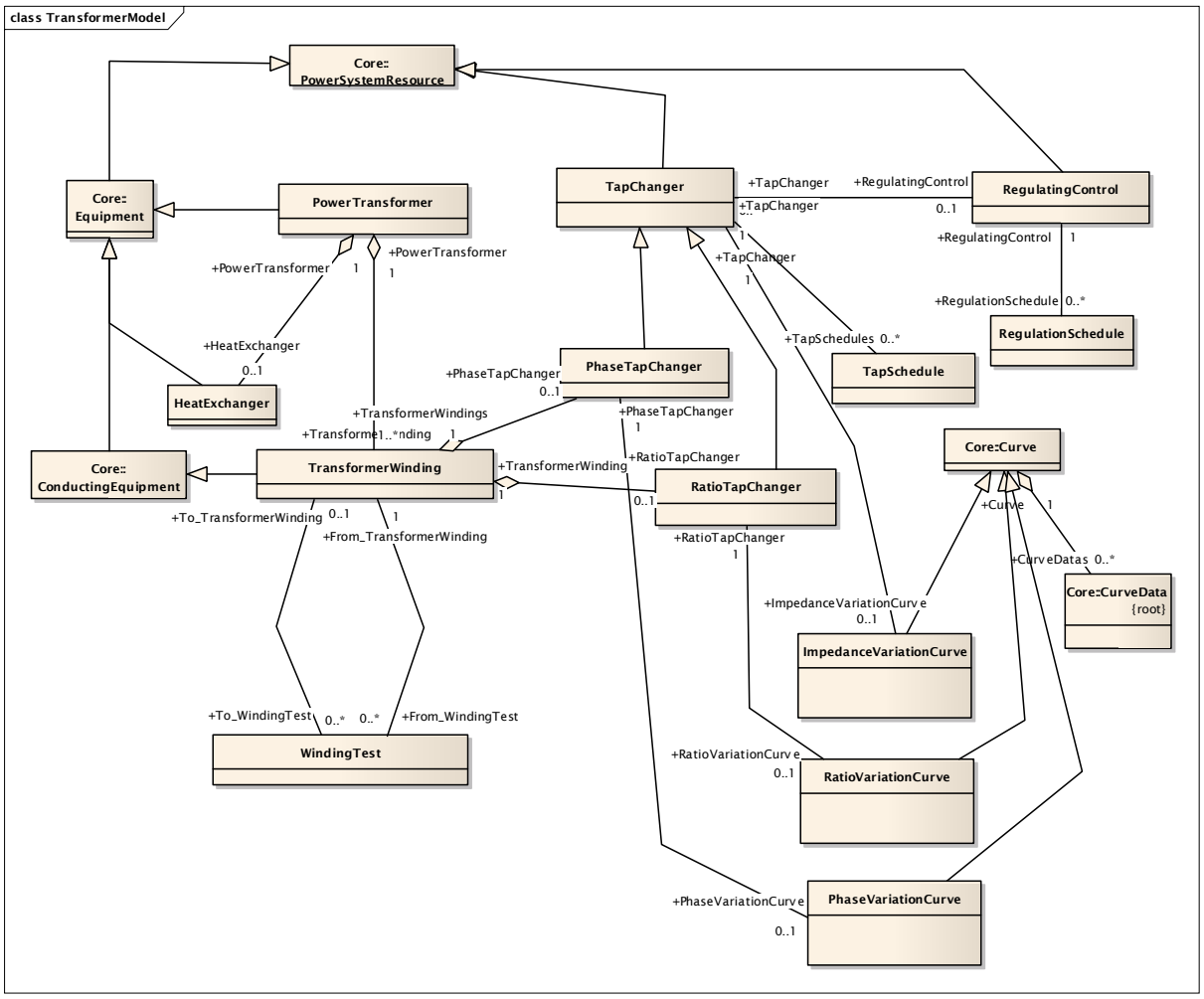

Figure 48 – Diagramme logique Wires::TransformerModel

Ce diagramme montre toutes les classes liées au modèle de transformateurs.

La Figure 49 montre le diagramme logique VoltageControl.

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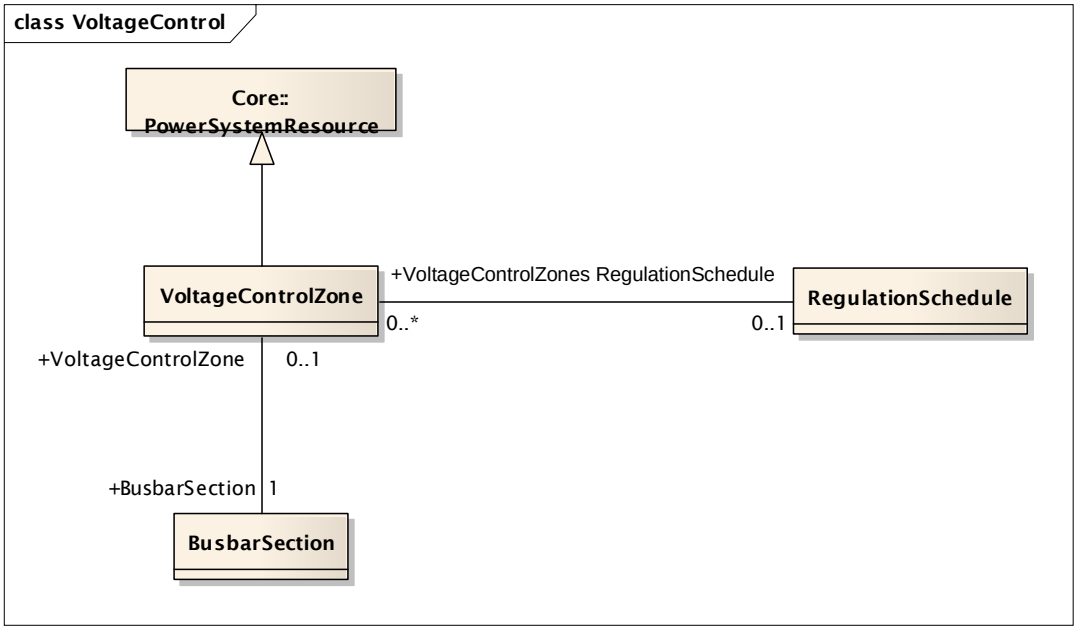

Figure 49 – Diagramme logique Wires::VoltageControl

Ce diagramme montre toutes les classes liées à la régulation régionale de tension.

6.1.7.2 ImpedanceVariationCurve

Une Impedance Variation Curve (courbe de variation d'impédance) décrit la modification des valeurs d'impédance des Transformer Winding (enroulements de transformateur) en relation avec les changements d'échelons des prises. L'échelon de prise est représenté en utilisant xValue, la résistance en utilisant y1value, la réactance en utilisant y2value, et la susceptance d'aimantation en utilisant y3value.

La résistance (r), la réactance (x) et le susceptance d'aimantation (b) du TransformerWinding associé définissent l'impédance lorsque la prise est à l'échelon neutre. Les valeurs de la courbe représentent la variation de l'impédance par rapport aux valeurs à l'échelon neutre. L'impédance à un échelon non neutre est calculée en ajoutant l'impédance à l'échelon neutre (du TransformerWinding) à la valeur delta issue de la courbe.

Le Tableau 137 montre tous les attributs de ImpedanceVariationCurve.

Tableau 137 – Attributs de Wires::ImpedanceVariationCurve

nom	type	description
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject

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nom	type	description
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 138 montre toutes les extrémités d'association de ImpedanceVariationCurve avec d'autres classes.

Tableau 138 – Extrémités d'association de Wires::ImpedanceVariationCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] TapChanger	TapChanger	Une ImpedanceVariationCurve définit les variations d'impédance pour un TapChanger
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.7.3 PhaseVariationCurve

Une Phase Variation Curve (courbe de variation de phase) décrit le déphasage en relation avec les changements d'échelons de prise. L'échelon de prise est représenté en utilisant la xValue et le déphasage est représenté en utilisant y1value.

Le Tableau 139 montre tous les attributs de PhaseVariationCurve.

Tableau 139 – Attributs de Wires::PhaseVariationCurve

nom	type	description
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 140 montre toutes les extrémités d'association de PhaseVariationCurve avec d'autres classes.

Tableau 140 – Extrémités d'association de Wires::PhaseVariationCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] PhaseTapChanger	PhaseTapChanger	Une PhaseVariationCurve définit les variations de déphasage pour un PhaseTapChanger
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.7.4 RatioVariationCurve

Une Ratio Variation Curve (courbe de variation de rapport) décrit la variation du rapport de prise en relation avec les changements d'échelons de prise. L'échelon de prise est représenté en utilisant la xValue et le rapport est représenté en utilisant y1value.

Le Tableau 141 montre tous les attributs de RatioVariationCurve.

Tableau 141 – Attributs de Wires::RatioVariationCurve

nom	type	description
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 142 montre toutes les extrémités d'association de RatioVariationCurve avec d'autres classes.

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Tableau 142 – Extrémités d'association de Wires::RatioVariationCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] RatioTapChanger	RatioTapChanger	Une RatioVariationCurve définit les changements de rapports de prise pour un RatioTapChanger
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.7.5 Enumération RegulatingControlModeKind

Le genre de modèle de régulation. Par exemple: tension de régulation, puissance réactive, puissance active, etc.

Le Tableau 143 montre tous les libellés de RegulatingControlModeKind.

Tableau 143 – Libellés de Wires::RegulatingControlModeKind

libellé	description
voltage	La tension est spécifiée
activePower	La puissance active est spécifiée
reactivePower	La puissance réactive est spécifiée
currentFlow	L'intensité est spécifiée
fixed	Le mode de régulation est fixe et donc pas de régulation
admittance	L'admittance est spécifiée
timeScheduled	La commande s'active/se désactive par heure du jour. Les heures peuvent varier à la fin de semaine ou dans des saisons différentes
temperature	La commande s'active/se désactive en fonction de la température locale (un thermostat)
powerFactor	

6.1.7.6 SwitchSchedule

Programme des positions de commutateur. Si RegularTimePoint.value1 est 0, le commutateur est ouvert. Si 1, le commutateur est fermé.

Le Tableau 144 montre tous les attributs de SwitchSchedule.

Tableau 144 – Attributs de Wires::SwitchSchedule

nom	type	description
timeStep	Seconds	hérité de: RegularIntervalSchedule
endTime	AbsoluteDateTime	hérité de: RegularIntervalSchedule
startTime	AbsoluteDateTime	hérité de: BasicIntervalSchedule
value1Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
value2Unit	UnitSymbol	hérité de: BasicIntervalSchedule

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nom	type	description
value2Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 145 montre toutes les extrémités d'association de SwitchSchedule avec d'autres classes.

Tableau 145 – Extrémités d'association de Wires::SwitchSchedule avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Switch	Switch	Un SwitchSchedule est associé à un Switch
[0..*]	[0..1] DayType	DayType	hérité de: SeasonDayTypeSchedule
[0..*]	[0..1] Season	Season	hérité de: SeasonDayTypeSchedule
[1..1]	[1..*] TimePoints	RegularTimePoint	hérité de: RegularIntervalSchedule

6.1.7.7 ACLineSegment

Un fil ou une combinaison de fils ayant des caractéristiques électriques cohérentes, et formant un seul système électrique, utilisé pour transporter du courant alternatif entre des points du réseau

Le Tableau 146 montre tous les attributs de ACLineSegment.

Tableau 146 – Attributs de Wires::ACLineSegment

nom	type	description
b0ch	Susceptance	Susceptance shunt homopolaire (de chargement), uniformément répartie, de la section de ligne complète
bch	Susceptance	Susceptance shunt directe (de chargement), uniformément répartie, de la section de ligne complète. Cette valeur représente le chargement total sur la longueur totale de la ligne
g0ch	Conductance	Conductance shunt homopolaire (de chargement), uniformément répartie, de la section de ligne complète
gch	Conductance	Conductance shunt directe (de chargement), uniformément répartie, de la section de ligne complète
r	Resistance	Résistance série directe de la section de ligne complète
r0	Resistance	Résistance série homopolaire de la section de ligne complète
x	Reactance	Réactance série directe de la section de ligne

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nom	type	description
		complète
x0	Reactance	Réactance série homopolaire de la section de ligne complète
length	Length	hérité de: Conductor
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 147 montre toutes les extrémités d'association de ACLineSegment avec d'autres classes.

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Tableau 147 – Extrémités d'association de Wires::ACLineSegment avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.8 Breaker

Dispositif de commutation mécanique capable d'établir, de transporter et d'interrompre des courants dans des conditions normales de circuit et aussi d'établir, de transporter pendant une durée déterminée et d'interrompre des courants dans des conditions anormales spécifiées de circuit, par exemple celles d'un court-circuit

Le Tableau 148 montre tous les attributs de Breaker.

Tableau 148 – Attributs de Wires::Breaker

nom	type	description
ratedCurrent	CurrentFlow	Courant de coupure assigné sur défaut
inTransitTime	Seconds	Le délai de transition de l'état ouvert à l'état fermé
normalOpen	Boolean	hérité de: Switch
switchOnCount	Integer	hérité de: Switch
switchOnDate	AbsoluteDateTime	hérité de: Switch
retained	Boolean	hérité de: Switch
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 149 montre toutes les extrémités d'association de Breaker avec d'autres classes.

Tableau 149 – Extrémités d'association de Wires::Breaker avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ProtectedSwitch
[1..1]	[0..*] RecloseSequences	RecloseSequence	hérité de: ProtectedSwitch
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	hérité de: Switch
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	hérité de: Switch
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	hérité de: Switch
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.9 BusbarSection

Conducteur, ou groupe de conducteurs, ayant une impédance négligeable, servant à connecter un autre équipement conducteur au sein d'un seul poste

Les mesures de tension sont habituellement obtenues à partir de VoltageTransformers (transformateurs de tension) connectés à des tronçons de jeu de barres. Un tronçon de jeu de barres peut avoir plusieurs bornes physiques mais, pour l'analyse, elle est modélisée avec une seule borne logique.

Le Tableau 150 montre tous les attributs de BusbarSection.

Tableau 150 – Attributs de Wires::BusbarSection

nom	type	description
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject

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nom	type	description
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 151 montre toutes les extrémités d'association de BusbarSection avec d'autres classes.

Tableau 151 – Extrémités d'association de Wires::BusbarSection avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..1] VoltageControlZone	VoltageControlZone	Une VoltageControlZone (zone de contrôle de la tension) est contrôlée par une BusbarSection (tronçon de jeu de barres) déterminée
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.10 CompositeSwitch

Modèle d'un ensemble de Switches (commutateurs) individuels compris dans la même armoire et si possible, avec des verrouillages qui restreignent la combinaison des positions de commutation. On peut les trouver généralement dans des réseaux électriques de distribution en moyenne tension.

Un CompositeSwitch peut représenter un Ring-Main-Unit (RMU) ou un appareillage de commutation monté par bloc, avec des dispositifs internes primaires tels qu'un jeu de barres interne plus 3 ou 4 interrupteurs internes qui peuvent être individuellement ouverts ou fermés. Un CompositeSwitch et un ensemble de Switches qu'il contient peuvent aussi être utilisés pour représenter un commutateur à plusieurs positions, par exemple un commutateur qui peut connecter un circuit à Ground (la terre), à Open (l'air), ou à Busbar (un jeu de barres).

Le Tableau 152 montre tous les attributs de CompositeSwitch.

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Tableau 152 – Attributs de Wires::CompositeSwitch

nom	type	description
compositeSwitchType	CompositeSwitchType	Un code alphanumérique qui peut être utilisé comme référence pour une information supplémentaire telle que la description du interlocking scheme (schéma de verrouillage), s'il y en a un
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 153 montre toutes les extrémités d'association de CompositeSwitch avec d'autres classes.

Tableau 153 – Extrémités d'association de Wires::CompositeSwitch avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] Switches	Switch	Les Switch contenus dans ce commutateur combiné (Composite switch)
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.11 Type de données CompositeSwitchType

Un code alphanumérique qui peut être utilisé comme référence pour une information supplémentaire telle que la description du interlocking scheme (schéma de verrouillage), s'il y en a un.

Le Tableau 154 montre tous les attributs de CompositeSwitchType.

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Tableau 154 – Attributs de Wires::CompositeSwitchType

nom	type	description
value	String	

6.1.7.12 Conductor

Combinaison de matériau conducteur ayant des caractéristiques électriques cohérentes et formant un seul système électrique, utilisé pour transporter du courant entre des points dans le système électrique.

Le Tableau 155 montre tous les attributs de Conductor.

Tableau 155 – Attributs de Wires::Conductor

nom	type	description
length	Length	Longueur du segment pour calculer les capacités d'une section de ligne
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 156 montre toutes les extrémités d'association de Conductor avec d'autres classes.

Tableau 156 – Extrémités d'association de Wires::Conductor avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource

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[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.13 Connector

Conducteur, ou groupe de conducteurs, d'une impédance négligeable, servant à connecter un autre équipement conducteur au sein d'un seul poste et qui sont modélisés avec une seule borne logique

Le Tableau 157 montre tous les attributs de Connector.

Tableau 157 – Attributs de Wires::Connector

nom	type	description
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 158 montre toutes les extrémités d'association de Connector avec d'autres classes.

Tableau 158 – Extrémités d'association de Wires::Connector avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource

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[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.14 Enumération CoolantType

Méthode de refroidissement d'une machine

Le Tableau 159 montre tous les libellés de CoolantType.

Tableau 159 – Libellés de Wires::CoolantType

libellé	description
air	
hydrogenGas	
water	

6.1.7.15 DCLineSegment

Fil ou combinaison de fils non isolés les uns des autres, ayant des caractéristiques électriques cohérentes, utilisés pour transporter du courant continu entre des points dans la section courant continu du système électrique.

Le Tableau 160 montre tous les attributs de DCLineSegment.

Tableau 160 – Attributs de Wires::DCLineSegment

nom	type	description
dcSegmentInductance	Inductance	Inductance du segment de ligne courant continu
dcSegmentResistance	Resistance	Résistance du segment de ligne courant continu
length	Length	hérité de: Conductor
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 161 montre toutes les extrémités d'association de DCLineSegment avec d'autres classes.

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Tableau 161 – Extrémités d'association de Wires::DCLineSegment avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.16 Disconnector

Dispositif de commutation mécanique exploité manuellement ou par un moteur utilisé pour changer les connexions dans un circuit ou pour isoler un circuit ou un équipement d'une source d'électricité. Les circuits doivent être ouverts ou fermés quand un courant négligeable est interrompu ou produit.

Le Tableau 162 montre tous les attributs de Disconnector.

Tableau 162 – Attributs de Wires::Disconnector

nom	type	description
normalOpen	Boolean	hérité de: Switch
switchOnCount	Integer	hérité de: Switch
switchOnDate	AbsoluteDateTime	hérité de: Switch
retained	Boolean	hérité de: Switch
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 163 montre toutes les extrémités d'association de Disconnector avec d'autres classes.

Tableau 163 – Extrémités d'association de Wires::Disconnector avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	hérité de: Switch
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	hérité de: Switch
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	hérité de: Switch
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.17 EnergyConsumer

Consommateur générique d'énergie - un point de consommation sur le modèle de système électrique.

Le Tableau 164 montre tous les attributs de EnergyConsumer.

Tableau 164 – Attributs de Wires::EnergyConsumer

nom	type	description
customerCount	Integer	Nombre de clients individuels représentés par cette Demand (demande)
pfixed	ActivePower	Puissance active de la charge dont la grandeur est fixe
pfixedPct	PerCent	Puissance active fixe exprimée en pourcentage de la puissance active fixe du groupe de charge
qfixed	ReactivePower	Puissance réactive de la charge dont la grandeur est fixe
qfixedPct	PerCent	Puissance réactive fixe exprimée en pourcentage de la puissance réactive fixe du groupe de charge
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment

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nom	type	description
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 165 montre toutes les extrémités d'association de EnergyConsumer avec d'autres classes.

Tableau 165 – Extrémités d'association de Wires::EnergyConsumer avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] LoadResponse	LoadResponseCharacteristic	La caractéristique de réponse de charge pour cette charge
[1..*]	[0..1] PowerCutZone	PowerCutZone	Un consommateur d'énergie est affecté à une zone de coupure de puissance
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.18 EnergySource

Équivalent générique pour un fournisseur d'énergie sur un niveau de tension de transport ou de distribution

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Le Tableau 166 montre tous les attributs de EnergySource.

Tableau 166 – Attributs de Wires::EnergySource

nom	type	description
xn	Reactance	Réactance inverse de Thevenin
rn	Resistance	Résistance inverse de Thevenin
nominalVoltage	Voltage	Tension nominale phase à phase
x	Reactance	Réactance directe de Thevenin
r	Resistance	Résistance directe de Thevenin
voltageAngle	AngleRadians	Angle de phase d'un circuit à phase ouvert
voltageMagnitude	Voltage	Valeur de la tension phase à phase d'un circuit ouvert
x0	Reactance	Réactance homopolaire de Thevenin
r0	Resistance	Résistance homopolaire de Thevenin
activePower	ActivePower	Charge de source haute tension
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 167 montre toutes les extrémités d'association de EnergySource avec d'autres classes.

Tableau 167 – Extrémités d'association de Wires::EnergySource avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource

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[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.19 FrequencyConverter

Un dispositif pour convertir une fréquence en une autre (par exemple, fréquence F1 en F2) comprend une paire d'instances FrequencyConverter. L'une convertit de F1 en CC (courant continu), l'autre de CC en F2.

Le Tableau 168 montre tous les attributs de FrequencyConverter.

Tableau 168 – Attributs de Wires::FrequencyConverter

nom	type	description
Fréquence	Fréquence	Fréquence du côté CA (courant alternatif)
maxP	ActivePower	La puissance active maximale du côté CC à laquelle il convient que le convertisseur de fréquence fonctionne
maxU	Voltage	La tension maximale du côté CC à laquelle il convient que le convertisseur de fréquence fonctionne
minP	ActivePower	La puissance active minimale du côté CC à laquelle il convient que le convertisseur de fréquence fonctionne
minU	Voltage	La tension minimale du côté CC à laquelle il convient que le convertisseur de fréquence fonctionne
operatingMode	OperatingMode	Mode de fonctionnement du convertisseur de fréquence
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 169 montre toutes les extrémités d'association de FrequencyConverter avec d'autres classes.

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Tableau 169 – Extrémités d'association de Wires::FrequencyConverter avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] RegulatingControl	RegulatingControl	hérité de: RegulatingCondEq
[0..1]	[1..*] Controls	Control	hérité de: RegulatingCondEq
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.20 Fuse

Dispositif de protection contre les surintensités avec un fusible à ouverture de circuit qui est chauffé et rompu quand une surintensité le traverse. Un fusible est considéré comme un organe de coupure parce qu'il interrompt le courant.

Le Tableau 170 montre tous les attributs de Fuse.

Tableau 170 – Attributs de Wires::Fuse

nom	type	description
ratingCurrent	CurrentFlow	Courant de coupure assigné sur défaut
normalOpen	Boolean	hérité de: Switch
switchOnCount	Integer	hérité de: Switch
switchOnDate	AbsoluteDateTime	hérité de: Switch
retained	Boolean	hérité de: Switch
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 171 montre toutes les extrémités d'association de Fuse avec d'autres classes.

Tableau 171 – Extrémités d'association de Wires::Fuse avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	hérité de: Switch
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	hérité de: Switch
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	hérité de: Switch
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.21 Ground

Point commun pour connecter un équipement conducteur mis à la terre tel que des condensateurs-shunts. Le modèle de réseau peut avoir plus d'une mise à la terre.

Le Tableau 172 montre tous les attributs de Ground.

Tableau 172 – Attributs de Wires::Ground

nom	type	description
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 173 montre toutes les extrémités d'association de Ground avec d'autres classes.

Tableau 173 – Extrémités d'association de Wires::Ground avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.22 GroundDisconnector

Un dispositif mécanique de commutation, motorisé ou opéré manuellement, utilisé pour isoler un circuit ou un équipement de Ground (terre).

Le Tableau 174 montre tous les attributs de GroundDisconnector.

Tableau 174 – Attributs de Wires::GroundDisconnector

nom	type	description
normalOpen	Boolean	hérité de: Switch
switchOnCount	Integer	hérité de: Switch
switchOnDate	AbsoluteDateTime	hérité de: Switch
retained	Boolean	hérité de: Switch
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 175 montre toutes les extrémités d'association de GroundDisconnector avec d'autres classes.

Tableau 175 – Extrémités d'association de Wires::GroundDisconnector avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	hérité de: Switch
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	hérité de: Switch
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	hérité de: Switch
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.23 HeatExchanger

Équipement pour le refroidissement de l'équipement électrique et l'extraction de chaleur.

Le Tableau 176 montre tous les attributs de HeatExchanger.

Tableau 176 – Attributs de Wires::HeatExchanger

nom	type	description
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 177 montre toutes les extrémités d'association de HeatExchanger avec d'autres classes.

Tableau 177 – Extrémités d'association de Wires::HeatExchanger avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] PowerTransformer	PowerTransformer	Un transformateur peut comporter un échangeur de chaleur
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.24 Jumper

Courte section de conducteur avec une impédance négligeable pouvant être enlevée et remplacée manuellement si le circuit n'est plus alimenté. Noter que les branches d'impédance nulle peuvent être modélisées par un ACLineSegment (segment de ligne de courant alternatif) avec un ConductorType (type de conducteur) d'impédance nulle.

Le Tableau 178 montre tous les attributs de Jumper.

Tableau 178 – Attributs de Wires::Jumper

nom	type	description
normalOpen	Boolean	hérité de: Switch
switchOnCount	Integer	hérité de: Switch
switchOnDate	AbsoluteDateTime	hérité de: Switch
retained	Boolean	hérité de: Switch
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 179 montre toutes les extrémités d'association de Jumper avec d'autres classes.

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Tableau 179 – Extrémités d'association de Wires::Jumper avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	hérité de: Switch
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	hérité de: Switch
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	hérité de: Switch
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.25 Junction

Point auquel un ou plusieurs équipements conducteurs sont connectés avec une résistance homopolaire.

Le Tableau 180 montre tous les attributs de Junction.

Tableau 180 – Attributs de Wires::Junction

nom	type	description
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 181 montre toutes les extrémités d'association de Junction avec d'autres classes.

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Tableau 181 – Extrémités d'association de Wires::Junction avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.26 Line

Contient des équipements au-delà du poste appartenant à une ligne de transport d'énergie électrique.

Le Tableau 182 montre tous les attributs de Line.

Tableau 182 – Attributs de Wires::Line

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 183 montre toutes les extrémités d'association de Line avec d'autres classes.

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Tableau 183 – Extrémités d'association de Wires::Line avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] Region	SubGeographicalRegion	Une Line (ligne) peut être contenue par une SubGeographical Region
[0..1]	[0..*] Equipments	Equipment	hérité de: EquipmentContainer
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	hérité de: ConnectivityNodeContainer
[0..1]	[0..*] TopologicalNode	TopologicalNode	hérité de: ConnectivityNodeContainer
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.27 LoadBreakSwitch

Dispositif de commutation mécanique capable de produire, transporter et interrompre des courants en conditions normales de fonctionnement.

Le Tableau 184 montre tous les attributs de LoadBreakSwitch.

Tableau 184 – Attributs de Wires::LoadBreakSwitch

nom	type	description
ratedCurrent	CurrentFlow	Courant nominal admissible d'un fil ou d'un câble dans des conditions thermiques énoncées
normalOpen	Boolean	hérité de: Switch
switchOnCount	Integer	hérité de: Switch
switchOnDate	AbsoluteDateTime	hérité de: Switch
retained	Boolean	hérité de: Switch
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 185 montre toutes les extrémités d'association de LoadBreakSwitch avec d'autres classes.

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Tableau 185 – Extrémités d'association de Wires::LoadBreakSwitch avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ProtectedSwitch
[1..1]	[0..*] RecloseSequences	RecloseSequence	hérité de: ProtectedSwitch
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	hérité de: Switch
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	hérité de: Switch
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	hérité de: Switch
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.28 MutualCoupling

Cette classe représente le couplage mutuel de ligne homopolaire.

Le Tableau 186 montre tous les attributs de MutualCoupling.

Tableau 186 – Attributs de Wires::MutualCoupling

nom	type	description
b0ch	Susceptance	Susceptance shunt de couplage mutuel homopolaire (de chargement), uniformément répartie, de la section de ligne complète
distance11	Length	Distance entre la première borne spécifiée de la ligne et le début de la région couplée
distance12	Length	Distance entre la première borne spécifiée de la ligne et la fin de la région couplée
distance21	Length	Distance entre la deuxième borne spécifiée de la ligne et le début de la région couplée
distance22	Length	Distance entre la deuxième borne spécifiée de la ligne et la fin de la région couplée
g0ch	Conductance	Conductance shunt de couplage mutuel homopolaire (de chargement), uniformément répartie, de la section de ligne complète

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nom	type	description
r0	Resistance	Couplage d'impédance mutuel homopolaire entre branches, résistance
x0	Reactance	Couplage d'impédance mutuel homopolaire entre branches, réactance
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 187 montre toutes les extrémités d'association de MutualCoupling avec d'autres classes.

Tableau 187 – Extrémités d'association de Wires::MutualCoupling avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Second_Terminal	Terminal	La borne de départ pour le calcul des distances le long de la deuxième branche du couplage mutuel
[0..*]	[1..1] First_Terminal	Terminal	La borne de départ pour le calcul des distances le long de la première branche du couplage mutuel. Normalement, le couplage mutuel MutualCoupling ne serait utilisé que pour des bornes de segments de ligne CA (en courant alternatif). Il convient que les première et seconde bornes d'un couplage mutuel pointent vers des segments de ligne CA différents

6.1.7.29 Type de données OperatingMode

Nom littéral d'un mode opératoire.

Le Tableau 188 montre tous les attributs de OperatingMode.

Tableau 188 – Attributs de Wires::OperatingMode

nom	type	description
value	String	

6.1.7.30 PhaseTapChanger

Une spécialisation d'un changeur de prise de tension qui a une modélisation détaillée pour des capacités de déphasage. En général, un changeur de prise déphaseur est aussi un transformateur de grandeur de tension. Les modèles de changeurs de prise transformateurs symétriques et asymétriques sont définis ici.

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Le Tableau 189 montre tous les attributs de PhaseTapChanger.

Tableau 189 – Attributs de Wires::PhaseTapChanger

nom	type	description
nominalVoltageOutOfPhase	Voltage	Semblable à TapChanger.nominalVoltage, mais il s'agit de la tension nominale dans l'enroulement en discordance de phases au niveau de l'échelon de prise nominal. Un cas typique peut avoir une tension nulle à l'échelon nominal, indiquant l'absence de déphasage à la tension nominale
phaseTapChangerType	PhaseTapChangerKind	Le type de construction de déphaseur
stepPhaseShiftIncrement	AngleDegrees	Déphasage par position du changeur. Une valeur positive indique un déphasage positif depuis l'enroulement où la prise est située jusqu'à l'autre enroulement (pour un transformateur à deux enroulements). L'incrément de déphasage réel pourrait être calculé plus précisément à partir des modèles symétriques ou asymétriques ou à partir d'une consultation de la table des échelons de prise si ceux-ci sont disponibles
voltageStepIncrementOutOfPhase	Voltage	L'incrément d'échelon de tension sur l'enroulement en discordance de phases. Cet échelon de tension sur l'enroulement en discordance de phases du déphaseur. Semblable à TapChanger.voltageStepIncrement, mais elle n'est appliquée qu'à l'enroulement en discordance de phases
windingConnectionAngle	AngleDegrees	L'angle de phase entre l'enroulement en phase et l'enroulement en discordance de phases utilisé pour créer le déphasage. Il n'est possible d'avoir un transformateur symétrique que si cet angle est de 90 degrés
xStepMax	Reactance	La réactance à l'échelon de prise maximal
xStepMin	Reactance	La réactance à l'échelon de prise minimal
highStep	Integer	hérité de: TapChanger
initialDelay	Seconds	hérité de: TapChanger
lowStep	Integer	hérité de: TapChanger
ltcFlag	Boolean	hérité de: TapChanger
neutralStep	Integer	hérité de: TapChanger
neutralU	Voltage	hérité de: TapChanger
normalStep	Integer	hérité de: TapChanger
regulationStatus	Boolean	hérité de: TapChanger
stepVoltageIncrement	PerCent	hérité de: TapChanger
subsequentDelay	Seconds	hérité de: TapChanger
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 190 montre toutes les extrémités d'association de PhaseTapChanger avec d'autres classes.

Tableau 190 – Extrémités d'association de Wires::PhaseTapChanger avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] TransformerWinding	TransformerWinding	L'enroulement de transformateur auquel le changeur de prise de phase appartient
[1..1]	[0..1] PhaseVariationCurve	PhaseVariationCurve	Un PhaseTapChanger peut avoir une PhaseVariationCurve associée pour définir des variations du déphasage en fonction des variations de l'échelon de prise
[0..1]	[1..1] Winding	DistributionTransformerWinding	L'enroulement de transformateur auquel ce changeur de prise de phase appartient
[0..*]	[0..1] RegulatingControl	RegulatingControl	hérité de: TapChanger
[1..1]	[0..1] SvTapStep	SvTapStep	hérité de: TapChanger
[1..1]	[0..1] ImpedanceVariationCurve	ImpedanceVariationCurve	hérité de: TapChanger
[1..1]	[0..*] TapSchedules	TapSchedule	hérité de: TapChanger
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.31 Enumération PhaseTapChangerKind

Le type de construction du changeur de prise déphaseur.

Le Tableau 191 montre tous les libellés de PhaseTapChangerKind.

Tableau 191 – Libellés de Wires::PhaseTapChangerKind

libellé	description
asymmetrical	Construction de déphaseur asymétrique. Le type de construction asymétrique amène le rapport de tensions à varier à mesure que le déphasage varie. Un déphaseur asymétrique peut avoir l'enroulement en discordance de phases raccordé à 90° ou autrement
symmetrical	La construction de déphaseur est symétrique. Une construction symétrique rend constants le rapport des nombres de spires et la transformation de l'amplitude de la tension alors que la phase de la tension est décalée. Une construction symétrique exige typiquement que l'enroulement en discordance de phases soit raccordé à 90°
unknown	Type de construction inconnu

6.1.7.32 Plant

Une Plant (une centrale) est une collection d'équipements utilisés à des fins de production.

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Le Tableau 192 montre tous les attributs de Plant.

Tableau 192 – Attributs de Wires::Plant

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 193 montre toutes les extrémités d'association de Plant avec d'autres classes.

Tableau 193 – Extrémités d'association de Wires::Plant avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] Equipments	Equipment	hérité de: EquipmentContainer
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	hérité de: ConnectivityNodeContainer
[0..1]	[0..*] TopologicalNode	TopologicalNode	hérité de: ConnectivityNodeContainer
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.33 PowerTransformer

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 de puissance active).

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Le Tableau 194 montre tous les attributs de PowerTransformer.

Tableau 194 – Attributs de Wires::PowerTransformer

nom	type	description
bmagSat	PerCent	Susceptance d'aimantation du shunt central dans la zone de saturation
magBaseU	Voltage	Tension de référence à laquelle les mesures de saturation d'aimantation ont été effectuées
magSatFlux	PerCent	Niveau de flux au coude de la courbe de saturation et d'aimantation du cœur
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 195 montre toutes les extrémités d'association de PowerTransformer avec d'autres classes.

Tableau 195 – Extrémités d'association de Wires::PowerTransformer avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[1..*] TransformerWindings	TransformerWinding	Un transformateur comporte des enroulements
[1..1]	[0..1] HeatExchanger	HeatExchanger	Un transformateur peut comporter un échangeur de chaleur
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.34 ProtectedSwitch

Un ProtectedSwitch (un commutateur protégé) est un dispositif de commutation qui peut être actionné par un ProtectionEquipment (un équipement de protection).

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Le Tableau 196 montre tous les attributs de ProtectedSwitch.

Tableau 196 – Attributs de Wires::ProtectedSwitch

nom	type	description
normalOpen	Boolean	hérité de: Switch
switchOnCount	Integer	hérité de: Switch
switchOnDate	AbsoluteDateTime	hérité de: Switch
retained	Boolean	hérité de: Switch
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 197 montre toutes les extrémités d'association de ProtectedSwitch avec d'autres classes.

Tableau 197 – Extrémités d'association de Wires::ProtectedSwitch avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	Les équipements de protection qui font fonctionner ce ProtectedSwitch
[1..1]	[0..*] RecloseSequences	RecloseSequence	Un disjoncteur peut avoir zéro à plusieurs réenclenchements automatiques après un déclenchement
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	hérité de: Switch
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	hérité de: Switch
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	hérité de: Switch
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource

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[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.35 RatioTapChanger

Un changeur de prise qui change le rapport de tensions ayant un impact sur la grandeur de la tension, mais pas directement sur l'angle de phase à travers le transformateur.

Le Tableau 198 montre tous les attributs de RatioTapChanger.

Tableau 198 – Attributs de Wires::RatioTapChanger

nom	type	description
tculControlMode	TransformerControlMode	Spécifie le mode de commande de régulation (tension ou puissance réactive) du RatioTapChanger
highStep	Integer	hérité de: TapChanger
initialDelay	Seconds	hérité de: TapChanger
lowStep	Integer	hérité de: TapChanger
ltcFlag	Boolean	hérité de: TapChanger
neutralStep	Integer	hérité de: TapChanger
neutralU	Voltage	hérité de: TapChanger
normalStep	Integer	hérité de: TapChanger
regulationStatus	Boolean	hérité de: TapChanger
stepVoltageIncrement	PerCent	hérité de: TapChanger
subsequentDelay	Seconds	hérité de: TapChanger
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 199 montre toutes les extrémités d'association de RatioTapChanger avec d'autres classes.

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Tableau 199 – Extrémités d'association de Wires::RatioTapChanger avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] TransformerWinding	TransformerWinding	L'enroulement de transformateur auquel le changeur de prise de réglage de rapport appartient
[1..1]	[0..1] RatioVariationCurve	RatioVariationCurve	Un RatioTapChanger peut avoir une RatioVariationCurve associée pour définir des variations de rapport par prise en fonction des variations de l'échelon de prise
[0..1]	[1..1] Winding	DistributionTransformerWinding	L'enroulement auquel ce changeur de prise de réglage de rapport appartient
[0..*]	[0..1] RegulatingControl	RegulatingControl	hérité de: TapChanger
[1..1]	[0..1] SvTapStep	SvTapStep	hérité de: TapChanger
[1..1]	[0..1] ImpedanceVariationCurve	ImpedanceVariationCurve	hérité de: TapChanger
[1..1]	[0..*] TapSchedules	TapSchedule	hérité de: TapChanger
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.36 ReactiveCapabilityCurve

Courbe enveloppe assignée de puissance réactive en fonction de la puissance active de la machine synchrone, en mode générateur et moteur. Il existe, pour chaque valeur de puissance active, une valeur limite supérieure et inférieure correspondante de la puissance réactive. Traditionnellement, il y aura une courbe distincte pour chaque état du fluide de refroidissement, tel que la pression de l'hydrogène. Les valeurs de l'axe Y1 représentent le minimum de la puissance réactive alors que les valeurs de l'axe Y2 représentent le maximum de la puissance réactive.

Le Tableau 200 montre tous les attributs de ReactiveCapabilityCurve.

Tableau 200 – Attributs de Wires::ReactiveCapabilityCurve

nom	type	description
coolantTemperature	Temperature	Température du fluide de refroidissement de la machine (par exemple l'air ambiant ou l'eau de circulation du stator)
hydrogenPressure	Pressure	Pression du fluide de refroidissement à base d'hydrogène
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve

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nom	type	description
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 201 montre toutes les extrémités d'association de ReactiveCapabilityCurve avec d'autres classes.

Tableau 201 – Extrémités d'association de Wires::ReactiveCapabilityCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..*] InitiallyUsedBySynchronousMachines	SynchronousMachine	Machines synchrones utilisant cette courbe comme courbe par défaut
[0..*]	[1..*] SynchronousMachines	SynchronousMachine	Machines synchrones utilisant cette courbe
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.7.37 RectifierInverter

Équipement de conversion alternatif/continu bidirectionnel pouvant être utilisé pour contrôler le courant continu, la tension continue, le flux d'énergie continue ou l'angle d'amorçage.

Le Tableau 202 montre tous les attributs de RectifierInverter.

Tableau 202 – Attributs de Wires::RectifierInverter

nom	type	description
ratedU	Voltage	Tension de base primaire du redresseur/onduleur
bridges	Integer	Nombre de ponts
commutatingReactance	Reactance	Réactance de commutation, sur la fréquence du bus alternatif
commutatingResistance	Resistance	Résistance de commutation
compoundResistance	Resistance	Résistance compound
minCompoundVoltage	Voltage	Tension continue compoundée minimale
frequency	Frequency	Fréquence du côté CA (courant alternatif)

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nom	type	description
maxP	ActivePower	La puissance active maximale du côté CC à laquelle il convient que le convertisseur fonctionne
minP	ActivePower	La puissance active minimale du côté CC à laquelle il convient que le convertisseur fonctionne
maxU	Voltage	La tension maximale du côté CC à laquelle il convient que le convertisseur fonctionne
minU	Voltage	La tension minimale du côté CC à laquelle il convient que le convertisseur fonctionne
operatingMode	OperatingMode	Mode de fonctionnement du convertisseur
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 203 montre toutes les extrémités d'association de RectifierInverter avec d'autres classes.

