European Network of
Transmission System Operators
for Electricity

REMEDIAL ACTION PROFILE SPECIFICATION

2022-09-21

SOC APPROVED
VERSION 2.1

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NOTE CONCERNING WORDING USED IN THIS DOCUMENT

The force of the following words is modified by the requirement level of the document in which they are used.

- SHALL: This word, or the terms “REQUIRED” or “MUST”, means that the definition is an absolute requirement of the specification.
- SHALL NOT: This phrase, or the phrase “MUST NOT”, means that the definition is an absolute prohibition of the specification.
- SHOULD: This word, or the adjective “RECOMMENDED”, means that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
- SHOULD NOT: This phrase, or the phrase “NOT RECOMMENDED”, means that there may exist valid reasons in particular circumstances when the particular behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.
- MAY: This word, or the adjective “OPTIONAL”, means that an item is truly optional.

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Revision History

Version	Release	Date	Paragraph	Comments
1	0	2021-10-12		SOC approved.
2	0	2022-02-16		SOC approved.
2	1	2022-09-21		SOC approved.

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1 Introduction

The remedial action profile enables an exchange of the remedial actions for the purpose of NC related business processes.

A remedial action means any measure applied by a TSO or several TSOs, manually or automatically, in order to maintain operational security.[1]

An available remedial action is a remedial action which is available to solve identified constraints. It includes the needed technical and cost information.[2]

The available remedial actions are input data for security analysis.

The available remedial action profile enables the exchange of both curative and preventive remedial actions. Grid state alterations (the change in the power system state that should be applied) are defined for each remedial action. The definition of grid state alterations allows for constraining or further precising some of the properties available in the IGM. Grid state alterations can be configured for every parameter of the steady state hypothesis instance data from the IGM. The available remedial action profile provides information on the availability of the remedial actions. In cases where it is necessary to only update the status of the remedial action, only an instance of RemedialAction class can be exchanged without any other objects from the profile.

2 Application profile specification

2.1 Version information

The content is generated from UML model file CIM100_CGMES31v01_501-20v02_NC21v47_MM10v01.eap.

This edition is based on the IEC 61970 UML version 'IEC61970CIM17v40', dated '2020-08-24'.

- Title: Remedial action Vocabulary
- Keyword: RA
- Description: This vocabulary is describing the remedial action profile.
- Version IRI: http://entsoe.eu/ns/CIM/RemedialAction-EU/2.1
- Version info: 2.1.0
- Prior version: http://entsoe.eu/ns/CIM/AvailableRemedialAction-EU/1.0
- Conforms to: urn:iso:std:iec:61970-600-2:ed-1|urn:iso:std:iec:61970-301:ed-7:amd1|file://iec61970cim17v40_iec61968cim13v13a_iec62325cim03v17a.eap|urn:iso:std:iec:61970-401:draft:ed-1|urn:iso:std:iec:61970-501:draft:ed-2|file://CGMES-30v25_501-20v01.eap
- Identifier: urn:uuid:57fcfe0e-258c-45f2-b2ed-ff5b6a9859bc

2.2 Constraints naming convention

The naming of the rules shall not be used for machine processing. The rule names are just a string. The naming convention of the constraints is as follows.

"{rule.Type}:{rule.Standard}:{rule.Profile}:{rule.Property}:{rule.Name}"

[1] [SOURCE: CACM art.2.13]

[2] [SOURCE: 2019 Inter-RSC report]

where

rule.Type: C – for constraint; R – for requirement

rule.Standard: the number of the standard e.g. 301 for 61970-301, 456 for 61970-456, 13 for 61968-13. 61970-600 specific constraints refer to 600 although they are related to one or combination of the 61970-450 series profiles. For NC profiles, NC is used.

rule.Profile: the abbreviation of the profile, e.g. TP for Topology profile. If set to “ALL” the constraint is applicable to all IEC 61970-600 profiles.

rule.Property: for UML classes, the name of the class, for attributes and associations, the name of the class and attribute or association end, e.g. EnergyConsumer, IdentifiedObject.name, etc. If set to “NA” the property is not applicable to a specific UML element.

rule.Name: the name of the rule. It is unique for the same property.

Example: C:600:ALL:IdentifiedObject.name:stringLength

2.3 Profile constraints

This clause defines requirements and constraints that shall be fulfilled by applications that conform to this document.

This document is the master for rules and constraints tagged "NC". For the sake of self-containment, the list below also includes a copy of the relevant rules from IEC 61970-452, tagged "452".

- C:452:ALL:NA:datatypes

  According to 61970-501, datatypes are not exchanged in the instance data. The UnitMultiplier is 1 in cases none value is specified in the profile.

- R:452:ALL:NA:exchange

  Optional and required attributes and associations must be imported and exported if they are in the model file prior to import.

- R:452:ALL:NA:exchange1

  If an optional attribute does not exist in the imported file, it does not have to be exported in case exactly the same data set is exported, i.e. the tool is not obliged to automatically provide this attribute. If the export is resulting from an action by the user performed after the import, e.g. data processing or model update the export can contain optional attributes.

- R:452:ALL:NA:exchange2

  In most of the profiles the selection of optional and required attributes is made so as to ensure a minimum set of required attributes without which the exchange does not fulfil its basic purpose. Business processes governing different exchanges can require mandatory exchange of certain optional attributes or associations. Optional and required attributes and associations shall therefore be supported by applications which claim conformance with certain functionalities of the IEC 61970-452. This provides flexibility for the business processes to adapt to different business requirements and base the exchanges on IEC 61970-452 compliant applications.

- R:452:ALL:NA:exchange3

An exporter may, at his or her discretion, produce a serialization containing additional class data described by the CIM Schema but not required by this document provided these data adhere to the conventions established in Clause 5.

- R:452:ALL:NA:exchange4

From the standpoint of the model import used by a data recipient, the document describes a subset of the CIM that importing software shall be able to interpret in order to import exported models. Data providers are free to exceed the minimum requirements described herein as long as their resulting data files are compliant with the CIM Schema and the conventions established in Clause 5. The document, therefore, describes additional classes and class data that, although not required, exporters will, in all likelihood, choose to include in their data files. The additional classes and data are labelled as required (cardinality 1..1) or as optional (cardinality 0..1) to distinguish them from their required counterparts. Please note, however, that data importers could potentially receive data containing instances of any and all classes described by the CIM Schema.

- R:452:ALL:NA:cardinality

The cardinality defined in the CIM model shall be followed, unless a more restrictive cardinality is explicitly defined in this document. For instance, the cardinality on the association between VoltageLevel and BaseVoltage indicates that a VoltageLevel shall be associated with one and only one BaseVoltage, but a BaseVoltage can be associated with zero to many VoltageLevels.

- R:452:ALL:NA:associations

Associations between classes referenced in this document and classes not referenced here are not required regardless of cardinality.

- R:452:ALL:IdentifiedObject.name:rule

The attribute “name” inherited by many classes from the abstract class IdentifiedObject is not required to be unique. It must be a human readable identifier without additional embedded information that would need to be parsed. The attribute is used for purposes such as User Interface and data exchange debugging. The MRID defined in the data exchange format is the only unique and persistent identifier used for this data exchange. The attribute IdentifiedObject.name is, however, always required for CoreEquipment profile and Short Circuit profile.

- R:452:ALL:IdentifiedObject.description:rule

The attribute “description” inherited by many classes from the abstract class IdentifiedObject must contain human readable text without additional embedded information that would need to be parsed.

- R:452:ALL:NA:uniqueIdentifier

All IdentifiedObject-s shall have a persistent and globally unique identifier (Master Resource Identifier - mRID).

- R:452:ALL:NA:unitMultiplier

For exchange of attributes defined using CIM Data Types (ActivePower, Susceptance, etc.) a unit multiplier of 1 is used if the UnitMultiplier specified in this document is “none”.

- C:452:ALL:IdentifiedObject.name:stringLength

The string IdentifiedObject.name has a maximum of 128 characters.

- C:452:ALL:IdentifiedObject.description:stringLength

The string IdentifiedObject.description is maximum 256 characters.

- C:452:ALL:NA:float

An attribute that is defined as float (e.g. has a type Float or a type which is a Datatype with .value attribute of type Float) shall support ISO/IEC 60559:2020 for floating-point arithmetic using single precision floating point. A single precision float supports 7 significant digits where the significant digits are described as an integer, or a decimal number with 6 decimal digits. Two float values are equal when the significant with 7 digits are identical, e.g. 1234567 is equal 1.234567E6 and so are 1.2345678 and 1.234567E0.

- R:NC:ALL:Region:reference

The reference to the Region is normally a reference to the capacity calculation region, which is identified by “Y” EIC code of the capacity calculation region.

- R:NC:ALL:SystemOperator:reference

The reference to the System Operator is normally identified by “X” EIC code of TSO.

- R:NC:RA:RemedialActionCostCharacteristic:usage

If the RemedialActionCostCharacteristic is not defined, the RemedialAction is non-costly.

- C:NC:RA:RemedialAction:gridStateAlteration

A RemedialAction shall have at least one GridStateAlteration.

- C:NC:RA:RemedialAction:connectingSystemOperator

A RemedialAction shall have one connecting SystemOperator.

- C:NC:RA:ContingencyWithRemedialAction.RemedialAction:usageCurative

ContingencyWithRemedialAction shall not reference preventive RemedialAction (RemedialAction.kind equals RemedialActionKind.preventive). If ContingencyWithRemedialAction references curative RemedialAction (RemedialAction.kind equals RemedialActionKind.curative or RemedialActionKind.curativeAndPreventive) the association end ContingencyWithRemedialAction.Contingency is required.

2.4 Metadata

ENTSO-E agreed to extend the header and metadata definitions by IEC 61970-552 Ed2. This new header definitions rely on W3C recommendations which are used worldwide and are positively recognised by the European Commission. The new definitions of the header mainly use Provenance ontology (PROV-O), Time Ontology and Data Catalog Vocabulary (DCAT). The global new header applicable for this profile is included in the metadata and document header specification document.