Tableau 203 – Extrémités d'association de Wires::RectifierInverter avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

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6.1.7.38 RegulatingCondEq

Un type d'équipement conducteur qui peut réguler une grandeur (tension ou flux) en un point spécifique du réseau.

Le Tableau 204 montre tous les attributs de RegulatingCondEq.

Tableau 204 – Attributs de Wires::RegulatingCondEq

nom	type	description
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 205 montre toutes les extrémités d'association de RegulatingCondEq avec d'autres classes.

Tableau 205 – Extrémités d'association de Wires::RegulatingCondEq avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] RegulatingControl	RegulatingControl	Le plan de commande de régulation auquel cet équipement participe
[0..1]	[1..*] Controls	Control	Les sorties de commande utilisées pour commander effectivement un dispositif de régulation, par exemple la magnétisation d'une machine synchrone ou l'actionneur disjoncteur d'une batterie de condensateurs
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

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6.1.7.39 RegulatingControl

Spécifie un ensemble d'équipements qui fonctionnent ensemble pour commander une grandeur de système électrique telle que la tension ou le flux.

Le Tableau 206 montre tous les attributs de RegulatingControl.

Tableau 206 – Attributs de Wires::RegulatingControl

nom	type	description
mode	RegulatingControlModeKind	Le mode de commande de régulation actuellement disponible. La présente spécification permet de déterminer le genre de régulation sans la nécessité d'obtenir les unités à partir d'un programme
targetRange	Float	Il s'agit de la plage cible d'entrée de cas. Elle exécute la même fonction que l'attribut value2 sur le programme de régulation dans le cas où les programmes ne sont pas utilisés. Les unités pour ceux qui sont appropriés pour ce mode
targetValue	Float	La valeur cible spécifiée pour "case input". Cette valeur peut être utilisée pour la valeur cible sans utilisation de programmes. Cette valeur a les unités appropriées à l'attribut de mode
discrete	Boolean	La régulation est effectuée dans un mode discret
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 207 montre toutes les extrémités d'association de RegulatingControl avec d'autres classes.

Tableau 207 – Extrémités d'association de Wires::RegulatingControl avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] TapChanger	TapChanger	Les changeurs de prise participant à la régulation
[0..*]	[0..1] Terminal	Terminal	La borne associée à cette commande de régulation
[0..1]	[0..*] RegulatingCondEq	RegulatingCondEq	L'équipement participant à la commande de régulation
[1..1]	[0..*] RegulationSchedule	RegulationSchedule	Programme pour cette commande de régulation
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource

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[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.40 RegulationSchedule

Modèle prédéfini sur une longue durée pour une variable commandée, par exemple la tension du jeu de barres.

Le Tableau 208 montre tous les attributs de RegulationSchedule.

Tableau 208 – Attributs de Wires::RegulationSchedule

nom	type	description
lineDropCompensation	Boolean	indicateur indiquant que la compensation de perte de ligne doit être appliquée
lineDropR	Resistance	Résistance de perte de ligne
lineDropX	Reactance	Réactance de perte de ligne
timeStep	Seconds	hérité de: RegularIntervalSchedule
endTime	AbsoluteDateTime	hérité de: RegularIntervalSchedule
startTime	AbsoluteDateTime	hérité de: BasicIntervalSchedule
value1Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
value2Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 209 montre toutes les extrémités d'association de RegulationSchedule avec d'autres classes.

Tableau 209 – Extrémités d'association de Wires::RegulationSchedule avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] RegulatingControl	RegulatingControl	Les commandes de régulation qui ont ce Schedule (ce programme)
[0..1]	[0..*] VoltageControlZones	VoltageControlZone	Une VoltageControlZone (zone de contrôle de la tension) peut comporter un programme de régulation de tension
[0..*]	[0..1] DayType	DayType	hérité de: SeasonDayTypeSchedule

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[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] Season	Season	hérité de: SeasonDayTypeSchedule
[1..1]	[1..*] TimePoints	RegularTimePoint	hérité de: RegularIntervalSchedule

6.1.7.41 Resistor

Résistance, typiquement utilisée dans les configurations de filtre ou comme résistance de mise à la terre pour des transformateurs. Utilisée pour le modèle électrique des réseaux de distribution.

Le Tableau 210 montre tous les attributs de Resistor.

Tableau 210 – Attributs de Wires::Resistor

nom	type	description
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 211 montre toutes les extrémités d'association de Resistor avec d'autres classes.

Tableau 211 – Extrémités d'association de Wires::Resistor avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource

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[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.42 SeriesCompensator

Un Series Compensator (compensateur série) est un condensateur ou une bobine de réactance série ou une ligne de transport en courant alternatif sans susceptance de charge. Il est un dispositif à deux bornes.

Le Tableau 212 montre tous les attributs de SeriesCompensator.

Tableau 212 – Attributs de Wires::SeriesCompensator

nom	type	description
r	Resistance	Résistance directe
x	Reactance	Réactance directe
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 213 montre toutes les extrémités d'association de SeriesCompensator avec d'autres classes.

Tableau 213 – Extrémités d'association de Wires::SeriesCompensator avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource

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[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.43 ShuntCompensator

Condensateur-shunt ou bobine de réactance ou batterie commutable de condensateurs-shunts ou de bobines de réactance. Une section d'un compensateur shunt est un condensateur individuelle ou une bobine de réactance individuelle. Une valeur négative pour reactivePerSection indique que le compensateur est une bobine de réactance. ShuntCompensator est un dispositif à une seule borne. La masse est impliquée.

Le Tableau 214 montre tous les attributs de ShuntCompensator.

Tableau 214 – Attributs de Wires::ShuntCompensator

nom	type	description
aVRDelay	Seconds	Durée, en secondes, nécessaire au dispositif pour être connecté ou déconnecté par une régulation automatique de tension (AVR, "Automatic Voltage Regulation")
b0PerSection	Susceptance	Susceptance shunt homopolaire (chargement), par section
bPerSection	Susceptance	Susceptance directe (chargement), par section
g0PerSection	Conductance	Conductance shunt homopolaire (chargement), par section
gPerSection	Conductance	Conductance directe (chargement), par section
maximumSections	Integer	Pour une batterie de condensateurs, nombre maximal de sections qui peuvent être commutées
maxU	Voltage	Tension maximale à laquelle il convient que la batterie de condensateurs fonctionne
minU	Voltage	Tension minimale à laquelle il convient que la batterie de condensateurs fonctionne
nomQ	ReactivePower	Sortie nominale de puissance réactive de la batterie de condensateurs à la tension nominale.. Il convient que ce nombre soit positif
nomU	Voltage	Tension nominale à laquelle la puissance réactive nominale a été mesurée. Il convient qu'elle soit normalement égale, à 10 % près, à la tension à laquelle le condensateur est connecté au réseau
normalSections	Integer	Pour une batterie de condensateurs, nombre normal de sections commutées. Il convient que ce nombre corresponde à la puissance réactive nominale (nomQ)
reactivePerSection	ReactivePower	Pour une batterie de condensateurs, taille en puissance réactive de chaque section commutable à la tension nominale

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nom	type	description
switchOnCount	Integer	Compteur de mise en route depuis la dernière initialisation ou réinitialisation du compteur de condensateur
switchOnDate	AbsoluteDateTime	Date et heure où la batterie de condensateurs a été activée pour la dernière fois
voltageSensitivity	VoltagePerReactivePower	Sensibilité de tension nécessaire au dispositif pour réguler la tension du bus en tension par puissance réactive
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 215 montre toutes les extrémités d'association de ShuntCompensator avec d'autres classes.

Tableau 215 – Extrémités d'association de Wires::ShuntCompensator avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..1] SvShuntCompensatorSections	SvShuntCompensatorSections	L'état pour le nombre des sections de compensateur shunt en service
[0..*]	[0..1] RegulatingControl	RegulatingControl	hérité de: RegulatingCondEq
[0..1]	[1..*] Controls	Control	hérité de: RegulatingCondEq
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

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6.1.7.44 StaticVarCompensator

Installation proposant une puissance réactive de shunt variable et modulable. Le SVC consiste généralement en un transformateur abaisseur, un filtre, un réacteur commandé par thyristor et des bras de condensateur commutés par thyristor.

Le SVC peut fonctionner dans le mode de sortie MVar fixe ou dans le mode de commande de tension. Dans le mode de commande de tension, la sortie du SVC sera proportionnelle à l'écart de tension au niveau du bus commandé par rapport au point de consigne de la tension. La pente caractéristique du SVC définit la proportion. Si la tension au niveau du bus commandé est égale au point de consigne de la tension, la sortie MVar du SVC est nulle.

Le Tableau 216 montre tous les attributs de StaticVarCompensator.

Tableau 216 – Attributs de Wires::StaticVarCompensator

nom	type	description
capacitiveRating	Reactance	Puissance réactive capacitive disponible maximale
inductiveRating	Reactance	Puissance réactive inductive disponible maximale
sVCControlMode	SVCControlMode	Mode de commande du SVC
slope	VoltagePerReactivePower	La pente de la caractéristique d'un SVC définit comment la sortie de puissance réactive change proportionnellement à la différence entre la tension régulée du bus et le point de consigne de la tension
voltageSetPoint	Voltage	La sortie de puissance réactive du SVC est proportionnelle à la différence entre la tension au bus régulé et le point de consigne de la tension (voltage set point). Lorsque la tension du bus régulé est égale au point de consigne de la tension, la sortie de puissance réactive est nulle
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 217 montre toutes les extrémités d'association de StaticVarCompensator avec d'autres classes.

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Tableau 217 – Extrémités d'association de Wires::StaticVarCompensator avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] RegulatingControl	RegulatingControl	hérité de: RegulatingCondEq
[0..1]	[1..*] Controls	Control	hérité de: RegulatingCondEq
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.45 Enumération SVCControlMode

Mode de commande du compensateur de VAr statique.

Le Tableau 218 montre tous les libellés de SVCControlMode.

Tableau 218 – Libellés de Wires::SVCControlMode

libellé	description
reactivePower	
voltage	
off	

6.1.7.46 Switch

Appareil générique visant à établir ou à interrompre le courant, ou les deux, dans un ou plusieurs circuits électriques.

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Le Tableau 219 montre tous les attributs de Switch.

Tableau 219 – Attributs de Wires::Switch

nom	type	description
normalOpen	Boolean	L'attribut est utilisé dans des cas où aucune Measurement (mesure) pour la valeur de statut n'est présente. Si le Switch a une mesure de statut, alors Discrete.normalValue est censé correspondre à Switch.normalOpen
switchOnCount	Integer	Compteur de mise en route depuis la dernière initialisation ou réinitialisation du Switch
switchOnDate	AbsoluteDateTime	Date et heure de la dernière mise en route du Switch
retained	Boolean	La branche est retenue dans un modèle en topologie nodale
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 220 montre toutes les extrémités d'association de Switch avec d'autres classes.

Tableau 220 – Extrémités d'association de Wires::Switch avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] SwitchSchedules	SwitchSchedule	Un Switch peut être associé avec SwitchSchedules
[0..*]	[0..1] CompositeSwitch	CompositeSwitch	Commutateur composite auquel ce Switch appartient
[0..*]	[0..*] SwitchingOperations	SwitchingOperation	Un organe de coupure peut être actionné par plusieurs programmes
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource

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[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.47 SynchronousMachine

Appareil électromécanique fonctionnant de façon synchrone avec le réseau. Il s'agit d'une machine unique opérant comme une génératrice, comme un condensateur synchrone ou comme une pompe.

Le Tableau 221 montre tous les attributs de SynchronousMachine.

Tableau 221 – Attributs de Wires::SynchronousMachine

nom	type	description
aVRToManualLag	Seconds	Retard requis pour le passage de la régulation de tension automatique (Automatic Voltage Regulation (AVR)) à Manuel pour une infraction MVAr de retard de phase
aVRToManualLead	Seconds	Retard requis pour le passage de la régulation de tension automatique (AVR) à Manuel pour une infraction MVAr d'avance de phase
baseQ	ReactivePower	Valeur par défaut de la puissance réactive de base. Cette valeur représente la puissance réactive initiale pouvant être utilisée par toute fonction d'application
condenserP	ActivePower	Puissance active consommée lors du fonctionnement en mode condensateur
coolantCondition	Float	Température ou pression du milieu du fluide de refroidissement
coolantType	CoolantType	Méthode de refroidissement de la machine
damping	Damping	Coefficient du couple d'amortissement, constante proportionnelle qui, lorsqu'elle est multipliée par la vitesse angulaire des pôles du rotor relative au champ magnétique (fréquence), se traduit par le couple d'amortissement
inertia	PU	Énergie stockée dans le rotor lorsqu'il fonctionne à une vitesse assignée. Cette valeur est utilisée dans le référentiel électrique d'accélération pour les programmes de simulateur de formation des exploitants
manualToAVR	Seconds	Retard requis pour le passage de Manuel à régulation automatique de tension. Cette valeur est utilisée dans le référentiel électrique d'accélération pour les programmes de calcul de répartition
maxQ	ReactivePower	Limite maximale de la puissance réactive. Il s'agit de la limite maximale (constructeur) de la tranche
maxU	Voltage	Limite de tension maximale de la tranche
minQ	ReactivePower	Limite de puissance réactive minimale de la tranche
minU	Voltage	Limite de tension minimale de la tranche

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nom	type	description
operatingMode	SynchronousMachineOperatingMode	Mode de fonctionnement courant
qPercent	PerCent	Pourcentage de la commande réactive coordonnée qui provient de cette machine
r	Resistance	Résistance directe de la machine synchrone
r0	Resistance	Résistance homopolaire de la machine synchrone
r2	Resistance	Résistance inverse
ratedS	ApparentPower	Puissance apparente nominale de la tranche selon la plaque constructeur.
referencePriority	Integer	Priorité de la tranche pour la sélection de bus de référence. 0 = don t care peu importe (par défaut) 1 = plus haute priorité. 2 est moins que 1 et ainsi de suite
type	SynchronousMachineType	Modes dans lesquels cette machine synchrone peut fonctionner
x	Reactance	Réactance directe de la machine synchrone
x0	Reactance	Réactance homopolaire de la machine synchrone
x2	Reactance	Réactance inverse
xDirectSubtrans	Reactance	Réactance subtransitoire longitudinale, également appelée X"d
xDirectSync	Reactance	Réactance synchrone longitudinale. quotient, pour une machine fonctionnant à une vitesse assignée, de la valeur permanente du composant alternatif de la tension d'induit, produit par le flux longitudinal total dû au courant d'induit longitudinal et de la valeur du composant alternatif de ce courant. (Xd)
xDirectTrans	Reactance	Réactance transitoire longitudinale, également appelée X'd
xQuadSubtrans	Reactance	Réactance subtransitoire transversale, également appelée X"q
xQuadSync	Reactance	Réactance synchrone transversale (Xq), rapport entre la composante de la tension réactive d'induit, due à la composante transversale du courant d'induit, et la composante du courant, selon des répartitions de modes à l'équilibre et à une fréquence assignée
xQuadTrans	Reactance	Réactance transitoire transversale, également appelée X'q
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 222 montre toutes les extrémités d'association de SynchronousMachine avec d'autres classes.

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Tableau 222 – Extrémités d'association de Wires::SynchronousMachine avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..1] HydroPump	HydroPump	La machine synchrone entraîne la turbine qui déplace l'eau de bas en haut. Le sens de rotation de la machine pour le pompage peut ou peut ne pas être identique à celui utilisé pour la production
[1..*]	[0..1] InitialReactiveCapabilityCurve	ReactiveCapabilityCurve	La courbe ReactiveCapabilityCurve par défaut pour être utilisée par une SynchronousMachine
[1..*]	[0..*] ReactiveCapabilityCurves	ReactiveCapabilityCurve	Toutes les courbes de capacité réactive disponibles pour cette SynchronousMachine
[1..*]	[0..1] GeneratingUnit	GeneratingUnit	Une machine synchrone peut fonctionner comme génératrice et devenir par conséquent un élément de l'unité de production
[0..*]	[0..*] PrimeMovers	PrimeMover	Machines motrices qui entraînent cette SynchronousMachine (cette machine synchrone)
[0..*]	[0..1] RegulatingControl	RegulatingControl	hérité de: RegulatingCondEq
[0..1]	[1..*] Controls	Control	hérité de: RegulatingCondEq
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.48 Enumération SynchronousMachineOperatingMode

Mode de fonctionnement de la machine synchrone.

Le Tableau 223 montre tous les libellés de SynchronousMachineOperatingMode.

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Tableau 223 – Libellés de Wires::SynchronousMachineOperatingMode

libellé	description
generator	
condenser	

6.1.7.49 Enumération SynchronousMachineType

Type de la machine synchrone.

Le Tableau 224 montre tous les libellés de SynchronousMachineType.

Tableau 224 – Libellés de Wires::SynchronousMachineType

libellé	description
generator	
condenser	
generator_or_condenser	

6.1.7.50 TapChanger

Mécanisme de modification des positions des prises de réglage.

Le Tableau 225 montre tous les attributs de TapChanger.

Tableau 225 – Attributs de Wires::TapChanger

nom	type	description
highStep	Integer	Position de la prise la plus élevée possible en partant de neutre
initialDelay	Seconds	Pour un changeur de prise en charge, retard de fonctionnement initial du régleur (première modification)
lowStep	Integer	Position de prise la plus basse possible (retardée à neutre)
ltcFlag	Boolean	Spécifie si, oui ou non, un TapChanger a des capacités de changeur de prise en charge
neutralStep	Integer	Position neutre de prise pour cet enroulement
neutralU	Voltage	Tension à laquelle l'enroulement fonctionne selon un réglage neutre
normalStep	Integer	Position de prise utilisée dans le fonctionnement “normal” du réseau pour cet enroulement. Régleur “Fixed" (fixe) indique le réglage matériel actuel
regulationStatus	Boolean	Spécifie le statut de régulation par défaut du TapChanger. True, il régule. False, il ne régule pas
stepVoltageIncrement	PerCent	Augmentation d’un pas de prise du changeur, exprimée en pourcentage de la tension nominale, par position de changeur. Pour un PhaseTapChanger symétrique, le stepVoltageIncrement est utilisé dans la formule pour le calcul de l'angle de phase. Pour un PhaseTapChanger symétrique, la grandeur de la tension ne varie pas avec l'échelon de prise.

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nom	type	description
subsequentDelay	Seconds	Pour un changeur de prise en charge, délai de fonctionnement supplémentaire du changeur de prise (deuxième modification et modifications suivantes de l'échelon)
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 226 montre toutes les extrémités d'association de TapChanger avec d'autres classes.

Tableau 226 – Extrémités d'association de Wires::TapChanger avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] RegulatingControl	RegulatingControl	Les changeurs de prise participant à la régulation
[1..1]	[0..1] SvTapStep	SvTapStep	L'état d'échelon de prise associé au changeur de prise
[1..1]	[0..1] ImpedanceVariationCurve	ImpedanceVariationCurve	Un TapChanger peut avoir une ImpedanceVariationCurve associée pour définir des variations d'impédance en fonction des variations de l'échelon de prise
[1..1]	[0..*] TapSchedules	TapSchedule	Un TapChanger peut avoir des TapSchedules
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.51 Enumération TapChangerKind

Type du changeur de prise du transformateur. Indique les capacités du changeur de prise indépendamment du mode de fonctionnement.

Le Tableau 227 montre tous les libellés de TapChangerKind.

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Tableau 227 – Libellés de Wires::TapChangerKind

libellé	description
fixed	Non capable de commande. Cela est aussi indiqué par l'absence d'association de TapChanger à un RegulatingControl
voltageControl	Capable de commande de la tension
phaseControl	Capable de commande de la phase
voltageAndPhaseControl	Capable de commande de la tension et de la phase

6.1.7.52 TapSchedule

Modèle prédéfini sur une durée pour un échelon de prise.

Le Tableau 228 montre tous les attributs de TapSchedule.

Tableau 228 – Attributs de Wires::TapSchedule

nom	type	description
lineDropCompensation	Boolean	Indicateur indiquant que la compensation de perte de ligne doit être appliquée
lineDropR	Resistance	Résistance de perte de ligne
lineDropX	Reactance	Réactance de perte de ligne
timeStep	Seconds	hérité de: RegularIntervalSchedule
endTime	AbsoluteDateTime	hérité de: RegularIntervalSchedule
startTime	AbsoluteDateTime	hérité de: BasicIntervalSchedule
value1Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
value2Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 229 montre toutes les extrémités d'association de TapSchedule avec d'autres classes.

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Tableau 229 – Extrémités d'association de Wires::TapSchedule avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] TapChanger	TapChanger	Un TapSchedule est associé à un TapChanger
[0..*]	[0..1] DayType	DayType	hérité de: SeasonDayTypeSchedule
[0..*]	[0..1] Season	Season	hérité de: SeasonDayTypeSchedule
[1..1]	[1..*] TimePoints	RegularTimePoint	hérité de: RegularIntervalSchedule

6.1.7.53 Enumération TransformerControlMode

Modes de commande pour un transformateur.

Le Tableau 230 montre tous les libellés de TransformerControlMode.

Tableau 230 – Libellés de Wires::TransformerControlMode

libellé	description
volt	Commande de tension
reactive	Commande du flux de puissance réactive

6.1.7.54 TransformerWinding

Un enroulement est associé à chaque borne définie pour un transformateur (ou déphaseur).

Le Tableau 231 montre tous les attributs de TransformerWinding.

Tableau 231 – Attributs de Wires::TransformerWinding

nom	type	description
b	Susceptance	Susceptance de branche magnétique (B mag). La valeur peut être positive ou négative
b0	Susceptance	Susceptance de branche magnétique homopolaire
connectionType	WindingConnection	Le type de connexion de l'enroulement
emergencyS	ApparentPower	La puissance apparente pouvant être supportée par l'enroulement dans des conditions d'urgence
g	Conductance	Conductance de branche magnétique (G mag)
g0	Conductance	Conductance de branche magnétique homopolaire
grounded	Boolean	Positionné si l'enroulement est mis à la terre
insulationU	Voltage	Tension assignée au niveau d'isolation principale
r	Resistance	Résistance série directe de l'enroulement. Pour un transformateur à deux enroulements, il convient d'entrer la résistance complète du transformateur sur l'enroulement (haute tension) primaire
r0	Resistance	Résistance série homopolaire de l'enroulement
ratedS	ApparentPower	Puissance apparente assignée normale de

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nom	type	description
		l'enroulement
ratedU	Voltage	Tension assignée (phase-phase) de l'enroulement, généralement identique à la tension neutre
rground	Resistance	Résistance de mise à la terre via un transformateur de mise à la terre connecté
shortTermS	ApparentPower	Puissance apparente pouvant être supportée par l'enroulement sur une courte période
windingType	WindingType	Le type d'enroulement
x	Reactance	Réactance série directe de l'enroulement. Pour un transformateur à deux enroulements, il convient d'entrer la réactance complète du transformateur sur l'enroulement (haute tension) primaire
x0	Reactance	Réactance série homopolaire de l'enroulement
xground	Reactance	Réactance de mise à la terre via un transformateur de mise à la terre connecté
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 232 montre toutes les extrémités d'association de TransformerWinding avec d'autres classes.

Tableau 232 – Extrémités d'association de Wires::TransformerWinding avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] From_WindingTest	WindingTest	Les essais d'enroulement de transformateur pour lesquels l'enroulement du transformateur (borne) participe en qualité de partie "from" (c'est-à-dire, de départ) de l'essai
[1..*]	[1..1] PowerTransformer	PowerTransformer	Un transformateur comporte des enroulements
[0..1]	[0..*] To_WindingTest	WindingTest	Les essais d'enroulement pour lesquels l'enroulement du transformateur (borne) participe en qualité d'extrémité "to" (c'est-à-dire, de destination) de l'essai
[1..1]	[0..1] PhaseTapChanger	PhaseTapChanger	Le changeur de prise de phase associé à l'enroulement de transformateur
[1..1]	[0..1] RatioTapChanger	RatioTapChanger	Le changeur de prise de réglage de rapport associé à l'enroulement de transformateur
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment

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[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.55 VoltageControlZone

Section du réseau électrique déterminée pour contrôler la tension secondaire. Une zone de contrôle de la tension consiste en une collection de postes avec un tronçon de jeu de barres déterminée dont la tension sera contrôlée.

Le Tableau 233 montre tous les attributs de VoltageControlZone.

Tableau 233 – Attributs de Wires::VoltageControlZone

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 234 montre toutes les extrémités d'association de VoltageControlZone avec d'autres classes.

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Tableau 234 – Extrémités d'association de Wires::VoltageControlZone avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] RegulationSchedule	RegulationSchedule	Une VoltageControlZone (zone de contrôle de la tension) peut comporter un programme de régulation de tension
[0..1]	[1..1] BusbarSection	BusbarSection	Une VoltageControlZone (zone de contrôle de la tension) est contrôlée par une BusbarSection (tronçon de jeu de barres) déterminée
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.7.56 Enumération WindingConnection

Type de connexion d'enroulement.

Le Tableau 235 montre tous les libellés de WindingConnection.

Tableau 235 – Libellés de Wires::WindingConnection

libellé	description
D	Delta
Y	Wye
Z	ZigZag
Yn	Wye (I grec, montage étoile), avec neutre sorti pour la mise à la terre
Zn	ZigZag, avec neutre sorti pour la mise à la terre
A	Enroulement commun d'autotransformateur
I	Enroulement indépendant, pour connexions monophasées

6.1.7.57 WindingTest

Données d'essai d'enroulement matériel pour les paires enroulement/régleur d'un transformateur (ou déphaseur). Ces données d'essai peuvent être utilisées pour dériver d'autres attributs de modèles de transformateur ou de déphaseur spécifiques.

Le Tableau 236 montre tous les attributs de WindingTest.

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Tableau 236 – Attributs de Wires::WindingTest

nom	type	description
excitingCurrent	PerCent	Courant d'excitation en essai de circuit ouvert, exprimé en pourcentage du courant assigné, à la tension nominale
fromTapStep	Integer	Nombre de pas de prise de l'enroulement “from” (départ) de la paire d'essai
leakageImpedance	Impedance	Impédance de fuite mesurée pour l'enroulement “from”, l'enroulement “to” (destination) étant en court-circuit et tous les autres en circuit ouvert. L'impédance de fuite est exprimée en unités, basées sur les valeurs assignées de puissance apparente et de tension de l'enroulement "from"
loadLoss	KWActivePower	Pertes en kW dues à la charge (enroulement "to" en court-circuit) sur le résultat de l'essai
noLoadLoss	KWActivePower	Non pertes kW dues à la charge (enroulement "to" en circuit ouvert) sur le résultat de l'essai
phaseShift	AngleDegrees	Déphasage mesuré sur l'enroulement “to” en circuit ouvert, l'enroulement "from" étant à la tension assignée de l'enroulement "from" et tous les autres en circuit ouvert
toTapStep	Integer	Nombre de pas de prise de l'enroulement “to” de la paire d'essai
voltage	Voltage	Tension mesurée sur l'enroulement “to” en circuit ouvert, l'enroulement "from" étant à la tension assignée de l'enroulement “from" et tous les autres en circuit ouvert
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 237 montre toutes les extrémités d'association de WindingTest avec d'autres classes.

Tableau 237 – Extrémités d'association de Wires::WindingTest avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] To_TransformerWinding	TransformerWinding	Enroulement vers lequel le test a été effectué. Noter que bien que le côté "from" (c'est-à-dire, de départ) de l'essai soit exigé, le côté "to" (c'est-à-dire, de destination) n'est pas toujours exigé
[0..*]	[1..1] From_TransformerWinding	TransformerWinding	Enroulement à partir duquel l'essai a été effectué

6.1.7.58 Enumération WindingType

Type d'enroulement.

Le Tableau 238 montre tous les libellés de WindingType.

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Tableau 238 – Libellés de Wires::WindingType

libellé	description
primary	
secondary	
tertiary	
quaternary	

6.1.8 Paquetage Generation

6.1.8.1 Généralités

Ce paquetage contient des paquetages qui portent de l'information pour les applications Unit Commitment (gestion de la production) et Economic Dispatch of Hydro and Thermal Generating Units (dispatching économiques des unités de production thermiques et hydrauliques), Load Forecasting (prévision de la charge), Automatic Generation Control (conduite automatique de production), and Unit Modeling for Dynamic Training Simulator (modélisation d'unité pour les simulateurs d'entraînement).

La Figure 50 montre le diagramme logique Main.

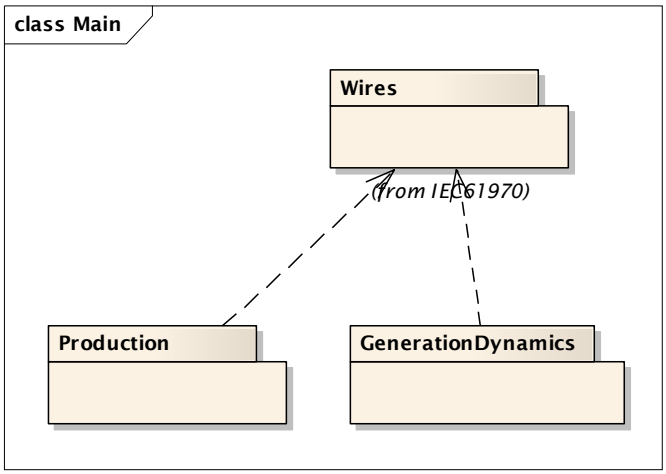

Figure 50 – Diagramme logique Generation::Main

Le diagramme montre les deux paquetages du "main" décrivant Generation et leurs relations avec le paquetage Wires.

6.1.8.2 Paquetage GenerationDynamics

6.1.8.2.1 Généralités

Le paquetage GenerationDynamics se compose de machines motrices, comme les turbines ou les chaudières, utiles pour la simulation et à des fins éducatives.

La Figure 51 montre le diagramme logique Main.

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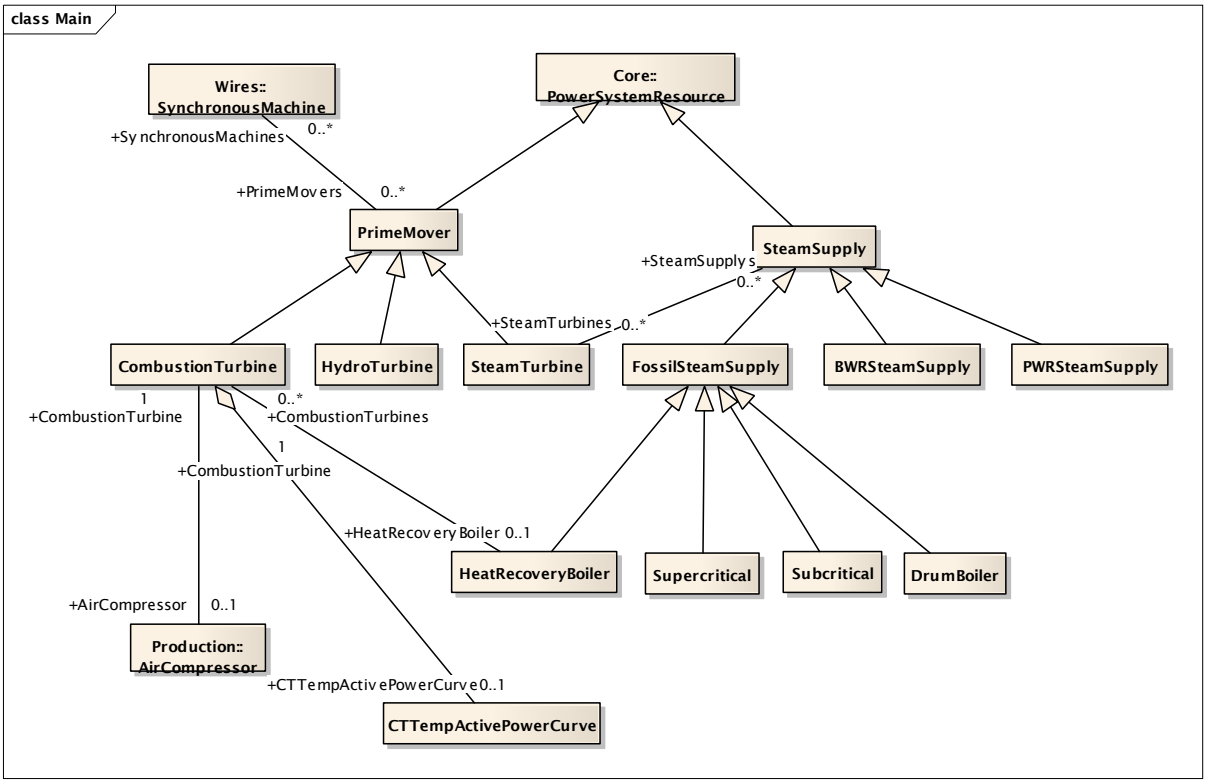

Figure 51 – Diagramme logique GenerationDynamics::Main

Ce diagramme montre toutes les classes incluses dans le paquetage GenerationDynamics de même que les classes-clés externes qui ont des associations avec des classes GenerationDynamics.

La Figure 52 montre le diagramme logique Datatypes.

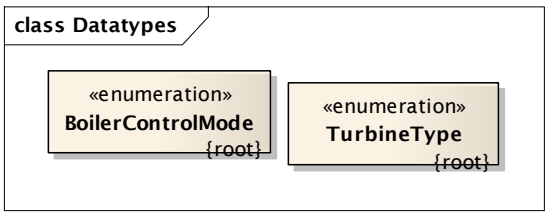

Figure 52 – Diagramme logique GenerationDynamics::Datatypes

Ce diagramme montre les types de données spécifiques au paquetage GenerationDynamics.

6.1.8.2.2 Enumération BoilerControlMode

Mode contrôle de la chaudière.

Le Tableau 239 montre tous les libellés de BoilerControlMode.

Tableau 239 – Libellés de GenerationDynamics::BoilerControlMode

libellé	description
following	
coordinated	

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6.1.8.2.3 BWRSteamSupply

Réacteur à eau bouillante alimentant en vapeur une turbine à vapeur.

Le Tableau 240 montre tous les attributs de BWRSteamSupply.

Tableau 240 – Attributs de GenerationDynamics::BWRSteamSupply

nom	type	description
highPowerLimit	PU	Limite haute de la puissance
inCoreThermalTC	Seconds	Constante de temps thermique dans le cœur
integralGain	Float	Gain intégral
lowerLimit	PU	Limite inférieure initiale
lowPowerLimit	PU	Limite basse de la puissance
pressureLimit	PU	Limite de pression
pressureSetpointGA	Float	Dispositif d'ajustage de gain de la valeur de consigne de la pression
pressureSetpointTC1	Seconds	Constante de temps de la valeur de consigne de la pression
pressureSetpointTC2	Seconds	Constante de temps de la valeur de consigne de la pression
proportionalGain	Float	Gain proportionnel
rfAux1	PU	Coefficient permettant de modéliser l'effet de la fréquence et de la tension hors-nominal sur la recirculation et le flux du cœur, et affectant la puissance de sortie BWR
rfAux2	PU	Coefficient permettant de modéliser l'effet de la fréquence et de la tension hors-nominal sur la recirculation et le flux du cœur, et affectant la puissance de sortie BWR
rfAux3	PU	Coefficient permettant de modéliser l'effet de la fréquence et de la tension hors-nominal sur la recirculation et le flux du cœur, et affectant la puissance de sortie BWR
rfAux4	PU	Coefficient permettant de modéliser l'effet de la fréquence et de la tension hors-nominal sur la recirculation et le flux du cœur, et affectant la puissance de sortie BWR
rfAux5	PU	Coefficient permettant de modéliser l'effet de la fréquence et de la tension hors-nominal sur la recirculation et le flux du cœur, et affectant la puissance de sortie BWR
rfAux6	PU	Coefficient permettant de modéliser l'effet de la fréquence et de la tension hors-nominal sur la recirculation et le flux du cœur, et affectant la puissance de sortie BWR
rfAux7	PU	Coefficient permettant de modéliser l'effet de la fréquence et de la tension hors-nominal sur la recirculation et le flux du cœur, et affectant la puissance de sortie BWR
rfAux8	PU	Coefficient permettant de modéliser l'effet de la fréquence et de la tension hors-nominal sur la recirculation et le flux du cœur, et affectant la puissance de sortie BWR
rodPattern	PU	Modèle de barre
rodPatternConstant	Float	Constante associée à un modèle de barre
upperLimit	PU	Limite supérieure initiale
steamSupplyRating	Float	hérité de: SteamSupply

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nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 241 montre toutes les extrémités d'association de BWRSteamSupply avec d'autres classes.

Tableau 241 – Extrémités d'association de GenerationDynamics::BWRSteamSupply avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] SteamTurbines	SteamTurbine	hérité de: SteamSupply
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.2.4 CombustionTurbine

Machine motrice généralement alimentée en combustible avec du gaz ou du fioul léger.

Le Tableau 242 montre tous les attributs de CombustionTurbine.

Tableau 242 – Attributs de GenerationDynamics::CombustionTurbine

nom	type	description
ambientTemp	Temperature	Température ambiante par défaut pour les applications de modélisation
auxPowerVersusFrequency	PU	Effet de la fréquence hors-nominal sur les auxiliaires de turbines. Réduction par unité de la consommation de puissance active des auxiliaires en fonction de la réduction par unité de la fréquence (à partir de la fréquence assignée)
auxPowerVersusVoltage	PU	Effet de la tension hors-nominal sur les auxiliaires de turbines. Réduction par unité de la consommation de puissance active des auxiliaires en fonction de la réduction par unité de la tension des barres de distribution des auxiliaires (à partir d'un niveau spécifié de tension)

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nom	type	description
capabilityVersusFrequency	PU	Effet de la fréquence hors-nominal sur la capacité de la turbine. Réduction par unité de la puissance active possible en fonction de la réduction par unité de la fréquence (à partir de la fréquence assignée)
heatRecoveryFlag	Boolean	Indicateur mis à true (vrai) si la turbine à combustion est liée à une chaudière de récupération de la chaleur
powerVariationByTemp	PU	Modification par unité de la puissance par (en fonction de) modification par unité de la température ambiante
referenceTemp	Temperature	Température de référence à laquelle la puissance de sortie de la turbine a été définie
timeConstant	Seconds	Constante de temps de la turbine
primeMoverRating	Float	hérité de: PrimeMover
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 243 montre toutes les extrémités d'association de CombustionTurbine avec d'autres classes.

Tableau 243 – Extrémités d'association de GenerationDynamics::CombustionTurbine avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..1] AirCompressor	AirCompressor	Un compresseur d'air CAES est entraîné par une turbine à combustion
[0..*]	[0..1] HeatRecoveryBoiler	HeatRecoveryBoiler	Une turbine à combustion peut comporter une chaudière de récupération de la chaleur pour produire de la vapeur
[1..1]	[0..1] CTTempActivePowerCurve	CTTempActivePowerCurve	Une turbine à combustion peut avoir une relation puissance active-température ambiante
[0..*]	[0..*] SynchronousMachines	SynchronousMachine	hérité de: PrimeMover
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

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6.1.8.2.5 CTTempActivePowerCurve

Relation entre la puissance de sortie assignée de la turbine à combustion en puissance active brute (axe X) et la température ambiante de l'air (axe Y).

Le Tableau 244 montre tous les attributs de CTTempActivePowerCurve.

Tableau 244 – Attributs de GenerationDynamics::CTTempActivePowerCurve

nom	type	description
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 245 montre toutes les extrémités d'association de CTTempActivePowerCurve avec d'autres classes.

Tableau 245 – Extrémités d'association de GenerationDynamics::CTTempActivePowerCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] CombustionTurbine	CombustionTurbine	Une turbine à combustion peut avoir une relation puissance active-température ambiante
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.2.6 DrumBoiler

Chaudière à tambour.

Le Tableau 246 montre tous les attributs de DrumBoiler.

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Tableau 246 – Attributs de GenerationDynamics::DrumBoiler

nom	type	description
drumBoilerRating	Float	Régime assigné d'une chaudière à tambour en unités de vapeur
auxPowerVersusFrequency	PU	hérité de: FossilSteamSupply
auxPowerVersusVoltage	PU	hérité de: FossilSteamSupply
boilerControlMode	BoilerControlMode	hérité de: FossilSteamSupply
controlErrorBiasP	Float	hérité de: FossilSteamSupply
controlIC	Float	hérité de: FossilSteamSupply
controlPC	Float	hérité de: FossilSteamSupply
controlPEB	Float	hérité de: FossilSteamSupply
controlPED	PU	hérité de: FossilSteamSupply
controlTC	Float	hérité de: FossilSteamSupply
feedWaterIG	Float	hérité de: FossilSteamSupply
feedWaterPG	Float	hérité de: FossilSteamSupply
feedWaterTC	Seconds	hérité de: FossilSteamSupply
fuelDemandLimit	PU	hérité de: FossilSteamSupply
fuelSupplyDelay	Seconds	hérité de: FossilSteamSupply
fuelSupplyTC	Seconds	hérité de: FossilSteamSupply
maxErrorRateP	Float	hérité de: FossilSteamSupply
mechPowerSensorLag	Seconds	hérité de: FossilSteamSupply
minErrorRateP	Float	hérité de: FossilSteamSupply
pressureCtrlDG	Float	hérité de: FossilSteamSupply
pressureCtrlIG	Float	hérité de: FossilSteamSupply
pressureCtrlPG	Float	hérité de: FossilSteamSupply
pressureFeedback	Integer	hérité de: FossilSteamSupply
superHeater1Capacity	Float	hérité de: FossilSteamSupply
superHeater2Capacity	Float	hérité de: FossilSteamSupply
superHeaterPipePD	Float	hérité de: FossilSteamSupply
throttlePressureSP	PU	hérité de: FossilSteamSupply
steamSupplyRating	Float	hérité de: SteamSupply
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 247 montre toutes les extrémités d'association de DrumBoiler avec d'autres classes.

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Tableau 247 – Extrémités d'association de GenerationDynamics::DrumBoiler avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] SteamTurbines	SteamTurbine	hérité de: SteamSupply
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.2.7 FossilSteamSupply

Chaudière alimentée en combustible fossile (par exemple: charbon, fioul, gaz).

Le Tableau 248 montre tous les attributs de FossilSteamSupply.

Tableau 248 – Attributs de GenerationDynamics::FossilSteamSupply

nom	type	description
auxPowerVersusFrequency	PU	Effet de la fréquence hors-nominal sur la puissance auxiliaire réelle. Variation de puissance active par unité en fonction de la variation de fréquence par unité
auxPowerVersusVoltage	PU	Effet de la tension hors-nominal sur la puissance auxiliaire réelle. Variation de puissance active par unité en fonction de la variation de tension par unité
boilerControlMode	BoilerControlMode	Mode de commande de la chaudière
controlErrorBiasP	Float	Rapport de biais systématique de la puissance active
controlIC	Float	Constante intégrale
controlPC	Float	Constante proportionnelle
controlPEB	Float	Rapport de biais systématique de la pression
controlPED	PU	Bande morte de réglage de la pression
controlTC	Float	Constante de temps
feedWaterIG	Float	Rapport de gain intégral de l'eau d'alimentation
feedWaterPG	Float	Rapport de gain proportionnel de l'eau d'alimentation
feedWaterTC	Seconds	Rapport de constante de temps de l'eau d'alimentation
fuelDemandLimit	PU	Limite de la demande en combustible
fuelSupplyDelay	Seconds	Temps de propagation du combustible
fuelSupplyTC	Seconds	Constante de temps de l'alimentation en combustible
maxErrorRateP	Float	Limite du taux d'erreur de puissance active maximum
mechPowerSensorLag	Seconds	Retard du capteur de puissance mécanique

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nom	type	description
minErrorRateP	Float	Limite du taux d'erreur de puissance active minimum
pressureCtrlDG	Float	Rapport de gain dérivé de la commande de la pression
pressureCtrlIG	Float	Rapport du gain intégral de la commande de la pression
pressureCtrlPG	Float	Rapport du gain proportionnel de la commande de la pression
pressureFeedback	Integer	Indicateur de rétroaction de la pression
superHeater1Capacity	Float	Capacité du surchauffeur tambour/primaire
superHeater2Capacity	Float	Capacité du superchauffeur secondaire
superHeaterPipePD	Float	Constante de chute de la pression du conduit du superchauffeur
throttlePressureSP	PU	Valeur de consigne de la pression amont
steamSupplyRating	Float	hérité de: SteamSupply
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 249 montre toutes les extrémités d'association de FossilSteamSupply avec d'autres classes.

Tableau 249 – Extrémités d'association de GenerationDynamics::FossilSteamSupply avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] SteamTurbines	SteamTurbine	hérité de: SteamSupply
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.2.8 HeatRecoveryBoiler

Système de récupération de la chaleur associé aux turbines à combustion permettant de produire de la vapeur destinée aux centrales à cycle combiné.

Le Tableau 250 montre tous les attributs de HeatRecoveryBoiler.

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Tableau 250 – Attributs de GenerationDynamics::HeatRecoveryBoiler

nom	type	description
steamSupplyRating2	Float	Régime assigné de l'alimentation en vapeur en kilopounds par heure, pour les chaudières à pression double
auxPowerVersusFrequency	PU	hérité de: FossilSteamSupply
auxPowerVersusVoltage	PU	hérité de: FossilSteamSupply
boilerControlMode	BoilerControlMode	hérité de: FossilSteamSupply
controlErrorBiasP	Float	hérité de: FossilSteamSupply
controlIC	Float	hérité de: FossilSteamSupply
controlPC	Float	hérité de: FossilSteamSupply
controlPEB	Float	hérité de: FossilSteamSupply
controlPED	PU	hérité de: FossilSteamSupply
controlTC	Float	hérité de: FossilSteamSupply
feedWaterIG	Float	hérité de: FossilSteamSupply
feedWaterPG	Float	hérité de: FossilSteamSupply
feedWaterTC	Seconds	hérité de: FossilSteamSupply
fuelDemandLimit	PU	hérité de: FossilSteamSupply
fuelSupplyDelay	Seconds	hérité de: FossilSteamSupply
fuelSupplyTC	Seconds	hérité de: FossilSteamSupply
maxErrorRateP	Float	hérité de: FossilSteamSupply
mechPowerSensorLag	Seconds	hérité de: FossilSteamSupply
minErrorRateP	Float	hérité de: FossilSteamSupply
pressureCtrlDG	Float	hérité de: FossilSteamSupply
pressureCtrlIG	Float	hérité de: FossilSteamSupply
pressureCtrlPG	Float	hérité de: FossilSteamSupply
pressureFeedback	Integer	hérité de: FossilSteamSupply
superHeater1Capacity	Float	hérité de: FossilSteamSupply
superHeater2Capacity	Float	hérité de: FossilSteamSupply
superHeaterPipePD	Float	hérité de: FossilSteamSupply
throttlePressureSP	PU	hérité de: FossilSteamSupply
steamSupplyRating	Float	hérité de: SteamSupply
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 251 montre toutes les extrémités d'association de HeatRecoveryBoiler avec d'autres classes.

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Tableau 251 – Extrémités d'association de GenerationDynamics::HeatRecoveryBoiler avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] CombustionTurbines	CombustionTurbine	Une turbine à combustion peut comporter une chaudière de récupération de la chaleur pour produire de la vapeur
[0..*]	[0..*] SteamTurbines	SteamTurbine	hérité de: SteamSupply
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.2.9 HydroTurbine

Machine motrice entraînée par l'eau. Les principaux types de turbines sont les suivants: Francis, Kaplan et Pelton.

Le Tableau 252 montre tous les attributs de HydroTurbine.

Tableau 252 – Attributs de GenerationDynamics::HydroTurbine

nom	type	description
gateRateLimit	Float	Limite du débit de la vanne
gateUpperLimit	PU	Limite supérieure de la vanne
minHeadMaxP	ActivePower	Puissance active à rendement maximal pour des cas de hauteur de chute minimale
maxHeadMaxP	ActivePower	Puissance activeà rendement maximal pour des cas de hauteur de chute maximale
speedRating	RotationSpeed	Vitesse assignée en nombre de tours
speedRegulation	PU	Régulation de la vitesse
transientDroopTime	Seconds	Constante de temps du statisme transitoire
transientRegulation	PU	Régulation transitoire
turbineRating	ActivePower	Puissance active assignée de la turbine
turbineType	TurbineType	Type de turbine
waterStartingTime	Seconds	Temps au démarrage de l'écoulement de l'eau
primeMoverRating	Float	hérité de: PrimeMover
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 253 montre toutes les extrémités d'association de HydroTurbine avec d'autres classes.

Tableau 253 – Extrémités d'association de GenerationDynamics::HydroTurbine avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] SynchronousMachines	SynchronousMachine	hérité de: PrimeMover
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.2.10 PrimeMover

Machine utilisée pour développer l'énergie mécanique utilisée pour entraîner une génératrice.

Le Tableau 254 montre tous les attributs de PrimeMover.

Tableau 254 – Attributs de GenerationDynamics::PrimeMover

nom	type	description
primeMoverRating	Float	Régime assigné de la machine motrice
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 255 montre toutes les extrémités d'association de PrimeMover avec d'autres classes.

Tableau 255 – Extrémités d'association de GenerationDynamics::PrimeMover avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] SynchronousMachines	SynchronousMachine	Machines synchrones entraînées par cette machine motrice
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource

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[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.2.11 PWRSteamSupply

Réacteur d'eau sous pression utilisé pour alimenter en vapeur une turbine à vapeur.

Le Tableau 256 montre tous les attributs de PWRSteamSupply.

Tableau 256 – Attributs de GenerationDynamics::PWRSteamSupply

nom	type	description
coldLegFBLagTC	PU	Constante de retard de la boucle de rétroaction branche froide
coldLegFBLeadTC1	PU	Constante d'avance de la boucle de rétroaction branche froide
coldLegFBLeadTC2	PU	Constante d'avance de la boucle de rétroaction branche froide
coldLegFG1	PU	Gain 1 de la boucle de rétroaction branche froide
coldLegFG2	PU	Gain 2 de la boucle de rétroaction branche froide
coldLegLagTC	PU	Constante de retard branche froide
coreHTLagTC1	PU	Constante de retard du transfert de chaleur du cœur
coreHTLagTC2	PU	Constante de retard du transfert de chaleur du cœur
coreNeutronicsEffTC	PU	Constante de temps réelle de la neutronique du cœur
coreNeutronicsHT	PU	Neutronique du cœur et transfert de chaleur
feedbackFactor	PU	Facteur de rétroaction
hotLegLagTC	PU	Constante de retard branche chaude
hotLegSteamGain	PU	Gain de vapeur branche chaude
hotLegToColdLegGain	PU	Gain entre branche chaude et branche froide
pressureCG	PU	Gain de commande de la pression
steamFlowFG	PU	Gain de la boucle de rétroaction du flux de vapeur
steamPressureDropLagTC	PU	Constante de retard de chute de la pression de vapeur
steamPressureFG	PU	Gain de la boucle de rétroaction de la pression de vapeur
throttlePressureFactor	PU	Facteur de pression d'admission
throttlePressureSP	PU	Valeur de consigne de la pression d'admission
steamSupplyRating	Float	hérité de: SteamSupply
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject

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nom	type	description
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 257 montre toutes les extrémités d'association de PWRSteamSupply avec d'autres classes.

Tableau 257 – Extrémités d'association de GenerationDynamics::PWRSteamSupply avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] SteamTurbines	SteamTurbine	hérité de: SteamSupply
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.2.12 SteamSupply

Alimentation en vapeur pour les turbines à vapeur.

Le Tableau 258 montre tous les attributs de SteamSupply.

Tableau 258 – Attributs de GenerationDynamics::SteamSupply

nom	type	description
steamSupplyRating	Float	Régime assigné de l'alimentation en vapeur
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 259 montre toutes les extrémités d'association de SteamSupply avec d'autres classes.

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Tableau 259 – Extrémités d'association de GenerationDynamics::SteamSupply avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] SteamTurbines	SteamTurbine	Les turbines à vapeur peuvent être alimentées en vapeur par une source d'alimentation en vapeur
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.2.13 SteamTurbine

Turbine à vapeur.

Le Tableau 260 montre tous les attributs de SteamTurbine.

Tableau 260 – Attributs de GenerationDynamics::SteamTurbine

nom	type	description
crossoverTC	Seconds	Constante de temps du point convergence
reheater1TC	Seconds	Constante de temps du premier resurchauffeur
reheater2TC	Seconds	Constante de temps du second resurchauffeur
shaft1PowerHP	Float	Fraction d'énergie à partir de la puissance de sortie de la turbine haute pression arbre 1
shaft1PowerIP	Float	Fraction d'énergie à partir de la puissance de sortie de la turbine pression intermédiaire arbre 1
shaft1PowerLP1	Float	Fraction d'énergie à partir de la puissance de sortie de la première turbine basse pression arbre 1
shaft1PowerLP2	Float	Fraction d'énergie à partir de la puissance de sortie de la seconde turbine basse pression arbre 1
shaft2PowerHP	Float	Fraction d'énergie à partir de la puissance de sortie de la turbine haute pression arbre 2
shaft2PowerIP	Float	Fraction d'énergie à partir de la puissance de sortie de la turbine pression intermédiaire arbre 2
shaft2PowerLP1	Float	Fraction d'énergie à partir de la puissance de sortie de la première turbine basse pression arbre 2
shaft2PowerLP2	Float	Fraction d'énergie à partir de la puissance de sortie de la seconde turbine basse pression arbre 2
steamChestTC	Seconds	Constante de temps du coffre de vapeur
primeMoverRating	Float	hérité de: PrimeMover
mRID	String	hérité de: IdentifiedObject

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nom	type	description
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 261 montre toutes les extrémités d'association de SteamTurbine avec d'autres classes.

Tableau 261 – Extrémités d'association de GenerationDynamics::SteamTurbine avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] SteamSupplys	SteamSupply	Les turbines à vapeur peuvent être alimentées en vapeur par une source d'alimentation en vapeur
[0..*]	[0..*] SynchronousMachines	SynchronousMachine	hérité de: PrimeMover
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.2.14 Subcritical

Chaudière sous-critique à circulation forcée.

Le Tableau 262 montre tous les attributs de Subcritical.

Tableau 262 – Attributs de GenerationDynamics::Subcritical

nom	type	description
auxPowerVersusFrequency	PU	hérité de: FossilSteamSupply
auxPowerVersusVoltage	PU	hérité de: FossilSteamSupply
boilerControlMode	BoilerControlMode	hérité de: FossilSteamSupply
controlErrorBiasP	Float	hérité de: FossilSteamSupply
controlIC	Float	hérité de: FossilSteamSupply
controlPC	Float	hérité de: FossilSteamSupply
controlPEB	Float	hérité de: FossilSteamSupply
controlPED	PU	hérité de: FossilSteamSupply
controlTC	Float	hérité de: FossilSteamSupply
feedWaterIG	Float	hérité de: FossilSteamSupply

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nom	type	description
feedWaterPG	Float	hérité de: FossilSteamSupply
feedWaterTC	Seconds	hérité de: FossilSteamSupply
fuelDemandLimit	PU	hérité de: FossilSteamSupply
fuelSupplyDelay	Seconds	hérité de: FossilSteamSupply
fuelSupplyTC	Seconds	hérité de: FossilSteamSupply
maxErrorRateP	Float	hérité de: FossilSteamSupply
mechPowerSensorLag	Seconds	hérité de: FossilSteamSupply
minErrorRateP	Float	hérité de: FossilSteamSupply
pressureCtrlDG	Float	hérité de: FossilSteamSupply
pressureCtrlIG	Float	hérité de: FossilSteamSupply
pressureCtrlPG	Float	hérité de: FossilSteamSupply
pressureFeedback	Integer	hérité de: FossilSteamSupply
superHeater1Capacity	Float	hérité de: FossilSteamSupply
superHeater2Capacity	Float	hérité de: FossilSteamSupply
superHeaterPipePD	Float	hérité de: FossilSteamSupply
throttlePressureSP	PU	hérité de: FossilSteamSupply
steamSupplyRating	Float	hérité de: SteamSupply
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 263 montre toutes les extrémités d'association de Subcritical avec d'autres classes.

Tableau 263 – Extrémités d'association de GenerationDynamics::Subcritical avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] SteamTurbines	SteamTurbine	hérité de: SteamSupply
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.2.15 Supercritical

Chaudière surcritique à circulation forcée.

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Le Tableau 264 montre tous les attributs de Supercritical.

Tableau 264 – Attributs de GenerationDynamics::Supercritical

nom	type	description
auxPowerVersusFrequency	PU	hérité de: FossilSteamSupply
auxPowerVersusVoltage	PU	hérité de: FossilSteamSupply
boilerControlMode	BoilerControlMode	hérité de: FossilSteamSupply
controlErrorBiasP	Float	hérité de: FossilSteamSupply
controlIC	Float	hérité de: FossilSteamSupply
controlPC	Float	hérité de: FossilSteamSupply
controlPEB	Float	hérité de: FossilSteamSupply
controlPED	PU	hérité de: FossilSteamSupply
controlTC	Float	hérité de: FossilSteamSupply
feedWaterIG	Float	hérité de: FossilSteamSupply
feedWaterPG	Float	hérité de: FossilSteamSupply
feedWaterTC	Seconds	hérité de: FossilSteamSupply
fuelDemandLimit	PU	hérité de: FossilSteamSupply
fuelSupplyDelay	Seconds	hérité de: FossilSteamSupply
fuelSupplyTC	Seconds	hérité de: FossilSteamSupply
maxErrorRateP	Float	hérité de: FossilSteamSupply
mechPowerSensorLag	Seconds	hérité de: FossilSteamSupply
minErrorRateP	Float	hérité de: FossilSteamSupply
pressureCtrlDG	Float	hérité de: FossilSteamSupply
pressureCtrlIG	Float	hérité de: FossilSteamSupply
pressureCtrlPG	Float	hérité de: FossilSteamSupply
pressureFeedback	Integer	hérité de: FossilSteamSupply
superHeater1Capacity	Float	hérité de: FossilSteamSupply
superHeater2Capacity	Float	hérité de: FossilSteamSupply
superHeaterPipePD	Float	hérité de: FossilSteamSupply
throttlePressureSP	PU	hérité de: FossilSteamSupply
steamSupplyRating	Float	hérité de: SteamSupply
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 265 montre toutes les extrémités d'association de Supercritical avec d'autres classes.

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Tableau 265 – Extrémités d'association de GenerationDynamics::Supercritical avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] SteamTurbines	SteamTurbine	hérité de: SteamSupply
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.2.16 Enumération TurbineType

Type de turbine.

Le Tableau 266 montre tous les libellés de TurbineType.

Tableau 266 – Libellés de GenerationDynamics::TurbineType

libellé	description
francis	
pelton	
kaplan	

6.1.8.3 Paquetage Production

6.1.8.3.1 Généralités

Le paquetage production se charge des classes décrivant différents types de génératrices. Ces classes fournissent également des informations relatives au coût de production, utilisées pour répartir, selon des critères économiques, la demande entre les unités engagées et pour calculer les quantités de réserve.

La Figure 53 montre le diagramme logique Nuclear.

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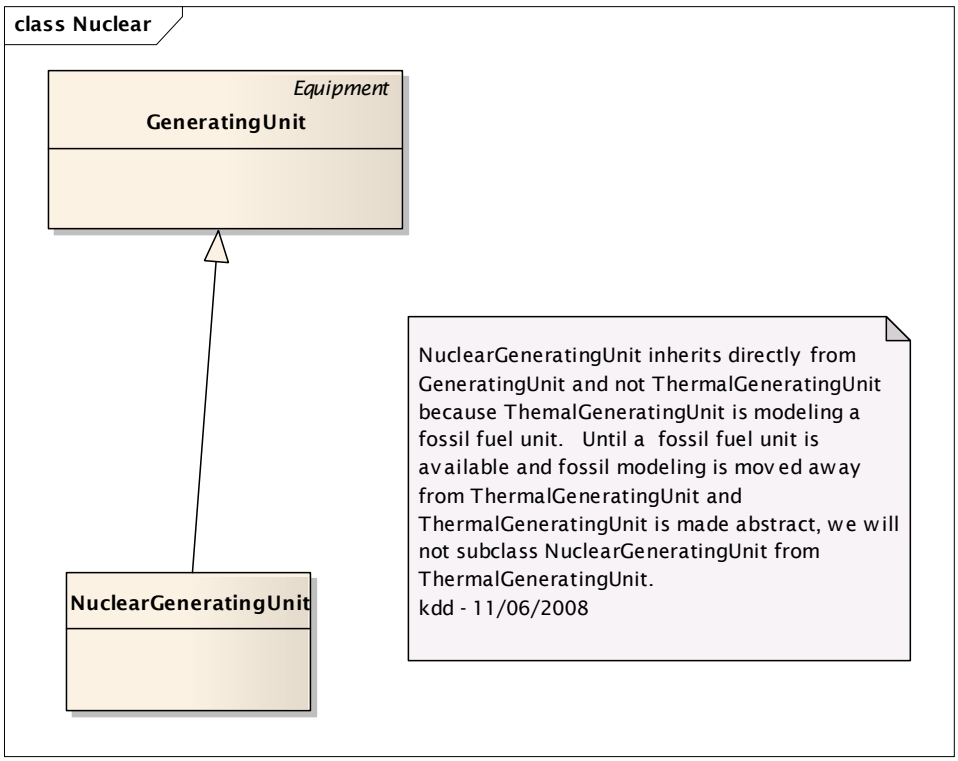

Légende

Anglais	Français
NuclearGeneratingUnit inherits directly from GeneratingUnit and not ThermalGeneratingUnit because ThemalGeneratingUnit is modeling a fossil fuel unit. Until a fossil fuel unit is available and fossil modeling is moved away from ThermalGeneratingUnit and ThermalGeneratingUnit is made abstract, we will not subclass NuclearGeneratingUnit from ThermalGeneratingUnit. kdd - 11/06/2008	NuclearGeneratingUnit hérite directement de GeneratingUnit et non de ThermalGeneratingUnit car ThemalGeneratingUnit modélise une unité de combustible fossile. Tant qu'une unité de combustible fossile n'est pas disponible et la modélisation de fossile n'est pas éloignée de ThermalGeneratingUnit et ThermalGeneratingUnit n'est pas rendu abstraite, nous ne ferons pas de NuclearGeneratingUnit une sous-classe de ThermalGeneratingUnit. kdd - 11/06/2008

Figure 53 – Diagramme logique Production::Nuclear

La Figure 54 montre le diagramme logique Main.

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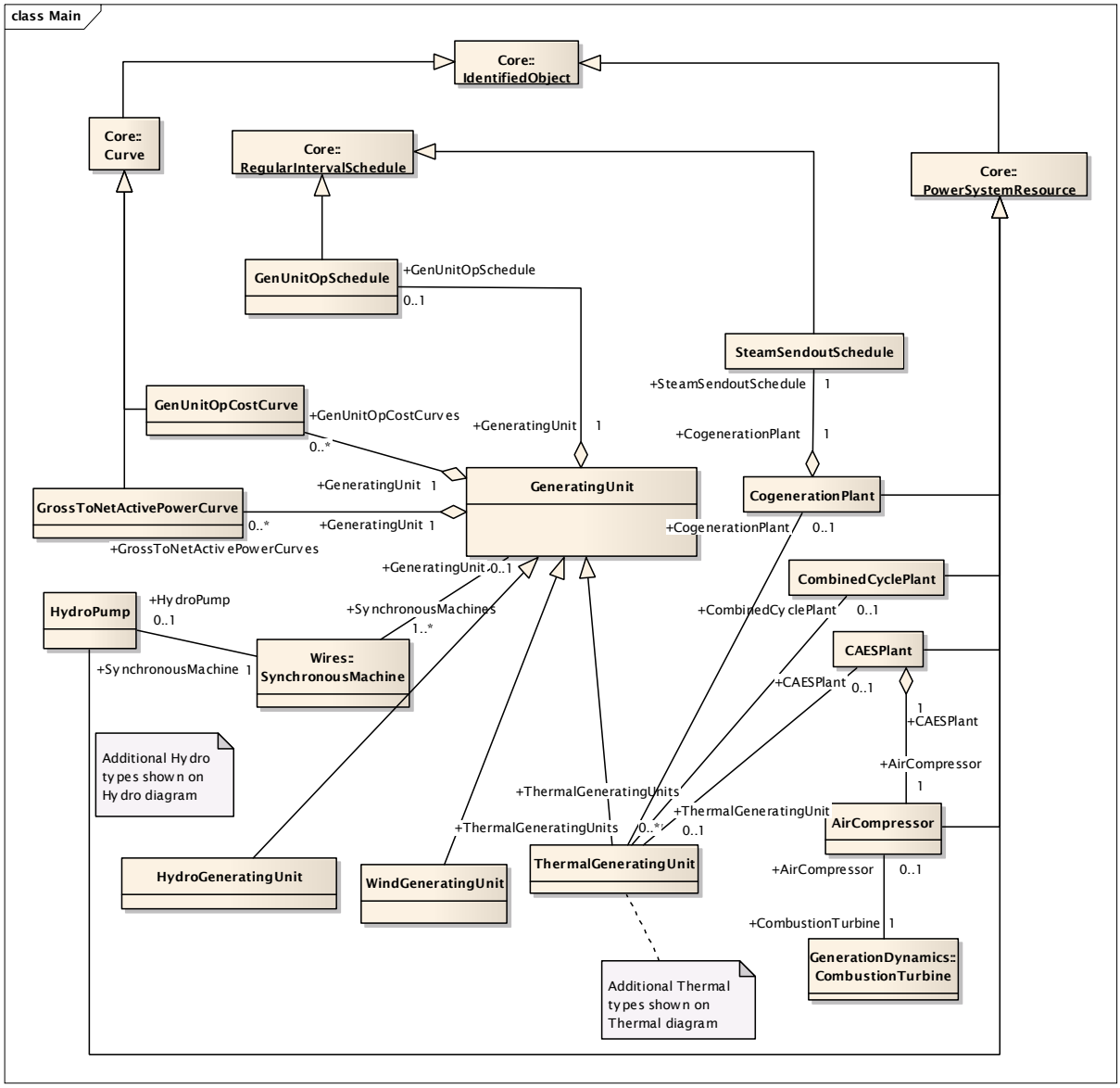

Légende

Anglais	Français
Additional Hydro types shown on Hydro diagram	Types Hydro supplémentaires montrés sur le diagramme Hydro
Additional Thermal types shown on Thermal diagram	Types Thermal supplémentaires montrés sur le diagramme Thermal

Figure 54 – Diagramme logique Production::Main

Ce diagramme montre toutes les classes incluses dans le paquetage Production qui sont nécessaires à la production Thermal (thermique) et aussi Hydro (hydraulique). Elle montre aussi les classes-clés externes qui ont des associations avec les classes de Production.

La Figure 55 montre le diagramme logique Datatypes.

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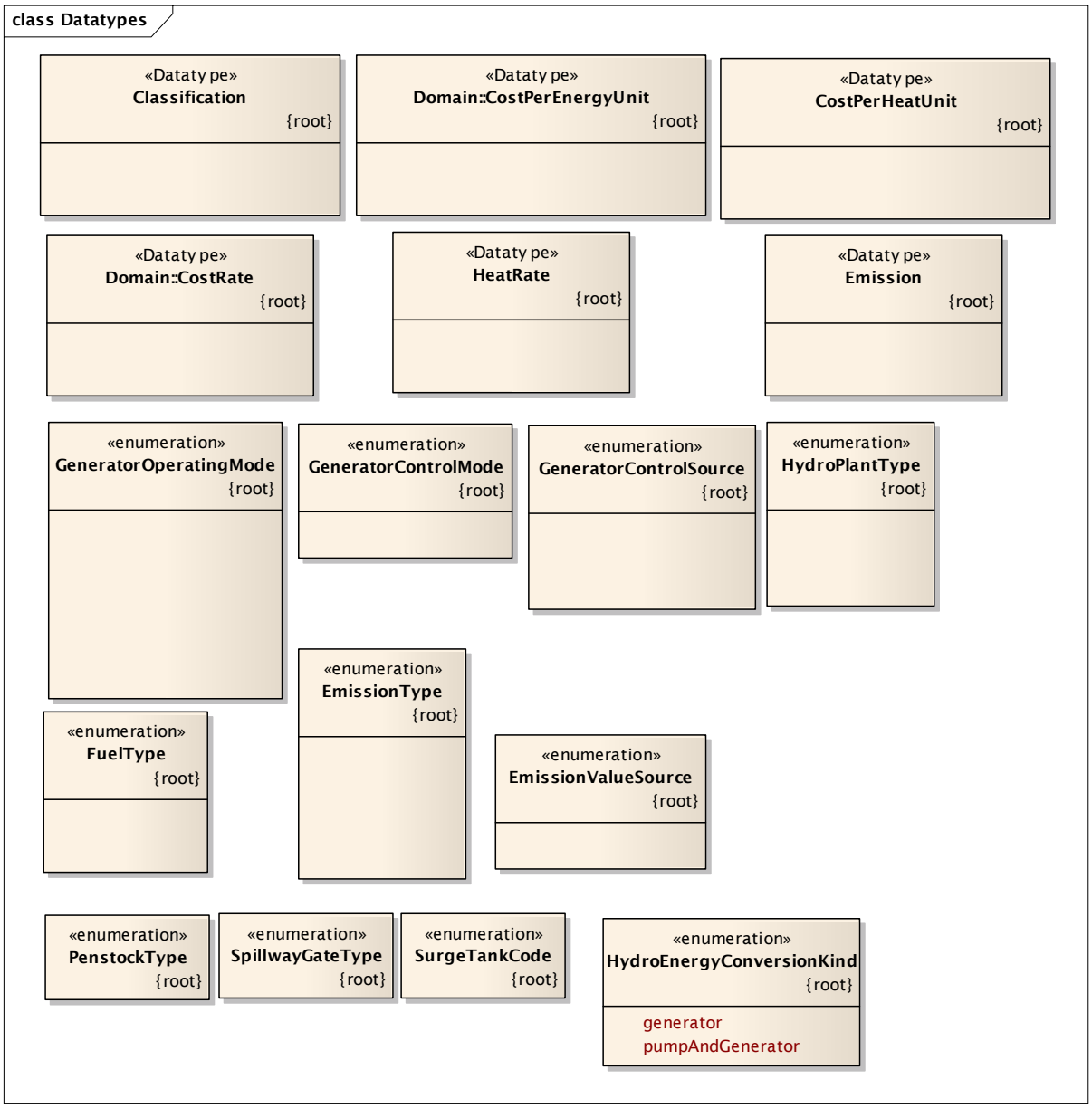

Figure 55 – Diagramme logique Production::Datatypes

Ce diagramme montre les types de données spécifiques au paquetage Production.

La Figure 56 montre le diagramme logique Hydro.

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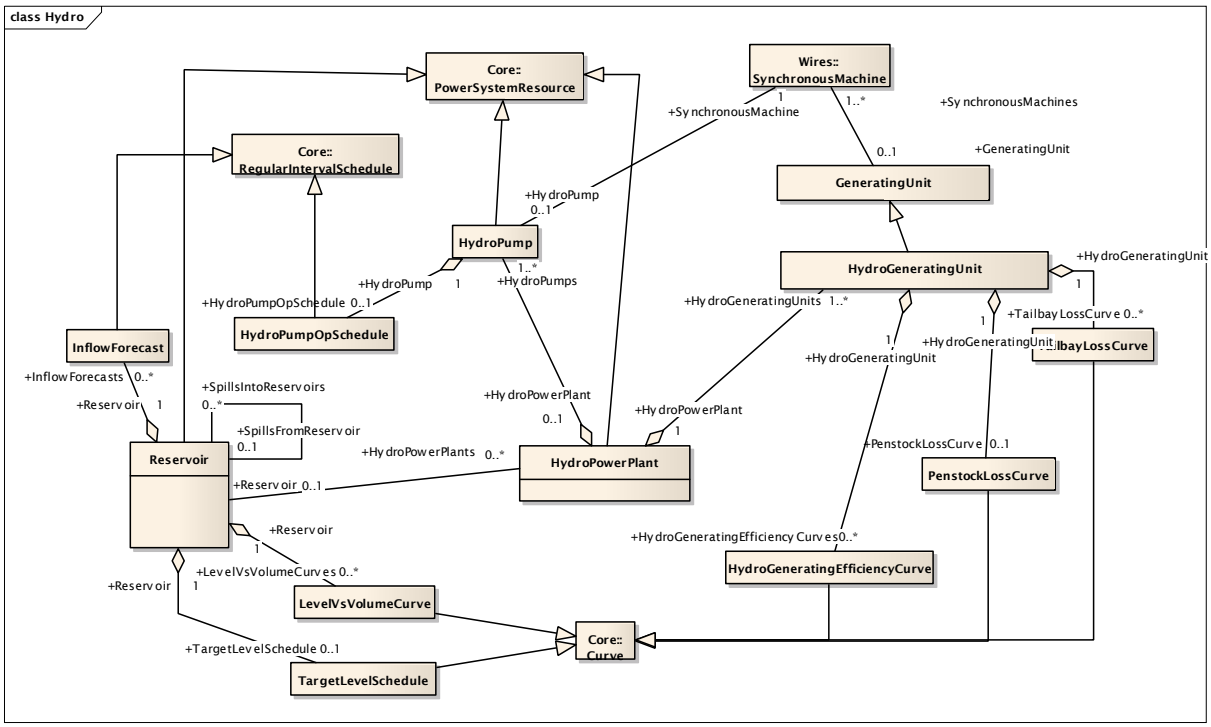

Figure 56 – Diagramme logique Production::Hydro

Ce diagramme montre toutes les classes incluses dans le paquetage Hydro de même que les classes-clés externes, qui ont des associations avec des classes Hydro.

La Figure 57 montre le diagramme logique Thermal.

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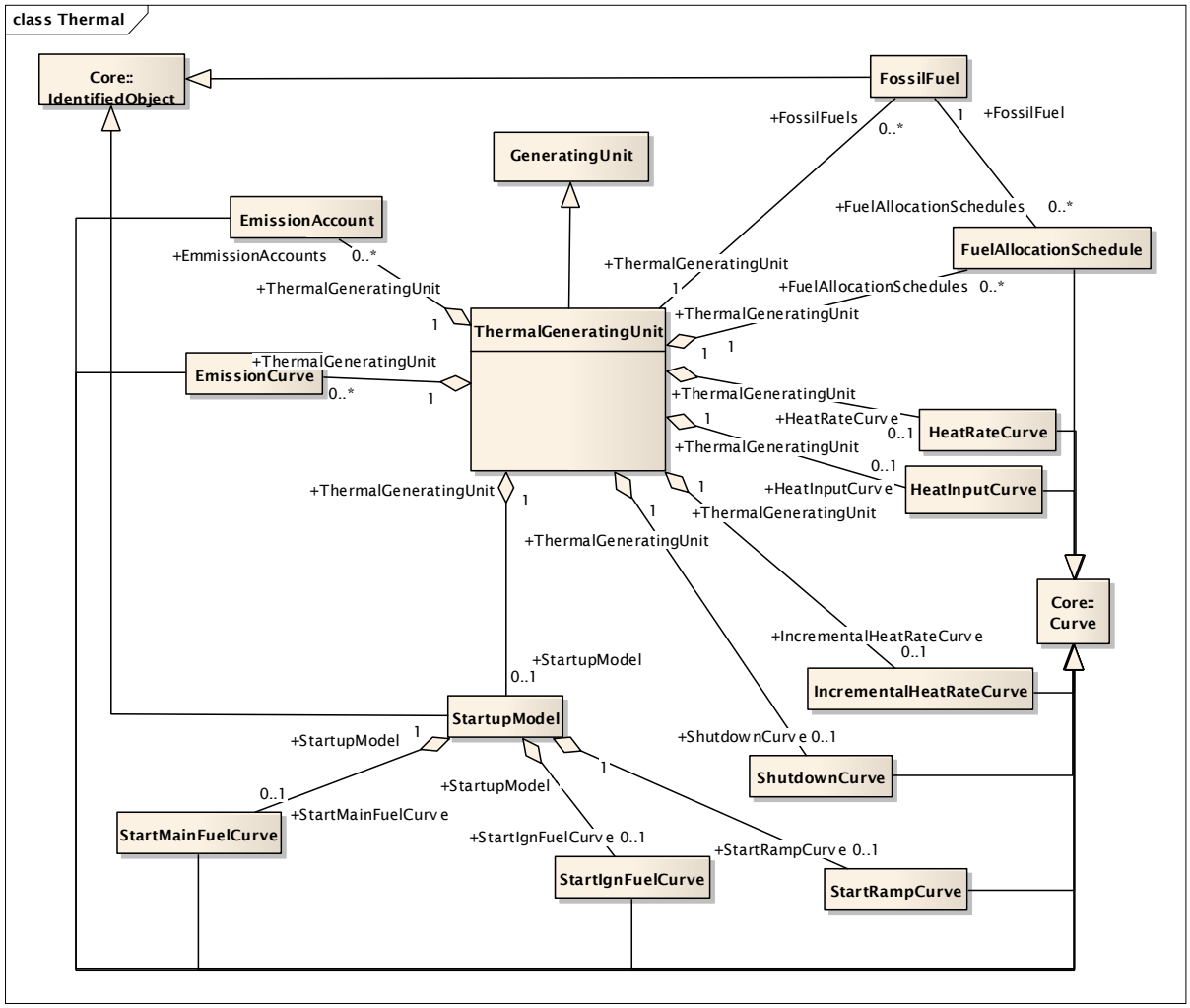

Figure 57 – Diagramme logique Production::Thermal

Ce diagramme montre toutes les classes incluses dans le paquetage Thermal de même que les classes-clés externes, qui ont des associations avec des classes Thermal.

6.1.8.3.2 Enumération HydroEnergyConversionKind

Spécifie la capacité de l'unité de production hydraulique à convertir l'énergie comme un générateur ou une pompe.

Le Tableau 267 montre tous les libellés de HydroEnergyConversionKind.

Tableau 267 – Libellés de Production::HydroEnergyConversionKind

libellé	description
generator	Capable de générer de la puissance, mais incapable de pomper l'eau pour stockage d'énergie
pumpAndGenerator	Capable à la fois de générer de la puissance et de pomper de l'eau pour le stockage d'énergie

6.1.8.3.3 NuclearGeneratingUnit

Unité de production nucléaire.

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Le Tableau 268 montre tous les attributs de NuclearGeneratingUnit.

Tableau 268 – Attributs de Production::NuclearGeneratingUnit

nom	type	description
allocSpinResP	ActivePower	hérité de: GeneratingUnit
autoCntrlMarginP	ActivePower	hérité de: GeneratingUnit
baseP	ActivePower	hérité de: GeneratingUnit
controlDeadband	ActivePower	hérité de: GeneratingUnit
controlPulseHigh	Seconds	hérité de: GeneratingUnit
controlPulseLow	Seconds	hérité de: GeneratingUnit
controlResponseRate	ActivePowerChangeRate	hérité de: GeneratingUnit
dispReserveFlag	Boolean	hérité de: GeneratingUnit
efficiency	PU	hérité de: GeneratingUnit
energyMinP	HeatRate	hérité de: GeneratingUnit
fastStartFlag	Boolean	hérité de: GeneratingUnit
fuelPriority	Integer	hérité de: GeneratingUnit
genControlMode	GeneratorControlMode	hérité de: GeneratingUnit
genControlSource	GeneratorControlSource	hérité de: GeneratingUnit
genOperatingMode	GeneratorOperatingMode	hérité de: GeneratingUnit
governorMPL	PU	hérité de: GeneratingUnit
governorSCD	PerCent	hérité de: GeneratingUnit
highControlLimit	ActivePower	hérité de: GeneratingUnit
initialP	ActivePower	hérité de: GeneratingUnit
longPF	Float	hérité de: GeneratingUnit
lowControlLimit	ActivePower	hérité de: GeneratingUnit
lowerRampRate	ActivePowerChangeRate	hérité de: GeneratingUnit
maxEconomicP	ActivePower	hérité de: GeneratingUnit
maximumAllowableSpinningReserve	ActivePower	hérité de: GeneratingUnit
maxOperatingP	ActivePower	hérité de: GeneratingUnit
minEconomicP	ActivePower	hérité de: GeneratingUnit
minimumOffTime	Seconds	hérité de: GeneratingUnit
minOperatingP	ActivePower	hérité de: GeneratingUnit
modelDetail	Classification	hérité de: GeneratingUnit
normalPF	Float	hérité de: GeneratingUnit
penaltyFactor	Float	hérité de: GeneratingUnit
raiseRampRate	ActivePowerChangeRate	hérité de: GeneratingUnit
ratedGrossMaxP	ActivePower	hérité de: GeneratingUnit
ratedGrossMinP	ActivePower	hérité de: GeneratingUnit
ratedNetMaxP	ActivePower	hérité de: GeneratingUnit
shortPF	Float	hérité de: GeneratingUnit
spinReserveRamp	ActivePowerChangeRate	hérité de: GeneratingUnit
startupCost	Money	hérité de: GeneratingUnit
startupTime	Seconds	hérité de: GeneratingUnit
stepChange	ActivePower	hérité de: GeneratingUnit

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nom	type	description
tieLinePF	Float	hérité de: GeneratingUnit
variableCost	Money	hérité de: GeneratingUnit
nominalP	ActivePower	hérité de: GeneratingUnit
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 269 montre toutes les extrémités d'association de NuclearGeneratingUnit avec d'autres classes.