The header vocabulary contains all attributes defined in IEC 61970-552. This is done only for the purpose of having one vocabulary for header and to ensure transition for data exchanges

that are using IEC 61970-552:2016 header. This profile does not use IEC 61970-552:2016 header attributes and relies only on the extended attributes.

2.4.1 Constraints

The identification of the constraints related to the metadata follows the same convention for naming of the constraints as for profile constraints.

- R:NC:ALL:wasAttributedTo:usage

  The prov:wasAttributedTo should normally be the “X” EIC code of the actor (prov:Agent).

2.4.2 Reference metadata

The header defined for this profile requires availability of a set of reference metadata. For instance, the attribute prov:wasGeneratedBy requires a reference to an activity which produced the model or the related process. The activities are defined as reference metadata and their identifiers are referenced from the header to enable the receiving entity to retrieve the “static” (reference) information that is not modified frequently. This approach imposes a requirement that both the sending entity and the receiving entity have access to a unique version of the reference metadata. Therefore, each business process shall define which reference metadata is used and where it is located.

3 Detailed Profile Specification

3.1 General

This package contains remedial action profile.

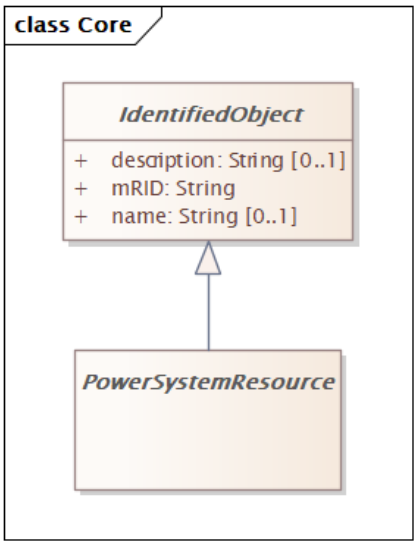


Figure 1 – Class diagram RemedialActionProfile::Core

Figure 1: The diagram shows classes from Base CIM used in the profile.

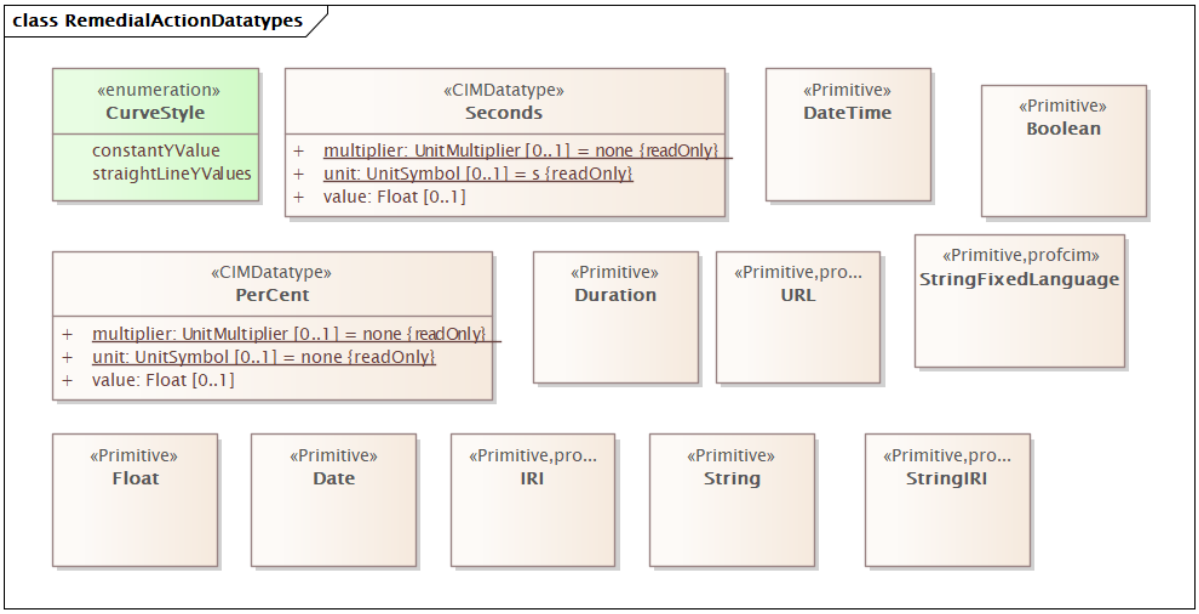
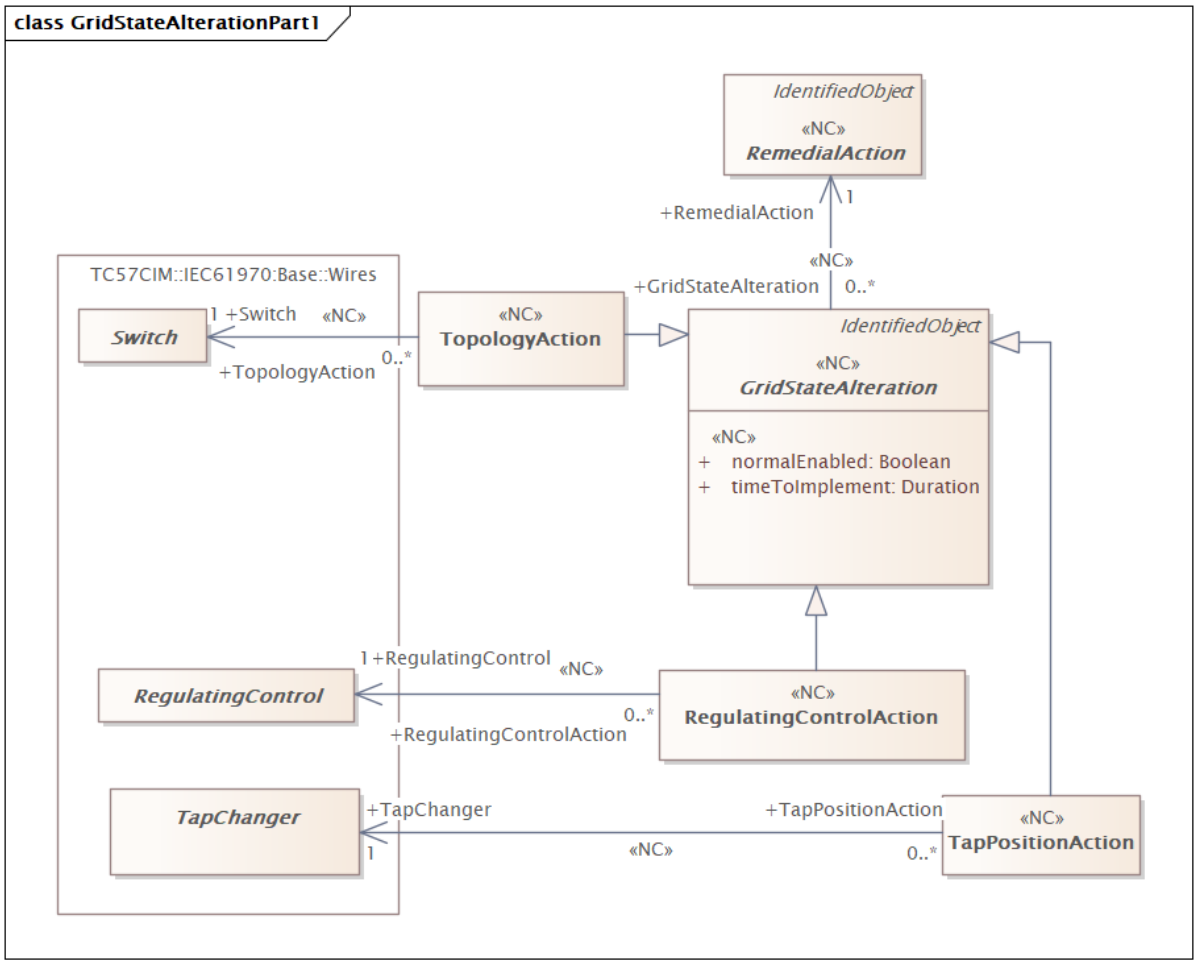


Figure 2 – Class diagram RemedialActionProfile::RemedialActionDatatypes

Figure 2: The diagram shows datatypes that are used by classes in the profile. Stereotypes are used to describe the datatypes. The following stereotypes are defined:
<<enumeration>> A list of permissible constant values.
<<Primitive>> The most basic data types used to compose all other data types.
<<CIMDatatype>> A datatype that contains a value attribute, an optional unit of measure and a unit multiplier. The unit and multiplier may be specified as a static variable initialized to the allowed value.
<<Compound>> A composite of Primitive, enumeration, CIMDatatype or other Compound classes, as long as the Compound classes do not recurse.
For all datatypes both positive and negative values are allowed unless stated otherwise for a particular datatype.



572

573 **Figure 3 – Class diagram RemedialActionProfile::GridStateAlterationPart1**

574 Figure 3: This diagram contains extended classes for the purpose of the remedial action data
575 exchange.

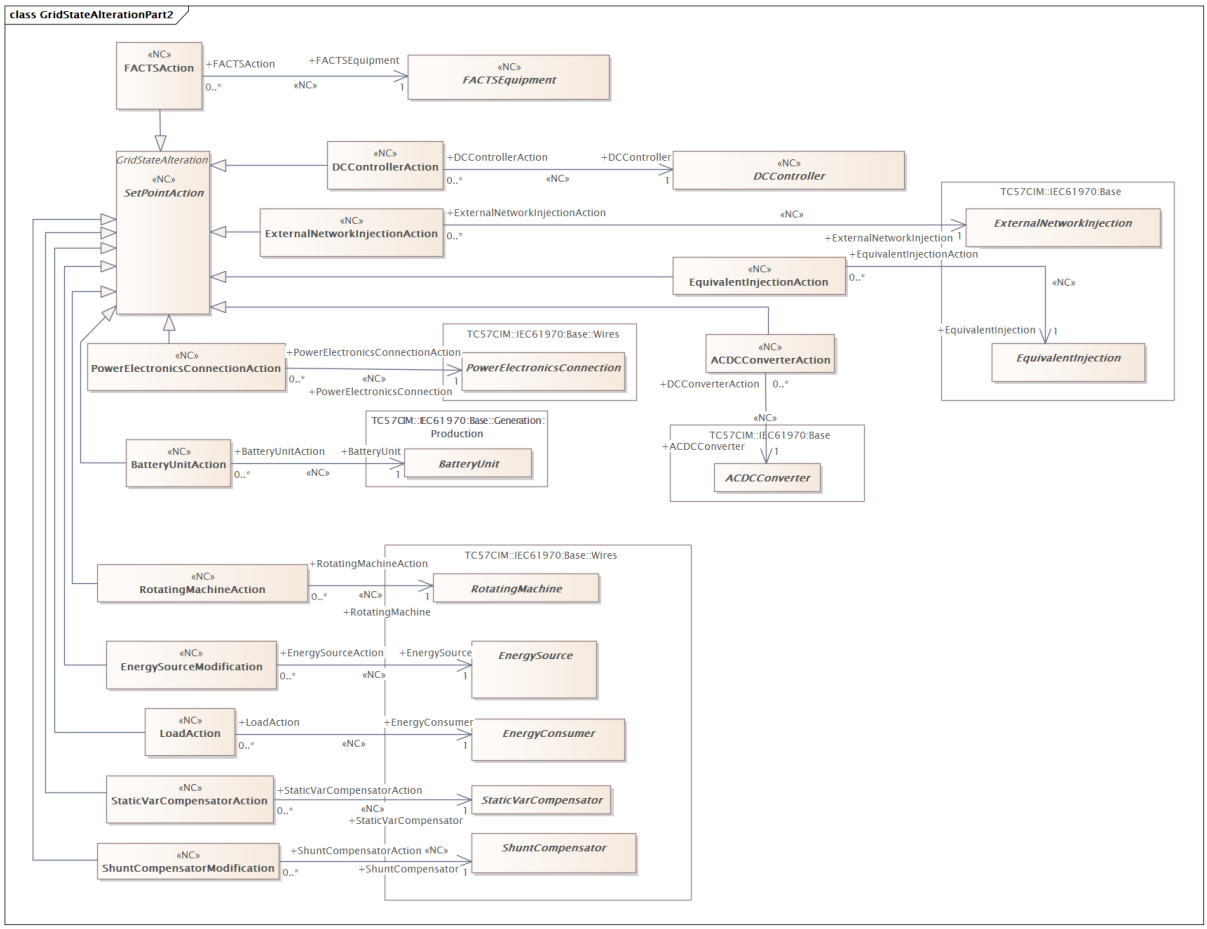
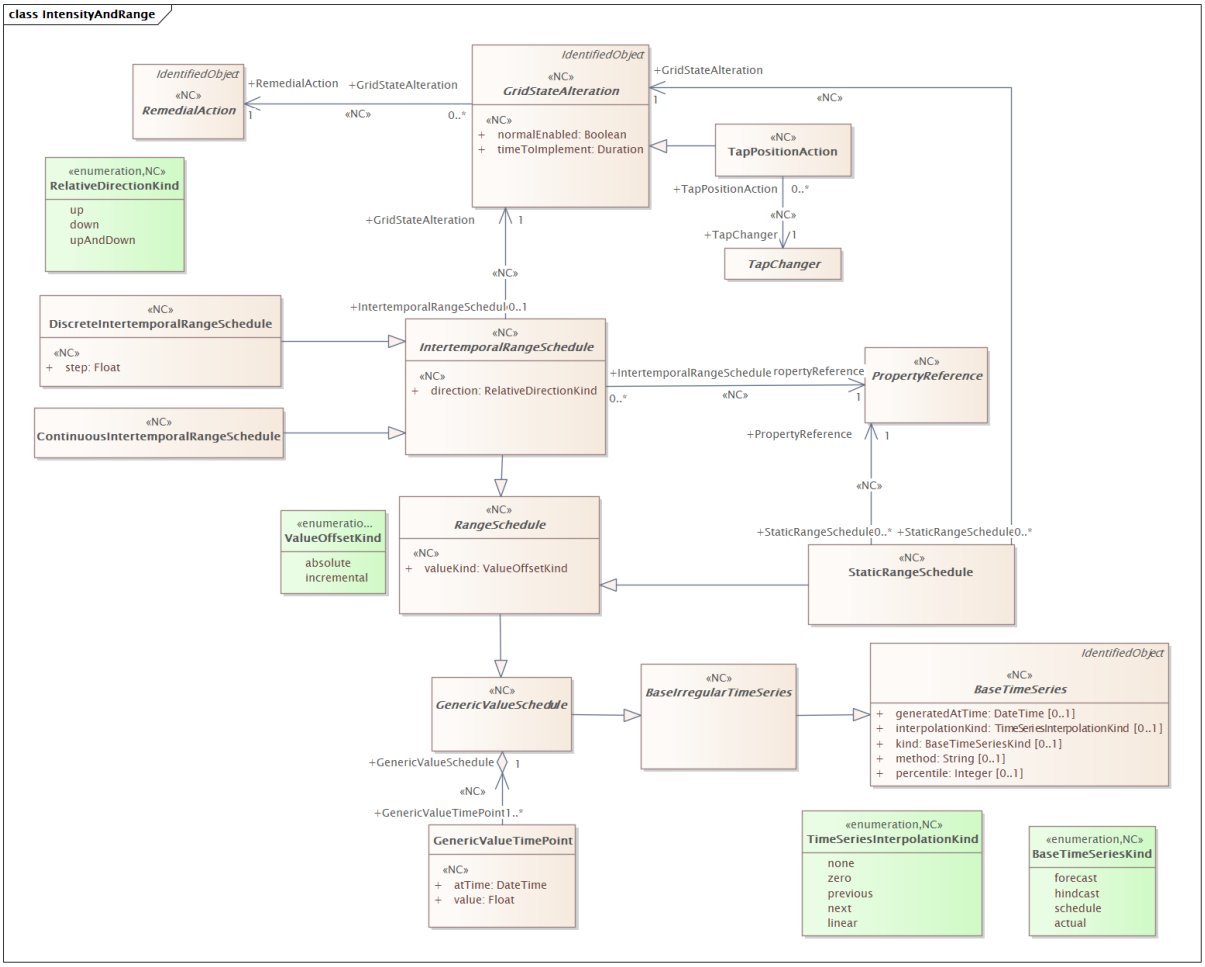


Figure 4 – Class diagram RemedialActionProfile::GridStateAlterationPart2

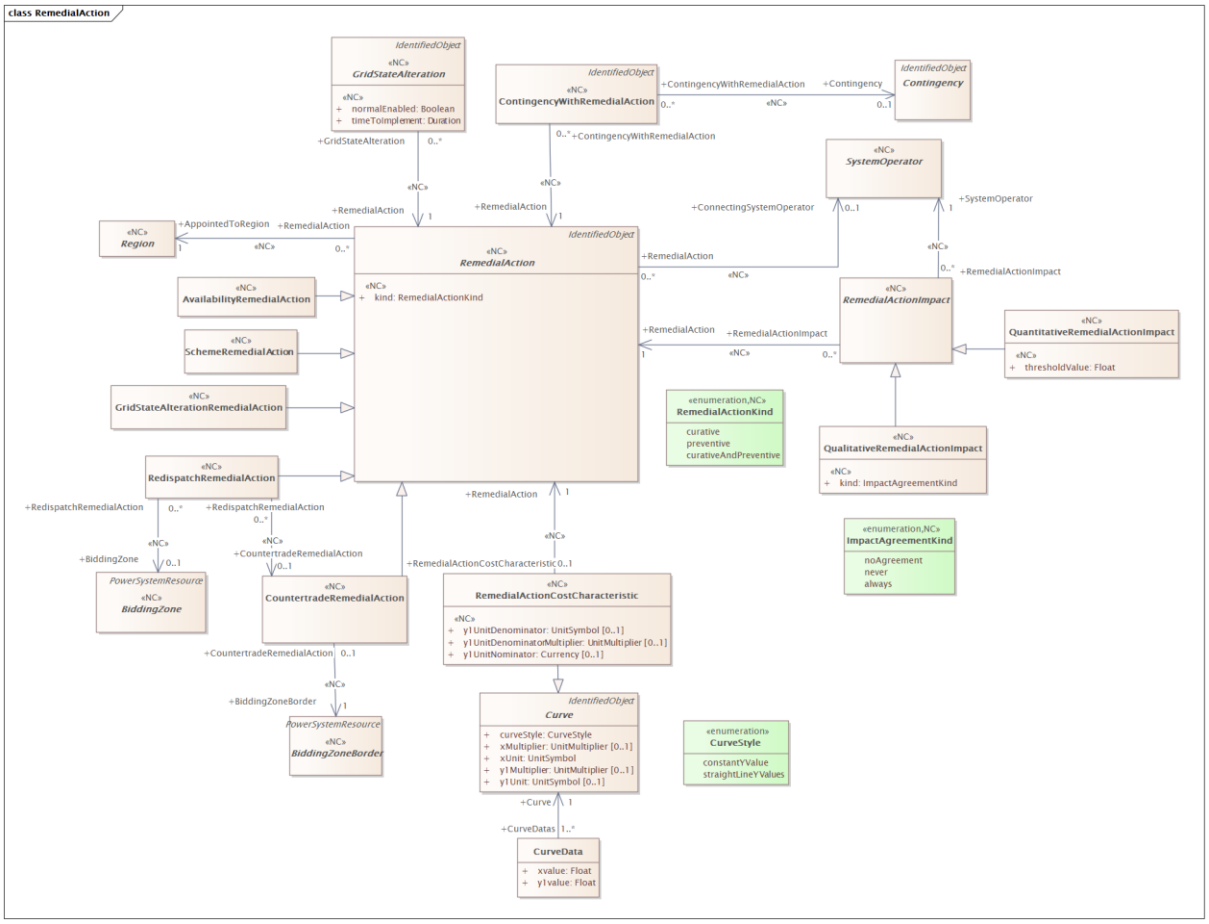
Figure 4: This diagram contains extended classes for the purpose of the remedial action data exchange.