Tableau 269 – Extrémités d'association de Production::NuclearGeneratingUnit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..*] SynchronousMachines	SynchronousMachine	hérité de: GeneratingUnit
[1..1]	[0..1] GenUnitOpSchedule	GenUnitOpSchedule	hérité de: GeneratingUnit
[1..1]	[0..*] GrossToNetActivePowerCurves	GrossToNetActivePowerCurve	hérité de: GeneratingUnit
[1..1]	[0..*] GenUnitOpCostCurves	GenUnitOpCostCurve	hérité de: GeneratingUnit
[1..1]	[0..*] ControlAreaGeneratingUnit	ControlAreaGeneratingUnit	hérité de: GeneratingUnit
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.3.4 WindGeneratingUnit

Bloc générateur éolien.

Le Tableau 270 montre tous les attributs de WindGeneratingUnit.

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Tableau 270 – Attributs de Production::WindGeneratingUnit

nom	type	description
allocSpinResP	ActivePower	hérité de: GeneratingUnit
autoCntrlMarginP	ActivePower	hérité de: GeneratingUnit
baseP	ActivePower	hérité de: GeneratingUnit
controlDeadband	ActivePower	hérité de: GeneratingUnit
controlPulseHigh	Seconds	hérité de: GeneratingUnit
controlPulseLow	Seconds	hérité de: GeneratingUnit
controlResponseRate	ActivePowerChangeRate	hérité de: GeneratingUnit
dispReserveFlag	Boolean	hérité de: GeneratingUnit
efficiency	PU	hérité de: GeneratingUnit
energyMinP	HeatRate	hérité de: GeneratingUnit
fastStartFlag	Boolean	hérité de: GeneratingUnit
fuelPriority	Integer	hérité de: GeneratingUnit
genControlMode	GeneratorControlMode	hérité de: GeneratingUnit
genControlSource	GeneratorControlSource	hérité de: GeneratingUnit
genOperatingMode	GeneratorOperatingMode	hérité de: GeneratingUnit
governorMPL	PU	hérité de: GeneratingUnit
governorSCD	PerCent	hérité de: GeneratingUnit
highControlLimit	ActivePower	hérité de: GeneratingUnit
initialP	ActivePower	hérité de: GeneratingUnit
longPF	Float	hérité de: GeneratingUnit
lowControlLimit	ActivePower	hérité de: GeneratingUnit
lowerRampRate	ActivePowerChangeRate	hérité de: GeneratingUnit
maxEconomicP	ActivePower	hérité de: GeneratingUnit
maximumAllowableSpinningReserve	ActivePower	hérité de: GeneratingUnit
maxOperatingP	ActivePower	hérité de: GeneratingUnit
minEconomicP	ActivePower	hérité de: GeneratingUnit
minimumOffTime	Seconds	hérité de: GeneratingUnit
minOperatingP	ActivePower	hérité de: GeneratingUnit
modelDetail	Classification	hérité de: GeneratingUnit
normalPF	Float	hérité de: GeneratingUnit
penaltyFactor	Float	hérité de: GeneratingUnit
raiseRampRate	ActivePowerChangeRate	hérité de: GeneratingUnit
ratedGrossMaxP	ActivePower	hérité de: GeneratingUnit
ratedGrossMinP	ActivePower	hérité de: GeneratingUnit
ratedNetMaxP	ActivePower	hérité de: GeneratingUnit
shortPF	Float	hérité de: GeneratingUnit
spinReserveRamp	ActivePowerChangeRate	hérité de: GeneratingUnit
startupCost	Money	hérité de: GeneratingUnit
startupTime	Seconds	hérité de: GeneratingUnit
stepChange	ActivePower	hérité de: GeneratingUnit
tieLinePF	Float	hérité de: GeneratingUnit
variableCost	Money	hérité de: GeneratingUnit

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nom	type	description
nominalP	ActivePower	hérité de: GeneratingUnit
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 271 montre toutes les extrémités d'association de WindGeneratingUnit avec d'autres classes.

Tableau 271 – Extrémités d'association de Production::WindGeneratingUnit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..*] SynchronousMachines	SynchronousMachine	hérité de: GeneratingUnit
[1..1]	[0..1] GenUnitOpSchedule	GenUnitOpSchedule	hérité de: GeneratingUnit
[1..1]	[0..*] GrossToNetActivePowerCurves	GrossToNetActivePowerCurve	hérité de: GeneratingUnit
[1..1]	[0..*] GenUnitOpCostCurves	GenUnitOpCostCurve	hérité de: GeneratingUnit
[1..1]	[0..*] ControlAreaGeneratingUnit	ControlAreaGeneratingUnit	hérité de: GeneratingUnit
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.3.5 AirCompressor

Compresseur d'air de la turbine à combustion qui fait partie intégrante d'une centrale CAES ("compressed air energy storage", c'est-à-dire accumulation d'énergie d'air comprimé).

Le Tableau 272 montre tous les attributs de AirCompressor.

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Tableau 272 – Attributs de Production::AirCompressor

nom	type	description
airCompressorRating	Float	Donnée assignée du compresseur d'air CAES
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 273 montre toutes les extrémités d'association de AirCompressor avec d'autres classes.

Tableau 273 – Extrémités d'association de Production::AirCompressor avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[1..1] CAESPlant	CAESPlant	Un compresseur d'air peut faire partie d'une centrale de stockage d'énergie sous forme d'air comprimé
[0..1]	[1..1] CombustionTurbine	CombustionTurbine	Un compresseur d'air CAES est entraîné par une turbine à combustion
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.3.6 CAESPlant

Centrale d'accumulation d'énergie sous forme d'air comprimé.

Le Tableau 274 montre tous les attributs de CAESPlant.

Tableau 274 – Attributs de Production::CAESPlant

nom	type	description
energyStorageCapacity	RealEnergy	La capacité assignée de stockage d'énergie
ratedCapacityP	ActivePower	Capacité génératrice assignée brute de la centrale CAES
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject

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nom	type	description
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 275 montre toutes les extrémités d'association de CAESPlant avec d'autres classes.

Tableau 275 – Extrémités d'association de Production::CAESPlant avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..1] ThermalGeneratingUnit	ThermalGeneratingUnit	Une unité de production thermique peut faire partie d'une centrale de stockage d'énergie sous forme d'air comprimé
[1..1]	[1..1] AirCompressor	AirCompressor	Un compresseur d'air peut faire partie d'une centrale de stockage d'énergie sous forme d'air comprimé
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.3.7 Type de données Classification

1..n, où 1 est la priorité la plus détaillée, la plus importante, etc.

Le Tableau 276 montre tous les attributs de Classification.

Tableau 276 – Attributs de Production::Classification

nom	type	description
value	Integer	
unit=none (const)	UnitSymbol	
multiplier=none (const)	UnitMultiplier	

6.1.8.3.8 CogenerationPlant

Ensemble d'unités de production thermique pour la production d'énergie électrique et de vapeur à usage industriel (généralement vapeur de sortie des turbines à vapeur). La vapeur évacuée est généralement utilisée dans un but industriel ou pour le chauffage et la ventilation urbains.

Le Tableau 277 montre tous les attributs de CogenerationPlant.

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Tableau 277 – Attributs de Production::CogenerationPlant

nom	type	description
cogenHPSendoutRating	Float	Émission de vapeur à haute pression
cogenHPSteamRating	Float	Caractéristique assignée de vapeur à haute pression
cogenLPSendoutRating	Float	Émission de vapeur à basse pression
cogenLPSteamRating	Float	Caractéristique assignée de vapeur à basse pression
ratedP	ActivePower	Puissance active de sortie assignée de la centrale de cogénération
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 278 montre toutes les extrémités d'association de CogenerationPlant avec d'autres classes.

Tableau 278 – Extrémités d'association de Production::CogenerationPlant avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] ThermalGeneratingUnits	ThermalGeneratingUnit	Une unité de production thermique peut faire partie d'une centrale de cogénération
[1..1]	[1..1] SteamSendoutSchedule	SteamSendoutSchedule	Une centrale de cogénération comporte un programme d'évacuation de vapeur
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.3.9 CombinedCyclePlant

Ensemble de turbines à combustion et de turbines à vapeur dans lequel la chaleur évacuée des turbines à combustion est récupérée pour générer de la vapeur destinée aux turbines à vapeur, entraînant ainsi un accroissement global du rendement de la centrale.

Le Tableau 279 montre tous les attributs de CombinedCyclePlant.

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Tableau 279 – Attributs de Production::CombinedCyclePlant

nom	type	description
combCyclePlantRating	ActivePower	Puissance active de sortie assignée de la centrale à cycle combiné
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 280 montre toutes les extrémités d'association de CombinedCyclePlant avec d'autres classes.

Tableau 280 – Extrémités d'association de Production::CombinedCyclePlant avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] ThermalGeneratingUnits	ThermalGeneratingUnit	Une unité de production thermique peut faire partie d'une centrale à cycle combiné
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.3.10 Type de données CostPerHeatUnit

Coût, en unités monétaires, par quantité de chaleur générée.

Le Tableau 281 montre tous les attributs de CostPerHeatUnit.

Tableau 281 – Attributs de Production::CostPerHeatUnit

nom	type	description
value	Float	
unit	MonetaryAmountPerHeat Unit	
multiplier	UnitMultiplier	

6.1.8.3.11 Type de données Emission

Quantité d'émission par capacité calorifique de chaleur du combustible

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Le Tableau 282 montre tous les attributs de Emission.

Tableau 282 – Attributs de Production::Emission

nom	type	description
value	Float	
unit=kg/J (const)	UnitSymbol	
multiplier	UnitMultiplier	

6.1.8.3.12 EmissionAccount

Comptes de suivi de l'utilisation et crédits d'émissions alloués aux unités de production thermique. Une unité peut avoir zéro à plusieurs comptes d'émissions et elle peut, généralement, avoir un compte pour le suivi d'utilisation et un autre pour le suivi des crédits.

Le Tableau 283 montre tous les attributs de EmissionAccount.

Tableau 283 – Attributs de Production::EmissionAccount

nom	type	description
emissionType	EmissionType	Type d'émission, par exemple, dioxyde de soufre (SO_2). Le y1AxisUnits de la courbe contient les unités de mesure (par exemple kg) tandis que emissionType est le type d'émission (par exemple dioxyde de soufre)
emissionValueSource	EmissionValueSource	Source de la valeur d'émission
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 284 montre toutes les extrémités d'association de EmissionAccount avec d'autres classes.

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Tableau 284 – Extrémités d'association de Production::EmissionAccount avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	Une unité de production thermique peut comporter un ou plusieurs comptes d'autorisation d'émission
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.13 EmissionCurve

Relation entre le taux d'émission de l'unité exprimé en unités de masse par heure (axe Y) et la puissance active de sortie (axe X) pour un type d'émission donné. Cette courbe ne s'applique que lorsqu'un seul type de combustible est brûlé.

Le Tableau 285 montre tous les attributs de EmissionCurve.

Tableau 285 – Attributs de Production::EmissionCurve

nom	type	description
emissionContent	Emission	Quantité d'émission par quantité de combustible brûlé
emissionType	EmissionType	Type d'émission qui fournit également l'unité de mesure du taux de production. Le y1AxisUnits de la courbe contient les unités de mesure (par exemple kg) tandis que emissionType est le type d'émission (par exemple dioxyde de soufre)
isNetGrossP	Boolean	L'indicateur est mis à true (vrai) lorsque la sortie est exprimée en puissance active nette
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 286 montre toutes les extrémités d'association de EmissionCurve avec d'autres classes.

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Tableau 286 – Extrémités d'association de Production::EmissionCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	Une unité de production thermique peut comporter une ou plusieurs courbes d'émission
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.14 Enumération EmissionType

Le type d'émission.

Le Tableau 287 montre tous les libellés de EmissionType.

Tableau 287 – Libellés de Production::EmissionType

libellé	description
sulfurDioxide	
carbonDioxide	
nitrogenOxide	
hydrogenSulfide	
chlorine	
carbonDisulfide	

6.1.8.3.15 Enumération EmissionValueSource

Source de la valeur d'émission.

Le Tableau 288 montre tous les libellés de EmissionValueSource.

Tableau 288 – Libellés de Production::EmissionValueSource

libellé	description
measured	
calculated	

6.1.8.3.16 FossilFuel

Combustible fossile consommé par les unités de production thermique non nucléaires (par exemple: charbon, fioul, gaz).

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Le Tableau 289 montre tous les attributs de FossilFuel.

Tableau 289 – Attributs de Production::FossilFuel

nom	type	description
fossilFuelType	FuelType	Type de combustible fossile tel que le charbon, le fioul ou le gaz
fuelCost	CostPerHeatUnit	Le coût en termes de pouvoir calorifique pour le type de combustible donné
fuelDispatchCost	CostPerHeatUnit	Coût du combustible utilisé pour le dispatching économique comprenant les éléments suivants: coût du combustible, coût du transport et coût de la maintenance supplémentaire
fuelEffFactor	PU	Facteur de rendement du combustible (par unité) en termes d'énergie réelle absorbée
fuelHandlingCost	CostPerHeatUnit	Coût de manipulation et de traitement associé à ce combustible
fuelHeatContent	Float	Quantité de chaleur par poids (ou par volume) du type de combustible donné
fuelMixture	PerCent	Quantité relative du type de combustible donné lorsque plusieurs combustibles sont consommés
fuelSulfur	PU	La partie du combustible des crédits de pollution par unité de capacité calorifique
highBreakpointP	ActivePower	Niveau de sortie en puissance active de l'unité auquel le type de combustible donné est démarré. Ce combustible (fioul par exemple) est parfois utilisé pour remplacer le combustible de base (charbon par exemple) à des niveaux élevés de sortie de puissance active
lowBreakpointP	ActivePower	Niveau de sortie en puissance active de l'unité auquel le type de combustible donné est arrêté. Ce combustible (fioul par exemple) est parfois utilisé pour stabiliser le combustible de base (charbon par exemple) à de faibles niveaux de sortie de puissance active
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 290 montre toutes les extrémités d'association de FossilFuel avec d'autres classes.

Tableau 290 – Extrémités d'association de Production::FossilFuel avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] FuelAllocationSchedules	FuelAllocationSchedule	Un programme d'attribution du combustible doit comporter un combustible fossile
[0..*]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	Une unité de production thermique peut comporter un ou plusieurs combustibles fossiles

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6.1.8.3.17 FuelAllocationSchedule

Quantité de combustible d'un type donné attribué à la consommation sur une période déterminée.

Le Tableau 291 montre tous les attributs de FuelAllocationSchedule.

Tableau 291 – Attributs de Production::FuelAllocationSchedule

nom	type	description
fuelAllocationEndDate	AbsoluteDateTime	Heure et date de fin du programme d'attribution du combustible
fuelAllocationStartDate	AbsoluteDateTime	Heure et date de début du programme d'attribution du combustible
fuelType	FuelType	Type de combustible, qui indique également l'unité de mesure correspondante
maxFuelAllocation	Float	Quantité maximale de combustible attribuée à la consommation pour la période programmée
minFuelAllocation	Float	Quantité minimale de combustible attribuée à la consommation pour la période programmée, sur la base, par exemple, d'un contrat "à prendre tel quel ou à payer"
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 292 montre toutes les extrémités d'association de FuelAllocationSchedule avec d'autres classes.

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Tableau 292 – Extrémités d'association de Production::FuelAllocationSchedule avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	Une unité de production thermique peut comporter un ou plusieurs programmes d'attribution de combustibles
[0..*]	[1..1] FossilFuel	FossilFuel	Un programme d'attribution du combustible doit comporter un combustible fossile
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.18 Enumération FuelType

Type de combustible.

Le Tableau 293 montre tous les libellés de FuelType.

Tableau 293 – Libellés de Production::FuelType

libellé	description
coal	
oil	
gas	
lignite	Le combustible est le charbon de lignite. Noter qu'il s'agit d'un type spécial de charbon et, donc, l'autre énumération de charbon est réservée aux types de charbon dur ou si le type exact du charbon n'est pas connu

6.1.8.3.19 GeneratingUnit

Une seule machine synchrone ou un ensemble de machines synchrones pour la conversion de la puissance mécanique en puissance à courant alternatif. Des machines individuelles dans un ensemble peuvent être, par exemple, définies dans un but de programmation alors qu'un seul signal de contrôle est dérivé pour l'ensemble. Dans ce cas, une GeneratingUnit (une unité de production) pour chaque membre de l'ensemble et une GeneratingUnit supplémentaire correspondant à l'ensemble pourraient être définies.

Le Tableau 294 montre tous les attributs de GeneratingUnit.

Tableau 294 – Attributs de Production::GeneratingUnit

nom	type	description
allocSpinResP	ActivePower	Capacité planifiée non utilisée (réserve tournante) qui peut être utilisée pour absorber une charge d'urgence
autoCntrlMarginP	ActivePower	Capacité planifiée non utilisée permettant d'absorber les à-coups de la régulation automatique

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nom	type	description
baseP	ActivePower	Pour les unités commandables, cette valeur représente le point de fonctionnement économique de base en puissance active alors que pour les unités non commandables, cette valeur correspond à la valeur fixe de production. La valeur doit être comprise entre les points haut et bas des limites de fonctionnement
controlDeadband	ActivePower	Bande morte de réglage. Lorsqu'une modification en puissance active requise pour l'unité est inférieure à cette bande morte, aucune impulsion de commande ne sera alors transmise à l'unité
controlPulseHigh	Seconds	Limite supérieure de l'impulsion correspondant à l'impulsion de commande la plus élevée à laquelle l'unité peut répondre
controlPulseLow	Seconds	Limite inférieure de l'impulsion correspondant à l'impulsion de commande la plus basse à laquelle l'unité peut répondre
controlResponseRate	ActivePowerChangeRate	Taux de réponse de l'unité spécifiant la modification de puissance active pour une impulsion de commande d'une seconde dans le niveau de charge le plus réactif de l'unité
dispReserveFlag	Boolean	
efficiency	PU	Rendement de l'unité à convertir l'énergie mécanique, depuis la machine motrice, en énergie électrique
energyMinP	HeatRate	
fastStartFlag	Boolean	
fuelPriority	Integer	
genControlMode	GeneratorControlMode	Le mode de commande de l'unité
genControlSource	GeneratorControlSource	La source de commandes pour une unité de production
genOperatingMode	GeneratorOperatingMode	Mode de fonctionnement pour réglage secondaire
governorMPL	PU	Limite de position du moteur du régulateur
governorSCD	PerCent	Statisme du changeur de vitesse du régulateur. Il s'agit de la variation de puissance de sortie du générateur divisée par la variation de fréquence normalisée par la puissance nominale du générateur et la fréquence nominale et exprimée en pourcentage et changée de signe. Une valeur positive du statisme de changement de vitesse fournit une sortie additive du générateur à la suite d'une chute de fréquence
highControlLimit	ActivePower	Limite supérieure du réglage secondaire (AGC, automatic generation control)
initialP	ActivePower	Valeur initiale par défaut de la puissance active, permettant d'enregistrer un résultat de flux d'énergie pour la valeur initiale de puissance active de cette unité, pour cette configuration réseau
longPF	Float	Facteur de participation économique de l'unité de production
lowControlLimit	ActivePower	Low limit for secondary (AGC) control
lowerRampRate	ActivePowerChangeRate	
maxEconomicP	ActivePower	Limite économique supérieure maximale de puissance active, il convient qu'elle ne dépasse pas la limite de puissance active maximum de fonctionnement

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nom	type	description
maximumAllowableSpinningReserve	ActivePower	Réserve tournante maximale autorisée. La réserve tournante ne sera jamais supérieure à cette valeur sans tenir compte du point de fonctionnement en cours
maxOperatingP	ActivePower	Limite maximale de puissance active de fonctionnement pouvant être entrée dans l'unité par le répartiteur
minEconomicP	ActivePower	Limite économique inférieure de puissance active devant être supérieure ou égale à la limite minimale de puissance active de fonctionnement
minimumOffTime	Seconds	Intervalle de temps minimal entre l'arrêt et le démarrage de l'unité
minOperatingP	ActivePower	Limite minimale de puissance active de fonctionnement pouvant être entrée dans l'unité par le dispatcheur
modelDetail	Classification	Détails des données de modèle de la génératrice
normalPF	Float	Facteur de participation économique de l'unité de production
penaltyFactor	Float	Défini de la manière suivante: 1 / (1 - perte de transport différentielle); la perte de transport différentielle est exprimée en valeur plus/moins. Les facteurs de retenue (penalty factors) types sont compris entre (0,9 et 1,1)
raiseRampRate	ActivePowerChangeRate	
ratedGrossMaxP	ActivePower	Capacité maximale brute assignée de l'unité (Book Value, valeur comptable)
ratedGrossMinP	ActivePower	Niveau de production minimal brut assigné avec lequel l'unité peut fonctionner sans risques en fournissant de l'énergie à la grille de transport
ratedNetMaxP	ActivePower	Capacité maximale nette assignée obtenue en soustrayant l'énergie auxiliaire utilisée pour faire fonctionner les machines internes de la centrale de la capacité maximale brute assignée
shortPF	Float	Facteur de participation économique de l'unité de production
spinReserveRamp	ActivePowerChangeRate	
startupCost	Money	Le coût de démarrage initial encouru pour chaque démarrage de l'unité de production GeneratingUnit
startupTime	Seconds	Temps requis pour connecter l'unité, à partir du moment où l'énergie mécanique des machines motrices est appliquée
stepChange	ActivePower	
tieLinePF	Float	Facteur de participation économique de l'unité de production
variableCost	Money	La composante coût variable de production par unité de puissance active (ActivePower)
nominalP	ActivePower	Puissance nominale de l'unité de production. Utilisée pour donner une signification précise à des attributs basés sur le pourcentage tels que le statisme de changement de vitesse du régulateur (attribut govenorSCD)
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject

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nom	type	description
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 295 montre toutes les extrémités d'association de GeneratingUnit avec d'autres classes.

Tableau 295 – Extrémités d'association de Production::GeneratingUnit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..*] SynchronousMachines	SynchronousMachine	Une machine synchrone peut fonctionner comme génératrice et devenir par conséquent un élément de l'unité de production
[1..1]	[0..1] GenUnitOpSchedule	GenUnitOpSchedule	Une unité de production peut comprendre un programme de fonctionnement, indiquant un fonctionnement planifié de l'unité
[1..1]	[0..*] GrossToNetActivePower Curves	GrossToNetActivePower Curve	Une unité de production peut comprendre une courbe de la puissance active brute en fonction de la puissance active nette, décrivant les pertes et les exigences d'énergie auxiliaire de l'unité
[1..1]	[0..*] GenUnitOpCostCurves	GenUnitOpCostCurve	Une unité de production peut avoir une ou plusieurs courbes de coûts, en fonction du mélange combustible et du prix du combustible
[1..1]	[0..*] ControlAreaGeneratingUnit	ControlAreaGeneratingUnit	Spécifications relatives à la zone de commande ControlArea pour cette unité de production
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.3.20 Enumération GeneratorControlMode

Modes de commande pour l'unité.

Le Tableau 296 montre tous les libellés de GeneratorControlMode.

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Tableau 296 – Libellés de Production::GeneratorControlMode

libellé	description
setpoint	
pulse	

6.1.8.3.21 Enumération GeneratorControlSource

La source de commandes pour une unité de production.

Le Tableau 297 montre tous les libellés de GeneratorControlSource.

Tableau 297 – Libellés de Production::GeneratorControlSource

libellé	description
unavailable	
offAGC	
onAGC	
plantControl	

6.1.8.3.22 Enumération GeneratorOperatingMode

Mode de fonctionnement pour commande de générateur secondaire.

Le Tableau 298 montre tous les libellés de GeneratorOperatingMode.

Tableau 298 – Libellés de Production::GeneratorOperatingMode

libellé	description
off	
manual	
fixed	
LFC	
AGC	
EDC	
MRN	
REG	

6.1.8.3.23 GenUnitOpCostCurve

Relation entre le coût de fonctionnement de l'unité (axe Y) et la puissance active de sortie de l'unité (axe X). La courbe de coût de fonctionnement des unités thermiques est dérivée des apports de chaleur et des coûts de combustible. La courbe de coût de fonctionnement des unités hydrauliques est dérivée des taux de débit d'eau et des coûts d'eau équivalents.

Le Tableau 299 montre tous les attributs de GenUnitOpCostCurve.

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Tableau 299 – Attributs de Production::GenUnitOpCostCurve

nom	type	description
isNetGrossP	Boolean	L'indicateur est mis à true (vrai) lorsque la sortie est exprimée en puissance active nette
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 300 montre toutes les extrémités d'association de GenUnitOpCostCurve avec d'autres classes.

Tableau 300 – Extrémités d'association de Production::GenUnitOpCostCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] GeneratingUnit	GeneratingUnit	Une unité de production peut avoir une ou plusieurs courbes de coûts, en fonction du mélange combustible et du prix du combustible
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.24 GenUnitOpSchedule

Programme (ou plan) de fonctionnement actuel approuvé par l'opérateur de l'unité de production, généralement produit à l'aide des analyses du type Plan de démarrage de tranche. L'axe X représente le temps absolu. L'axe Y1 représente le statut (0=off-line (hors ligne) et unavailable (non disponible): 1=available (disponible): 2=must run (marche imposée): 3=must run at fixed power value (marche imposée à une valeur de puissance fixe): etc.). L'axe Y2 représente la valeur de puissance imposée fixe le cas échéant.

Le Tableau 301 montre tous les attributs de GenUnitOpSchedule.

Tableau 301 – Attributs de Production::GenUnitOpSchedule

nom	type	description

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nom	type	description
timeStep	Seconds	hérité de: RegularIntervalSchedule
endTime	AbsoluteDateTime	hérité de: RegularIntervalSchedule
startTime	AbsoluteDateTime	hérité de: BasicIntervalSchedule
value1Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
value2Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 302 montre toutes les extrémités d'association de GenUnitOpSchedule avec d'autres classes.

Tableau 302 – Extrémités d'association de Production::GenUnitOpSchedule avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] GeneratingUnit	GeneratingUnit	Une unité de production peut comprendre un programme de fonctionnement, indiquant un fonctionnement planifié de l'unité
[1..1]	[1..*] TimePoints	RegularTimePoint	hérité de: RegularIntervalSchedule

6.1.8.3.25 GrossToNetActivePowerCurve

Relation entre la sortie de puissance active brute de l'unité de production sur l'axe X (mesurée sur les bornes de la (des) machine(s)) et la sortie de puissance active nette de l'unité de production sur l'axe Y (basée sur les mesures définies par l'entreprise de services publics à la centrale électrique). Il convient que les charges de service de poste, si modélisées, soient considérées comme des charges de jeu de barres non conformes. Il peut exister plus d'une courbe, en fonction de l'équipement auxiliaire en service.

Le Tableau 303 montre tous les attributs de GrossToNetActivePowerCurve.

Tableau 303 – Attributs de Production::GrossToNetActivePowerCurve

nom	type	description
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve

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nom	type	description
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 304 montre toutes les extrémités d'association de GrossToNetActivePowerCurve avec d'autres classes.

Tableau 304 – Extrémités d'association de Production::GrossToNetActivePowerCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] GeneratingUnit	GeneratingUnit	Une unité de production peut comprendre une courbe de la puissance active brute en fonction de la puissance active nette, décrivant les pertes et les exigences d'énergie auxiliaire de l'unité
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.26 HeatInputCurve

Relation entre l'apport de chaleur de l'unité en énergie par durée pour le combustible principal (axe Y1) et le combustible complémentaire (axe Y2) en fonction de la sortie de l'unité en puissance active (axe X). La quantité de combustible principal utilisé pour soutenir la production à ce niveau de sortie est distribuée au prorata pour un réglage entre les points de définition. La quantité de combustible additionnel utilisé à ce niveau de sortie est fixée et n'est pas distribuée au prorata.

Le Tableau 305 montre tous les attributs de HeatInputCurve.

Tableau 305 – Attributs de Production::HeatInputCurve

nom	type	description
auxPowerOffset	ActivePower	Sortie de puissance - facteur d'ajustement de compensation puissance auxiliaire
auxPowerMult	PU	Sortie de puissance - facteur d'ajustement de multiplication puissance auxiliaire
heatInputEff	PU	Apport de chaleur - facteur d'ajustement de multiplication de rendement
heatInputOffset	HeatRate	Apport de chaleur - facteur d'ajustement de compensation
isNetGrossP	Boolean	L'indicateurest mis à true (vrai) lorsque la sortie est exprimée en puissance active nette

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nom	type	description
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 306 montre toutes les extrémités d'association de HeatInputCurve avec d'autres classes.

Tableau 306 – Extrémités d'association de Production::HeatInputCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	Une unité de production thermique peut comporter une courbe d'apport de chaleur
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.27 Type de données HeatRate

Chaleur générée, en énergie par unité de durée de temps écoulé.

Le Tableau 307 montre tous les attributs de HeatRate.

Tableau 307 – Attributs de Production::HeatRate

nom	type	description
value	Float	
unit=J/s (const)	UnitSymbol	
multiplier	UnitMultiplier	

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6.1.8.3.28 HeatRateCurve

Relation entre consomation de chaleur de l'unité par puissance active (axe Y) et la sortie de l'unité (axe X). L'apport de chaleur provient de tous les combustibles.

Le Tableau 308 montre tous les attributs de HeatRateCurve.

Tableau 308 – Attributs de Production::HeatRateCurve

nom	type	description
isNetGrossP	Boolean	L'indicateurest mis à true (vrai) lorsque la sortie est exprimée en puissance active nette
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 309 montre toutes les extrémités d'association de HeatRateCurve avec d'autres classes.

Tableau 309 – Extrémités d'association de Production::HeatRateCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	Une unité de production thermique peut comporter une HeatRateCurve
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.29 HydroGeneratingEfficiencyCurve

Relation entre rendement de l'unité en pourcentage et la puissance active de sortie de l'unité pour une hauteur de chute nette en mètres. La relation entre rendement, décharge, hauteur de chute et sortie de puissance est exprimée comme suit:

$$E = KP / HQ$$

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où

E est le pourcentage;

P est la puissance active;

H est la hauteur;

Q est l'unité volume/temps;

K est la constante.

Par exemple, une courbe pour une hauteur de chute nette donnée pourrait indiquer le rendement (axe Y) en fonction de la sortie de puissance active (axe X) ou en fonction de la décharge sur l'axe X.

Le Tableau 310 montre tous les attributs de HydroGeneratingEfficiencyCurve.

Tableau 310 – Attributs de Production::HydroGeneratingEfficiencyCurve

nom	type	description
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 311 montre toutes les extrémités d'association de HydroGeneratingEfficiencyCurve avec d'autres classes.

Tableau 311 – Extrémités d'association de Production::HydroGeneratingEfficiencyCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] HydroGeneratingUnit	HydroGeneratingUnit	Une unité hydrogénératrice a une courbe de rendement
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

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6.1.8.3.30 HydroGeneratingUnit

Unité de production dont la machine motrice est une turbine hydraulique (par exemple, Francis, Pelton, Kaplan par exemple).

Le Tableau 312 montre tous les attributs de HydroGeneratingUnit.

Tableau 312 – Attributs de Production::HydroGeneratingUnit

nom	type	description
energyConversionCapability	HydroEnergyConversionKind	Fonctionnalité de conversion d'énergie pour la production
hydroUnitWaterCost	Float	Coût équivalent d'eau entraînant la turbine hydraulique, exprimé en coût par volume
allocSpinResP	ActivePower	hérité de: GeneratingUnit
autoCntrlMarginP	ActivePower	hérité de: GeneratingUnit
baseP	ActivePower	hérité de: GeneratingUnit
controlDeadband	ActivePower	hérité de: GeneratingUnit
controlPulseHigh	Seconds	hérité de: GeneratingUnit
controlPulseLow	Seconds	hérité de: GeneratingUnit
controlResponseRate	ActivePowerChangeRate	hérité de: GeneratingUnit
dispReserveFlag	Boolean	hérité de: GeneratingUnit
efficiency	PU	hérité de: GeneratingUnit
energyMinP	HeatRate	hérité de: GeneratingUnit
fastStartFlag	Boolean	hérité de: GeneratingUnit
fuelPriority	Integer	hérité de: GeneratingUnit
genControlMode	GeneratorControlMode	hérité de: GeneratingUnit
genControlSource	GeneratorControlSource	hérité de: GeneratingUnit
genOperatingMode	GeneratorOperatingMode	hérité de: GeneratingUnit
governorMPL	PU	hérité de: GeneratingUnit
governorSCD	PerCent	hérité de: GeneratingUnit
highControlLimit	ActivePower	hérité de: GeneratingUnit
initialP	ActivePower	hérité de: GeneratingUnit
longPF	Float	hérité de: GeneratingUnit
lowControlLimit	ActivePower	hérité de: GeneratingUnit
lowerRampRate	ActivePowerChangeRate	hérité de: GeneratingUnit
maxEconomicP	ActivePower	hérité de: GeneratingUnit
maximumAllowableSpinningReserve	ActivePower	hérité de: GeneratingUnit
maxOperatingP	ActivePower	hérité de: GeneratingUnit
minEconomicP	ActivePower	hérité de: GeneratingUnit
minimumOffTime	Seconds	hérité de: GeneratingUnit
minOperatingP	ActivePower	hérité de: GeneratingUnit
modelDetail	Classification	hérité de: GeneratingUnit
normalPF	Float	hérité de: GeneratingUnit
penaltyFactor	Float	hérité de: GeneratingUnit
raiseRampRate	ActivePowerChangeRate	hérité de: GeneratingUnit
ratedGrossMaxP	ActivePower	hérité de: GeneratingUnit

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nom	type	description
ratedGrossMinP	ActivePower	hérité de: GeneratingUnit
ratedNetMaxP	ActivePower	hérité de: GeneratingUnit
shortPF	Float	hérité de: GeneratingUnit
spinReserveRamp	ActivePowerChangeRate	hérité de: GeneratingUnit
startupCost	Money	hérité de: GeneratingUnit
startupTime	Seconds	hérité de: GeneratingUnit
stepChange	ActivePower	hérité de: GeneratingUnit
tieLinePF	Float	hérité de: GeneratingUnit
variableCost	Money	hérité de: GeneratingUnit
nominalP	ActivePower	hérité de: GeneratingUnit
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 313 montre toutes les extrémités d'association de HydroGeneratingUnit avec d'autres classes.

Tableau 313 – Extrémités d'association de Production::HydroGeneratingUnit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] TailbayLossCurve	TailbayLossCurve	Une unité hydrogénératrice a une courbe de perte de sortie d'écluse
[1..*]	[1..1] HydroPowerPlant	HydroPowerPlant	L'unité hydrogénératriceappartient à une centrale hydroélectrique
[1..1]	[0..*] HydroGeneratingEfficiency Curves	HydroGeneratingEfficiency Curve	Une unité hydrogénératrice a une courbe de rendement
[1..1]	[0..1] PenstockLossCurve	PenstockLossCurve	Une unité hydrogénératrice a une courbe de perte de conduite forcée
[0..1]	[1..*] SynchronousMachines	SynchronousMachine	hérité de: GeneratingUnit
[1..1]	[0..1] GenUnitOpSchedule	GenUnitOpSchedule	hérité de: GeneratingUnit
[1..1]	[0..*] GrossToNetActivePowerCurves	GrossToNetActivePower Curve	hérité de: GeneratingUnit
[1..1]	[0..*] GenUnitOpCostCurves	GenUnitOpCostCurve	hérité de: GeneratingUnit
[1..1]	[0..*] ControlAreaGeneratingUnit	ControlAreaGeneratingUnit	hérité de: GeneratingUnit
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource

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[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.3.31 Énumération HydroPlantType

Type de centrale hydro-électrique.

Le Tableau 314 montre tous les libellés de HydroPlantType.

Tableau 314 – Libellés de Production::HydroPlantType

libellé	description
runOfRiver	
pumpedStorage	
majorStorage	
minorStorage	

6.1.8.3.32 HydroPowerPlant

Centrale hydroélectrique de production ou de pompage. Pour la production, les turbines génératrices reçoivent l'eau d'un réservoir supérieur. Pour le pompage, les pompes reçoivent l'eau d'un réservoir inférieur.

Le Tableau 315 montre tous les attributs de HydroPowerPlant.

Tableau 315 – Attributs de Production::HydroPowerPlant

nom	type	description
dischargeTravelDelay	Seconds	Course de l'eau depuis la sortie d'écluse jusqu'à la prochaine centrale hydroélectrique en aval
genRatedP	ActivePower	Régime assigné de production de la centrale hydroélectrique en puissance active, dans des conditions de hauteur de chute assignée
hydroPlantType	HydroPlantType	Type de centrale hydro-électrique
penstockType	PenstockType	Type et configuration de la (des) conduite(s) forcée(s) de la centrale hydroélectrique
plantDischargeCapacity	Float	Capacité totale d'évacuation de la centrale en mètres cubes par seconde
plantRatedHead	Length	Hauteur de chute brute assignée de la centrale
pumpRatedP	ActivePower	Régime assigné de pompage de la centrale hydroélectrique en puissance active, dans des conditions de hauteur de chute assignée
surgeTankCode	SurgeTankCode	Code décrivant le type (ou absence) de cheminée d'équilibre liée à la centrale hydro-électrique

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nom	type	description
surgeTankCrestLevel	WaterLevel	Niveau à partir duquel la cheminée d'équilibre déborde
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 316 montre toutes les extrémités d'association de HydroPowerPlant avec d'autres classes.

Tableau 316 – Extrémités d'association de Production::HydroPowerPlant avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..*] HydroPumps	HydroPump	La pompe hydraulique peut être un élément de la centrale de stockage par pompage ou une pompe de distribution d'eau
[0..*]	[0..1] Reservoir	Reservoir	Un réservoir en aval reçoit l'eau évacuée par des génératrices ou alimente des pompes en eau
[0..*]	[1..1] GenSourcePumpDischargeReservoir	Reservoir	Un réservoir en amont alimente des génératrices en eau ou reçoit l'eau évacuée par des pompes
[1..1]	[1..*] HydroGeneratingUnits	HydroGeneratingUnit	L'unité hydrogénératrice appartient à une centrale hydroélectrique
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.3.33 HydroPump

Pompe synchrone entraînée par moteur, généralement associée à une centrale de pompage.

Le Tableau 317 montre tous les attributs de HydroPump.

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Tableau 317 – Attributs de Production::HydroPump

nom	type	description
pumpDischAtMaxHead	Float	Évacuation du pompage (m^3/s) en cas de hauteur de chute maximale, habituellement avec vannes au maximum
pumpDischAtMinHead	Float	Évacuation du pompage (m^3/s) en cas de hauteur de chute minimale, habituellement avec vannes au maximum
pumpPowerAtMaxHead	ActivePower	Puissance du pompage en cas de hauteur de chute maximale, habituellement avec vannes au maximum
pumpPowerAtMinHead	ActivePower	Puissance du pompage en cas de hauteur de chute minimale, habituellement avec vannes au maximum
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 318 montre toutes les extrémités d'association de HydroPump avec d'autres classes.

Tableau 318 – Extrémités d'association de Production::HydroPump avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..1] HydroPumpOpSchedule	HydroPumpOpSchedule	La pompe hydraulique possède un programme de pompage sur la durée, précisant le moment où le pompage doit avoir lieu
[0..1]	[1..1] SynchronousMachine	SynchronousMachine	La machine synchrone entraîne la turbine qui déplace l'eau de bas en haut. Le sens de rotation de la machine pour le pompage peut ou peut ne pas être identique à celui utilisé pour la production
[1..*]	[0..1] HydroPowerPlant	HydroPowerPlant	La pompe hydraulique peut être unélément de la centrale de stockage par pompage ou une pompe de distribution d'eau
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

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6.1.8.3.34 HydroPumpOpSchedule

Programme (ou plan) de fonctionnement en cours approuvé par un opérateur de la pompe hydraulique, généralement établi à l'aide d'analyses de type plan de démarrage de tranche (Unit Commitment). Le statut du programme de fonctionnement pour l'unité est typiquement donné comme étant: (0 = unavailable, non disponible) (1 = available to startup or shutdown, c'est-à-dire disponible pour démarrage ou arrêt) (2 = must pump, pompage imposé).

Le Tableau 319 montre tous les attributs de HydroPumpOpSchedule.

Tableau 319 – Attributs de Production::HydroPumpOpSchedule

nom	type	description
timeStep	Seconds	hérité de: RegularIntervalSchedule
endTime	AbsoluteDateTime	hérité de: RegularIntervalSchedule
startTime	AbsoluteDateTime	hérité de: BasicIntervalSchedule
value1Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
value2Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 320 montre toutes les extrémités d'association de HydroPumpOpSchedule avec d'autres classes.

Tableau 320 – Extrémités d'association de Production::HydroPumpOpSchedule avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] HydroPump	HydroPump	La pompe hydraulique possède un programme de pompage sur la durée, précisant le moment où le pompage doit avoir lieu
[1..1]	[1..*] TimePoints	RegularTimePoint	hérité de: RegularIntervalSchedule

6.1.8.3.35 IncrementalHeatRateCurve

Relation entre la consomation incrémentale de chaleur (IHR, incremental heat rate) de l'unité en (delta energie/temps) par (delta puissance active) et la sortie de l'unité en puissance active. La courbe IHR représente la pente de la HeatInputCurve. Noter que la consomation IHR et la consomation de chaleur (heat rate)" sont exprimés dans les mêmes unités techniques.