580

581 **Figure 5 – Class diagram RemedialActionProfile::IntensityAndRange**

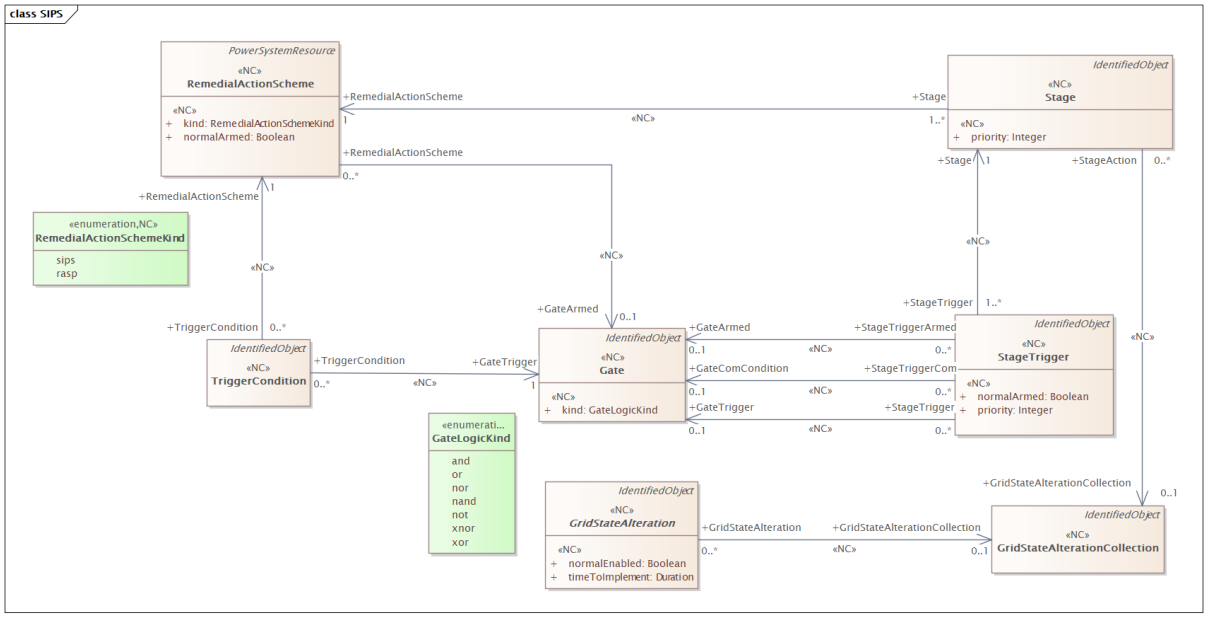
582 Figure 5: This diagram contains extended classes related to the modelling of static, dynamic
583 ranges and intensity.



584

585 **Figure 6 – Class diagram RemedialActionProfile::RemedialAction**

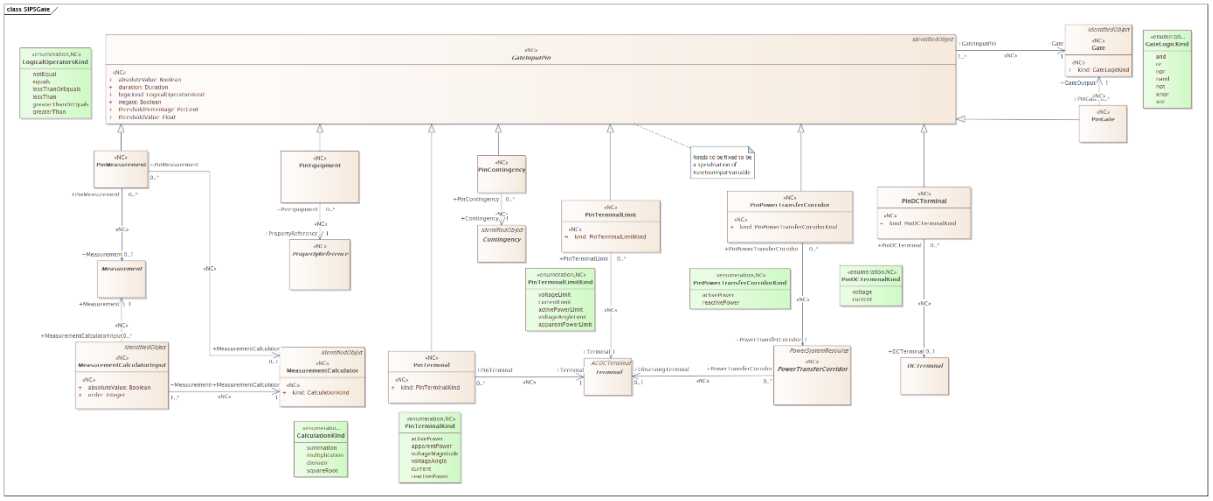
586 Figure 6: The diagram contains main classes related to the remedial action.



587

588 **Figure 7 – Class diagram RemedialActionProfile::SIPS**

589 Figure 7: The diagram shows SIPS related classes.



590

591 **Figure 8 – Class diagram RemedialActionProfile::SIPSGate**

592 Figure 8: The diagram shows SIPS gate related classes.

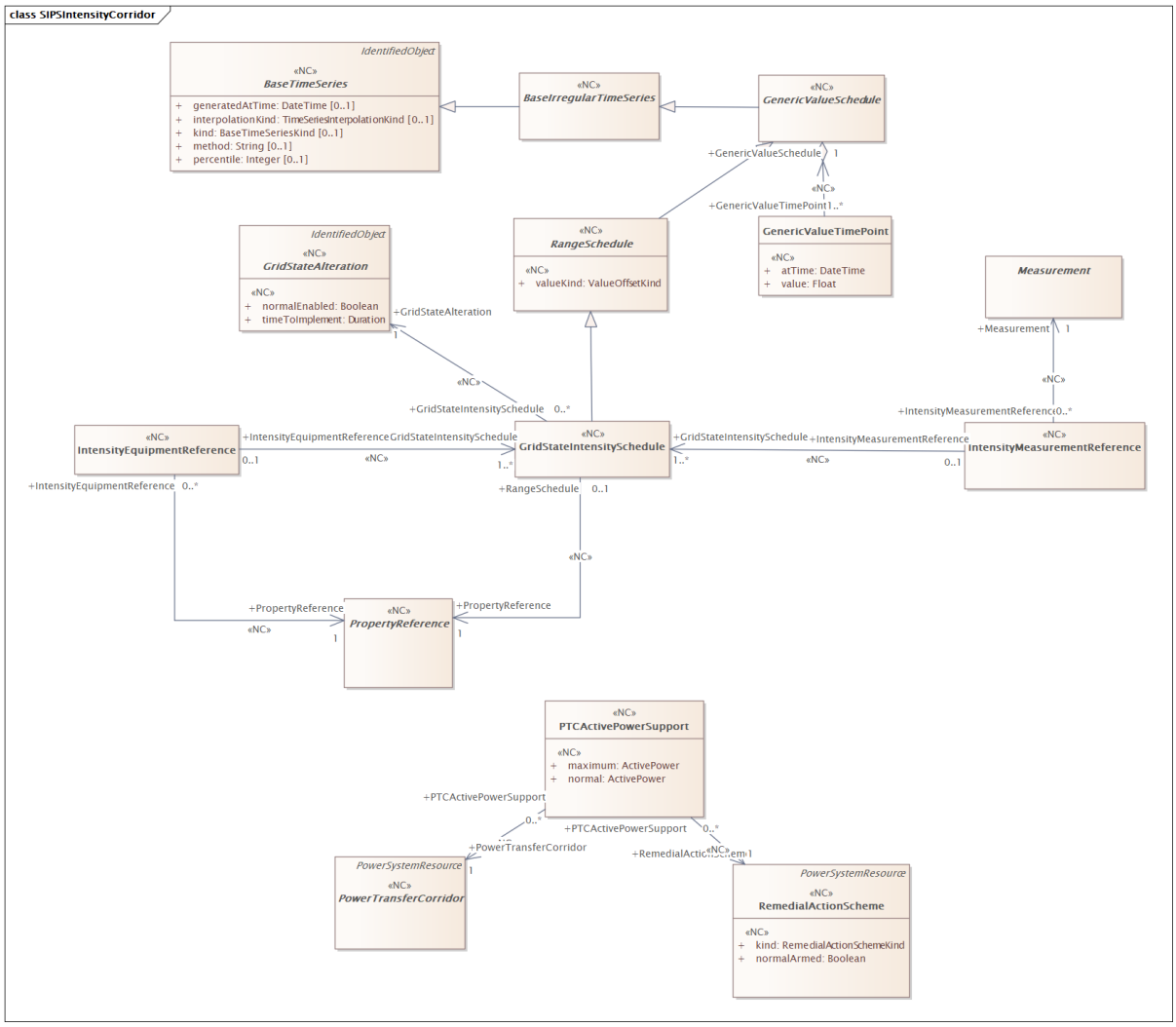


Figure 9 – Class diagram RemedialActionProfile::SIPSIntensityCorridor

Figure 9: The diagram shows SIPS intensity corridor related classes.

3.2 (abstract) ACDCConverter root class

A unit with valves for three phases, together with unit control equipment, essential protective and switching devices, DC storage capacitors, phase reactors and auxiliaries, if any, used for conversion.

3.3 (NC) ACDCConverterAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
Alternate current Direct current (ACDC) converter action.
Table 1 shows all attributes of ACDCConverterAction.

Table 1 – Attributes of RemedialActionProfile::ACDCConverterAction

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject

name	mult	type	description
name	0..1	String	inherited from: IdentifiedObject

Table 2 shows all association ends of ACDCConverterAction with other classes.

Table 2 – Association ends of RemedialActionProfile::ACDCConverterAction with other classes

mult from	name	mult to	type	description
0..*	ACDCConverter	1..1	ACDCConverter	(NC) The ACDCConverter that is associated with an action.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.4 (abstract) ACDCTerminal

Inheritance path = IdentifiedObject
An electrical connection point (AC or DC) to a piece of conducting equipment. Terminals are connected at physical connection points called connectivity nodes.
Table 3 shows all attributes of ACDCTerminal.

Table 3 – Attributes of RemedialActionProfile::ACDCTerminal

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.5 (NC) AvailabilityRemedialAction

Inheritance path = RemedialAction : IdentifiedObject
Availability remedial action is a remedial action that cancel or reschedule an availability schedule.
Table 4 shows all attributes of AvailabilityRemedialAction.

Table 4 – Attributes of RemedialActionProfile::AvailabilityRemedialAction

name	mult	type	description
kind	1..1	RemedialActionKind	(NC) inherited from: RemedialAction
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 5 shows all association ends of AvailabilityRemedialAction with other classes.

Table 5 – Association ends of RemedialActionProfile::AvailabilityRemedialAction with other classes

mult from	name	mult to	type	description
0..*	AppointedToRegion	1..1	Region	(NC) inherited from: RemedialAction
0..*	ConnectingSystemOperator	0..1	SystemOperator	(NC) inherited from: RemedialAction

627

628 ### 3.6 (abstract,NC) BaseIrregularTimeSeries

629 Inheritance path = BaseTimeSeries : IdentifiedObject
630 Time series that has irregular points in time.
631 Table 6 shows all attributes of BaseIrregularTimeSeries.

632 **Table 6 – Attributes of RemedialActionProfile::BaseIrregularTimeSeries**

name	mult	type	description
generatedAtTime	0..1	DateTime	inherited from: BaseTimeSeries
interpolationKind	0..1	TimeSeriesInterpolationKind	inherited from: BaseTimeSeries
kind	0..1	BaseTimeSeriesKind	inherited from: BaseTimeSeries
method	0..1	String	inherited from: BaseTimeSeries
percentile	0..1	Integer	inherited from: BaseTimeSeries
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

633

634 ### 3.7 (abstract,NC) BaseTimeSeries

635 Inheritance path = IdentifiedObject
636 Time series of values at points in time.
637 Table 7 shows all attributes of BaseTimeSeries.

638 **Table 7 – Attributes of RemedialActionProfile::BaseTimeSeries**

name	mult	type	description
generatedAtTime	0..1	DateTime	The time this time series (entity) come to existents and available for use.
interpolationKind	0..1	TimeSeriesInterpolationKind	Kind of interpolation done between time point.
kind	0..1	BaseTimeSeriesKind	Kind of base time series.
method	0..1	String	Method used for create the value. This is used for identification in the case where there is multiple time series for the same validity period and kind.
percentile	0..1	Integer	The percentile is a number where a certain percentage of scores/ranking/values of a sample fall below that number. This is a way for expressing uncertainty in the number provided.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

639

640 ### 3.8 (abstract) BatteryUnit root class

641 An electrochemical energy storage device.

642 ### 3.9 (NC) BatteryUnitAction

643 Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
644 Battery unit setpoint action.
645 Table 8 shows all attributes of BatteryUnitAction.

Table 8 – Attributes of RemedialActionProfile::BatteryUnitAction

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 9 shows all association ends of BatteryUnitAction with other classes.

Table 9 – Association ends of RemedialActionProfile::BatteryUnitAction with other classes

mult from	name	mult to	type	description
0..*	BatteryUnit	1..1	BatteryUnit	(NC) The BatteryUnit that is associated with an action.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.10 (abstract,NC) BiddingZone

Inheritance path = PowerSystemResource : IdentifiedObject

A bidding zone is a market-based method for handling power transmission congestion. It consists of scheduling areas that include the relevant production (supply) and consumption (demand) to form an electrical area with the same market price without capacity allocation.

Table 10 shows all attributes of BiddingZone.

Table 10 – Attributes of RemedialActionProfile::BiddingZone

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.11 (abstract,NC) BiddingZoneBorder

Inheritance path = PowerSystemResource : IdentifiedObject

Defines the aggregated connection capacity between two Bidding Zones.

Table 11 shows all attributes of BiddingZoneBorder.

Table 11 – Attributes of RemedialActionProfile::BiddingZoneBorder

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.12 (NC) ContinuousIntertemporalRangeSchedule

Inheritance path = IntertemporalRangeSchedule : RangeSchedule : GenericValueSchedule : BaseIrregularTimeSeries : BaseTimeSeries : IdentifiedObject

It represents a continuous change in the schedule.
Table 12 shows all attributes of ContinuousIntertemporalRangeSchedule.

Table 12 – Attributes of RemedialActionProfile::ContinuousIntertemporalRangeSchedule

name	mult	type	description
direction	1..1	RelativeDirectionKind	(NC) inherited from: IntertemporalRangeSchedule
valueKind	1..1	ValueOffsetKind	(NC) inherited from: RangeSchedule
generatedAtTime	0..1	DateTime	inherited from: BaseTimeSeries
interpolationKind	0..1	TimeSeriesInterpolationKind	inherited from: BaseTimeSeries
kind	0..1	BaseTimeSeriesKind	inherited from: BaseTimeSeries
method	0..1	String	inherited from: BaseTimeSeries
percentile	0..1	Integer	inherited from: BaseTimeSeries
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 13 shows all association ends of ContinuousIntertemporalRangeSchedule with other classes.

Table 13 – Association ends of RemedialActionProfile::ContinuousIntertemporalRangeSchedule with other classes

mult from	name	mult to	type	description
0..1	GridStateAlteration	1..1	GridStateAlteration	(NC) inherited from: IntertemporalRangeSchedule
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: IntertemporalRangeSchedule

3.13 (NC) CountertradeRemedialAction

Inheritance path = RemedialAction : IdentifiedObject
Countertrade is a remedial action to relieve physical congestions where the location of activated resources within the bidding zone is not known.
Table 14 shows all attributes of CountertradeRemedialAction.

Table 14 – Attributes of RemedialActionProfile::CountertradeRemedialAction

name	mult	type	description
kind	1..1	RemedialActionKind	(NC) inherited from: RemedialAction
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 15 shows all association ends of CountertradeRemedialAction with other classes.

687 **Table 15 – Association ends of RemedialActionProfile::CountertradeRemedialAction**
688 **with other classes**

mult from	name	mult to	type	description
0..1	BiddingZoneBorder	1..1	BiddingZoneBorder	(NC) The BiddingZoneBorder where the countertrade is done.
0..*	AppointedToRegion	1..1	Region	(NC) inherited from: RemedialAction
0..*	ConnectingSystemOperator	0..1	SystemOperator	(NC) inherited from: RemedialAction

689

690 ### 3.14 (abstract) Contingency

691 Inheritance path = IdentifiedObject
692 An event threatening system reliability, consisting of one or more contingency elements.
693 Table 16 shows all attributes of Contingency.

694 **Table 16 – Attributes of RemedialActionProfile::Contingency**

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

695

696 ### 3.15 (NC) ContingencyWithRemedialAction

697 Inheritance path = IdentifiedObject
698 The combination of a contingency and a remedial action.
699 Table 17 shows all attributes of ContingencyWithRemedialAction.

700 **Table 17 – Attributes of RemedialActionProfile::ContingencyWithRemedialAction**

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

701
702 Table 18 shows all association ends of ContingencyWithRemedialAction with other classes.

703 **Table 18 – Association ends of RemedialActionProfile::ContingencyWithRemedialAction**
704 **with other classes**

mult from	name	mult to	type	description
0..*	Contingency	0..1	Contingency	(NC) The contingency that is associated with a remedial action, i.e. the contingency that is the cause for the creation of a remedial action and justifies it or would usually be resolved with a remedial action.
0..*	RemedialAction	1..1	RemedialAction	(NC) The remedial action defined for this contingency and remedial action combination.

705

706 ### 3.16 (abstract) Curve

707 Inheritance path = IdentifiedObject

A multi-purpose curve or functional relationship between an independent variable (X-axis) and dependent (Y-axis) variables.
Table 19 shows all attributes of Curve.

Table 19 – Attributes of RemedialActionProfile::Curve

name	mult	type	description
curveStyle	1..1	CurveStyle	The style or shape of the curve.
xMultiplier	0..1	UnitMultiplier	Multiplier for X-axis.
xUnit	1..1	UnitSymbol	The X-axis units of measure.
y1Multiplier	0..1	UnitMultiplier	Multiplier for Y1-axis.
y1Unit	0..1	UnitSymbol	The Y1-axis units of measure.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.17 CurveData root class

Multi-purpose data points for defining a curve. The use of this generic class is discouraged if a more specific class can be used to specify the X and Y axis values along with their specific data types.
Table 20 shows all attributes of CurveData.

Table 20 – Attributes of RemedialActionProfile::CurveData

name	mult	type	description
xvalue	1..1	Float	The data value of the X-axis variable, depending on the X-axis units.
y1value	1..1	Float	The data value of the first Y-axis variable, depending on the Y-axis units.

Table 21 shows all association ends of CurveData with other classes.

Table 21 – Association ends of RemedialActionProfile::CurveData with other classes

mult from	name	mult to	type	description
1..*	Curve	1..1	Curve	The curve of this curve data point.

3.18 (abstract,NC) DCController root class

The direct current controller providing the power regulation setpoint for one or more direct current poles.

3.19 (NC) DCControllerAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
Direct current (DC) controller action.
Table 22 shows all attributes of DCControllerAction.

Table 22 – Attributes of RemedialActionProfile::DCControllerAction

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 23 shows all association ends of DCControllerAction with other classes.

Table 23 – Association ends of RemedialActionProfile::DCControllerAction with other classes

mult from	name	mult to	type	description
0..*	DCController	1..1	DCController	(NC) The DCController that is associated with an action.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.20 (abstract) DCTerminal root class

An electrical connection point to generic DC conducting equipment.

3.21 (NC) DiscreteIntertemporalRangeSchedule

Inheritance path = IntertemporalRangeSchedule : RangeSchedule : GenericValueSchedule : BaseIrregularTimeSeries : BaseTimeSeries : IdentifiedObject
It represents a discrete change in the schedule given by the step.
Table 24 shows all attributes of DiscreteIntertemporalRangeSchedule.