Le Tableau 321 montre tous les attributs de IncrementalHeatRateCurve.

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Tableau 321 – Attributs de Production::IncrementalHeatRateCurve

nom	type	description
isNetGrossP	Boolean	L'indicateurest mis à true (vrai) lorsque la sortie est exprimée en puissance active nette
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 322 montre toutes les extrémités d'association de IncrementalHeatRateCurve avec d'autres classes.

Tableau 322 – Extrémités d'association de Production::IncrementalHeatRateCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	Une unité de production thermique peut comporter une courbe de consommation de chaleur avec incréments
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.36 InflowForecast

Arrivée naturelle d'eau dans un réservoir, normalement calculable d'après la quantité d'eau de pluie et de neige fondue prévue. Généralement en incréments d'une heure pendant une période pouvant aller jusqu'à 10 jours. La prévision est estimée en mètres cubes par seconde en moyenne sur la durée de l'augmentation.

Le Tableau 323 montre tous les attributs de InflowForecast.

Tableau 323 – Attributs de Production::InflowForecast

nom	type	description
timeStep	Seconds	hérité de: RegularIntervalSchedule
endTime	AbsoluteDateTime	hérité de: RegularIntervalSchedule
startTime	AbsoluteDateTime	hérité de: BasicIntervalSchedule
value1Unit	UnitSymbol	hérité de: BasicIntervalSchedule

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nom	type	description
value1Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
value2Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 324 montre toutes les extrémités d'association de InflowForecast avec d'autres classes.

Tableau 324 – Extrémités d'association de Production::InflowForecast avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Reservoir	Reservoir	Un réservoir peut inclure une prévision d'arrivée d'eau "naturelle"
[1..1]	[1..*] TimePoints	RegularTimePoint	hérité de: RegularIntervalSchedule

6.1.8.3.37 LevelVsVolumeCurve

Relation entre le volume d'un réservoir et le niveau du réservoir. Le volume est en ordonnée (sur l'axe Y) et le niveau du réservoir en abscisse (sur l'axe X).

Le Tableau 325 montre tous les attributs de LevelVsVolumeCurve.

Tableau 325 – Attributs de Production::LevelVsVolumeCurve

nom	type	description
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 326 montre toutes les extrémités d'association de LevelVsVolumeCurve avec d'autres classes.

Tableau 326 – Extrémités d'association de Production::LevelVsVolumeCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Reservoir	Reservoir	Un réservoir peut avoir une relation niveau/volume
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.38 PenstockLossCurve

Relation entre la perte de la hauteur de chute de la conduite forcée (en mètres) et l'évacuation totale à travers la conduite forcée (en mètres cubes par seconde). Une ou plusieurs turbines peuvent être connectées à la même conduite forcée.

Le Tableau 327 montre tous les attributs de PenstockLossCurve.

Tableau 327 – Attributs de Production::PenstockLossCurve

nom	type	description
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 328 montre toutes les extrémités d'association de PenstockLossCurve avec d'autres classes.

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Tableau 328 – Extrémités d'association de Production::PenstockLossCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] HydroGeneratingUnit	HydroGeneratingUnit	Une unité hydrogénératrice a une courbe de perte de conduite forcée
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.39 Enumération PenstockType

Type de conduite forcée de centrale hydraulique.

6.1.8.3.40 Reservoir

Équipement de stockage de l'eau dans un système hydraulique, comprenant des bassins, des lacs, des lagons et des rivières. Le stockage se fait généralement après un barrage.

Le Tableau 329 montre tous les attributs de Reservoir.

Tableau 329 – Attributs de Production::Reservoir

nom	type	description
activeStorageCapacity	Volume	Volume de stockage entre le niveau d'alimentation plein et le niveau de fonctionnement normal minimum
energyStorageRating	Float	Régime assigné de stockage de l'énergie du réservoir, en énergie, pour des cas de hauteur de chute donnés
fullSupplyLevel	WaterLevel	Niveau d'alimentation plein, au-dessus duquel l'eau déborde. Peut correspondre au niveau de crête du canal de trop-plein ou au niveau atteint au sommet des vannes fermées
grossCapacity	Volume	Capacité totale du réservoir
normalMinOperateLevel	WaterLevel	Niveau de fonctionnement normal minimum en dessous duquel les conduites forcées drainent de l'air
riverOutletWorks	String	ouvrages fluviaux pour lâchage d'eau lié aux droits riverains ou pour d'autres raisons
spillTravelDelay	Seconds	Temps additionnel de course de l'eau du canal de trop-plein jusqu'au prochain réservoir en aval
spillwayCapacity	Float	Capacité d'écoulement du canal de trop-plein, en mètres cubes par seconde
spillwayCrestLength	Length	Longueur de la crête de trop-plein
spillwayCrestLevel	WaterLevel	Niveau de crête du niveau de trop-plein au-dessus duquel l'eau déborde
spillWayGateType	SpillwayGateType	Type de vanne de canal de trop-plein, comprenant des paramètres
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 330 montre toutes les extrémités d'association de Reservoir avec d'autres classes.

Tableau 330 – Extrémités d'association de Production::Reservoir avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] SpillsIntoReservoirs	Reservoir	Un réservoir peut s'écouler dans un réservoir situé en aval
[1..1]	[0..*] LevelVsVolumeCurves	LevelVsVolumeCurve	Un réservoir peut avoir une relation niveau/volume
[1..1]	[0..*] InflowForecasts	InflowForecast	Un réservoir peut inclure une prévision d'arrivée d'eau "naturelle"
[0..1]	[0..*] HydroPowerPlants	HydroPowerPlant	Un réservoir en aval reçoit l'eau évacuée par des génératrices ou alimente des pompes en eau
[1..1]	[0..*] UpstreamFromHydroPower Plants	HydroPowerPlant	Un réservoir en amont alimente des génératrices en eau ou reçoit l'eau évacuée par des pompes
[1..1]	[0..1] TargetLevelSchedule	TargetLevelSchedule	Un réservoir peut comprendre un programme d'objectif à atteindre en niveau d'eau
[0..*]	[0..1] SpillsFromReservoir	Reservoir	Un réservoir peut s'écouler dans un réservoir situé en aval
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.8.3.41 ShutdownCurve

Relation entre le taux exprimé en puissance active brute par minute (axe Y) auquel il convient qu'une unité s'arrête et la sortie brute actuelle en MW (axe X) de l'unité.

Le Tableau 331 montre tous les attributs de ShutdownCurve.

Tableau 331 – Attributs de Production::ShutdownCurve

nom	type	description
shutdownCost	Money	Coût fixe de l'arrêt
shutdownDate	AbsoluteDateTime	Date et heure du dernier arrêt de l'unité de production
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve

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nom	type	description
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 332 montre toutes les extrémités d'association de ShutdownCurve avec d'autres classes.

Tableau 332 – Extrémités d'association de Production::ShutdownCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	Une unité de production thermique peut comporter une courbe d'arrêt
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.42 Enumération SpillwayGateType

Type de vanne de canal de trop-plein.

6.1.8.3.43 StartIgnFuelCurve

Quantité de combustible d'allumage (axe Y) utilisée pour redémarrer et compenser l'énergie auxiliaire consommée en fonction du nombre d'heures (axe X) pendant lesquelles l'unité était hors service.

Le Tableau 333 montre tous les attributs de StartIgnFuelCurve.

Tableau 333 – Attributs de Production::StartIgnFuelCurve

nom	type	description
ignitionFuelType	FuelType	Type de combustible d'allumage
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve

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nom	type	description
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 334 montre toutes les extrémités d'association de StartIgnFuelCurve avec d'autres classes.

Tableau 334 – Extrémités d'association de Production::StartIgnFuelCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] StartupModel	StartupModel	Le modèle de démarrage de l'unité peut comporter une courbe de combustible d'allumage de démarrage
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.44 StartMainFuelCurve

Quantité de combustible principal (axe Y) utilisée pour redémarrer et compenser l'énergie auxiliaire consommée en fonction du nombre d'heures (axe X) pendant lesquelles l'unité était hors service.

Le Tableau 335 montre tous les attributs de StartMainFuelCurve.

Tableau 335 – Attributs de Production::StartMainFuelCurve

nom	type	description
mainFuelType	FuelType	Type de combustible principal
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject

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nom	type	description
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 336 montre toutes les extrémités d'association de StartMainFuelCurve avec d'autres classes.

Tableau 336 – Extrémités d'association de Production::StartMainFuelCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] StartupModel	StartupModel	Le modèle de démarrage de l'unité peut comporter une courbe de combustible principal de démarrage
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.45 StartRampCurve

Taux exprimé en puissance active brute par minute (axe Y) auquel une unité peut être chargée en fonction du nombre d'heures (axe X) pendant lesquelles l'unité était hors service.

Le Tableau 337 montre tous les attributs de StartRampCurve.

Tableau 337 – Attributs de Production::StartRampCurve

nom	type	description
hotStandbyRamp	ActivePowerChangeRate	Le taux de démarrage de la rampe en brut pour une unité en attente à chaud
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 338 montre toutes les extrémités d'association de StartRampCurve avec d'autres classes.

Tableau 338 – Extrémités d'association de Production::StartRampCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] StartupModel	StartupModel	Le modèle de démarrage de l'unité peut comporter une courbe de rampe de démarrage
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.46 StartupModel

Caractéristiques de démarrage de l'unité qui sont fonction de la durée pendant laquelle l'unité a été hors service.

Le Tableau 339 montre tous les attributs de StartupModel.

Tableau 339 – Attributs de Production::StartupModel

nom	type	description
fixedMaintCost	CostRate	Coût fixe de la maintenance
hotStandbyHeat	HeatRate	Quantité d'apport de chaleur requise par unité de temps pour un fonctionnement en arrêt à chaud
incrementalMaintCost	CostPerEnergyUnit	Coût marginal de maintenance
minimumDownTime	Hours	Nombre minimal d'heures pendant lesquelles l'unité doit être arrêtée avant de redémarrer
minimumRunTime	Hours	Nombre minimal d'heures pendant lesquelles l'unité doit fonctionner avant de pouvoir être arrêtée
riskFactorCost	Money	Coût d'opportunité lié aux rentrées en unités monétaires. Ce coût représente la “part” de dépréciation de l'unité et de risque qu'un incident susceptible d'endommager l'unité se produise, due au redémarrage
startupCost	Money	Coûts totaux divers de démarrage
startupDate	AbsoluteDateTime	Date et heure du dernier démarrage de l'unité de production
startupPriority	Integer	Priorité de démarrage à l'intérieur de la zone de contrôle où des nombres plus petits correspondent à des priorités plus hautes. Plusieurs unités de production d'une zone peuvent se voir attribuer la même priorité
stbyAuxP	ActivePower	Consommation de puissance active auxiliaire de l'unité de production permettant de rester en mode "stand-by"
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 340 montre toutes les extrémités d'association de StartupModel avec d'autres classes.

Tableau 340 – Extrémités d'association de Production::StartupModel avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] ThermalGeneratingUnit	ThermalGeneratingUnit	Une unité de production thermique peut comporter un modèle de démarrage
[1..1]	[0..1] StartRampCurve	StartRampCurve	Le modèle de démarrage de l'unité peut comporter une courbe de rampe de démarrage
[1..1]	[0..1] StartIgnFuelCurve	StartIgnFuelCurve	Le modèle de démarrage de l'unité peut comporter une courbe de combustible d'allumage de démarrage
[1..1]	[0..1] StartMainFuelCurve	StartMainFuelCurve	Le modèle de démarrage de l'unité peut comporter une courbe de combustible principal de démarrage

6.1.8.3.47 SteamSendoutSchedule

Programme d'émission de vapeur de la centrale de cogénération en volume par unité de temps.

Le Tableau 341 montre tous les attributs de SteamSendoutSchedule.

Tableau 341 – Attributs de Production::SteamSendoutSchedule

nom	type	description
timeStep	Seconds	hérité de: RegularIntervalSchedule
endTime	AbsoluteDateTime	hérité de: RegularIntervalSchedule
startTime	AbsoluteDateTime	hérité de: BasicIntervalSchedule
value1Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
value2Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 342 montre toutes les extrémités d'association de SteamSendoutSchedule avec d'autres classes.

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Tableau 342 – Extrémités d'association de Production::SteamSendoutSchedule avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[1..1] CogenerationPlant	CogenerationPlant	Une centrale de cogénération comporte un programme d'évacuation de vapeur
[1..1]	[1..*] TimePoints	RegularTimePoint	hérité de: RegularIntervalSchedule

6.1.8.3.48 Enumération SurgeTankCode

Type (ou absence) de cheminée d'équilibre liée à la centrale hydro-électrique.

6.1.8.3.49 TailbayLossCurve

Relation entre la perte de hauteur de chute de sortie d'écluse, en hauteur (axe Y), et l'évacuation totale dans la sortie d'écluse de la centrale électrique, en volume par unité de temps (axe X). Il est possible d'obtenir plusieurs courbes, selon le niveau du réservoir de la sortie d'écluse ou le niveau de la rivière.

Le Tableau 343 montre tous les attributs de TailbayLossCurve.

Tableau 343 – Attributs de Production::TailbayLossCurve

nom	type	description
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 344 montre toutes les extrémités d'association de TailbayLossCurve avec d'autres classes.

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Tableau 344 – Extrémités d'association de Production::TailbayLossCurve avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] HydroGeneratingUnit	HydroGeneratingUnit	Une unité hydrogénératrice a une courbe de perte de sortie d'écluse
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.50 TargetLevelSchedule

Objectifs de niveau d'eau dans le réservoir établis d'après des études avancées ou des "courbes d'exploitation optimum". Généralement en incréments d'une heure pendant une période pouvant aller jusqu'à 10 jours.

Le Tableau 345 montre tous les attributs de TargetLevelSchedule.

Tableau 345 – Attributs de Production::TargetLevelSchedule

nom	type	description
highLevelLimit	WaterLevel	Limite supérieure du niveau à atteindre, au-dessus de laquelle le réservoir ne pourra pas fonctionner normalement
lowLevelLimit	WaterLevel	Limite inférieure du niveau à atteindre, en dessous de laquelle le réservoir ne pourra pas fonctionner normalement
curveStyle	CurveStyle	hérité de: Curve
xMultiplier	UnitMultiplier	hérité de: Curve
xUnit	UnitSymbol	hérité de: Curve
y1Multiplier	UnitMultiplier	hérité de: Curve
y1Unit	UnitSymbol	hérité de: Curve
y2Multiplier	UnitMultiplier	hérité de: Curve
y2Unit	UnitSymbol	hérité de: Curve
y3Multiplier	UnitMultiplier	hérité de: Curve
y3Unit	UnitSymbol	hérité de: Curve
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 346 montre toutes les extrémités d'association de TargetLevelSchedule avec d'autres classes.

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Tableau 346 – Extrémités d'association de Production::TargetLevelSchedule avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] Reservoir	Reservoir	Un réservoir peut comprendre un programme d'objectif à atteindre en niveau d'eau
[1..1]	[0..*] CurveDatas	CurveData	hérité de: Curve

6.1.8.3.51 ThermalGeneratingUnit

Unité de production ayant pour machine motrice, par exemple, une turbine à vapeur, une turbine à combustion ou un moteur diesel.

Le Tableau 347 montre tous les attributs de ThermalGeneratingUnit.

Tableau 347 – Attributs de Production::ThermalGeneratingUnit

nom	type	description
oMCost	CostPerHeatUnit	Coût de fonctionnement et de maintenance de l'unité de production thermique
allocSpinResP	ActivePower	hérité de: GeneratingUnit
autoCntrlMarginP	ActivePower	hérité de: GeneratingUnit
baseP	ActivePower	hérité de: GeneratingUnit
controlDeadband	ActivePower	hérité de: GeneratingUnit
controlPulseHigh	Seconds	hérité de: GeneratingUnit
controlPulseLow	Seconds	hérité de: GeneratingUnit
controlResponseRate	ActivePowerChangeRate	hérité de: GeneratingUnit
dispReserveFlag	Boolean	hérité de: GeneratingUnit
efficiency	PU	hérité de: GeneratingUnit
energyMinP	HeatRate	hérité de: GeneratingUnit
fastStartFlag	Boolean	hérité de: GeneratingUnit
fuelPriority	Integer	hérité de: GeneratingUnit
genControlMode	GeneratorControlMode	hérité de: GeneratingUnit
genControlSource	GeneratorControlSource	hérité de: GeneratingUnit
genOperatingMode	GeneratorOperatingMode	hérité de: GeneratingUnit
governorMPL	PU	hérité de: GeneratingUnit
governorSCD	PerCent	hérité de: GeneratingUnit
highControlLimit	ActivePower	hérité de: GeneratingUnit
initialP	ActivePower	hérité de: GeneratingUnit
longPF	Float	hérité de: GeneratingUnit
lowControlLimit	ActivePower	hérité de: GeneratingUnit
lowerRampRate	ActivePowerChangeRate	hérité de: GeneratingUnit
maxEconomicP	ActivePower	hérité de: GeneratingUnit
maximumAllowableSpinningReserve	ActivePower	hérité de: GeneratingUnit
maxOperatingP	ActivePower	hérité de: GeneratingUnit

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nom	type	description
minEconomicP	ActivePower	hérité de: GeneratingUnit
minimumOffTime	Seconds	hérité de: GeneratingUnit
minOperatingP	ActivePower	hérité de: GeneratingUnit
modelDetail	Classification	hérité de: GeneratingUnit
normalPF	Float	hérité de: GeneratingUnit
penaltyFactor	Float	hérité de: GeneratingUnit
raiseRampRate	ActivePowerChangeRate	hérité de: GeneratingUnit
ratedGrossMaxP	ActivePower	hérité de: GeneratingUnit
ratedGrossMinP	ActivePower	hérité de: GeneratingUnit
ratedNetMaxP	ActivePower	hérité de: GeneratingUnit
shortPF	Float	hérité de: GeneratingUnit
spinReserveRamp	ActivePowerChangeRate	hérité de: GeneratingUnit
startupCost	Money	hérité de: GeneratingUnit
startupTime	Seconds	hérité de: GeneratingUnit
stepChange	ActivePower	hérité de: GeneratingUnit
tieLinePF	Float	hérité de: GeneratingUnit
variableCost	Money	hérité de: GeneratingUnit
nominalP	ActivePower	hérité de: GeneratingUnit
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 348 montre toutes les extrémités d'association de ThermalGeneratingUnit avec d'autres classes.

Tableau 348 – Extrémités d'association de Production::ThermalGeneratingUnit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..1] HeatRateCurve	HeatRateCurve	Une unité de production thermique peut comporter une courbe de consommation de chaleur
[0..*]	[0..1] CogenerationPlant	CogenerationPlant	Une unité de production thermique peut faire partie d'une centrale de cogénération
[1..1]	[0..*] FuelAllocationSchedules	FuelAllocationSchedule	Une unité de production thermique peut comporter un ou plusieurs programmes d'attribution de combustibles
[1..1]	[0..1] StartupModel	StartupModel	Une unité de production thermique peut comporter un modèle de

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[mult à partir de]	[mult vers] nom	type	description
			démarrage
[1..1]	[0..*] EmissionCurves	EmissionCurve	Une unité de production thermique peut comporter une ou plusieurs courbes d'émission
[1..1]	[0..1] ShutdownCurve	ShutdownCurve	Une unité de production thermique peut comporter une courbe d'arrêt
[1..1]	[0..1] IncrementalHeatRateCurve	IncrementalHeatRateCurve	Une unité de production thermique peut comporter une courbe de consommation de chaleur avec incréments
[1..1]	[0..*] FossilFuels	FossilFuel	Une unité de production thermique peut comporter un ou plusieurs combustibles fossiles
[0..1]	[0..1] CAESPlant	CAESPlant	Une unité de production thermique peut faire partie d'une centrale d'accumulation d'énergie sous forme d'air comprimé
[0..*]	[0..1] CombinedCyclePlant	CombinedCyclePlant	Une unité de production thermique peut faire partie d'une centrale à cycle combiné
[1..1]	[0..*] EmmissionAccounts	EmissionAccount	Une unité de production thermique peut comporter un ou plusieurs rapports d'autorisation d'émission
[1..1]	[0..1] HeatInputCurve	HeatInputCurve	Une unité de production thermique peut comporter une courbe d'apport de chaleur
[0..1]	[1..*] SynchronousMachines	SynchronousMachine	hérité de: GeneratingUnit
[1..1]	[0..1] GenUnitOpSchedule	GenUnitOpSchedule	hérité de: GeneratingUnit
[1..1]	[0..*] GrossToNetActivePower Curves	GrossToNetActivePower Curve	hérité de: GeneratingUnit
[1..1]	[0..*] GenUnitOpCostCurves	GenUnitOpCostCurve	hérité de: GeneratingUnit
[1..1]	[0..*] ControlAreaGeneratingUnit	ControlAreaGeneratingUnit	hérité de: GeneratingUnit
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.9 Paquetage LoadModel

6.1.9.1 Généralités

Ce paquetage est chargé de la modélisation des consommateurs d'énergie et de la charge du système sous forme de courbes et de données de courbe associées. Des circonstances particulières pouvant affecter la charge, telles que les saisons et les types de jour, sont également incluses ici.

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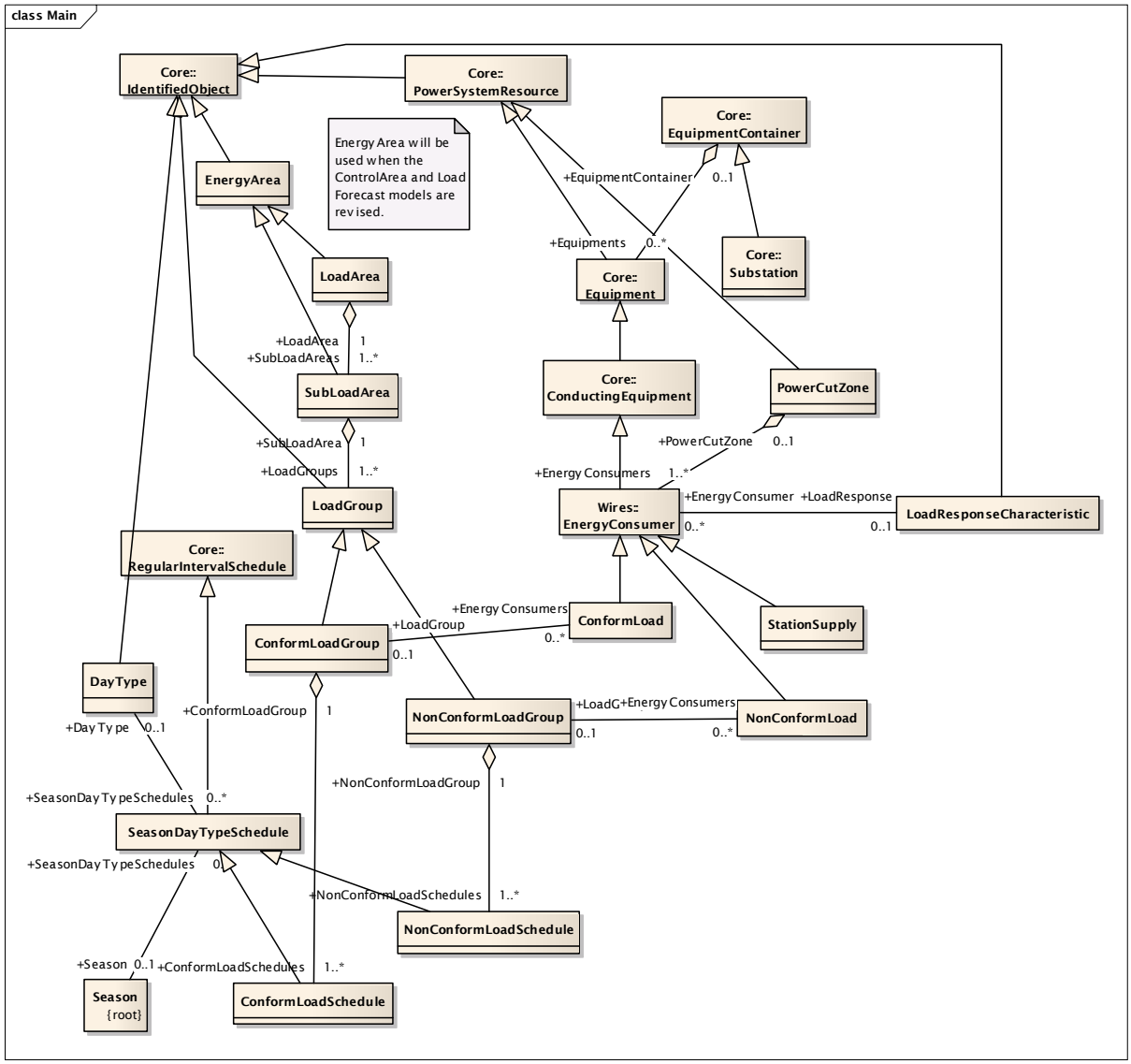
Ces informations sont utilisées par Load Forecasting (prévision de la charge) et Load Management (gestion de la charge).

La Figure 58 montre le diagramme logique Main.



Légende

Anglais	Français
Energy Area will be used when the ControlArea and Load Forecast models are revised.	Une zone d'énergie (Energy Area) sera utilisée lorsque les modèles ControlArea et Load Forecast seront révisés.

Figure 58 – Diagramme logique LoadModel::Main

Ce diagramme montre toutes les classes incluses dans le paquetage LoadModel de même que les classes-clés externes qui ont des associations avec des classes LoadModel.

La Figure 59 montre le diagramme logique Datatypes.

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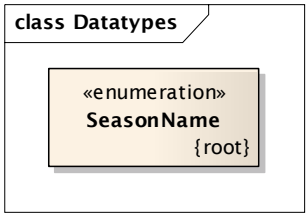

Figure 59 – Diagramme logique LoadModel::Datatypes

6.1.9.2 ConformLoad

Les charges conformes ConformLoad représentent les charges qui suivent un profil de modification quotidienne, ce profil étant utilisé pour normaliser la charge avec un système de charge.

Le Tableau 349 montre tous les attributs de ConformLoad.

Tableau 349 – Attributs de LoadModel::ConformLoad

nom	type	description
customerCount	Integer	hérité de: EnergyConsumer
pfixed	ActivePower	hérité de: EnergyConsumer
pfixedPct	PerCent	hérité de: EnergyConsumer
qfixed	ReactivePower	hérité de: EnergyConsumer
qfixedPct	PerCent	hérité de: EnergyConsumer
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 350 montre toutes les extrémités d'association de ConformLoad avec d'autres classes.

Tableau 350 – Extrémités d'association de LoadModel::ConformLoad avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] LoadGroup	ConformLoadGroup	Group of this ConformLoad
[0..*]	[0..1] LoadResponse	LoadResponseCharacteristic	hérité de: EnergyConsumer
[1..*]	[0..1] PowerCutZone	PowerCutZone	hérité de: EnergyConsumer
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment

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[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.9.3 ConformLoadGroup

Groupe de charges qui se conforment à un modèle d'attribution.

Le Tableau 351 montre tous les attributs de ConformLoadGroup.

Tableau 351 – Attributs de LoadModel::ConformLoadGroup

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 352 montre toutes les extrémités d'association de ConformLoadGroup avec d'autres classes.

Tableau 352 – Extrémités d'association de LoadModel::ConformLoadGroup avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] EnergyConsumers	ConformLoad	Charges conformes (ConformLoad) affectées à ce groupe de charges conformes (ConformLoadGroup)
[1..1]	[1..*] ConformLoadSchedules	ConformLoadSchedule	Les programmes ConformLoadSchedule contenus dans le groupe ConformLoadGroup
[1..*]	[1..1] SubLoadArea	SubLoadArea	hérité de: LoadGroup

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6.1.9.4 ConformLoadSchedule

Courbe de la charge en fonction du temps (axe X) indiquant les valeurs de puissance active (axe Y1) et de puissance réactive (axe Y2) de chaque unité de la période couverte. Cette courbe représente un modèle de charge classique pour une période sur un type de jour et une saison donnés.

Le Tableau 353 montre tous les attributs de ConformLoadSchedule.

Tableau 353 – Attributs de LoadModel::ConformLoadSchedule

nom	type	description
timeStep	Seconds	hérité de: RegularIntervalSchedule
endTime	AbsoluteDateTime	hérité de: RegularIntervalSchedule
startTime	AbsoluteDateTime	hérité de: BasicIntervalSchedule
value1Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
value2Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 354 montre toutes les extrémités d'association de ConformLoadSchedule avec d'autres classes.

Tableau 354 – Extrémités d'association de LoadModel::ConformLoadSchedule avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..*]	[1..1] ConformLoadGroup	ConformLoadGroup	Le ConformLoadGroup auquel appartient le programme ConformLoadSchedule
[0..*]	[0..1] DayType	DayType	hérité de: SeasonDayTypeSchedule
[0..*]	[0..1] Season	Season	hérité de: SeasonDayTypeSchedule
[1..1]	[1..*] TimePoints	RegularTimePoint	hérité de: RegularIntervalSchedule

6.1.9.5 DayType

Groupe de jours similaires: par exemple Mon/Tue/Wed (Lun/Ma/Me), Thu/Fri (Jeu/Vend), Sat/Sun (Sam/Dim), Holiday1 (Vacances1), Holiday2 (Vacances2).

Le Tableau 355 montre tous les attributs de DayType.

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Tableau 355 – Attributs de LoadModel::DayType

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 356 montre toutes les extrémités d'association de DayType avec d'autres classes.

Tableau 356 – Extrémités d'association de LoadModel::DayType avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] SeasonDayTypeSchedules	SeasonDayTypeSchedule	Programmes utilisant ce DayType

6.1.9.6 EnergyArea

La classe décrit une zone comportant la production ou la consommation d'énergie. La classe est la base d'une spécialisation plus poussée.

Le Tableau 357 montre tous les attributs de EnergyArea.

Tableau 357 – Attributs de LoadModel::EnergyArea

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 358 montre toutes les extrémités d'association de EnergyArea avec d'autres classes.

Tableau 358 – Extrémités d'association de LoadModel::EnergyArea avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..1] ControlArea	ControlArea	La spécification relative aux zones de contrôle qui est utilisée pour la prévision de charge

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6.1.9.7 LoadArea

La classe est la racine ou le premier niveau dans une structure hiérarchique pour regrouper des charges à des fins de mise à l'échelle des charges du flux de charge.

Le Tableau 359 montre tous les attributs de LoadArea.

Tableau 359 – Attributs de LoadModel::LoadArea

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 360 montre toutes les extrémités d'association de LoadArea avec d'autres classes.

Tableau 360 – Extrémités d'association de LoadModel::LoadArea avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[1..*] SubLoadAreas	SubLoadArea	Les SubLoadAreas dans le LoadArea
[0..1]	[0..1] ControlArea	ControlArea	hérité de: EnergyArea

6.1.9.8 LoadGroup

La classe est le troisième niveau dans une structure hiérarchique pour regrouper des charges à des fins de mise à l'échelle des charges du flux de charge.

Le Tableau 361 montre tous les attributs de LoadGroup.

Tableau 361 – Attributs de LoadModel::LoadGroup

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 362 montre toutes les extrémités d'association de LoadGroup avec d'autres classes.

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Tableau 362 – Extrémités d'association de LoadModel::LoadGroup avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..*]	[1..1] SubLoadArea	SubLoadArea	Le SubLoadArea auquel le Loadgroup appartient

6.1.9.9 LoadResponseCharacteristic

Modélise la réponse caractéristique de la demande de charge due aux variations des conditions du système telles que la tension et la fréquence. Elle n'est pas liée à la réponse à la demande.

Si LoadResponseCharacteristic.exponentModel est True, les exposants de la tension sont spécifiés et utilisés pour calculer:

Active power component (à savoir Composante de la puissance active) = Pnominal * (Voltage/cim:BaseVoltage.nominalVoltage) ** cim:LoadResponseCharacteristic.pVoltageExponent

Reactive power component (à savoir Composante de la puissance réacive) = Qnominal * (Voltage/cim:BaseVoltage.nominalVoltage)** cim:LoadResponseCharacteristic.qVoltageExponent

où * signifie "multiplier" et ** est "à la puissance".

Le Tableau 363 montre tous les attributs de LoadResponseCharacteristic.

Tableau 363 – Attributs de LoadModel::LoadResponseCharacteristic

nom	type	description
exponentModel	Boolean	Indique que le modèle de dépendance exponentielle de la tension (pVoltageExponent ou qVoltageExponent) doit être utilisé. S'il est mis à false (faux), le modèle du coefficient (constitué de pConstantImpedance, pConstantCurrent, pConstantPower, qConstantImpedance, qConstantCurrent, et qConstantPower) doit être utilisé
pConstantCurrent	Float	Partie de la charge de puissance active modélisée comme courant constant. Utilisée seulement si useExponentModel est false (faux). Cette valeur est normalisée par rapport à la somme de pZ, pI, et pP
pConstantImpedance	Float	Partie de la charge de puissance active modélisée comme impédance constante. Utilisée seulement si useExponentModel est false (faux). Cette valeur est normalisée par rapport à la somme de pZ, pI, et pP
pConstantPower	Float	Partie de la charge de puissance active modélisée comme puissance constante. Utilisée seulement si useExponentModel est false (faux). Cette valeur est normalisée par rapport à la somme de pZ, pI, et pP
pFrequencyExponent	Float	Exposant de la fréquence par unité émettant une puissance active
pVoltageExponent	Float	Exposant de la tension par unité émettant une puissance réelle. Ce modèle est utilisé seulement si "useExponentModel" est true (vrai)

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nom	type	description
qConstantCurrent	Float	Partie de la charge de puissance réactive modélisée comme courant constant. Utilisée seulement si useExponentModel est false (faux). Cette valeur est normalisée par rapport à la somme de qZ, qI, et qP
qConstantImpedance	Float	Partie de la charge de puissance réactive modélisée comme impédance constante. Utilisée seulement si useExponentModel est false (faux). Cette valeur est normalisée par rapport à la somme de qZ, qI, et qP
qConstantPower	Float	Partie de la charge de puissance réactive modélisée comme puissance constante. Utilisée seulement si useExponentModel est false (faux). Cette valeur est normalisée par rapport à la somme de qZ, qI, et qP
qFrequencyExponent	Float	Exposant de la fréquence par unité émettant une puissance réactive
qVoltageExponent	Float	Exposant de la tension par unité émettant une puissance réactive. Ce modèle est utilisé seulement si "useExponentModel" est true (vrai)
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 364 montre toutes les extrémités d'association de LoadResponseCharacteristic avec d'autres classes.

Tableau 364 – Extrémités d'association de LoadModel::LoadResponseCharacteristic avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] EnergyConsumer	EnergyConsumer	L'ensemble de charges ayant la caractéristique de réponse

6.1.9.10 NonConformLoad

Les charges non conformes NonConformLoad représentent des charges qui ne suivent pas un profil de variation quotidienne de charge et les variations ne sont pas corrélées au profil de variation de charge quotidienne.

Le Tableau 365 montre tous les attributs de NonConformLoad.

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Tableau 365 – Attributs de LoadModel::NonConformLoad

nom	type	description
customerCount	Integer	hérité de: EnergyConsumer
pfixed	ActivePower	hérité de: EnergyConsumer
pfixedPct	PerCent	hérité de: EnergyConsumer
qfixed	ReactivePower	hérité de: EnergyConsumer
qfixedPct	PerCent	hérité de: EnergyConsumer
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 366 montre toutes les extrémités d'association de NonConformLoad avec d'autres classes.

Tableau 366 – Extrémités d'association de LoadModel::NonConformLoad avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] LoadGroup	NonConformLoadGroup	Group of this ConformLoad
[0..*]	[0..1] LoadResponse	LoadResponseCharacteristic	hérité de: EnergyConsumer
[1..*]	[0..1] PowerCutZone	PowerCutZone	hérité de: EnergyConsumer
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

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6.1.9.11 NonConformLoadGroup

Charges qui ne suivent pas un profil de variation quotidienne et saisonnière de charge.

Le Tableau 367 montre tous les attributs de NonConformLoadGroup.

Tableau 367 – Attributs de LoadModel::NonConformLoadGroup

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 368 montre toutes les extrémités d'association de NonConformLoadGroup avec d'autres classes.

Tableau 368 – Extrémités d'association de LoadModel::NonConformLoadGroup avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] EnergyConsumers	NonConformLoad	Charges conformes (ConformLoad) affectées à ce groupe de charges conformes (ConformLoadGroup)
[1..1]	[1..*] NonConformLoadSchedules	NonConformLoadSchedule	Les programmes NonConformLoadSchedules dans le groupe NonConformLoadGroup
[1..*]	[1..1] SubLoadArea	SubLoadArea	hérité de: LoadGroup

6.1.9.12 NonConformLoadSchedule

Programme (courbes) de puissance active (axe Y1) et de puissance réactive (axe Y2) en fonction du temps (axe X) pour les charges non conformes, par exemple charge industrielle significative ou utilisation de centrale électrique (si modélisée).

Le Tableau 369 montre tous les attributs de NonConformLoadSchedule.

Tableau 369 – Attributs de LoadModel::NonConformLoadSchedule

nom	type	description
timeStep	Seconds	hérité de: RegularIntervalSchedule
endTime	AbsoluteDateTime	hérité de: RegularIntervalSchedule
startTime	AbsoluteDateTime	hérité de: BasicIntervalSchedule
value1Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
value2Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule

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nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 370 montre toutes les extrémités d'association de NonConformLoadSchedule avec d'autres classes.

Tableau 370 – Extrémités d'association de LoadModel::NonConformLoadSchedule avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..*]	[1..1] NonConformLoadGroup	NonConformLoadGroup	Le groupe NonConformLoadGroup auquel le programme NonConformLoadSchedule appartient
[0..*]	[0..1] DayType	DayType	hérité de: SeasonDayTypeSchedule
[0..*]	[0..1] Season	Season	hérité de: SeasonDayTypeSchedule
[1..1]	[1..*] TimePoints	RegularTimePoint	hérité de: RegularIntervalSchedule

6.1.9.13 PowerCutZone

Section ou zone du réseau utilisée pour le délestage.

Le Tableau 371 montre tous les attributs de PowerCutZone.

Tableau 371 – Attributs de LoadModel::PowerCutZone

nom	type	description
cutLevel1	PerCent	Premier niveau (quantité) de charge à couper en pourcentages de la charge totale de zone
cutLevel2	PerCent	Second niveau (quantité) de charge à couper en pourcentages de la charge totale de zone
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 372 montre toutes les extrémités d'association de PowerCutZone avec d'autres classes.

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Tableau 372 – Extrémités d'association de LoadModel::PowerCutZone avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..*] EnergyConsumers	EnergyConsumer	Un consommateur d'énergie est affecté à une zone de coupure de puissance
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.9.14 Classe racine Season

Période déterminée sur l'année, par exemple: Printemps, Été, Automne, Hiver.

Le Tableau 373 montre tous les attributs de Season.

Tableau 373 – Attributs de LoadModel::Season

nom	type	description
name	SeasonName	Nom de la saison
endDate	AbsoluteDateTime	Date de fin de la saison
startDate	AbsoluteDateTime	Date de début de la saison

Le Tableau 374 montre toutes les extrémités d'association de Season avec d'autres classes.

Tableau 374 – Extrémités d'association de LoadModel::Season avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..*] SeasonDayTypeSchedules	SeasonDayTypeSchedule	Programmes utilisant cette saison Season

6.1.9.15 SeasonDayTypeSchedule

Le programme spécialise RegularIntervalSchedule avec des données de courbes de type pour un jour et une saison spécifiques. Cela signifie que les courbes de ce type couvrent une période de 24 heures.

Le Tableau 375 montre tous les attributs de SeasonDayTypeSchedule.

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Tableau 375 – Attributs de LoadModel::SeasonDayTypeSchedule

nom	type	description
timeStep	Seconds	hérité de: RegularIntervalSchedule
endTime	AbsoluteDateTime	hérité de: RegularIntervalSchedule
startTime	AbsoluteDateTime	hérité de: BasicIntervalSchedule
value1Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
value2Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 376 montre toutes les extrémités d'association de SeasonDayTypeSchedule avec d'autres classes.

Tableau 376 – Extrémités d'association de LoadModel::SeasonDayTypeSchedule avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] DayType	DayType	DayType (type de jour) pour le programme Schedule
[0..*]	[0..1] Season	Season	Season (saison) pour le programme Schedule
[1..1]	[1..*] TimePoints	RegularTimePoint	hérité de: RegularIntervalSchedule

6.1.9.16 Enumération SeasonName

Nom de la saison.

Le Tableau 377 montre tous les libellés de SeasonName.

Tableau 377 – Libellés de LoadModel::SeasonName

libellé	description
winter	
spring	
summer	
fall	

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6.1.9.17 StationSupply

Approvisionnement du poste avec une charge dérivée de la sortie de poste.

Le Tableau 378 montre tous les attributs de StationSupply.

Tableau 378 – Attributs de LoadModel::StationSupply

nom	type	description
customerCount	Integer	hérité de: EnergyConsumer
pfixed	ActivePower	hérité de: EnergyConsumer
pfixedPct	PerCent	hérité de: EnergyConsumer
qfixed	ReactivePower	hérité de: EnergyConsumer
qfixedPct	PerCent	hérité de: EnergyConsumer
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 379 montre toutes les extrémités d'association de StationSupply avec d'autres classes.

Tableau 379 – Extrémités d'association de LoadModel::StationSupply avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] LoadResponse	LoadResponseCharacteristic	hérité de: EnergyConsumer
[1..*]	[0..1] PowerCutZone	PowerCutZone	hérité de: EnergyConsumer
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource

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[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.9.18 SubLoadArea

La classe est le deuxième niveau dans une structure hiérarchique pour regrouper des charges à des fins de mise à l'échelle des charges du flux de charge.

Le Tableau 380 montre tous les attributs de SubLoadArea.

Tableau 380 – Attributs de LoadModel::SubLoadArea

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 381 montre toutes les extrémités d'association de SubLoadArea avec d'autres classes.

Tableau 381 – Extrémités d'association de LoadModel::SubLoadArea avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[1..*] LoadGroups	LoadGroup	Les Loadgroup dans le SubLoadArea
[1..*]	[1..1] LoadArea	LoadArea	Le LoadArea auquel le SubLoadArea appartient
[0..1]	[0..1] ControlArea	ControlArea	hérité de: EnergyArea

6.1.10 Paquetage Outage

6.1.10.1 Généralités

Extension des paquetages Core (cœur) et Wires (fils) qui modélise les informations relatives à la configuration réseau planifiée et actuelle. Ces entités sont facultatives pour les applications réseau typiques.

La Figure 60 montre le diagramme logique Datatypes.

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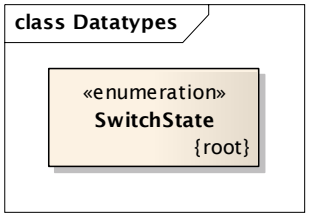

Figure 60 – Diagramme logique Outage::Datatypes

Ce diagramme montre les types de données spécifiques au paquetage Outage.

La Figure 61 montre le diagramme logique Main.

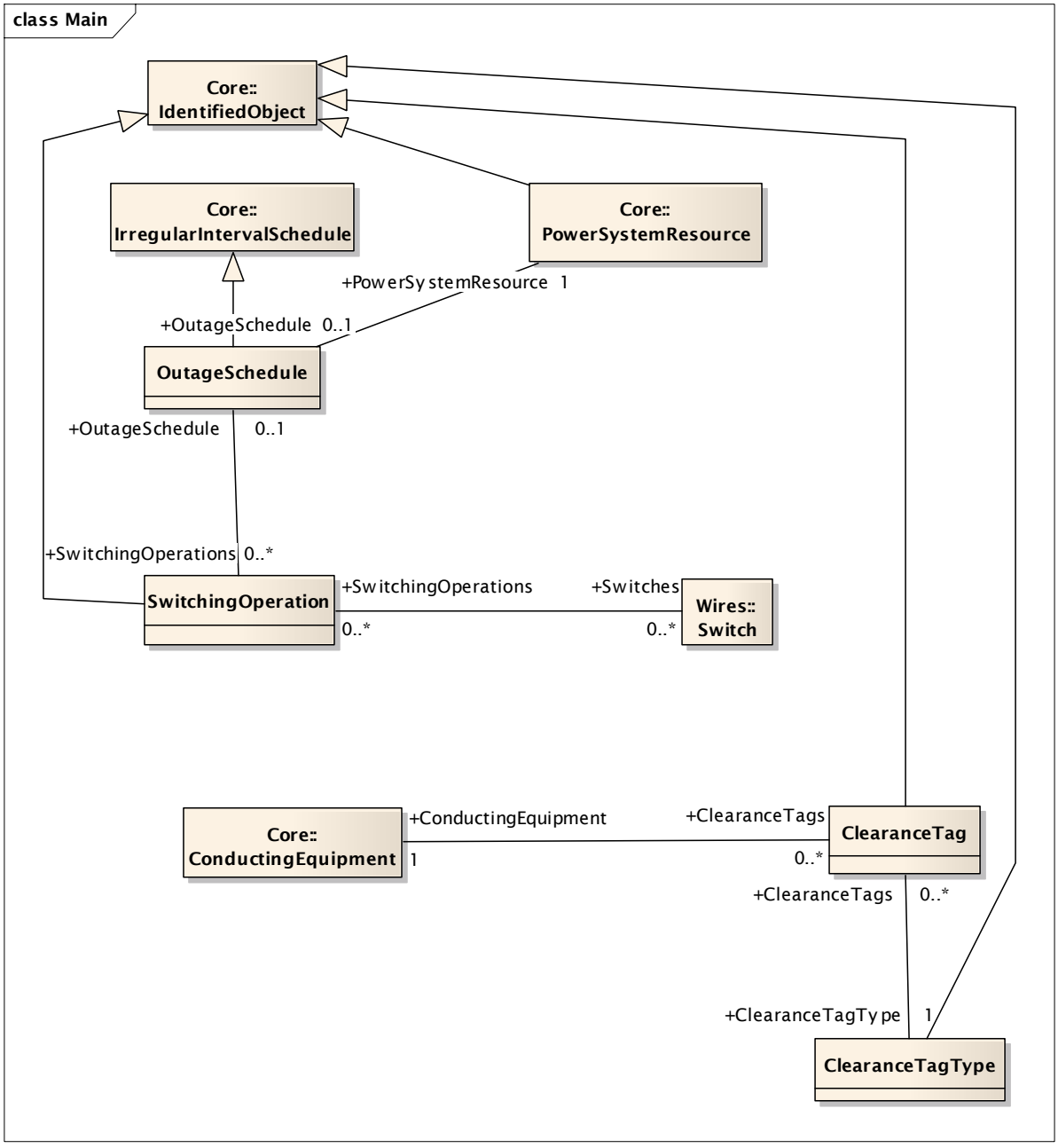

Figure 61 – Diagramme logique Outage::Main

Ce diagramme montre toutes les classes incluses dans le paquetage Outage de même que les classes-clés externes qui ont des associations avec des classes Outage.

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6.1.10.2 ClearanceTag

Marqueur de consignation utilisé pour autoriser et programmer la tâche à effectuer sur l'équipement conducteur sur le terrain. L'équipement marqué n'est pas disponible pour une utilisation commerciale.

Le Tableau 382 montre tous les attributs de ClearanceTag.

Tableau 382 – Attributs de Outage::ClearanceTag

nom	type	description
authorityName	String	Nom de la personne autorisée à émettre le marqueur
deenergizeReqFlag	Boolean	Mis à true (vrai) si les équipements doivent être mis hors ligne
groundReqFlag	Boolean	Mis à true (vrai) si les équipements doivent être mis à la terre
phaseCheckReqFlag	Boolean	Mis à true (vrai) si le phasage des équipements doit être vérifié
tagIssueTime	AbsoluteDateTime	Heure à laquelle le marqueur de consignation a été émis
workDescription	String	Description de la tâche à réaliser
workEndTime	AbsoluteDateTime	Heure à laquelle le retrait du marqueur de consignation est programmé
workStartTime	AbsoluteDateTime	Heure à laquelle la mise du marqueur de consignation est programmée
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 383 montre toutes les extrémités d'association de ClearanceTag avec d'autres classes.

Tableau 383 – Extrémités d'association de Outage::ClearanceTag avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] ConductingEquipment	ConductingEquipment	L'équipement conducteur peut comporter plusieurs marqueurs de consignation pour la tâche autorisée sur le terrain
[0..*]	[1..1] ClearanceTagType	ClearanceTagType	Type de marqueur dépendant de l'objectif de la tâche à réaliser et/ou du type de contrôle de supervision autorisé

6.1.10.3 ClearanceTagType

Type de ClearanceTag. Peut indiquer le type de tâche à effectuer et/ou le type de supervision.

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Le Tableau 384 montre tous les attributs de ClearanceTagType.

Tableau 384 – Attributs de Outage::ClearanceTagType

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 385 montre toutes les extrémités d'association de ClearanceTagType avec d'autres classes.

Tableau 385 – Extrémités d'association de Outage::ClearanceTagType avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] ClearanceTags	ClearanceTag	Les marqueurs ClearanceTags actuellement en cours de définition pour ce type

6.1.10.4 OutageSchedule

Durée pendant laquelle un équipement est hors service, par exemple pour la maintenance ou pour des essais; y compris la puissance active assignée de l'équipement pendant qu'il est en maintenance. L'axe X représente le temps absolu et l'axe Y représente la caractéristique assignée disponible de l'équipement lorsqu'il est hors service.

Le Tableau 386 montre tous les attributs de OutageSchedule.

Tableau 386 – Attributs de Outage::OutageSchedule

nom	type	description
startTime	AbsoluteDateTime	hérité de: BasicIntervalSchedule
value1Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value1Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
value2Unit	UnitSymbol	hérité de: BasicIntervalSchedule
value2Multiplier	UnitMultiplier	hérité de: BasicIntervalSchedule
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 387 montre toutes les extrémités d'association de OutageSchedule avec d'autres classes.

Tableau 387 – Extrémités d'association de Outage::OutageSchedule avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] PowerSystemResource	PowerSystemResource	Une ressource de réseau électrique peut avoir un programme d'indisponibilité
[0..1]	[0..*] SwitchingOperations	SwitchingOperation	Un OutageSchedule (programme d'indisponibilité) peut actionner plusieurs organes de coupure
[1..1]	[1..*] TimePoints	IrregularTimePoint	hérité de: IrregularIntervalSchedule

6.1.10.5 SwitchingOperation

Une SwitchingOperation (opération de commutation) est utilisée pour définir les commandes de commutation individuelles d'un OutageSchedule (programme d'indisponibilité). Cet OutageSchedule peut être associé à une autre entité de Substation (poste) telle que Transformer (transformateur), Line (ligne), ou Generator (générateur), ou Switch (organe de coupure) lui-même comme PowerSystemResource (ressource de réseau électrique). Un organe de coupure peut être référencé dans plusieurs OutageSchedules.

Le Tableau 388 montre tous les attributs de SwitchingOperation.

Tableau 388 – Attributs de Outage::SwitchingOperation

nom	type	description
operationTime	AbsoluteDateTime	Durée de fonctionnement en unités identiques à celles des OutageSchedule.xAxisUnits
newState	SwitchState	La position de commutateur qui doit résulter de ce SwitchingOperation (opération de commutation)
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 389 montre toutes les extrémités d'association de SwitchingOperation avec d'autres classes.

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Tableau 389 – Extrémités d'association de Outage::SwitchingOperation avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..*] Switches	Switch	Un organe de coupure peut être actionné par plusieurs programmes
[0..*]	[0..1] OutageSchedule	OutageSchedule	Un OutageSchedule (programme d'indisponibilité) peut actionner plusieurs organes de coupure

6.1.10.6 Énumération SwitchState

Positions possibles d'un organe de coupure.

Le Tableau 390 montre tous les libellés de SwitchState.

Tableau 390 – Libellés de Outage::SwitchState

libellé	description
open	
close	

6.1.11 Paquetage Protection

6.1.11.1 Généralités

Extension des paquetages Core (cœur) et Wires (fils) qui modélise les informations relatives à l'équipement de protection tel que les relais. Ces entités sont utilisées dans les simulateurs de formation et les applications de localisation de défauts d'un réseau de distribution.

La Figure 62 montre le diagramme logique Main.

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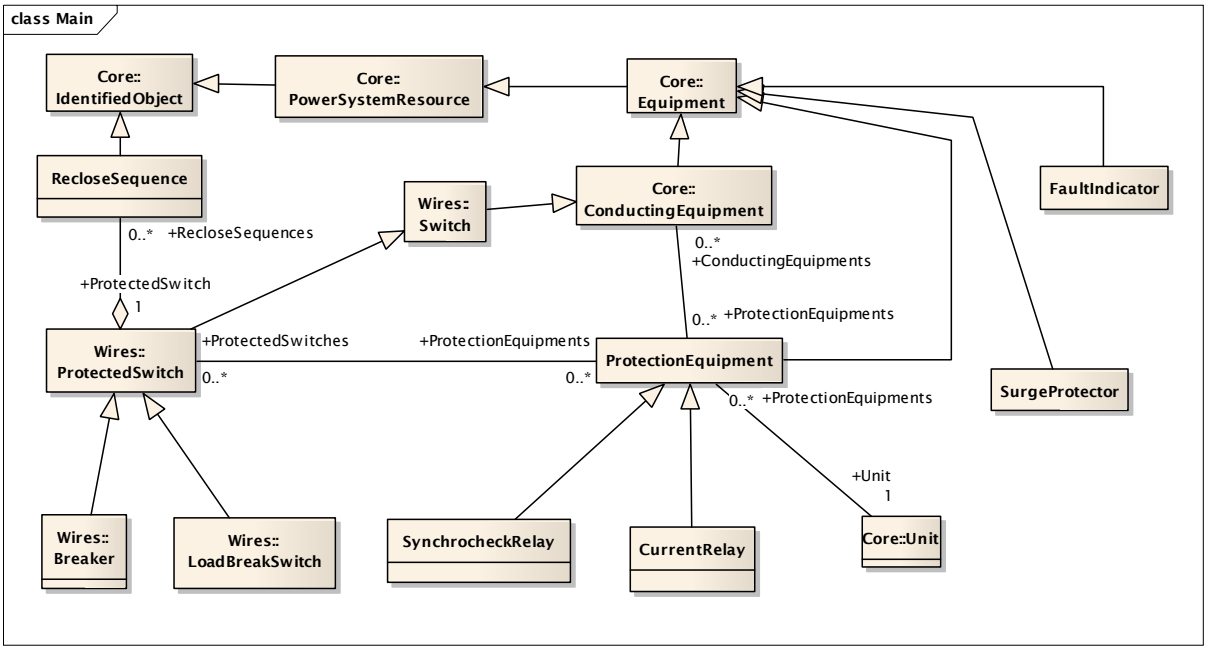

Figure 62 – Diagramme logique Protection::Main

Ce diagramme montre toutes les classes incluses dans le paquetage Protection de même que les classes-clés externes qui ont des associations avec des classes Protection.

6.1.11.2 CurrentRelay

Appareil contrôlant les valeurs de circulation du courant dans n'importe quelle direction ou dans une direction déterminée.

Le Tableau 391 montre tous les attributs de CurrentRelay.

Tableau 391 – Attributs de Protection::CurrentRelay

nom	type	description
currentLimit1	CurrentFlow	Courant-limite n°1 de lecture du temps inverse
currentLimit2	CurrentFlow	Courant-limite n°2 de lecture du temps inverse
currentLimit3	CurrentFlow	Courant-limite n°3 de lecture du temps inverse
inverseTimeFlag	Boolean	Mis à true (vrai) si le relais du courant possède une caractéristique de temps inverse.
timeDelay1	Seconds	Retard de temps inverse n°1 du courant-limite n°1
timeDelay2	Seconds	Retard de temps inverse n°2 du courant-limite n°2
timeDelay3	Seconds	Retard de temps inverse n°3 du courant-limite n°3
relayDelayTime	Seconds	hérité de: ProtectionEquipment
highLimit	Float	hérité de: ProtectionEquipment
lowLimit	Float	hérité de: ProtectionEquipment
powerDirectionFlag	Boolean	hérité de: ProtectionEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject

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nom	type	description
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 392 montre toutes les extrémités d'association de CurrentRelay avec d'autres classes.

Tableau 392 – Extrémités d'association de Protection::CurrentRelay avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Unit	Unit	hérité de: ProtectionEquipment
[0..*]	[0..*] ProtectedSwitches	ProtectedSwitch	hérité de: ProtectionEquipment
[0..*]	[0..*] ConductingEquipments	ConductingEquipment	hérité de: ProtectionEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.11.3 FaultIndicator

Un FaultIndicator est typiquement un indicateur uniquement (qui peut ou peut ne pas être surveillé à distance) et non un équipement qui déclenche effectivement un événement de protection. Il est utilisé à des fins de FLISR (Fault Location, Isolation and Supply Restoration, c'est-à-dire localisation, isolation de pannes et rétablissement de l'alimentation), en portant assistance avec le détachement d'équipes à la partie "la plus vraisemblable" du réseau (c'est-à-dire qu'il aide à déterminer la section de circuit où la panne s'est le plus vraisemblablement produite).

Le Tableau 393 montre tous les attributs de FaultIndicator.

Tableau 393 – Attributs de Protection::FaultIndicator

nom	type	description
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject

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nom	type	description
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 394 montre toutes les extrémités d'association de FaultIndicator avec d'autres classes.

Tableau 394 – Extrémités d'association de Protection::FaultIndicator avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.11.4 ProtectionEquipment

Appareil électrique visant à répondre de façon déterminée aux conditions d'entrée à condition que des conditions spécifiées entraînant une opération de contact ou une modification extrême équivalente dans les circuits de commande électrique associés, ou visant simplement à afficher la condition détectée aient été remplies. Les équipements de protection sont associés à l'équipement conducteur et font généralement fonctionner les disjoncteurs.

Le Tableau 395 montre tous les attributs de ProtectionEquipment.

Tableau 395 – Attributs de Protection::ProtectionEquipment

nom	type	description
relayDelayTime	Seconds	Retard de la détection de conditions anormales au fonctionnement du relais
highLimit	Float	Valeur maximale admissible
lowLimit	Float	Valeur minimale admissible
powerDirectionFlag	Boolean	Direction identique à la valeur du flux d'énergie active et positive
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject

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nom	type	description
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 396 montre toutes les extrémités d'association de ProtectionEquipment avec d'autres classes.

Tableau 396 – Extrémités d'association de Protection::ProtectionEquipment avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Unit	Unit	L'unité pour l'équipement de protection
[0..*]	[0..*] ProtectedSwitches	ProtectedSwitch	Commutateurs protégés actionnés par ce ProtectionEquipment (équipement de protection)
[0..*]	[0..*] ConductingEquipments	ConductingEquipment	Le dispositif de protection peut être utilisé pour protéger un équipement conducteur spécifique. De multiples équipements peuvent être protégés ou supervisés par plusieurs dispositifs de protection
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.11.5 RecloseSequence

Une séquence de réenclenchement (ouvrir et interrompre le courant) est définie pour chaque nouvelle fermeture possible d'un disjoncteur.

Le Tableau 397 montre tous les attributs de RecloseSequence.

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Tableau 397 – Attributs de Protection::RecloseSequence

nom	type	description
recloseDelay	Seconds	Indique le laps de temps avant que l'étape de réenclenchement se réalise
recloseStep	Integer	Indique la position ordinale de l'étape de réenclenchement par rapport à d'autres étapes dans la séquence
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 398 montre toutes les extrémités d'association de RecloseSequence avec d'autres classes.

Tableau 398 – Extrémités d'association de Protection::RecloseSequence avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] ProtectedSwitch	ProtectedSwitch	Un disjoncteur peut avoir zéro à plusieurs réenclenchements automatiques après un déclenchement

6.1.11.6 SurgeProtector

Dispositif shunt, installé sur le réseau, habituellement à proximité de l'équipement électrique afin de protéger ledit équipement contre les surtensions transitoires dues à la foudre ou à l'activité de commutation.

Le Tableau 399 montre tous les attributs de SurgeProtector.

Tableau 399 – Attributs de Protection::SurgeProtector

nom	type	description
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 400 montre toutes les extrémités d'association de SurgeProtector avec d'autres classes.

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Tableau 400 – Extrémités d'association de Protection::SurgeProtector avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.11.7 SynchrocheckRelay

Appareil fonctionnant lorsque deux circuits de courant alternatif se situent dans les limites souhaitées de fréquence, d'angle de phase et de tension afin de permettre ou d'entraîner la mise en parallèle de ces deux circuits. Utilisé pour éviter la mise en parallèle d'îlots topologiques asynchrones.

Le Tableau 401 montre tous les attributs de SynchrocheckRelay.

Tableau 401 – Attributs de Protection::SynchrocheckRelay

nom	type	description
maxAngleDiff	AngleRadians	La différence maximale admissible de l'angle de phase du vecteur de tension à travers l'appareil ouvert
maxFreqDiff	Fréquence	Différence de fréquence maximale admissible à travers l'appareil ouvert
maxVoltDiff	Voltage	Tension de différence maximale admissible à travers l'appareil ouvert
relayDelayTime	Seconds	hérité de: ProtectionEquipment
highLimit	Float	hérité de: ProtectionEquipment
lowLimit	Float	hérité de: ProtectionEquipment
powerDirectionFlag	Boolean	hérité de: ProtectionEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 402 montre toutes les extrémités d'association de SynchrocheckRelay avec d'autres classes.

Tableau 402 – Extrémités d'association de Protection::SynchrocheckRelay avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Unit	Unit	hérité de: ProtectionEquipment
[0..*]	[0..*] ProtectedSwitches	ProtectedSwitch	hérité de: ProtectionEquipment
[0..*]	[0..*] ConductingEquipments	ConductingEquipment	hérité de: ProtectionEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.12 Paquetage Equivalents

6.1.12.1 Généralités

Le paquetage Equivalents modélise les réseaux équivalents.

La Figure 63 montre le diagramme logique Main.

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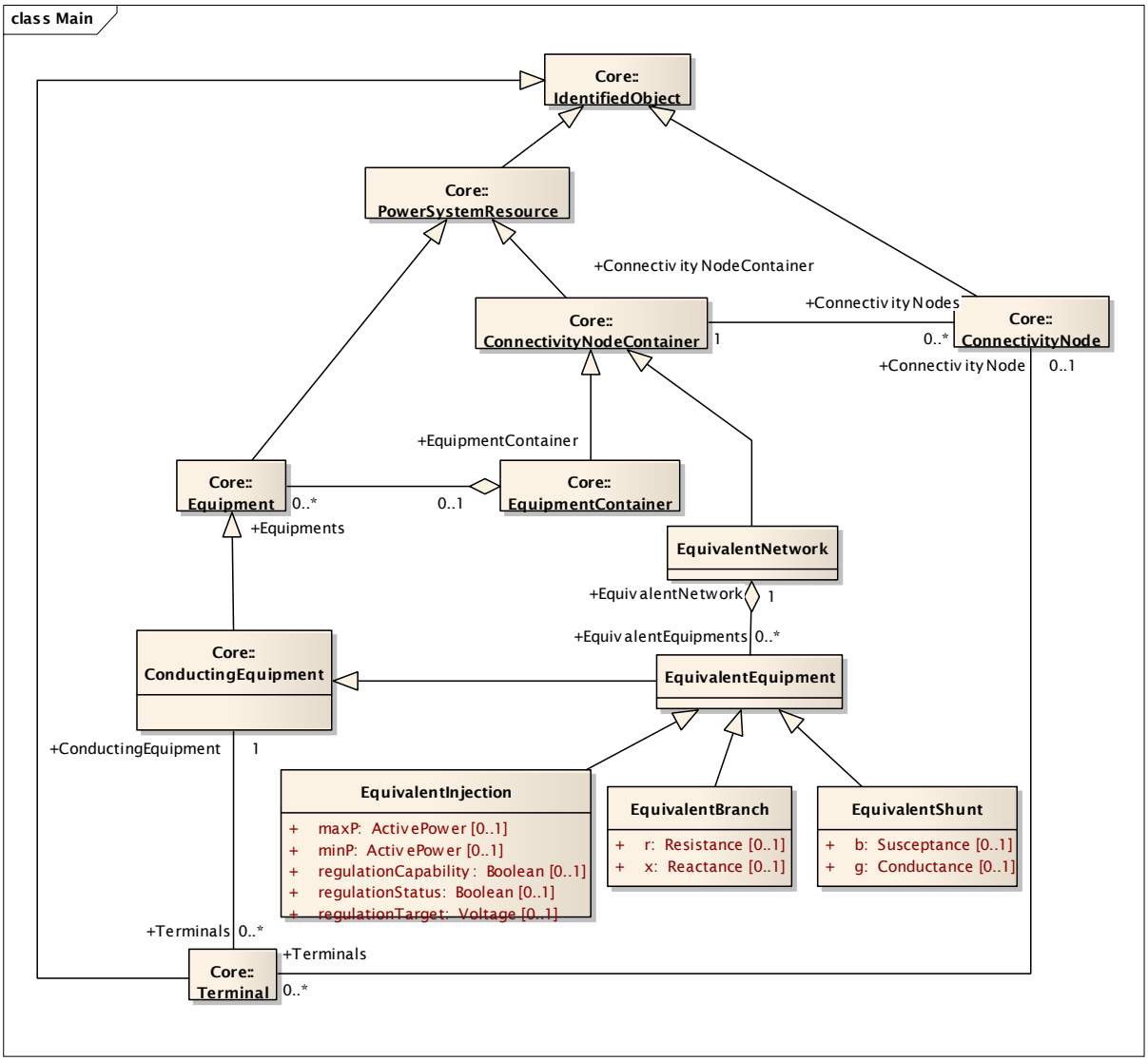

Figure 63 – Diagramme logique Equivalents::Main

6.1.12.2 EquivalentInjection

Cette classe représente des injections équivalentes (production ou charge). La régulation de tension n'est seulement qu'au niveau du nœud de connectivité local.

Le Tableau 403 montre tous les attributs de EquivalentInjection.

Tableau 403 – Attributs de Equivalents::EquivalentInjection

nom	type	description
maxP	ActivePower	Puissance active minimale de l'injection
minP	ActivePower	Puissance active maximale de l'injection
regulationCapability	Boolean	Spécifie si, oui ou non, l'EquivalentInjection a la capacité de réguler la tension locale
regulationStatus	Boolean	Spécifie le statut de régulation par défaut de l'EquivalentInjection. True, il régule. False, il ne régule pas
regulationTarget	Voltage	Tension-cible pour la régulation de tension
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment

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nom	type	description
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 404 montre toutes les extrémités d'association de EquivalentInjection avec d'autres classes.

Tableau 404 – Extrémités d'association de Equivalents::EquivalentInjection avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] EquivalentNetwork	EquivalentNetwork	hérité de: EquivalentEquipment
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.12.3 EquivalentBranch

La classe représente les branches équivalentes.

Le Tableau 405 montre tous les attributs de EquivalentBranch.

Tableau 405 – Attributs de Equivalents::EquivalentBranch

nom	type	description
r	Resistance	Résistance série directe de la branche réduite
x	Reactance	Réactance série directe de la branche réduite
phases	PhaseCode	hérité de: ConductingEquipment

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nom	type	description
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 406 montre toutes les extrémités d'association de EquivalentBranch avec d'autres classes.

Tableau 406 – Extrémités d'association de Equivalents::EquivalentBranch avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] EquivalentNetwork	EquivalentNetwork	hérité de: EquivalentEquipment
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.12.4 EquivalentEquipment

La classe représente les objets équivalents qui sont le résultat d'une réduction de réseau. La classe est la base pour les objets équivalents de types différents.

Le Tableau 407 montre tous les attributs de EquivalentEquipment.

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Tableau 407 – Attributs de Equivalents::EquivalentEquipment

nom	type	description
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 408 montre toutes les extrémités d'association de EquivalentEquipment avec d'autres classes.

Tableau 408 – Extrémités d'association de Equivalents::EquivalentEquipment avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] EquivalentNetwork	EquivalentNetwork	L'équivalent auquel le modèle réduit appartient
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.12.5 EquivalentNetwork

Classe représentant un réseau maillé extérieur qui a été réduit à un modèle électriquement équivalent. Les ConnectivityNode contenus dans l'équivalent sont censés refléter les nœuds internes de l'équivalent. Les nœuds de connectivité aux limites lorsque l'équivalent se connecte à l'extérieur de lui-même NE SONT PAS contenus dans l'équivalent.

Le Tableau 409 montre tous les attributs de EquivalentNetwork.

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Tableau 409 – Attributs de Equivalents::EquivalentNetwork

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 410 montre toutes les extrémités d'association de EquivalentNetwork avec d'autres classes.

Tableau 410 – Extrémités d'association de Equivalents::EquivalentNetwork avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] EquivalentEquipments	EquivalentEquipment	Les équivalents réduits associés
[1..1]	[0..*] ConnectivityNodes	ConnectivityNode	hérité de: ConnectivityNodeContainer
[0..1]	[0..*] TopologicalNode	TopologicalNode	hérité de: ConnectivityNodeContainer
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.12.6 EquivalentShunt

La classe représente les shunts équivalents.

Le Tableau 411 montre tous les attributs de EquivalentShunt.

Tableau 411 – Attributs de Equivalents::EquivalentShunt

nom	type	description
b	Susceptance	Susceptance shunt directe
g	Conductance	Conductance shunt directe
phases	PhaseCode	hérité de: ConductingEquipment
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject

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nom	type	description
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 412 montre toutes les extrémités d'association de EquivalentShunt avec d'autres classes.

Tableau 412 – Extrémités d'association de Equivalents::EquivalentShunt avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] EquivalentNetwork	EquivalentNetwork	hérité de: EquivalentEquipment
[0..*]	[0..1] BaseVoltage	BaseVoltage	hérité de: ConductingEquipment
[1..1]	[0..*] Terminals	Terminal	hérité de: ConductingEquipment
[0..*]	[0..*] ProtectionEquipments	ProtectionEquipment	hérité de: ConductingEquipment
[1..1]	[0..*] ClearanceTags	ClearanceTag	hérité de: ConductingEquipment
[1..1]	[0..1] SvStatus	SvStatus	hérité de: ConductingEquipment
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

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6.1.13 Paquetage Meas

6.1.13.1 Généralités

Comprend des entités décrivant des données de mesure dynamiques partagées par les applications.

La Figure 64 montre le diagramme logique Datatypes.

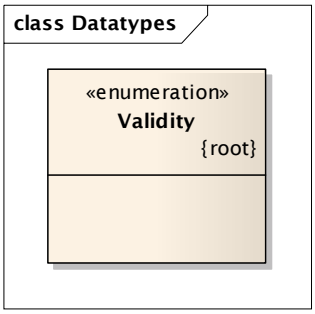

Figure 64 – Diagramme logique Meas::Datatypes

La Figure 65 montre le diagramme logique Meas.

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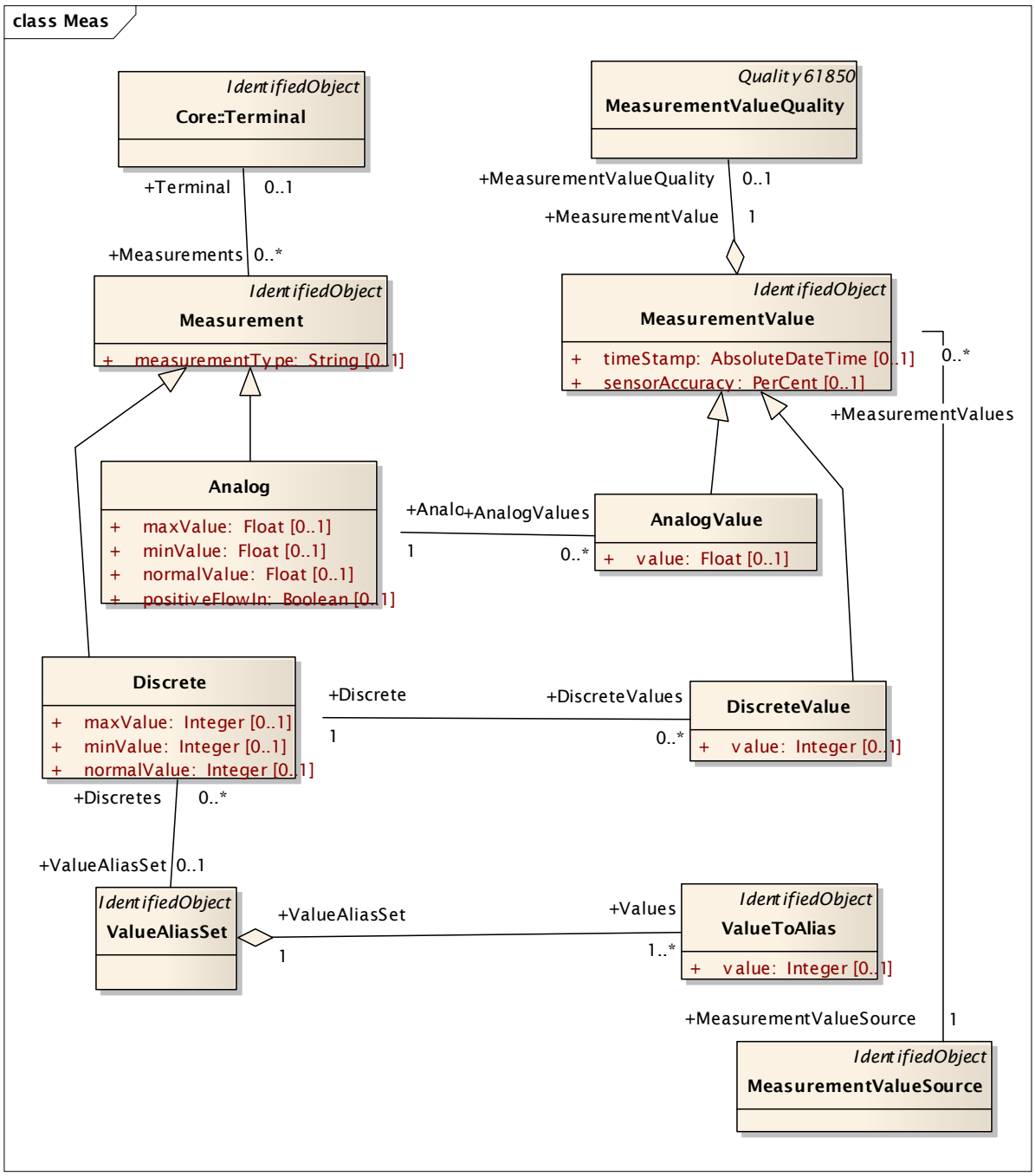

Figure 65 – Diagramme logique Meas::Meas

La Figure 66 montre le diagramme logique Control.

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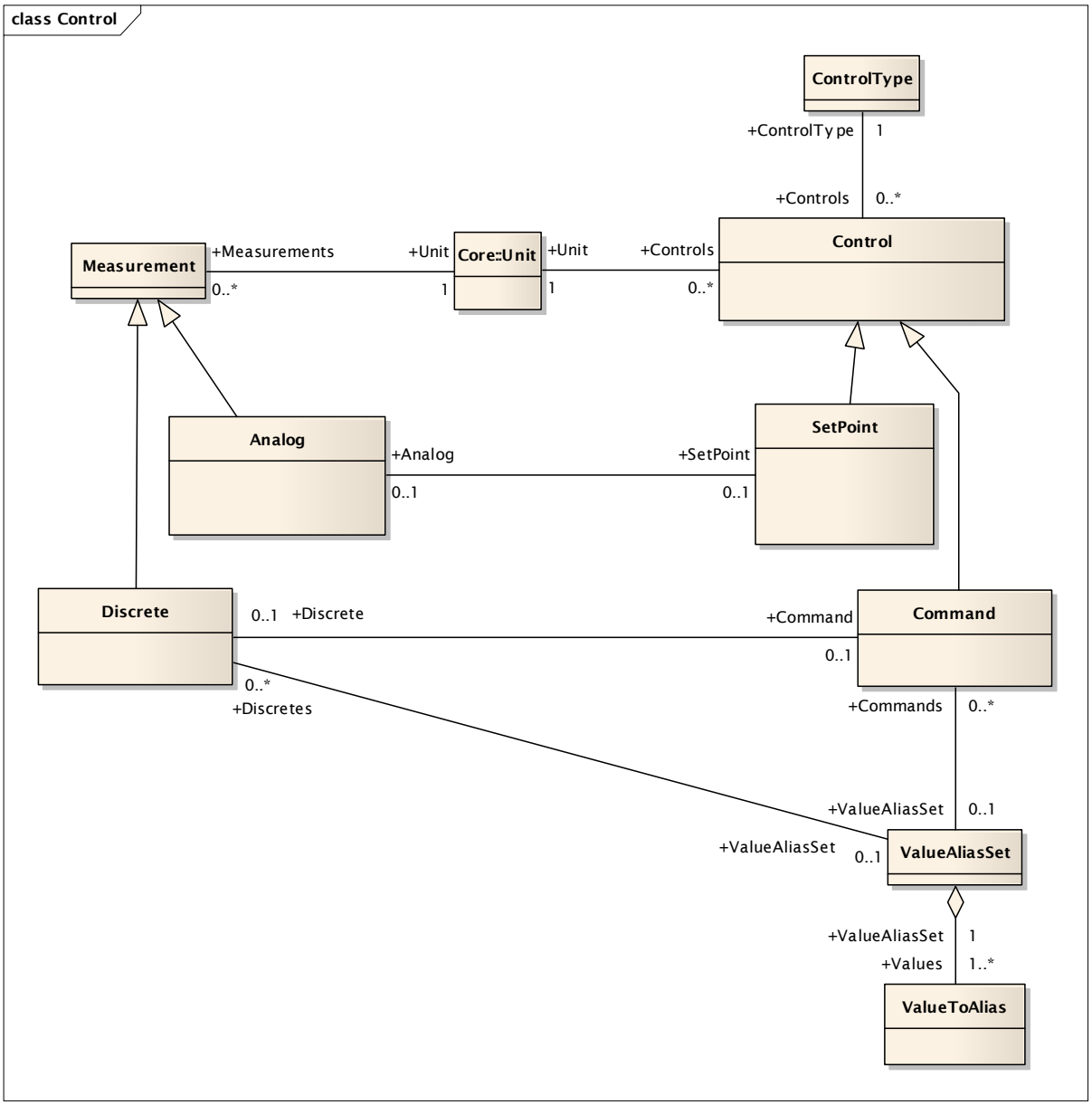

Figure 66 – Diagramme logique Meas::Control

Ce diagramme montre toutes les classes incluses dans le paquetage Meas.

La Figure 67 montre le diagramme logique InheritanceStructure.

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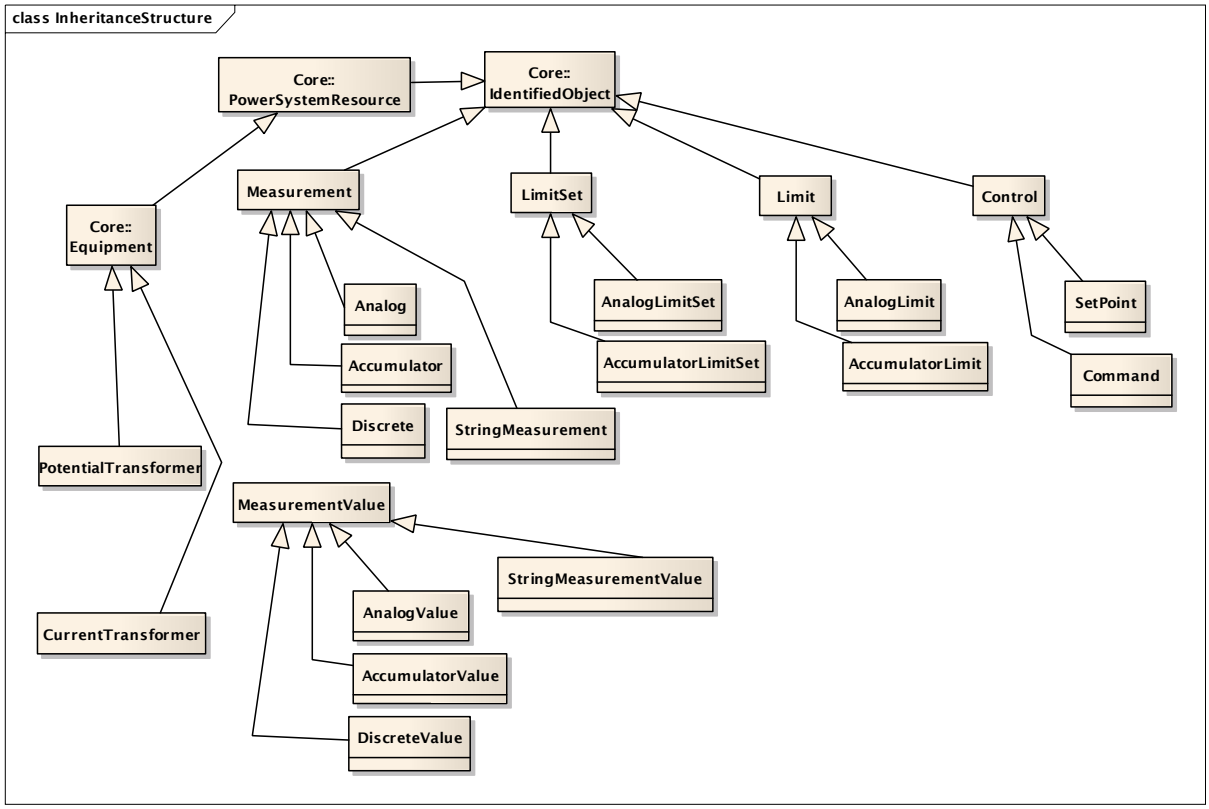

Figure 67 – Diagramme logique Meas::InheritanceStructure

Ce diagramme montre les classes de mesures hériter des classes de base.