Table 24 – Attributes of RemedialActionProfile::DiscreteIntertemporalRangeSchedule

name	mult	type	description
step	1..1	Float	(NC) It defines the step of change.
direction	1..1	RelativeDirectionKind	(NC) inherited from: IntertemporalRangeSchedule
valueKind	1..1	ValueOffsetKind	(NC) inherited from: RangeSchedule
generatedAtTime	0..1	DateTime	inherited from: BaseTimeSeries
interpolationKind	0..1	TimeSeriesInterpolationKind	inherited from: BaseTimeSeries
kind	0..1	BaseTimeSeriesKind	inherited from: BaseTimeSeries
method	0..1	String	inherited from: BaseTimeSeries
percentile	0..1	Integer	inherited from: BaseTimeSeries
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 25 shows all association ends of DiscreteIntertemporalRangeSchedule with other classes.

Table 25 – Association ends of RemedialActionProfile::DiscreteIntertemporalRangeSchedule with other classes

mult from	name	mult to	type	description
0..1	GridStateAlteration	1..1	GridStateAlteration	(NC) inherited from: IntertemporalRangeSchedule
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: IntertemporalRangeSchedule

3.22 (abstract) EnergyConsumer root class

Generic user of energy - a point of consumption on the power system model. EnergyConsumer.pfixed, .qfixed, .pfixedPct and .qfixedPct have meaning only if there is no LoadResponseCharacteristic associated with EnergyConsumer or if LoadResponseCharacteristic.exponentModel is set to False.

3.23 (abstract) EnergySource root class

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

3.24 (NC) EnergySourceModification

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
Energy source action.
Table 26 shows all attributes of EnergySourceModification.

Table 26 – Attributes of RemedialActionProfile::EnergySourceModification

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 27 shows all association ends of EnergySourceModification with other classes.

Table 27 – Association ends of RemedialActionProfile::EnergySourceModification with other classes

mult from	name	mult to	type	description
0..*	EnergySource	1..1	EnergySource	(NC) The EnergySource which is associated with an EnergySourceAction.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.25 (abstract) EquivalentInjection root class

This class represents equivalent injections (generation or load). Voltage regulation is allowed only at the point of connection.

3.26 (NC) EquivalentInjectionAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
Equivalent injection action.
Table 28 shows all attributes of EquivalentInjectionAction.

Table 28 – Attributes of RemedialActionProfile::EquivalentInjectionAction

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 29 shows all association ends of EquivalentInjectionAction with other classes.

Table 29 – Association ends of RemedialActionProfile::EquivalentInjectionAction with other classes

mult from	name	mult to	type	description
0..*	EquivalentInjection	1..1	EquivalentInjection	(NC) The EquivalentInjection that is associated with an action.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.27 (abstract) ExternalNetworkInjection root class

This class represents the external network and it is used for IEC 60909 calculations.

3.28 (NC) ExternalNetworkInjectionAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
External network injection action.
Table 30 shows all attributes of ExternalNetworkInjectionAction.

Table 30 – Attributes of RemedialActionProfile::ExternalNetworkInjectionAction

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 31 shows all association ends of ExternalNetworkInjectionAction with other classes.

Table 31 – Association ends of RemedialActionProfile::ExternalNetworkInjectionAction with other classes

mult from	name	mult to	type	description
0..*	ExternalNetworkInjection	1..1	ExternalNetworkInjection	(NC) The ExternalNetworkInjection that is associated with an action.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.29 (NC) FACTSAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
FACTS action.
Table 32 shows all attributes of FACTSAction.

Table 32 – Attributes of RemedialActionProfile::FACTSAction

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 33 shows all association ends of FACTSAction with other classes.

Table 33 – Association ends of RemedialActionProfile::FACTSAction with other classes

mult from	name	mult to	type	description
0..*	FACTSEquipment	1..1	FACTSEquipment	(NC) ShuntCompensator that is associated with an action.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.30 (abstract,NC) FACTSEquipment root class

Flexible Alternating Current Transmission System regulating equipment.

3.31 (NC) Gate

Inheritance path = IdentifiedObject
Logical gate that supports a logical operation based on the input.
Table 34 shows all attributes of Gate.

Table 34 – Attributes of RemedialActionProfile::Gate

name	mult	type	description
kind	1..1	GateLogicKind	(NC) The logical operation of the gate.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.32 (abstract,NC) GateInputPin

Inheritance path = IdentifiedObject
Input pin for a logical gate. The condition described in the input pin gives a logical true or false.
The result from measurement and calculation are converted to a true or false.
Table 35 shows all attributes of GateInputPin.

Table 35 – Attributes of RemedialActionProfile::GateInputPin

name	mult	type	description
absoluteValue	1..1	Boolean	(NC) Indicates if the absolute value is used for comparison. If true, use the absolute value. If false, use the complex value (vector).
logicKind	1..1	LogicalOperatorsKind	(NC) The logical operator kind used for comparison.
duration	1..1	Duration	(NC) The time duration for which the condition is satisfied before acting. Default is 0 seconds.
negate	1..1	Boolean	(NC) Invert/negate the result of the comparison.
thresholdPercentage	1..1	PerCent	(NC) The threshold percentage that should be used for compare with the percentage change between input value and threshold value.
thresholdValue	1..1	Float	(NC) The threshold value that should be used for compare with the input value.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 36 shows all association ends of GateInputPin with other classes.

Table 36 – Association ends of RemedialActionProfile::GateInputPin with other classes

mult from	name	mult to	type	description
1..*	Gate	1..1	Gate	(NC) The Gate that has this input.

3.33 (Description) GeneratingUnit root class

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.

3.34 (abstract,NC) GenericValueSchedule

Inheritance path = BaseIrregularTimeSeries : BaseTimeSeries : IdentifiedObject

Time series represent irregular generic value at given points in time. The type of value is given by the reference association.

Table 37 shows all attributes of GenericValueSchedule.

Table 37 – Attributes of RemedialActionProfile::GenericValueSchedule

name	mult	type	description
generatedAtTime	0..1	DateTime	inherited from: BaseTimeSeries
interpolationKind	0..1	TimeSeriesInterpolationKind	inherited from: BaseTimeSeries
kind	0..1	BaseTimeSeriesKind	inherited from: BaseTimeSeries
method	0..1	String	inherited from: BaseTimeSeries
percentile	0..1	Integer	inherited from: BaseTimeSeries
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject

name	mult	type	description
name	0..1	String	inherited from: IdentifiedObject

3.35 GenericValueTimePoint root class

Generic value for a given point in time.
Table 38 shows all attributes of GenericValueTimePoint.

Table 38 – Attributes of RemedialActionProfile::GenericValueTimePoint

name	mult	type	description
atTime	1..1	DateTime	(NC) The time the data is valid for.
value	1..1	Float	(NC) The value at the time. The meaning of the value is defined by the derived type of the associated schedule. The value can be integer, float or boolean. In case of boolean 1 equals true and 0 equals false.

Table 39 shows all association ends of GenericValueTimePoint with other classes.

Table 39 – Association ends of RemedialActionProfile::GenericValueTimePoint with other classes

mult from	name	mult to	type	description
1..*	GenericValueSchedule	1..1	GenericValueSchedule	(NC) Time series the time point values belongs to.

3.36 (abstract,NC) GridStateAlteration

Inheritance path = IdentifiedObject
Grid state alteration is a change of values describing state (operating point) of one element in the grid model compared to the base case.
Table 40 shows all attributes of GridStateAlteration.

Table 40 – Attributes of RemedialActionProfile::GridStateAlteration

name	mult	type	description
timeToImplement	1..1	Duration	(NC) Time to implement a grid state alteration.
normalEnabled	1..1	Boolean	(NC) The default/normal value used when other active signal/values are missing.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 41 shows all association ends of GridStateAlteration with other classes.

Table 41 – Association ends of RemedialActionProfile::GridStateAlteration with other classes

mult from	name	mult to	type	description
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) The collection that has a GridStateAlteration.
0..*	RemedialAction	1..1	RemedialAction	(NC) The remedial action associated with a given grid state alteration.

3.37 (NC) GridStateAlterationCollection

Inheritance path = IdentifiedObject
A collection of grid state alterations.
Table 42 shows all attributes of GridStateAlterationCollection.

Table 42 – Attributes of RemedialActionProfile::GridStateAlterationCollection

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.38 (NC) GridStateAlterationRemedialAction

Inheritance path = RemedialAction : IdentifiedObject
Grid state alteration remedial action is a remedial action that describe one of many grid state alterations applied to a grid model state or particular scenario in order to resolve one or more Identified constraints.
Table 43 shows all attributes of GridStateAlterationRemedialAction.

Table 43 – Attributes of RemedialActionProfile::GridStateAlterationRemedialAction

name	mult	type	description
kind	1..1	RemedialActionKind	(NC) inherited from: RemedialAction
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 44 shows all association ends of GridStateAlterationRemedialAction with other classes.

Table 44 – Association ends of RemedialActionProfile::GridStateAlterationRemedialAction with other classes

mult from	name	mult to	type	description
0..*	AppointedToRegion	1..1	Region	(NC) inherited from: RemedialAction
0..*	ConnectingSystemOperator	0..1	SystemOperator	(NC) inherited from: RemedialAction

3.39 (NC) GridStateIntensitySchedule

Inheritance path = RangeSchedule : GenericValueSchedule : BaseIrregularTimeSeries : BaseTimeSeries : IdentifiedObject
Defines the intensity applied for a given grid state alteration. It is primarily used in exchanges related to the remedial action schedule. The value of the schedule will replace the value of the attribute to which the schedule refers to.
Table 45 shows all attributes of GridStateIntensitySchedule.

Table 45 – Attributes of RemedialActionProfile::GridStateIntensitySchedule

name	mult	type	description
valueKind	1..1	ValueOffsetKind	(NC) inherited from: RangeSchedule
generatedAtTime	0..1	DateTime	inherited from: BaseTimeSeries

name	mult	type	description
interpolationKind	0..1	TimeSeriesInterpolationKind	inherited from: BaseTimeSeries
kind	0..1	BaseTimeSeriesKind	inherited from: BaseTimeSeries
method	0..1	String	inherited from: BaseTimeSeries
percentile	0..1	Integer	inherited from: BaseTimeSeries
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 46 shows all association ends of GridStateIntensitySchedule with other classes.

Table 46 – Association ends of RemedialActionProfile::GridStateIntensitySchedule with other classes

mult from	name	mult to	type	description
0..*	GridStateAlteration	1..1	GridStateAlteration	(NC) The grid state alteration which has intensity.
0..1	PropertyReference	1..1	PropertyReference	(NC) The property reference for this range schedule.

3.40 (abstract) IdentifiedObject root class

This is a root class to provide common identification for all classes needing identification and naming attributes.
Table 47 shows all attributes of IdentifiedObject.

Table 47 – Attributes of RemedialActionProfile::IdentifiedObject

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

3.41 (NC) IntensityEquipmentReference root class

The intensity for a equipment reference.
Table 48 shows all association ends of IntensityEquipmentReference with other classes.

892 **Table 48 – Association ends of RemedialActionProfile::IntensityEquipmentReference**
893 **with other classes**

mult from	name	mult to	type	description
0..*	PropertyReference	1..1	PropertyReference	(NC)
0..1	GridStateIntensitySchedule	1..*	GridStateIntensitySchedule	(NC) The grid state intensity schedule that has this intensity equipment reference.

894

895 ### 3.42 (NC) IntensityMeasurementReference root class

896 The value of the MeasurementValue is taken.
897 Table 49 shows all association ends of IntensityMeasurementReference with other classes.

898 **Table 49 – Association ends of RemedialActionProfile::IntensityMeasurementReference**
899 **with other classes**

mult from	name	mult to	type	description
0..*	Measurement	1..1	Measurement	(NC) The measurement that has this intensity measurement reference.
0..1	GridStateIntensitySchedule	1..*	GridStateIntensitySchedule	(NC) The grid state intensity schedule that has this intensity measurement reference.

900

901 ### 3.43 (abstract,NC) IntertemporalRangeSchedule

902 Inheritance path = RangeSchedule : GenericValueSchedule : BaseIrregularTimeSeries :
903 BaseTimeSeries : IdentifiedObject
904 It represents the intertemporal range, which means that this is the maximum change of an
905 attribute value between two time stamps or per time unit (e.g. hour). Both up and down
906 directions are defined by the direction attribute, i.e. There are different schedules per direction.
907 For instance the following example illustrates the approach:
908 - A tap changer related grid state alteration having two intertemporal range schedules.
909 - For a particular point in time, the value from up schedule is 6 and the value from down
910 schedule is 3.
911 - Then, the GridStateIntensity for the same point in time cannot be more than plus 6 taps from
912 the current, or more than minus 3 taps from the current.
913 Table 50 shows all attributes of IntertemporalRangeSchedule.

914 **Table 50 – Attributes of RemedialActionProfile::IntertemporalRangeSchedule**

name	mult	type	description
direction	1..1	RelativeDirectionKind	(NC) Defines the direction of the value of the schedule.
valueKind	1..1	ValueOffsetKind	(NC) inherited from: RangeSchedule
generatedAtTime	0..1	DateTime	inherited from: BaseTimeSeries
interpolationKind	0..1	TimeSeriesInterpolationKind	inherited from: BaseTimeSeries
kind	0..1	BaseTimeSeriesKind	inherited from: BaseTimeSeries
method	0..1	String	inherited from: BaseTimeSeries
percentile	0..1	Integer	inherited from: BaseTimeSeries
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject

name	mult	type	description
name	0..1	String	inherited from: IdentifiedObject

Table 51 shows all association ends of IntertemporalRangeSchedule with other classes.

Table 51 – Association ends of RemedialActionProfile::IntertemporalRangeSchedule with other classes

mult from	name	mult to	type	description
0..1	GridStateAlteration	1..1	GridStateAlteration	(NC) The grid state alteration which has an intertemporal range.
0..*	PropertyReference	1..1	PropertyReference	(NC) The property reference for this intertemporal schedule.

3.44 (Description) Line root class

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

3.45 (NC) LoadAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject

Load action.

Table 52 shows all attributes of LoadAction.

Table 52 – Attributes of RemedialActionProfile::LoadAction

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 53 shows all association ends of LoadAction with other classes.

Table 53 – Association ends of RemedialActionProfile::LoadAction with other classes

mult from	name	mult to	type	description
0..*	EnergyConsumer	1..1	EnergyConsumer	(NC) The EnergyConsumer that is associated with a load action.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.46 (abstract) Measurement root class

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 leaves, 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 (VT) or potential 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.
If both a Terminal and PSR are associated, and the PSR is of type ConductingEquipment, the associated Terminal should belong to that ConductingEquipment instance.
When the sensor location is needed both Measurement-PSR and Measurement-Terminal are used. The Measurement-Terminal association is never used alone.

3.47 (NC) MeasurementCalculator

Inheritance path = IdentifiedObject
Result of a calculation of one or more measurement.
Table 54 shows all attributes of MeasurementCalculator.

Table 54 – Attributes of RemedialActionProfile::MeasurementCalculator

name	mult	type	description
kind	1..1	CalculationKind	(NC) Calculation operation executed on the operands.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.48 (NC) MeasurementCalculatorInput

Inheritance path = IdentifiedObject
Input to measurement calculation. It supports Analog, Discrete and Accumulator measurements.
Table 55 shows all attributes of MeasurementCalculatorInput.

Table 55 – Attributes of RemedialActionProfile::MeasurementCalculatorInput

name	mult	type	description
absoluteValue	1..1	Boolean	(NC) Indicates if the absolute value is used for comparison. If true, use the absolute value. If false, use the complex value (vector).
order	1..1	Integer	(NC) Positive number that defines the order of the operand in the calculation. 0 means default in which case the order is not relevant.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 56 shows all association ends of MeasurementCalculatorInput with other classes.

Table 56 – Association ends of RemedialActionProfile::MeasurementCalculatorInput with other classes

mult from	name	mult to	type	description
0..*	Measurement	1..1	Measurement	(NC) Measurement used as input to a calculation.
1..*	MeasurementCalculator	1..1	MeasurementCalculator	(NC) The measurement calculator using this calculator input.

966

967 ### 3.49 (NC) PinContingency

968 Inheritance path = GateInputPin : IdentifiedObject
969 Input pin associated with a Contingency. It is used for comparison.
970 Table 57 shows all attributes of PinContingency.

971 **Table 57 – Attributes of RemedialActionProfile::PinContingency**

name	mult	type	description
absoluteValue	1..1	Boolean	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
duration	1..1	Duration	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	1..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	1..1	Float	(NC) inherited from: GateInputPin
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

972
973 Table 58 shows all association ends of PinContingency with other classes.

974 **Table 58 – Association ends of RemedialActionProfile::PinContingency with other**
975 **classes**

mult from	name	mult to	type	description
0..*	Contingency	1..1	Contingency	(NC) The Contingency that is used in the input pin.
1..*	Gate	1..1	Gate	(NC) inherited from: GateInputPin

976

977 ### 3.50 (NC) PinDCTerminal

978 Inheritance path = GateInputPin : IdentifiedObject
979 Input pin associated with a DCTerminal. It is used for comparison.
980 Table 59 shows all attributes of PinDCTerminal.

981 **Table 59 – Attributes of RemedialActionProfile::PinDCTerminal**

name	mult	type	description
kind	1..1	PinDCTerminalKind	(NC) The kind of quantity which is used as an input value.
absoluteValue	1..1	Boolean	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
duration	1..1	Duration	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	1..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	1..1	Float	(NC) inherited from: GateInputPin
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 60 – Association ends of RemedialActionProfile::PinDCTerminal with other classes

mult from	name	mult to	type	description
0..*	DCTerminal	0..1	DCTerminal	(NC) The DC terminal that has this pin DC terminal.
1..*	Gate	1..1	Gate	(NC) inherited from: GateInputPin

3.51 (NC) PinEquipment

Inheritance path = GateInputPin : IdentifiedObject
Input pin associated with an Equipment. It is used for the comparison.
Table 61 shows all attributes of PinEquipment.

Table 61 – Attributes of RemedialActionProfile::PinEquipment

name	mult	type	description
absoluteValue	1..1	Boolean	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
duration	1..1	Duration	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	1..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	1..1	Float	(NC) inherited from: GateInputPin
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 62 shows all association ends of PinEquipment with other classes.

Table 62 – Association ends of RemedialActionProfile::PinEquipment with other classes

mult from	name	mult to	type	description
0..*	PropertyReference	1..1	PropertyReference	(NC)
1..*	Gate	1..1	Gate	(NC) inherited from: GateInputPin

3.52 (NC) PinGate

Inheritance path = GateInputPin : IdentifiedObject
An output from one gate represents an input to another gate.
Table 63 shows all attributes of PinGate.

Table 63 – Attributes of RemedialActionProfile::PinGate

name	mult	type	description
absoluteValue	1..1	Boolean	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
duration	1..1	Duration	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin

name	mult	type	description
thresholdPercentage	1..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	1..1	Float	(NC) inherited from: GateInputPin
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 64 shows all association ends of PinGate with other classes.

Table 64 – Association ends of RemedialActionProfile::PinGate with other classes

mult from	name	mult to	type	description
0..*	GateOutput	1..1	Gate	(NC) The output of the gate.
1..*	Gate	1..1	Gate	(NC) inherited from: GateInputPin

3.53 (NC) PinMeasurement

Inheritance path = GateInputPin : IdentifiedObject
Input pin associated with a Measurement. It is used for comparison.
Table 65 shows all attributes of PinMeasurement.

Table 65 – Attributes of RemedialActionProfile::PinMeasurement

name	mult	type	description
absoluteValue	1..1	Boolean	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
duration	1..1	Duration	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	1..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	1..1	Float	(NC) inherited from: GateInputPin
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 66 shows all association ends of PinMeasurement with other classes.