La Figure 68 montre le diagramme logique Measurement avec des limites.

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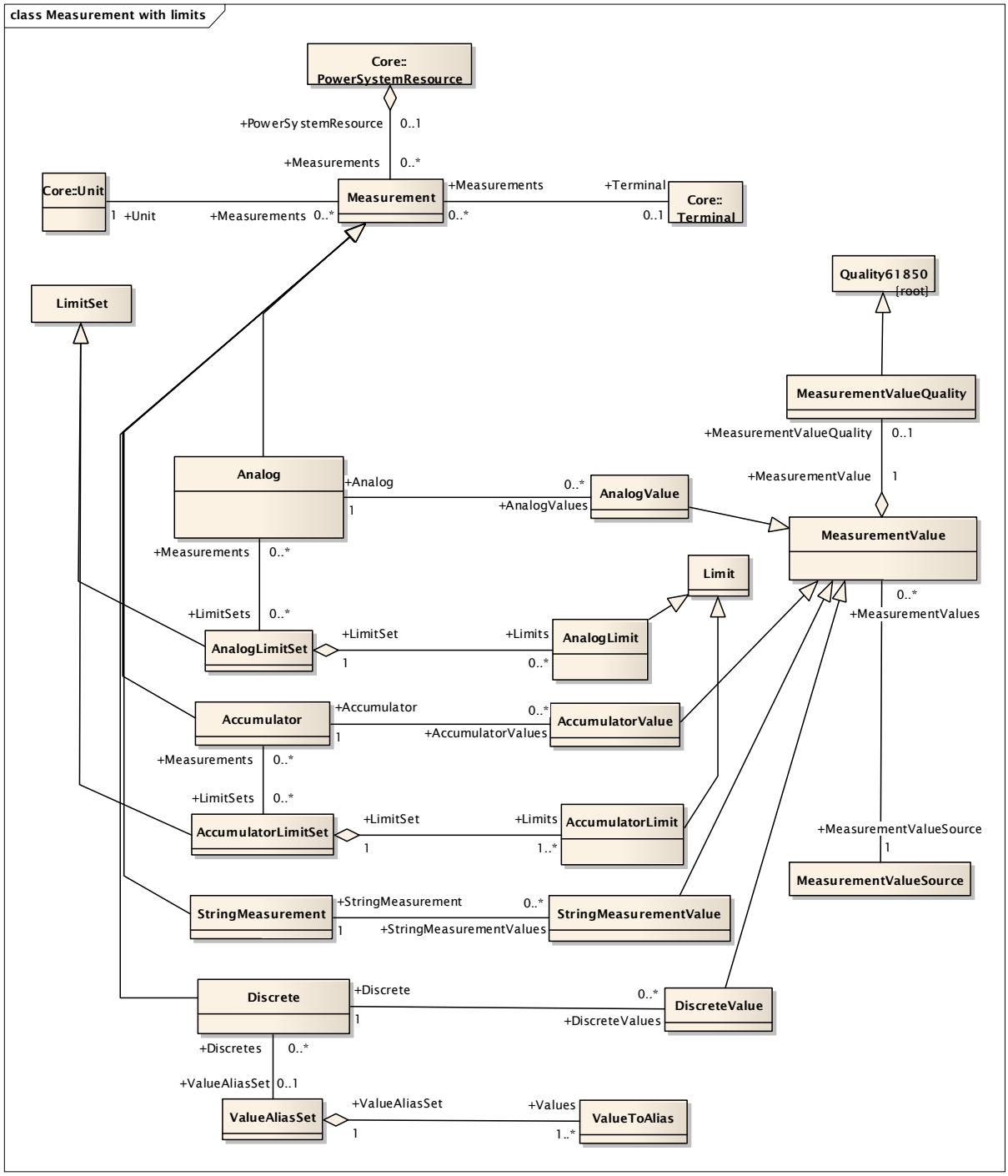

Figure 68 – Diagramme logique Meas::Measurement avec des limites

Ce diagramme montre les classes centrales au paquetage Measurement et les connexions à un certain nombre de classes externes.

La Figure 69 montre le diagramme logique Quality.

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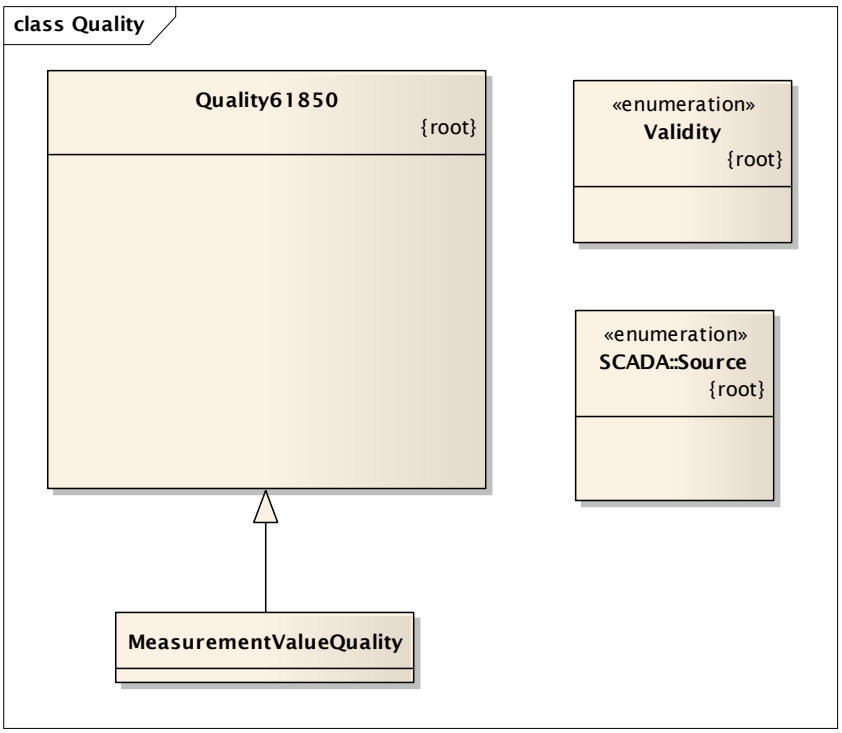

Figure 69 – Diagramme logique Meas::Quality

Ce diagramme montre le détail des codes de qualité. Les indicateurs de qualité peuvent aussi être utilisés dans d'autres paquetages qui ne sont pas strictement spécifiques à des MeasurementValues. Une classe générique Quality est ajoutée et héritée dans MeasurementValueQuality.

6.1.13.2 Accumulator

Accumulator (accumulateur) représente une Measurement cumulée (comptée), par exemple une valeur d'énergie.

Le Tableau 413 montre tous les attributs de Accumulator.

Tableau 413 – Attributs de Meas::Accumulator

nom	type	description
maxValue	Integer	Gamme maximale de valeurs normales d'un nombre quelconque des MeasurementValues.values. Utilisée pour la mise à l'échelle, par exemple dans les graphiques à barres ou les valeurs brutes de télémesures
measurementType	String	hérité de: Measurement
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 414 montre toutes les extrémités d'association de Accumulator avec d'autres classes.

Tableau 414 – Extrémités d'association de Meas::Accumulator avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] AccumulatorValues	AccumulatorValue	Les valeurs connectées à cette mesure
[0..*]	[0..*] LimitSets	AccumulatorLimitSet	Une mesure peut avoir zéro à plusieurs gammes de limites qui lui sont propres
[0..*]	[1..1] Unit	Unit	hérité de: Measurement
[0..*]	[0..1] Terminal	Terminal	hérité de: Measurement
[0..*]	[0..1] PowerSystemResource	PowerSystemResource	hérité de: Measurement

6.1.13.3 AccumulatorLimit

Valeurs limites pour les mesures de l'accumulateur Accumulator.

Le Tableau 415 montre tous les attributs de AccumulatorLimit.

Tableau 415 – Attributs de Meas::AccumulatorLimit

nom	type	description
value	Integer	La valeur qu'il ne faut pas dépasser. La valeur est positive
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 416 montre toutes les extrémités d'association de AccumulatorLimit avec d'autres classes.

Tableau 416 – Extrémités d'association de Meas::AccumulatorLimit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..*]	[1..1] LimitSet	AccumulatorLimitSet	L'ensemble de limites

6.1.13.4 AccumulatorLimitSet

Un AccumulatorLimitSet spécifie un ensemble de Limits (limites) qui sont associés à une mesure de l'Accumulator.

Le Tableau 417 montre tous les attributs de AccumulatorLimitSet.

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Tableau 417 – Attributs de Meas::AccumulatorLimitSet

nom	type	description
isPercentageLimits	Boolean	hérité de: LimitSet
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 418 montre toutes les extrémités d'association de AccumulatorLimitSet avec d'autres classes.

Tableau 418 – Extrémités d'association de Meas::AccumulatorLimitSet avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[1..*] Limits	AccumulatorLimit	Les valeurs limites utilisées pour la surveillance des Measurements
[0..*]	[0..*] Measurements	Accumulator	Les Measurements utilisant le LimitSet

6.1.13.5 AccumulatorValue

AccumulatorValue représente une MeasurementValue accumulée (compté).

Le Tableau 419 montre tous les attributs de AccumulatorValue.

Tableau 419 – Attributs de Meas::AccumulatorValue

nom	type	description
value	Integer	La valeur à surveiller. La valeur est positive
timeStamp	AbsoluteDateTime	hérité de: MeasurementValue
sensorAccuracy	PerCent	hérité de: MeasurementValue
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 420 montre toutes les extrémités d'association de AccumulatorValue avec d'autres classes.

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Tableau 420 – Extrémités d'association de Meas::AccumulatorValue avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Accumulator	Accumulator	Measurement à laquelle cette valeur est connectée
[1..1]	[0..1] RemoteSource	RemoteSource	hérité de: MeasurementValue
[1..1]	[0..1] MeasurementValueQuality	MeasurementValueQuality	hérité de: MeasurementValue
[0..*]	[1..1] MeasurementValueSource	MeasurementValueSource	hérité de: MeasurementValue

6.1.13.6 Analog

Analog (analogique) représente une Measurement analogique.

Le Tableau 421 montre tous les attributs de Analog.

Tableau 421 – Attributs de Meas::Analog

nom	type	description
maxValue	Float	Gamme maximale de valeurs normales d'un nombre quelconque des MeasurementValues.values. Utilisée pour la mise à l'échelle, par exemple dans les graphiques à barres ou les valeurs brutes de télémesures
minValue	Float	Gamme minimale de valeurs normales d'un nombre quelconque des MeasurementValues.values. Utilisée pour la mise à l'échelle, par exemple dans les graphiques à barres ou les valeurs brutes de télémesures
normalValue	Float	Valeur de mesure normale, par exemple utilisée pour des calculs de pourcentages
positiveFlowIn	Boolean	Si true (vrai), cette mesure est une puissance active, une puissance réactive ou un courant selon le principe qu'une valeur positive mesurée sur la Terminal indique que le courant pénètre dans la PowerSystemResource (ressource de réseau électrique) correspondante
measurementType	String	hérité de: Measurement
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 422 montre toutes les extrémités d'association de Analog avec d'autres classes.

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Tableau 422 – Extrémités d'association de Meas::Analog avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] AnalogValues	AnalogValue	Les valeurs connectées à cette mesure
[0..*]	[0..*] LimitSets	AnalogLimitSet	Une mesure peut avoir zéro à plusieurs gammes de limites qui lui sont propres
[0..1]	[0..1] SetPoint	SetPoint	La variable de commande (Control) associée à l'objet Measurement
[0..*]	[1..1] Unit	Unit	hérité de: Measurement
[0..*]	[0..1] Terminal	Terminal	hérité de: Measurement
[0..*]	[0..1] PowerSystemResource	PowerSystemResource	hérité de: Measurement

6.1.13.7 AnalogLimit

Valeurs limites pour les mesures Analog (analogiques).

Le Tableau 423 montre tous les attributs de AnalogLimit.

Tableau 423 – Attributs de Meas::AnalogLimit

nom	type	description
value	Float	La valeur qu'il ne faut pas dépasser
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 424 montre toutes les extrémités d'association de AnalogLimit avec d'autres classes.

Tableau 424 – Extrémités d'association de Meas::AnalogLimit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] LimitSet	AnalogLimitSet	L'ensemble de limites

6.1.13.8 AnalogLimitSet

Un AnalogLimitSet spécifie un ensemble de Limits (limites) qui sont associés à une mesure Analog (analogique).

Le Tableau 425 montre tous les attributs de AnalogLimitSet.

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Tableau 425 – Attributs de Meas::AnalogLimitSet

nom	type	description
isPercentageLimits	Boolean	hérité de: LimitSet
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 426 montre toutes les extrémités d'association de AnalogLimitSet avec d'autres classes.

Tableau 426 – Extrémités d'association de Meas::AnalogLimitSet avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] Limits	AnalogLimit	Les valeurs limites utilisées pour la surveillance des Measurements
[0..*]	[0..*] Measurements	Analog	Les Measurements utilisant le LimitSet

6.1.13.9 AnalogValue

AnalogValue représente une MeasurementValue analogique.

Le Tableau 427 montre tous les attributs de AnalogValue.

Tableau 427 – Attributs de Meas::AnalogValue

nom	type	description
value	Float	La valeur à surveiller
timeStamp	AbsoluteDateTime	hérité de: MeasurementValue
sensorAccuracy	PerCent	hérité de: MeasurementValue
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 428 montre toutes les extrémités d'association de AnalogValue avec d'autres classes.

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Tableau 428 – Extrémités d'association de Meas::AnalogValue avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Analog	Analog	Measurement à laquelle cette valeur est connectée
[1..1]	[0..*] AltGeneratingUnit	AltGeneratingUnitMeas	Unité de production alternative pour laquelle cette valeur de mesure s'applique
[1..1]	[0..*] AltTieMeas	AltTieMeas	L'utilisation de la mesure dans la zone de commande
[1..1]	[0..1] RemoteSource	RemoteSource	hérité de: MeasurementValue
[1..1]	[0..1] MeasurementValueQuality	MeasurementValueQuality	hérité de: MeasurementValue
[0..*]	[1..1] MeasurementValueSource	MeasurementValueSource	hérité de: MeasurementValue

6.1.13.10 Command

Une Command est une commande discrète utilisée pour la conduite.

Le Tableau 429 montre tous les attributs de Command.

Tableau 429 – Attributs de Meas::Command

nom	type	description
value	Integer	La valeur représentant la sortie de l'actionneur
normalValue	Integer	Valeur usuelle pour Control.value, par exemple pour calculer les pourcentages de mise à l'échelle
timeStamp	AbsoluteDateTime	hérité de: Control
operationInProgress	Boolean	hérité de: Control
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 430 montre toutes les extrémités d'association de Command avec d'autres classes.

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Tableau 430 – Extrémités d'association de Meas::Command avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] ValueAliasSet	ValueAliasSet	Les Command utilisant l'ensemble pour la traduction
[0..1]	[0..1] Discrete	Discrete	La variable Measurement utilisée pour le contrôle
[0..*]	[1..1] Unit	Unit	hérité de: Control
[1..1]	[0..1] RemoteControl	RemoteControl	hérité de: Control
[1..*]	[0..1] RegulatingCondEq	RegulatingCondEq	hérité de: Control
[0..*]	[1..1] ControlType	ControlType	hérité de: Control

6.1.13.11 Control

Control est utilisé pour assurer la commande de surveillance/de dispositifs. Il représente les sorties de commande qui sont utilisées pour changer l'état du processus, par exemple ouvrir ou fermer un disjoncteur, une valeur de point de consigne, ou un échelon de commande ("raise lower command").

Le Tableau 431 montre tous les attributs de Control.

Tableau 431 – Attributs de Meas::Control

nom	type	description
timeStamp	AbsoluteDateTime	Date et heure de la dernière commande émise
operationInProgress	Boolean	Indique que le client est en train d'émettre des commandes de contrôle et que cette action n'est pas terminée
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 432 montre toutes les extrémités d'association de Control avec d'autres classes.

Tableau 432 – Extrémités d'association de Meas::Control avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Unit	Unit	L'unité Unit pour le Control
[1..1]	[0..1] RemoteControl	RemoteControl	Point distant commandant l'actionneur physique
[1..*]	[0..1] RegulatingCondEq	RegulatingCondEq	Dispositif de régulation régi par cette sortie de commande
[0..*]	[1..1] ControlType	ControlType	Le type de Control (type de commande)

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6.1.13.12 ControlType

Spécifie le type de Control, par exemple BreakerOn/Off (disjoncteur en service/hors service), GeneratorVoltageSetPoint (point de consigne de tension du générateur), TieLineFlow (flux de ligne de jonction, etc. Le ControlType.name décrit le type et doit être unique parmi tous les types spécifiés. ControlType.aliasName est destiné à être utilisé pour la localisation.

Le Tableau 433 montre tous les attributs de ControlType.

Tableau 433 – Attributs de Meas::ControlType

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 434 montre toutes les extrémités d'association de ControlType avec d'autres classes.

Tableau 434 – Extrémités d'association de Meas::ControlType avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] Controls	Control	Les Controls ayant le ControlType

6.1.13.13 CurrentTransformer

Transformateur de mesure utilisé pour mesurer des qualités électriques du circuit qui est protégé et/ou surveillé. Typiquement utilisé comme transducteur de courant à des fins de comptage ou de protection. Une valeur assignée typique du courant secondaire serait de 5 A.

Le Tableau 435 montre tous les attributs de CurrentTransformer.

Tableau 435 – Attributs de Meas::CurrentTransformer

nom	type	description
ctClass	String	Classification de CT (Transformateur de courant); c'est-à-dire classe 10P
accuracyClass	String	Classe de précision du transformateur de courant (CT)
accuracyLimit	String	Pourcentage du courant assigné pour lequel le transformateur de courant reste précis dans les limites spécifiées
maxRatio	Float	Rapport admissible maximal pouvant être atteint dans le cas des transformateurs de courant à plusieurs rapports
coreCount	Integer	Nombre de noyaux
usage	String	Usage prévu du transformateur de courant; c'est-à-dire comptage, protection

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nom	type	description
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 436 montre toutes les extrémités d'association de CurrentTransformer avec d'autres classes.

Tableau 436 – Extrémités d'association de Meas::CurrentTransformer avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.13.14 Discrete

Discrete représente une Measurement discrète, à savoir une Measurement représentant des valeurs discrètes, par exemple une position de Breaker (disjoncteur).

Le Tableau 437 montre tous les attributs de Discrete.

Tableau 437 – Attributs de Meas::Discrete

nom	type	description
maxValue	Integer	Gamme maximale de valeurs normales d'un nombre quelconque des MeasurementValues.values. Utilisée pour la mise à l'échelle, par exemple dans les graphiques à barres ou les valeurs brutes de télémesures
minValue	Integer	Gamme minimale de valeurs normales d'un nombre quelconque des MeasurementValues.values. Utilisée pour la mise à l'échelle, par exemple dans les graphiques à barres ou les valeurs brutes de télémesures
normalValue	Integer	Valeur de mesure normale, par exemple utilisée pour des calculs de pourcentages
measurementType	String	hérité de: Measurement
mRID	String	hérité de: IdentifiedObject

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nom	type	description
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 438 montre toutes les extrémités d'association de Discrete avec d'autres classes.

Tableau 438 – Extrémités d'association de Meas::Discrete avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..1] Command	Command	La variable de commande (Control) associée à l'objet Measurement
[1..1]	[0..*] DiscreteValues	DiscreteValue	Les valeurs connectées à cette mesure
[0..*]	[0..1] ValueAliasSet	ValueAliasSet	Le ValueAliasSet utilisé pour traduire une MeasurementValue.value en un nom
[0..*]	[1..1] Unit	Unit	hérité de: Measurement
[0..*]	[0..1] Terminal	Terminal	hérité de: Measurement
[0..*]	[0..1] PowerSystemResource	PowerSystemResource	hérité de: Measurement

6.1.13.15 DiscreteValue

DiscreteValue représente une MeasurementValue discrète.

Le Tableau 439 montre tous les attributs de DiscreteValue.

Tableau 439 – Attributs de Meas::DiscreteValue

nom	type	description
value	Integer	La valeur à surveiller
timeStamp	AbsoluteDateTime	hérité de: MeasurementValue
sensorAccuracy	PerCent	hérité de: MeasurementValue
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 440 montre toutes les extrémités d'association de DiscreteValue avec d'autres classes.

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Tableau 440 – Extrémités d'association de Meas::DiscreteValue avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Discrete	Discrete	Measurement à laquelle cette valeur est connectée
[1..1]	[0..1] RemoteSource	RemoteSource	hérité de: MeasurementValue
[1..1]	[0..1] MeasurementValueQuality	MeasurementValueQuality	hérité de: MeasurementValue
[0..*]	[1..1] MeasurementValueSource	MeasurementValueSource	hérité de: MeasurementValue

6.1.13.16 Limit

Spécifie une valeur limite pour une Measurement (mesure). Une Measurement a typiquement plusieurs limites qui sont regroupées dans la classe LimitSet. La signification précise et l'usage de l'instance d'un objet Limit ne sont pas donnés par la classe Limit (c'est-à-dire, s'il s'agit d'une alarme, d'un avertissement ou bien d'une limite haute ou basse). Cependant, le nom donné à une instance de Limit peut indiquer à la fois ce qu'elle signifie et son usage.

Le Tableau 441 montre tous les attributs de Limit.

Tableau 441 – Attributs de Meas::Limit

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

6.1.13.17 LimitSet

Spécifie un ensemble d'objets Limit qui sont associés à un objet Measurement. Un objet Measurement peut avoir plusieurs LimitSets correspondant à des conditions de changement liées aux saisons ou autres. La condition est traduite dans les attributs name et description. Le même objet LimitSet peut être partagé entre plusieurs Measurements. En particulier, les limites en pourcentage sont utilisées de cette manière.

Le Tableau 442 montre tous les attributs de LimitSet.

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Tableau 442 – Attributs de Meas::LimitSet

nom	type	description
isPercentageLimits	Boolean	Indique si les valeurs limites sont données en pourcentage de normalValue (valeur normale) ou en Unit (unité) spécifiée pour Measurements et Controls
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

6.1.13.18 Measurement

Un objet Measurement représente n'importe quelle grandeur mesurée, calculée ou non mesurée non calculée. N'importe quel équipement peut contenir des Measurements, par exemple: un poste peut avoir des mesures de température et des indicateurs d'ouverture de porte, un transformateur peut avoir une mesure de la température d'huile et de la pression du réservoir, une cellule peut contenir un certain nombre de mesures de flux d'énergie ("powerflow") et un Breaker (disjoncteur) peut contenir une mesure de la position de l'organe de coupure.

L'association PSR-Measurement est destinée à traduire cet usage de Measurement et est incluse dans la hiérarchie de dénomination ("naming hierarchy") basée sur EquipmentContainer. La hiérarchie de dénomination ("naming hierarchy") a typiquement des Measurement comme feuilles, par exemple: Substation-VoltageLevel-Bay-Switch-Measurement

Certaines Measurements représentent des grandeurs relatives à l'emplacement particulier d'un capteur dans le réseau, par exemple un transformateur de tension (PT) sur un jeu de barres ou un transformateur de courant (CT) sur une barre entre un disjoncteur et un sectionneur. La localisation de la mesure n'est pas traduite par l'association PSR-Measurement. À l'inverse, elle est traduite dans l'association Measurement - Terminal qui est utilisée pour définir l'emplacement du capteur dans la topologie du réseau. L'emplacement est défini par le point de connexion entre la Terminal (la borne) et le ConductingEquipment (l'équipement conducteur).

Deux chemins possibles existent:

a) Measurement-Terminal- ConnectivityNode-Terminal-ConductingEquipment

b) Measurement-Terminal-ConductingEquipment

L'alternative b) est la seule voie autorisée.

Lorsque l'emplacement du capteur est recherché, les associations Measurement-PSR et Measurement-Terminal sont utilisées toutes les deux. L'association Measurement-Terminal n'est jamais utilisée seule.

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Le Tableau 443 montre tous les attributs de Measurement.

Tableau 443 – Attributs de Meas::Measurement

nom	type	description
measurementType	String	Spécifie le type de Measurement, par exemple IndoorTemperature, OutDoorTemperature, BusVoltage, GeneratorVoltage, LineFlow, etc.
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 444 montre toutes les extrémités d'association de Measurement avec d'autres classes.

Tableau 444 – Extrémités d'association de Meas::Measurement avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Unit	Unit	L'Unit (unité) de la Measurement
[0..*]	[0..1] Terminal	Terminal	Une ou plusieurs mesures peuvent être associées à une borne du réseau
[0..*]	[0..1] PowerSystemResource	PowerSystemResource	La PowerSystemResource qui contient Measurement dans la hiérarchie de dénomination

6.1.13.19 MeasurementValue

L'état courant d'une Measurement. La valeur de l'état est une instance d'une mesure provenant d'une source spécifique. Les objets Measurements peuvent être associés à différentes valeurs d'état, chacune représentant une source différente pour la mesure.

Le Tableau 445 montre tous les attributs de MeasurementValue.

Tableau 445 – Attributs de Meas::MeasurementValue

nom	type	description
timeStamp	AbsoluteDateTime	La date et heure de la dernière mise à jour de la valeur
sensorAccuracy	PerCent	Limite, exprimée en pourcentages du maximum du capteur, que les erreurs n'excéderont pas lorsque le capteur sera utilisé dans les conditions de référence
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 446 montre toutes les extrémités d'association de MeasurementValue avec d'autres classes.

Tableau 446 – Extrémités d'association de Meas::MeasurementValue avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..1] RemoteSource	RemoteSource	Lien avec les points physiques de télémesure associé à cette mesure
[1..1]	[0..1] MeasurementValueQuality	MeasurementValueQuality	Une MeasurementValue a une MeasurementValueQuality associée
[0..*]	[1..1] MeasurementValueSource	MeasurementValueSource	Une référence au type de source qui met à jour la MeasurementValue (valeur de mesure), par exemple SCADA, CCLink, manuelle, etc. Les conventions d'utilisateur pour les noms des sources sont contenues dans l'introduction à la CEI 61970-301.

6.1.13.20 MeasurementValueQuality

Indicateurs de qualité d'un objet Measurement. Les bits 0 à 10 sont définis pour l'automatisation d'un poste dans la CEI 61850-7-3. Les bits 11 à 15 sont réservés à de futures évolutions de ce document. Les bits 16 à 31 sont réservés aux applications de l'EMS (système de gestion de l'énergie).

Le Tableau 447 montre tous les attributs de MeasurementValueQuality.

Tableau 447 – Attributs de Meas::MeasurementValueQuality

nom	type	description
badReference	Boolean	hérité de: Quality61850
estimatorReplaced	Boolean	hérité de: Quality61850
failure	Boolean	hérité de: Quality61850
oldData	Boolean	hérité de: Quality61850
operatorBlocked	Boolean	hérité de: Quality61850
oscillatory	Boolean	hérité de: Quality61850
outOfRange	Boolean	hérité de: Quality61850
overFlow	Boolean	hérité de: Quality61850
source	Source	hérité de: Quality61850
suspect	Boolean	hérité de: Quality61850
test	Boolean	hérité de: Quality61850
validity	Validity	hérité de: Quality61850

Le Tableau 448 montre toutes les extrémités d'association de MeasurementValueQuality avec d'autres classes.

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Tableau 448 – Extrémités d'association de Meas::MeasurementValueQuality avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] MeasurementValue	MeasurementValue	Une MeasurementValue a une MeasurementValueQuality associée

6.1.13.21 MeasurementValueSource

MeasurementValueSource décrit les sources alternatives pour mettre à jour une MeasurementValue. Les conventions d'utilisateur sur la manière d'utiliser les attributs de MeasurementValueSource sont décrites dans l'introduction à la présente norme.

Le Tableau 449 montre tous les attributs de MeasurementValueSource.

Tableau 449 – Attributs de Meas::MeasurementValueSource

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 450 montre toutes les extrémités d'association de MeasurementValueSource avec d'autres classes.

Tableau 450 – Extrémités d'association de Meas::MeasurementValueSource avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] MeasurementValues	MeasurementValue	Les MeasurementValues (les valeurs de mesure) mises à jour par la source

6.1.13.22 PotentialTransformer

Transformateur de mesure (également appelé "Transformateur de tension") utilisé pour mesurer des qualités électriques du circuit qui est protégé et/ou surveillé. Typiquement utilisé comme transducteur de tension à des fins de comptage ou de protection, ou parfois comme alimentation de poste auxiliaire. Une valeur assignée typique de la tension secondaire serait de 120 V.

Le Tableau 451 montre tous les attributs de PotentialTransformer.

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Tableau 451 – Attributs de Meas::PotentialTransformer

nom	type	description
ptClass	String	Classification de transformateur de puissance (PT)
accuracyClass	String	Classe de précision du transformateur de puissance (PT)
nominalRatio	Float	Rapport nominal entre la tension primaire et la tension secondaire
normallyInService	Boolean	hérité de: Equipment
aggregate	Boolean	hérité de: Equipment
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 452 montre toutes les extrémités d'association de PotentialTransformer avec d'autres classes.

Tableau 452 – Extrémités d'association de Meas::PotentialTransformer avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[0..1] EquipmentContainer	EquipmentContainer	hérité de: Equipment
[1..1]	[0..*] OperationalLimitSet	OperationalLimitSet	hérité de: Equipment
[1..1]	[0..*] ContingencyEquipment	ContingencyEquipment	hérité de: Equipment
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.13.23 Classe racine Quality61850

Les indicateurs de qualité de cette classe sont définis dans la CEI 61850-7-3:2010, à l'exception de estimatorReplaced, qui a été inclus dans cette classe par commodité.

Le Tableau 453 montre tous les attributs de Quality61850.

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Tableau 453 – Attributs de Meas::Quality61850

nom	type	description
badReference	Boolean	La valeur de Measurement peut être incorrecte à cause d'une référence hors calibre
estimatorReplaced	Boolean	La valeur a été remplacée par l'Estimateur d'État. estimatorReplaced n'est pas un bit qualité IEC61850 mais a été placé dans cette classe par commodité
failure	Boolean	Cet identificateur indique que la fonction de surveillance a détecté une défaillance interne ou externe, par exemple une erreur de communication
oldData	Boolean	La valeur de Measurement est ancienne et peut être non valide car elle n'a pas été mise à jour avec succès pendant un intervalle de temps spécifié
operatorBlocked	Boolean	La valeur de Measurement est bloquée et donc non disponible pour être transmise
oscillatory	Boolean	Pour prévenir une surcharge des communications, il est raisonnable de détecter et de supprimer les entrées binaires battantes (qui changent très vite). Si un signal change dans un intervalle de temps défini (tosc) deux fois dans le même sens (de 0 à 1 ou de 1 à 0) alors son caractère battant est détecté et l'indicateur de détail de la qualité "oscillatory" est positionné. Si ce cas est détecté, des nombres configurables de changements transitoires peuvent ne pas être pris en compte. Pendant cette période, l'état "questionable" (douteux) de "validity" est mis. Si, après ce nombre défini de changements d'états, le signal est toujours battant, la valeur doit être mise soit dans l'état opposé à la dernière valeur stable, soit à une valeur par défaut prédéfinie. Dans ce cas l'état "questionable" de "validity" est remplacé par "invalid" aussi longtemps que le signal reste battant. Si, du fait de la configuration, il convient de n'ignorer aucun changement transitoire, "validity" est immédiatement mis à "invalid" en plus de l'indicateur de qualité de détail "oscillatory" (applicable à l'information de statut uniquement)
outOfRange	Boolean	La valeur de Measurement est au-delà d'une gamme de valeurs prédéfinies
overFlow	Boolean	La valeur Measurement est au-delà des valeurs susceptibles d'être représentées correctement. Par exemple, une valeur de compteur excède la valeur maximale de comptage en reprenant la valeur zéro
source	Source	Source donne des informations relatives à l'origine de la valeur. La valeur peut être acquise du processus, être donnée par défaut ou être substituée
suspect	Boolean	Une fonction de corrélation a détecté que la valeur n'est pas cohérente avec d'autres valeurs. Positionnée typiquement par un Estimateur d'États de réseau
test	Boolean	La valeur de Measurement est transmise aux fins de tests
validity	Validity	La validité de la valeur de mesure

6.1.13.24 SetPoint

Un Setpoint (une valeur de consigne) est une commande analogique utilisée pour la conduite.

Le Tableau 454 montre tous les attributs de SetPoint.

Tableau 454 – Attributs de Meas::SetPoint

nom	type	description
value	Float	La valeur représentant la sortie de l'actionneur
maxValue	Float	Amplitude maximale normale pour toutes les Control.value. Utilisée pour la mise à l'échelle, par exemple dans des graphiques à barres
minValue	Float	Amplitude minimale normale pour toutes les Control.value. Utilisée pour la mise à l'échelle, par exemple dans des graphiques à barres

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nom	type	description
normalValue	Float	Valeur usuelle pour Control.value, par exemple pour calculer les pourcentages de mise à l'échelle
timeStamp	AbsoluteDateTime	hérité de: Control
operationInProgress	Boolean	hérité de: Control
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 455 montre toutes les extrémités d'association de SetPoint avec d'autres classes.

Tableau 455 – Extrémités d'association de Meas::SetPoint avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..1] Analog	Analog	La variable Measurement utilisée pour le contrôle
[0..*]	[1..1] Unit	Unit	hérité de: Control
[1..1]	[0..1] RemoteControl	RemoteControl	hérité de: Control
[1..*]	[0..1] RegulatingCondEq	RegulatingCondEq	hérité de: Control
[0..*]	[1..1] ControlType	ControlType	hérité de: Control

6.1.13.25 StringMeasurement

StringMeasurement représente une mesure avec des valeurs de type String (chaîne de caractères).

Le Tableau 456 montre tous les attributs de StringMeasurement.

Tableau 456 – Attributs de Meas::StringMeasurement

nom	type	description
measurementType	String	hérité de: Measurement
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 457 montre toutes les extrémités d'association de StringMeasurement avec d'autres classes.

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Tableau 457 – Extrémités d'association de Meas::StringMeasurement avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] StringMeasurementValues	StringMeasurementValue	Les valeurs connectées à cette mesure
[0..*]	[1..1] Unit	Unit	hérité de: Measurement
[0..*]	[0..1] Terminal	Terminal	hérité de: Measurement
[0..*]	[0..1] PowerSystemResource	PowerSystemResource	hérité de: Measurement

6.1.13.26 StringMeasurementValue

StringMeasurementValue représente une valeur de mesure de type String (chaîne de caractères).

Le Tableau 458 montre tous les attributs de StringMeasurementValue.

Tableau 458 – Attributs de Meas::StringMeasurementValue

nom	type	description
value	String	La valeur à surveiller
timeStamp	AbsoluteDateTime	hérité de: MeasurementValue
sensorAccuracy	PerCent	hérité de: MeasurementValue
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 459 montre toutes les extrémités d'association de StringMeasurementValue avec d'autres classes.

Tableau 459 – Extrémités d'association de Meas::StringMeasurementValue avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] StringMeasurement	StringMeasurement	Measurement à laquelle cette valeur est connectée
[1..1]	[0..1] RemoteSource	RemoteSource	hérité de: MeasurementValue
[1..1]	[0..1] MeasurementValueQuality	MeasurementValueQuality	hérité de: MeasurementValue
[0..*]	[1..1] MeasurementValueSource	MeasurementValueSource	hérité de: MeasurementValue

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6.1.13.27 Enumération Validity

Validité de MeasurementValue.

Le Tableau 460 montre tous les libellés de Validity.

Tableau 460 – Libellés de Meas::Validity

libellé	description
GOOD	La valeur est marquée valide si aucune anomalie n'est signalée par la fonction d'acquisition ou par la source de l'information
QUESTIONABLE	La valeur est marquée douteuse si une fonction de surveillance détecte un comportement anormal, cependant la valeur peut être néanmoins valide. Il incombe au client la responsabilité de déterminer s'il convient d'utiliser ou non les valeurs "questionable" (douteuses)
INVALID	La valeur est marquée comme "invalid" (non valide) lorsqu'une fonction de surveillance reconnaît des conditions anormales affectant la fonction d'acquisition ou la source d'informations (dispositifs de mise à jour absents ou non opérationnels). La valeur n'est pas définie dans ces conditions. La marque invalide est utilisée pour indiquer au client que la valeur peut être incorrecte et ne doit pas être utilisée

6.1.13.28 ValueAliasSet

Décrit la traduction d'un ensemble de valeurs en un nom et est censé faciliter les traductions personnalisées. Chaque ValueAliasSet a un nom, une description, etc. Un objet Measurement peut représenter un état discret comme Open, Closed, Intermediate, etc. Il faut donc une traduction de la valeur numérique de MeasurementValue.value en chaîne de caractères, par exemple 0="Invalid", 1="Open", 2="Closed", 3="Intermediate". Chaque membre ValueToAlias dans ValueAliasSet.Value décrit une correspondance entre une valeur particulière et un nom.

Le Tableau 461 montre tous les attributs de ValueAliasSet.

Tableau 461 – Attributs de Meas::ValueAliasSet

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 462 montre toutes les extrémités d'association de ValueAliasSet avec d'autres classes.

Tableau 462 – Extrémités d'association de Meas::ValueAliasSet avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[1..*] Values	ValueToAlias	Les correspondances de ValueToAlias incluses dans l'ensemble
[0..1]	[0..*] Discretes	Discrete	Les Measurement utilisant l'ensemble pour la traduction
[0..1]	[0..*] Commands	Command	Le ValueAliasSet utilisé pour traduire une valeur de Control en un nom

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6.1.13.29 ValueToAlias

Décrit la traduction d'une valeur particulière en un nom, par exemple 1="Open".

Le Tableau 463 montre tous les attributs de ValueToAlias.

Tableau 463 – Attributs de Meas::ValueToAlias

nom	type	description
value	Integer	La valeur qui est cartographiée
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 464 montre toutes les extrémités d'association de ValueToAlias avec d'autres classes.

Tableau 464 – Extrémités d'association de Meas::ValueToAlias avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..*]	[1..1] ValueAliasSet	ValueAliasSet	Le ValueAliasSet ayant les correspondances de ValueToAlias

6.1.14 Paquetage SCADA

6.1.14.1 Généralités

Contient des entités pour modéliser les informations utilisées par les applications de commande de surveillance et acquisition de données (SCADA, supervisory control and data acquisition). La commande de surveillance prend en charge la commande de l'équipement par l'opérateur, telle que l'ouverture ou la fermeture d'un disjoncteur. L'acquisition de données rassemble les données télémétrées provenant de diverses sources. Les sous-types de l'entité Telemetry concordent délibérément aux définitions de l'UCA et de la CEI 61850.

Ce paquetage prend également en charge la présentation d'alarmes mais n'est pas censé être utilisé par d'autres applications.

La Figure 70 montre le diagramme logique Datatypes.

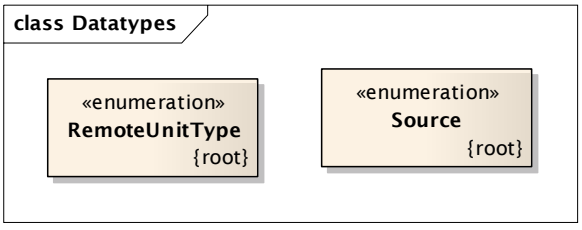

Figure 70 – Diagramme logique SCADA::Datatypes

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La Figure 71 montre le diagramme logique Main.

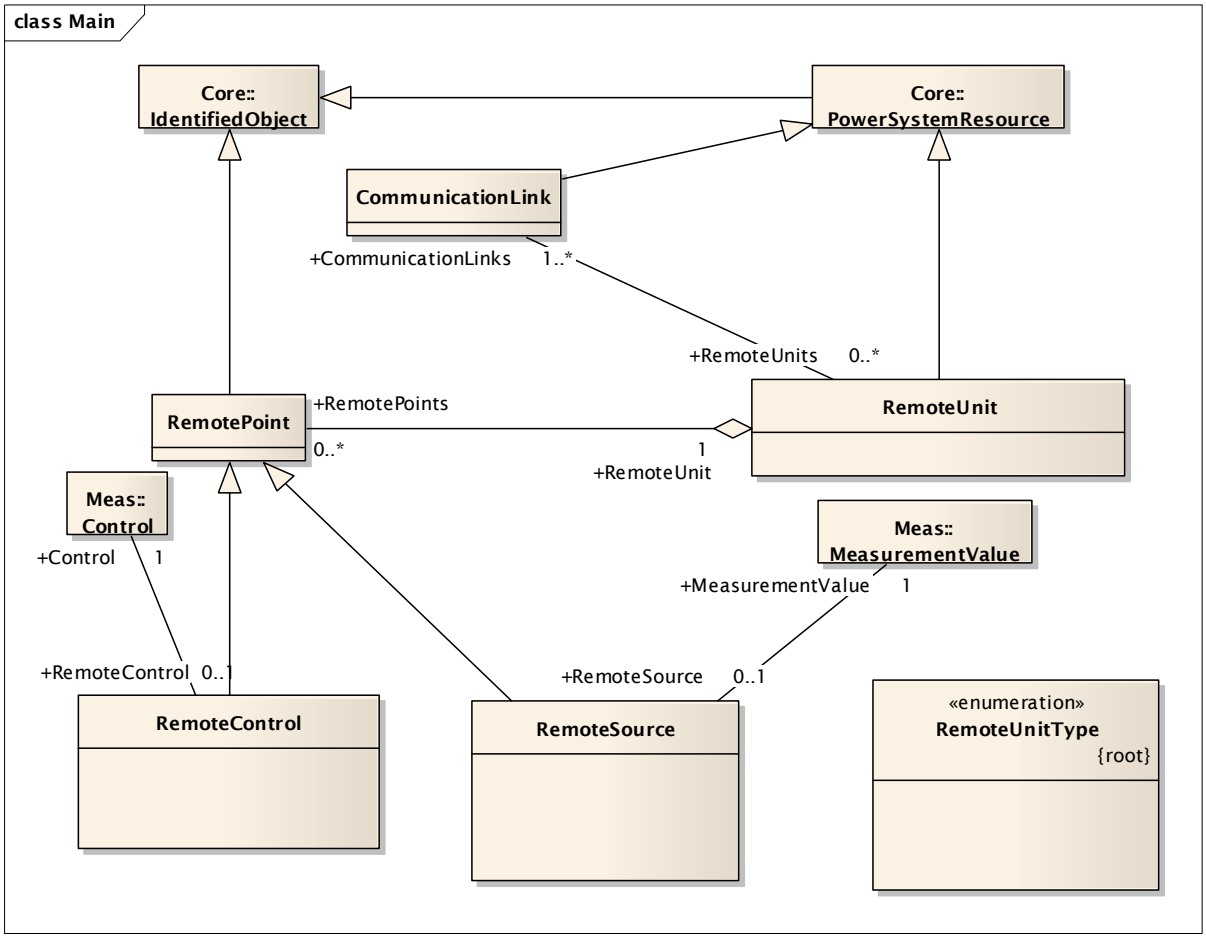

Figure 71 – Diagramme logique SCADA::Main

Ce diagramme montre toutes les classes incluses dans le paquetage SCADA de même que les classes-clés externes qui ont des associations avec des classes SCADA.

6.1.14.2 CommunicationLink

La connexion à des unités distantes se fait par l'intermédiaire d'une ou plusieurs liaisons de communication. Des liaisons redondantes peuvent exister. La classe CommunicationLink hérite de PowerSystemResource. L'intention est de permettre aux CommunicationLinks (liaisons de communication) d'avoir des Measurements. Ces Measurements peuvent être utilisées pour modéliser l'état de la liaison comme étant opérationnel, hors service, défaillance d'unité, etc.

Le Tableau 465 montre tous les attributs de CommunicationLink.

Tableau 465 – Attributs de SCADA::CommunicationLink

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

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Le Tableau 466 montre toutes les extrémités d'association de CommunicationLink avec d'autres classes.

Tableau 466 – Extrémités d'association de SCADA::CommunicationLink avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..*]	[0..*] RemoteUnits	RemoteUnit	Des unités distantes RTU (remote unit) peuvent être jointes à des liaisons de communication
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.14.3 RemoteControl

Les commandes distantes sont des sorties envoyées par l'unité distante à des actionneurs dans le processus.

Le Tableau 467 montre tous les attributs de RemoteControl.

Tableau 467 – Attributs de SCADA::RemoteControl

nom	type	description
remoteControlled	Boolean	Mis à true (vrai) si l'actionneur est commandé à distance
actuatorMaximum	Float	La valeur maximale de point de consigne acceptée par le point de commande à distance
actuatorMinimum	Float	La valeur minimale de point de consigne acceptée par le point de commande à distance
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 468 montre toutes les extrémités d'association de RemoteControl avec d'autres classes.

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Tableau 468 – Extrémités d'association de SCADA::RemoteControl avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] Control	Control	Le Control (la commande) pour le point RemoteControl (commande à distance)
[0..*]	[1..1] RemoteUnit	RemoteUnit	hérité de: RemotePoint

6.1.14.4 RemotePoint

Pour une RTU, les points distants correspondent à des valeurs télémétrées ou sorties de commande. D'autres unités (par exemple, centres de conduite) aussi contiennent habituellement des valeurs calculées.

Le Tableau 469 montre tous les attributs de RemotePoint.

Tableau 469 – Attributs de SCADA::RemotePoint

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 470 montre toutes les extrémités d'association de RemotePoint avec d'autres classes.

Tableau 470 – Extrémités d'association de SCADA::RemotePoint avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] RemoteUnit	RemoteUnit	Unité distante à laquelle ce point appartient

6.1.14.5 RemoteSource

Les sources distantes sont des variables d'état qui sont télémétrées ou calculées au sein de l'unité distante.

Le Tableau 471 montre tous les attributs de RemoteSource.

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Tableau 471 – Attributs de SCADA::RemoteSource

nom	type	description
sensorMaximum	Float	La valeur maximale que peut retourner l'entité de télémétrie
sensorMinimum	Float	La valeur minimale que peut retourner l'entité de télémétrie
scanInterval	Seconds	L'intervalle de temps entre balayages
deadband	Float	La plus petite variation de valeur devant être communiquée
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 472 montre toutes les extrémités d'association de RemoteSource avec d'autres classes.

Tableau 472 – Extrémités d'association de SCADA::RemoteSource avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] MeasurementValue	MeasurementValue	Lien avec le point physique de télémesure associé à cette mesure
[0..*]	[1..1] RemoteUnit	RemoteUnit	hérité de: RemotePoint

6.1.14.6 RemoteUnit

Une unité distante peut être une RTU, un IED (intelligent electronic device, c'est-à-dire dispositif électronique intelligent), un système de contrôle de poste, un centre de conduite, etc. La communication avec l'unité distante peut être effectuée par divers protocoles normalisés (par exemple CEI 61850) ou protocoles non norrmalisés (par exemple DNP, RP570, etc.). Une unité distante contient des points de données distants qui pourraient être télémétrés, recueillis ou calculés. La classe RemoteUnit hérite de PowerSystemResource. L'intention est de permettre aux RemoteUnit (aux unités distantes) d'avoir des Measurements. Ces Measurements peuvent être utilisées pour modéliser l'état de l'unité comme étant opérationnel, hors service, défaillance d'unité, etc.

Le Tableau 473 montre tous les attributs de RemoteUnit.

Tableau 473 – Attributs de SCADA::RemoteUnit

nom	type	description
remoteUnitType	RemoteUnitType	Type d'unité distante
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject

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nom	type	description
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 474 montre toutes les extrémités d'association de RemoteUnit avec d'autres classes.

Tableau 474 – Extrémités d'association de SCADA::RemoteUnit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..*] CommunicationLinks	CommunicationLink	Des RTUs (Remote Terminal Unit) peuvent être jointes à des liaisons de communication
[1..1]	[0..*] RemotePoints	RemotePoint	Points Remote (distants) que contient cette unité Remote (distante)
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

6.1.14.7 Enumération RemoteUnitType

Type d'unité distante.

Le Tableau 475 montre tous les libellés de RemoteUnitType.

Tableau 475 – Libellés de SCADA::RemoteUnitType

libellé	description
RTU	
SubstationControlSystem	
ControlCenter	
IED	

6.1.14.8 Enumération Source

Source donne des informations relatives à l'origine de la valeur.

Le Tableau 476 montre tous les libellés de Source.

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Tableau 476 – Libellés de SCADA::Source

libellé	description
PROCESS	La valeur est fournie par une entrée du processus E/S ou calculée par une fonction
DEFAULTED	La valeur contient une valeur par défaut
SUBSTITUTED	La valeur est fournie par entrée de l'opérateur ou par une source automatique

6.1.15 Paquetage ControlArea

6.1.15.1 Généralités

Le paquetage ControlArea modélise les spécifications relatives aux zones qui peuvent être utilisées à des fins diverses. Le paquetage dans son ensemble modélise les spécifications de zones de conduite qui se chevauchent potentiellement, à des fins de contrôle de production réel, de saisie de charge dans des zones de prévision de charge, ou d'analyse basée sur le flux de puissance.

La Figure 72 montre le diagramme logique ControlArea.

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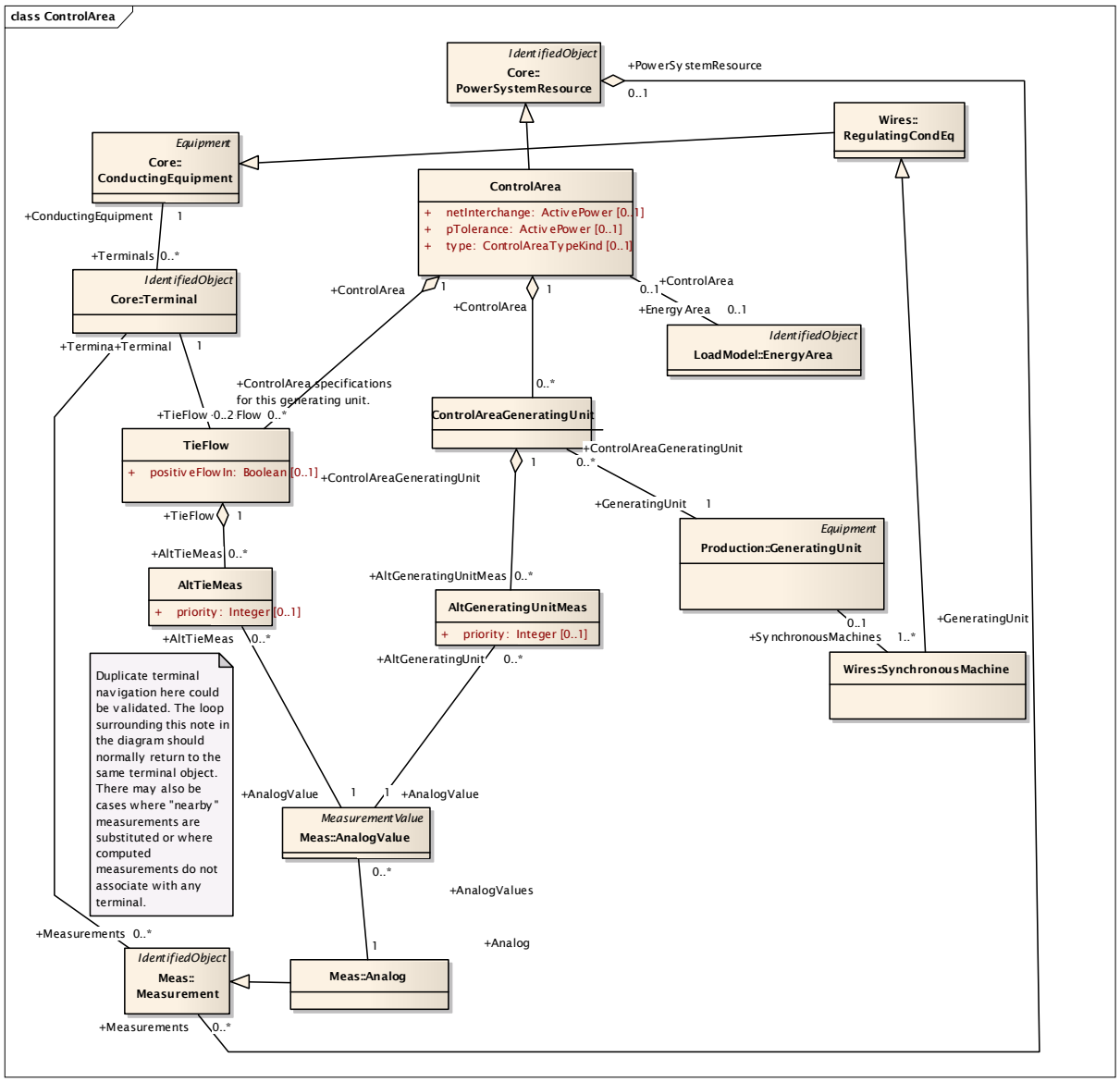

Légende

Anglais	Français
Duplicate terminal navigation here could be validated. The loop surrounding this note in the diagram should normally return to the same terminal object. There may also be cases where "nearby" measurements are substituted or where computed measurements do not associate with any terminal.	Un doublon de navigation de bornes (Terminal) ici pourrait être validé. Il convient normalement que la boucle entourant cette note dans le diagramme retourne au même objet borne (Terminal). Il peut aussi exister des cas dans lesquels les mesures (Measurement) "limitrophes" sont substituées ou des mesures (Measurement) calculées ne sont associées à aucune borne (Terminal).

Figure 72 – Diagramme logique ControlArea::ControlArea

Ce diagramme montre la spécification relative aux zones de contrôle et un certain nombre de classes liées. Les liaisons Terminal à AnalogValue sont montrées par souci de clarté pour comprendre la spécification relative aux zones de contrôle. Les liaisons GeneratingUnit à Terminal sont également montrées pour illustrer comment les flux de production sont spécifiquement attachés au réseau.

La Figure 73 montre le diagramme logique ControlAreaInheritance.

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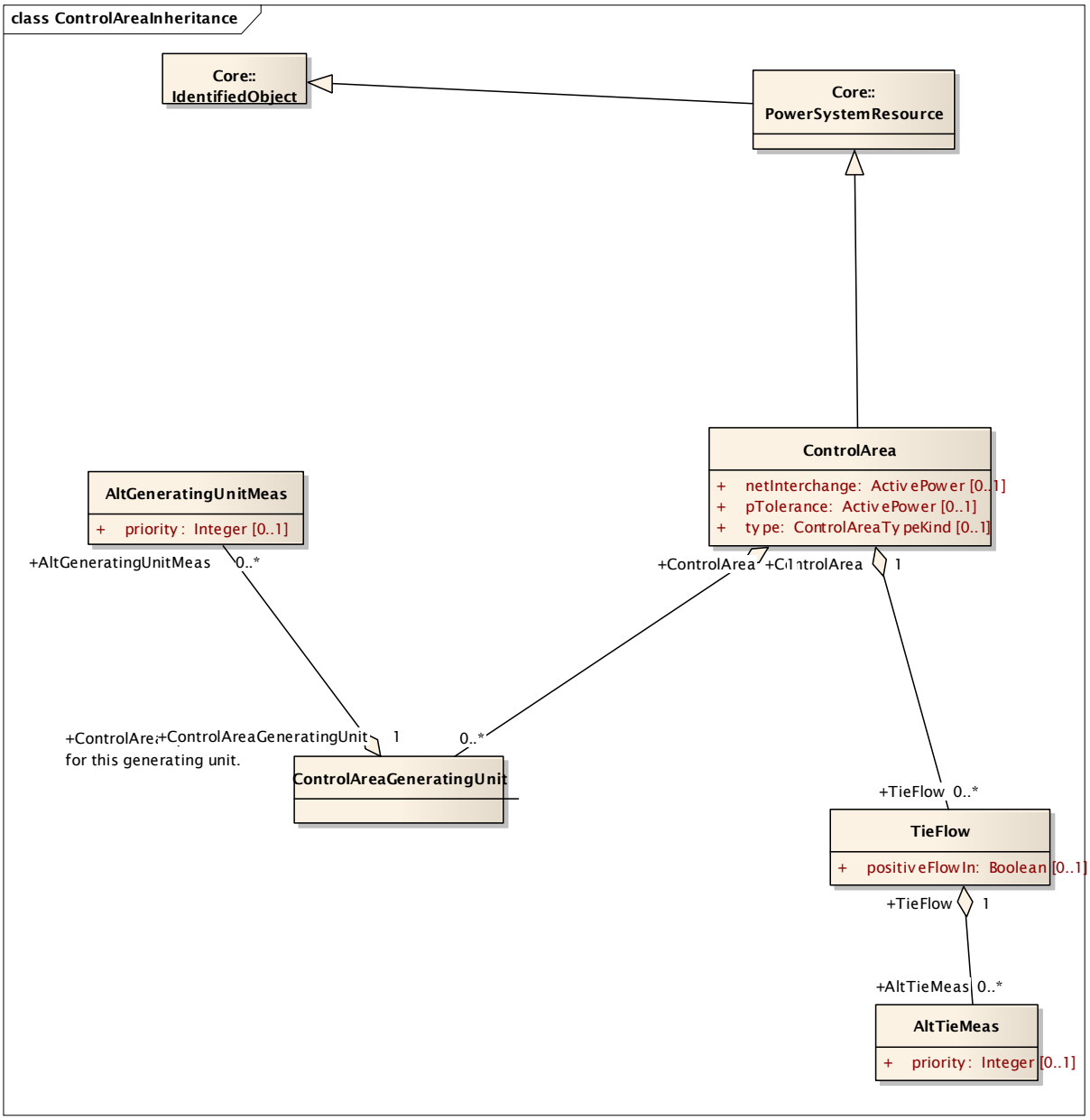

Figure 73 – Diagramme logique ControlArea::ControlAreaInheritance

Montre les relations d'héritage des classes dans ce paquetage.

La Figure 74 montre le diagramme logique Datatypes.

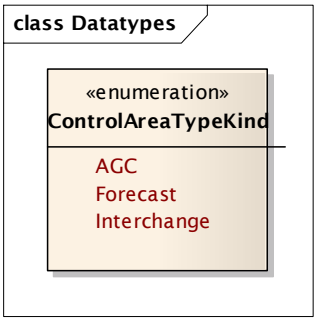

Figure 74 – Diagramme logique ControlArea::Datatypes

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6.1.15.2 Classe racine AltGeneratingUnitMeas

Mesure hiérarchisée par ordre de priorité à utiliser pour l'unité de production dans la spécification relative aux zones de contrôle.

Le Tableau 477 montre tous les attributs de AltGeneratingUnitMeas.

Tableau 477 – Attributs de ControlArea::AltGeneratingUnitMeas

nom	type	description
priority	Integer	Priorité d'un usage de mesure. Les nombres plus petits ont la première priorité

Le Tableau 478 montre toutes les extrémités d'association de AltGeneratingUnitMeas avec d'autres classes.

Tableau 478 – Extrémités d'association de ControlArea::AltGeneratingUnitMeas avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] ControlAreaGeneratingUnit	ControlAreaGeneratingUnit	Unité de production de zone de contrôle à laquelle est appliquée l'affectation de mesure hiérarchisée
[0..*]	[1..1] AnalogValue	AnalogValue	La valeur analogique spécifique utilisée comme source

6.1.15.3 Classe racine AltTieMeas

Une mesure hiérarchisée par ordre de priorité à utiliser pour le flux d'attache comme partie de la spécification relative aux zones de contrôles.

Le Tableau 479 montre tous les attributs de AltTieMeas.

Tableau 479 – Attributs de ControlArea::AltTieMeas

nom	type	description
priority	Integer	Priorité d'un usage de mesure. Les nombres plus petits ont la première priorité

Le Tableau 480 montre toutes les extrémités d'association de AltTieMeas avec d'autres classes.

Tableau 480 – Extrémités d'association de ControlArea::AltTieMeas avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] TieFlow	TieFlow	Le flux d'attache des mesures alternatives
[0..*]	[1..1] AnalogValue	AnalogValue	La valeur analogique spécifique utilisée comme source

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6.1.15.4 ControlArea

Un "control area" (zone de contrôle) est un groupement de "generating units" (unités de production) et/ou de charge et un ensemble de coupure de lignes de jonction (comme des "terminals", c'est-à-dire des bornes) qui peut être utilisé à des fins diverses, y compris le réglage de production automatique, la spécification du contrôle des échanges de zone des solutions de flux de puissance, et injecté comme entrée à la prévision de charge. Noter que n'importe quel nombre de spécifications de zones de contrôle se chevauchant peuvent être superposées sur le modèle physique.

Le Tableau 481 montre tous les attributs de ControlArea.

Tableau 481 – Attributs de ControlArea::ControlArea

nom	type	description
netInterchange	ActivePower	L'échange net positif spécifié dans la zone de contrôle
pTolerance	ActivePower	Tolérance sur l'échange net de puissance active
type	ControlAreaTypeKind	Le type de définition de zone de contrôle utilisé pour déterminer s'il est utilisé pour le contrôle automatique de production, pour planifier le contrôle des échanges ou pour d'autres fins
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 482 montre toutes les extrémités d'association de ControlArea avec d'autres classes.

Tableau 482 – Extrémités d'association de ControlArea::ControlArea avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..1] EnergyArea	EnergyArea	La zone d'énergie qui est prévue à partir de la spécification de cette zone de contrôle
[1..1]	[0..*] Spécifications relatives à la zone de commande ControlArea pour cette unité de production	ControlAreaGeneratingUnit	Spécifications relatives à la zone de commande ControlArea pour cette unité de production
[1..1]	[0..*] TieFlow	TieFlow	Les flux d'attache associés à la zone de contrôle
[0..*]	[0..1] PSRType	PSRType	hérité de: PowerSystemResource
[0..1]	[0..*] Measurements	Measurement	hérité de: PowerSystemResource
[1..1]	[0..*] OperatingShare	OperatingShare	hérité de: PowerSystemResource
[0..*]	[0..*] PsrLists	PsrList	hérité de: PowerSystemResource
[1..1]	[0..1] OutageSchedule	OutageSchedule	hérité de: PowerSystemResource
[0..*]	[0..*] ReportingGroup	ReportingGroup	hérité de: PowerSystemResource
[0..*]	[0..1] Location	Location	hérité de: PowerSystemResource

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6.1.15.5 Classe racine ControlAreaGeneratingUnit

Une unité de production de la zone de contrôle. Cette classe est nécessaire afin que les définitions alternatives de zone de contrôle puissent inclure la même unité de production. Noter qu'il convient qu'une seule instance dans la zone de contrôle référence une unité de production spécifique.

Le Tableau 483 montre toutes les extrémités d'association de ControlAreaGeneratingUnit avec d'autres classes.

Tableau 483 – Extrémités d'association de ControlArea::ControlAreaGeneratingUnit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] GeneratingUnit	GeneratingUnit	L'unité de production spécifiée pour cette zone de contrôle. Noter qu'il convient qu'une zone de contrôle inclue un GeneratingUnit une seule fois
[0..*]	[1..1] ControlArea	ControlArea	La zone de contrôle parente pour les spécifications relatives à l'unité de production
[1..1]	[0..*] AltGeneratingUnitMeas	AltGeneratingUnitMeas	La liaison à des mesures hiérarchisées par ordre de priorité pour ce GeneratingUnit

6.1.15.6 Enumération ControlAreaTypeKind

Le type de zone de contrôle.

Le Tableau 484 montre tous les libellés de ControlAreaTypeKind.

Tableau 484 – Libellés de ControlArea::ControlAreaTypeKind

libellé	description
AGC	Utilisé pour le contrôle automatique de production
Forecast	Utilisé pour la prévision de charge
Interchange	Utilisé pour la spécification ou le contrôle des échanges

6.1.15.7 Classe racine TieFlow

Une spécification de flux en termes d'emplacement et de sens pour une zone de contrôle.

Le Tableau 485 montre tous les attributs de TieFlow.

Tableau 485 – Attributs de ControlArea::TieFlow

nom	type	description
positiveFlowIn	Boolean	Le flux est positif s'il pénètre dans le terminal. Un flux est positif s'il s'agit d'une importation dans la zone de contrôle

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Le Tableau 486 montre toutes les extrémités d'association de TieFlow avec d'autres classes.

Tableau 486 – Extrémités d'association de ControlArea::TieFlow avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] ControlArea	ControlArea	La zone de contrôle des flux d'attache
[0..2]	[1..1] Terminal	Terminal	La borne à laquelle ce flux d'attache appartient
[1..1]	[0..*] AltTieMeas	AltTieMeas	Mesures du flux d'attache primaire et alternatif associées au flux d'attache

6.1.16 Paquetage Contingency

6.1.16.1 Généralités

Contingences devant être étudiées.

La Figure 75 montre le diagramme logique Contingency.

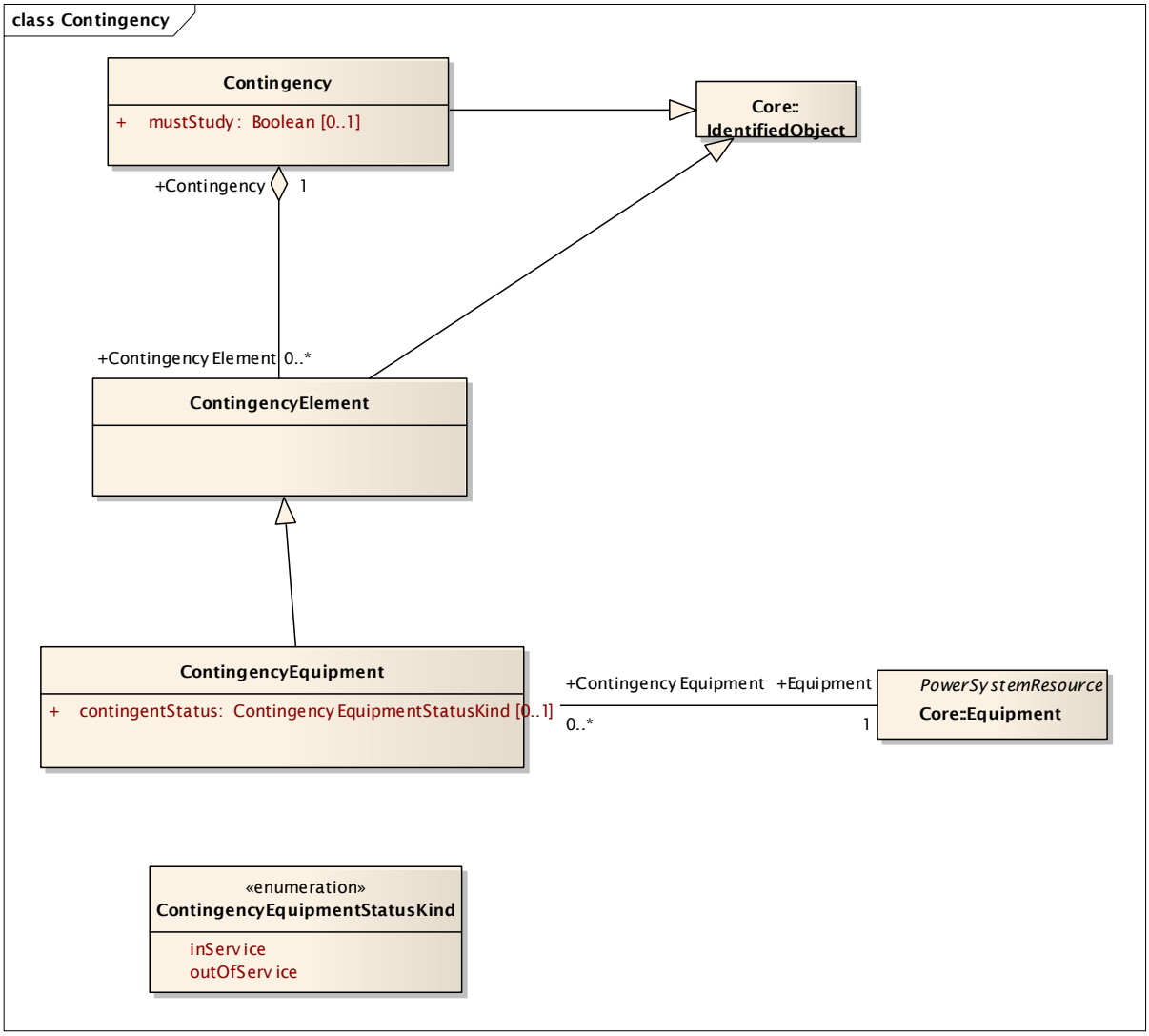

Figure 75 – Diagramme logique Contingency::Contingency

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6.1.16.2 ContingencyEquipment

Un équipement dont le statut en service doit changer, tel qu'un transformateur de puissance ou un segment de ligne de courant alternatif.

Le Tableau 487 montre tous les attributs de ContingencyEquipment.

Tableau 487 – Attributs de Contingency::ContingencyEquipment

nom	type	description
contingentStatus	ContingencyEquipmentStatusKind	Le statut pour l'équipement associé lorsqu'il est dans l'état de contingence. Ce statut est indépendant du cas auquel la contingence est appliquée initialement, mais il définit le statut de l'équipement lorsque la contingence est appliquée
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 488 montre toutes les extrémités d'association de ContingencyEquipment avec d'autres classes.

Tableau 488 – Extrémités d'association de Contingency::ContingencyEquipment avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Equipment	Equipment	L'équipement auquel appliquer la contingence
[0..*]	[1..1] Contingency	Contingency	hérité de: ContingencyElement

6.1.16.3 Énumération ContingencyEquipmentStatusKind

Indique le statut dans lequel l'équipement de contingence se trouvera lorsque la contingence sera appliquée.

Le Tableau 489 montre tous les libellés de ContingencyEquipmentStatusKind.

Tableau 489 – Libellés de Contingency::ContingencyEquipmentStatusKind

libellé	description
inService	L'équipement est en service
outOfService	L'équipement doit être mis hors service

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6.1.16.4 Contingency

Un événement menaçant la fiabilité du système, constitué d'un ou plusieurs éléments de contingence.

Le Tableau 490 montre tous les attributs de Contingency.

Tableau 490 – Attributs de Contingency::Contingency

nom	type	description
mustStudy	Boolean	Mis à true (vrai) s'il faut étudier cette contingence
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 491 montre toutes les extrémités d'association de Contingency avec d'autres classes.

Tableau 491 – Extrémités d'association de Contingency::Contingency avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[1..1]	[0..*] ContingencyElement	ContingencyElement	Une contingence peut avoir un nombre quelconque d'éléments de contingence

6.1.16.5 ContingencyElement

Un élément d'un événement système à étudier par analyse de contingence, représentant un changement de statut d'un seul équipement.

Le Tableau 492 montre tous les attributs de ContingencyElement.

Tableau 492 – Attributs de Contingency::ContingencyElement

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 493 montre toutes les extrémités d'association de ContingencyElement avec d'autres classes.

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Tableau 493 – Extrémités d'association de Contingency::ContingencyElement avec d'autres classes

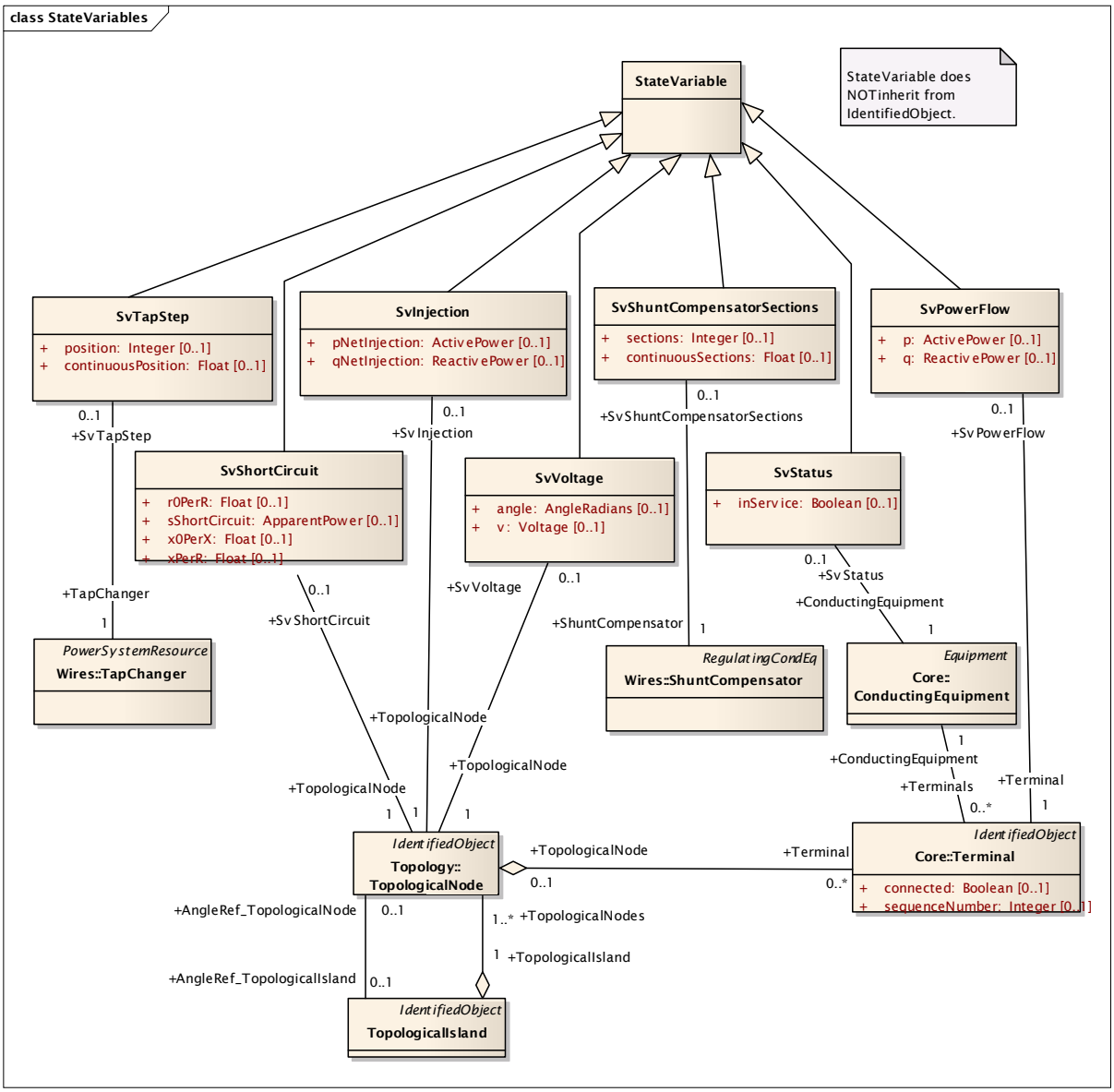
[mult à partir de]	[mult vers] nom	type	description
[0..*]	[1..1] Contingency	Contingency	Un élément de contingence appartient à une contingence

6.1.17 Paquetage StateVariables

6.1.17.1 Généralités

Variables d'état pour des solutions d'analyse telles que le flux de puissance.

La Figure 76 montre le diagramme logique StateVariables.



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Légende

Anglais	Français
StateVariable does NOT inherit from IdentifiedObject	StateVariable n'hérite PAS de IdentifiedObject

Figure 76 – Diagramme logique StateVariables::StateVariables

Les variables d'état de solutions telles que dérivées de la classe StateVariable de base. Noter que les variables d'état spécialisées sont associées à des objets dérivés de l'IdentifiedObject, mais StateVariable ne dérive pas de IdentifiedObject.

6.1.17.2 SvShortCircuit

Variable d'état pour le court-circuit

Le Tableau 494 montre tous les attributs de SvShortCircuit.

Tableau 494 – Attributs de StateVariables::SvShortCircuit

nom	type	description
r0PerR	Float	Le rapport de la résistance homopolaire sur la résistance directe
sShortCircuit	ApparentPower	La puissance apparente de court-circuit tirée en ce nœud lorsqu'il est en défaut
x0PerX	Float	Le rapport de la réactance homopolaire par la réactance directe
xPerR	Float	Le rapport de la réactance directe par la résistance directe

Le Tableau 495 montre toutes les extrémités d'association de SvShortCircuit avec d'autres classes.

Tableau 495 – Extrémités d'association de StateVariables::SvShortCircuit avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] TopologicalNode	TopologicalNode	Le nœud topologique associé à l'état de court-circuit

6.1.17.3 Classe racine StateVariable

Une classe abstraite pour variables d'état.

6.1.17.4 SvInjection

Variable d'état d'injection.

Le Tableau 496 montre tous les attributs de SvInjection.

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Tableau 496 – Attributs de StateVariables::SvInjection

nom	type	description
pNetInjection	ActivePower	La puissance active injectée dans le bus en cet emplacement. Un signe positif signifie une injection vers le bus
qNetInjection	ReactivePower	La puissance réactive injectée dans le bus en cet emplacement. Un signe positif signifie une injection vers le bus

Le Tableau 497 montre toutes les extrémités d'association de SvInjection avec d'autres classes.

Tableau 497 – Extrémités d'association de StateVariables::SvInjection avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] TopologicalNode	TopologicalNode	Le nœud topologique associé à l'état injection

6.1.17.5 SvPowerFlow

Variable d'état pour le flux de puissance.

Le Tableau 498 montre tous les attributs de SvPowerFlow.

Tableau 498 – Attributs de StateVariables::SvPowerFlow

nom	type	description
p	ActivePower	Le flux de puissance active pénétrant dans la borne
q	ReactivePower	Le flux de puissance réactive pénétrant dans la borne

Le Tableau 499 montre toutes les extrémités d'association de SvPowerFlow avec d'autres classes.

Tableau 499 – Extrémités d'association de StateVariables::SvPowerFlow avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] Terminal	Terminal	La borne associée à l'état de flux de puissance

6.1.17.6 SvShuntCompensatorSections

Variable d'état pour le nombre des sections en service pour un compensateur shunt.

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Le Tableau 500 montre tous les attributs de SvShuntCompensatorSections.

Tableau 500 – Attributs de StateVariables::SvShuntCompensatorSections

nom	type	description
sections	Integer	Le nombre de sections en service
continuousSections	Float	Le nombre de sections en service comme variable continue

Le Tableau 501 montre toutes les extrémités d'association de SvShuntCompensatorSections avec d'autres classes.

Tableau 501 – Extrémités d'association de StateVariables::SvShuntCompensatorSections avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] ShuntCompensator	ShuntCompensator	Le compensateur shunt pour lequel l'état s'applique

6.1.17.7 SvStatus

Variable d'état pour le statut.

Le Tableau 502 montre tous les attributs de SvStatus.

Tableau 502 – Attributs de StateVariables::SvStatus

nom	type	description
inService	Boolean	Le statut en service comme résultat d'un traitement de topologie

Le Tableau 503 montre toutes les extrémités d'association de SvStatus avec d'autres classes.

Tableau 503 – Extrémités d'association de StateVariables::SvStatus avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] ConductingEquipment	ConductingEquipment	L'équipement conducteur associé à l'état de statut

6.1.17.8 SvTapStep

Variable d'état pour l'échelon de prise de transformateur. Cette classe doit être utilisée pour les prises de transformateurs LTC (load tap changing, c'est-à-dire changeurs de prise en charge), pas pour des transformateurs à prises fixes. Normalement, un profil spécifie un seul des attributs "position" ou "tapRatio".

Le Tableau 504 montre tous les attributs de SvTapStep.

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Tableau 504 – Attributs de StateVariables::SvTapStep

nom	type	description
position	Integer	Position de prise entière
continuousPosition	Float	Position de prise virgule flottante

Le Tableau 505 montre toutes les extrémités d'association de SvTapStep avec d'autres classes.

Tableau 505 – Extrémités d'association de StateVariables::SvTapStep avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] TapChanger	TapChanger	Le changeur de prise associé à l'état d'échelon de prise

6.1.17.9 SvVoltage

Variable d'état pour la tension.

Le Tableau 506 montre tous les attributs de SvVoltage.

Tableau 506 – Attributs de StateVariables::SvVoltage

nom	type	description
angle	AngleRadians	L'angle de la tension en radians du nœud topologique
v	Voltage	La valeur de la tension du nœud topologique

Le Tableau 507 montre toutes les extrémités d'association de SvVoltage avec d'autres classes.

Tableau 507 – Extrémités d'association de StateVariables::SvVoltage avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[1..1] TopologicalNode	TopologicalNode	Le nœud topologique associé à l'état de tension

6.1.17.10 TopologicalIsland

Sous-ensemble du réseau électriquement connecté. Les îlots topologiques peuvent changer à mesure que l'état de réseau courant varie (c'est-à-dire que l'état de switch ou Terminal.connected varie).

Le Tableau 508 montre tous les attributs de TopologicalIsland.

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Tableau 508 – Attributs de StateVariables::TopologicalIsland

nom	type	description
mRID	String	hérité de: IdentifiedObject
name	String	hérité de: IdentifiedObject
localName	String	hérité de: IdentifiedObject
pathName	String	hérité de: IdentifiedObject
aliasName	String	hérité de: IdentifiedObject
description	String	hérité de: IdentifiedObject

Le Tableau 509 montre toutes les extrémités d'association de TopologicalIsland avec d'autres classes.

Tableau 509 – Extrémités d'association de StateVariables::TopologicalIsland avec d'autres classes

[mult à partir de]	[mult vers] nom	type	description
[0..1]	[0..1] AngleRef_TopologicalNode	TopologicalNode	La référence angulaire de l'îlot. Normalement, il y a un TopologicalNode qui est sélectionné comme référence angulaire pour chaque îlot. D'autres schémas de référence existent et, donc, l'association est facultative
[1..1]	[1..*] TopologicalNodes	TopologicalNode	Un nœud topologique appartient à un îlot topologique

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W3C: Extensible Markup Language (XML) 1.0, disponible à l'adresse <http://www.w3.org/XML/>

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