Table 66 – Association ends of RemedialActionProfile::PinMeasurement with other classes

mult from	name	mult to	type	description
0..*	Measurement	0..1	Measurement	(NC) The Measurement that is used in the input pin.
0..*	MeasurementCalculator	0..1	MeasurementCalculator	(NC) The result of the calculation used as input to a gate.
1..*	Gate	1..1	Gate	(NC) inherited from: GateInputPin

3.54 (NC) PinPowerTransferCorridor

Inheritance path = GateInputPin : IdentifiedObject
Input pin associated with a PowerTransferCorridor. It is used for comparison.

Table 67 shows all attributes of PinPowerTransferCorridor.

Table 67 – Attributes of RemedialActionProfile::PinPowerTransferCorridor

name	mult	type	description
kind	1..1	PinPowerTransferCorridorKind	(NC) The kind of quantity which is used as an input value.
absoluteValue	1..1	Boolean	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
duration	1..1	Duration	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	1..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	1..1	Float	(NC) inherited from: GateInputPin
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 68 – Association ends of RemedialActionProfile::PinPowerTransferCorridor with other classes

mult from	name	mult to	type	description
0..*	PowerTransferCorridor	1..1	PowerTransferCorridor	(NC) The PowerTransferCorridor that is used in the input pin.
1..*	Gate	1..1	Gate	(NC) inherited from: GateInputPin

3.55 (NC) PinTerminal

Inheritance path = GateInputPin : IdentifiedObject

Input pin associated with a Terminal. It is used for comparison.

Table 69 shows all attributes of PinTerminal.

Table 69 – Attributes of RemedialActionProfile::PinTerminal

name	mult	type	description
kind	1..1	PinTerminalKind	(NC) The kind of quantity which is used as an input value.
absoluteValue	1..1	Boolean	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
duration	1..1	Duration	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	1..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	1..1	Float	(NC) inherited from: GateInputPin
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 70 – Association ends of RemedialActionProfile::PinTerminal with other classes

mult from	name	mult to	type	description
0..*	Terminal	1..1	Terminal	(NC) The Terminal that is used in the input pin.
1..*	Gate	1..1	Gate	(NC) inherited from: GateInputPin

3.56 (NC) PinTerminalLimit

Inheritance path = GateInputPin : IdentifiedObject
Input pin associated with the limits of a Terminal. It is used for comparison.
Table 71 shows all attributes of PinTerminalLimit.

Table 71 – Attributes of RemedialActionProfile::PinTerminalLimit

name	mult	type	description
kind	1..1	PinTerminalLimitKind	(NC) The kind of limit which is used as an input value.
absoluteValue	1..1	Boolean	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
duration	1..1	Duration	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	1..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	1..1	Float	(NC) inherited from: GateInputPin
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 72 – Association ends of RemedialActionProfile::PinTerminalLimit with other classes

mult from	name	mult to	type	description
0..*	Terminal	1..1	Terminal	(NC) The Terminal that is used in the input pin.
1..*	Gate	1..1	Gate	(NC) inherited from: GateInputPin

3.57 (abstract) PowerElectronicsConnection root class

A connection to the AC network for energy production or consumption that uses power electronics rather than rotating machines.

3.58 (NC) PowerElectronicsConnectionAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
Power electronics setpoint action.
Table 73 shows all attributes of PowerElectronicsConnectionAction.

Table 73 – Attributes of RemedialActionProfile::PowerElectronicsConnectionAction

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration

name	mult	type	description
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 74 – Association ends of RemedialActionProfile::PowerElectronicsConnectionAction with other classes

mult from	name	mult to	type	description
0..*	PowerElectronicsConnection	1..1	PowerElectronicsConnection	(NC) The PowerElectronicsConnection that is applied to an action.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.59 (abstract) PowerSystemResource

Inheritance path = IdentifiedObject
A power system resource (PSR) can be an item of equipment such as a switch, an equipment container containing many individual items of equipment such as a substation, or an organisational entity such as sub-control area. Power system resources can have measurements associated.
Table 75 shows all attributes of PowerSystemResource.

Table 75 – Attributes of RemedialActionProfile::PowerSystemResource

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.60 (abstract,NC) PowerTransferCorridor

Inheritance path = PowerSystemResource : IdentifiedObject
A power transfer corridor is defined as a set of circuits (transmission lines or transformers) separating two portions of the power system, or a subset of circuits exposed to a substantial portion of the transmission exchange between two parts of the system.
Table 76 shows all attributes of PowerTransferCorridor.

Table 76 – Attributes of RemedialActionProfile::PowerTransferCorridor

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 77 shows all association ends of PowerTransferCorridor with other classes.

Table 77 – Association ends of RemedialActionProfile::PowerTransferCorridor with other classes

mult from	name	mult to	type	description
0..*	ObservingTerminal	0..1	Terminal	(NC) The terminal that identifies the power transfer corridor.

3.61 (abstract,NC) PropertyReference root class

The reference to a class and one of its properties.

3.62 (NC) PTCActivePowerSupport root class

Defines the active power capability (support) of the scheme in relation to a PowerTransferCorridor.
Table 78 shows all attributes of PTCActivePowerSupport.

Table 78 – Attributes of RemedialActionProfile::PTCActivePowerSupport

name	mult	type	description
maximum	1..1	ActivePower	(NC) Maximum support that a System Integrity Protection Scheme (SIPS) can provide to a Power Transfer Corridor (PTC). This is normally limited by the maximum power system disconnect allowed.
normal	1..1	ActivePower	(NC) Normal support that a System Integrity Protection Scheme (SIPS) is expected to provide when enabled to a Power Transfer Corridor (PTC).

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

Table 79 – Association ends of RemedialActionProfile::PTCActivePowerSupport with other classes

mult from	name	mult to	type	description
0..*	PowerTransferCorridor	1..1	PowerTransferCorridor	(NC) The PowerTransferCorridor that has a specific active power support.
0..*	RemedialActionScheme	1..1	RemedialActionScheme	(NC) The RemedialActionScheme which has active power support from the PowerTransferCorridor.

3.63 (NC) QualitativeRemedialActionImpact

Inheritance path = RemedialActionImpact
It provides the qualitative impact for a remedial action.
Table 80 shows all attributes of QualitativeRemedialActionImpact.

Table 80 – Attributes of RemedialActionProfile::QualitativeRemedialActionImpact

name	mult	type	description
kind	1..1	ImpactAgreementKind	(NC) The impact agreement kind.

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

Table 81 – Association ends of RemedialActionProfile::QualitativeRemedialActionImpact with other classes

mult from	name	mult to	type	description
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: RemedialActionImpact
0..*	SystemOperator	1..1	SystemOperator	(NC) inherited from: RemedialActionImpact

3.64 (NC) QuantitativeRemedialActionImpact

Inheritance path = RemedialActionImpact

It provides the quantitative threshold for a remedial action. It is only applicable to quantifiable grid state alterations such as tap alteration, redispatch, target value alteration, but not status related alterations.

Table 82 shows all attributes of QuantitativeRemedialActionImpact.

Table 82 – Attributes of RemedialActionProfile::QuantitativeRemedialActionImpact

name	mult	type	description
thresholdValue	1..1	Float	(NC) The value is the threshold about which the System Operator is potentially impacted.

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

Table 83 – Association ends of RemedialActionProfile::QuantitativeRemedialActionImpact with other classes

mult from	name	mult to	type	description
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: RemedialActionImpact
0..*	SystemOperator	1..1	SystemOperator	(NC) inherited from: RemedialActionImpact

3.65 (abstract,NC) RangeSchedule

Inheritance path = GenericValueSchedule : BaseIrregularTimeSeries : BaseTimeSeries : IdentifiedObject

Defines the range schedule for static or intertemporal schedule.

Table 84 shows all attributes of RangeSchedule.

Table 84 – Attributes of RemedialActionProfile::RangeSchedule

name	mult	type	description
valueKind	1..1	ValueOffsetKind	(NC) The kind of value1 and value2 of the associated IrregularIntervalSchedule.
generatedAtTime	0..1	DateTime	inherited from: BaseTimeSeries
interpolationKind	0..1	TimeSeriesInterpolationKind	inherited from: BaseTimeSeries
kind	0..1	BaseTimeSeriesKind	inherited from: BaseTimeSeries
method	0..1	String	inherited from: BaseTimeSeries
percentile	0..1	Integer	inherited from: BaseTimeSeries
description	0..1	String	inherited from: IdentifiedObject

name	mult	type	description
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.66 (NC) RedispatchRemedialAction

Inheritance path = RemedialAction : IdentifiedObject

Redispatch remedial action is a remedial action that through rearranging power schedules is eliminating breaches of constraints.

Table 85 shows all attributes of RedispatchRemedialAction.

Table 85 – Attributes of RemedialActionProfile::RedispatchRemedialAction

name	mult	type	description
kind	1..1	RemedialActionKind	(NC) inherited from: RemedialAction
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 86 – Association ends of RemedialActionProfile::RedispatchRemedialAction with other classes

mult from	name	mult to	type	description
0..*	BiddingZone	0..1	BiddingZone	(NC)
0..*	CountertradeRemedialAction	0..1	CountertradeRemedialAction	(NC)
0..*	AppointedToRegion	1..1	Region	(NC) inherited from: RemedialAction
0..*	ConnectingSystemOperator	0..1	SystemOperator	(NC) inherited from: RemedialAction

3.67 (abstract,NC) Region root class

A region where the system operator belongs to.

3.68 (abstract) RegulatingControl root class

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

Remote bus voltage control is possible by specifying the controlled terminal located at some place remote from the controlling equipment.

The specified terminal shall be associated with the connectivity node of the controlled point. The most specific subtype of RegulatingControl shall be used in case such equipment participate in the control, e.g. TapChangerControl for tap changers.

For flow control, load sign convention is used, i.e. positive sign means flow out from a TopologicalNode (bus) into the conducting equipment.

The attribute minAllowedTargetValue and maxAllowedTargetValue are required in the following cases:

- For a power generating module operated in power factor control mode to specify maximum and minimum power factor values;
- Whenever it is necessary to have an off center target voltage for the tap changer regulator. For instance, due to long cables to off shore wind farms and the need to have a simpler setup at the off shore transformer platform, the voltage is controlled from the land at the connection point for the off shore wind farm. Since there usually is a voltage rise along the cable, there is

typical and overvoltage of up 3-4 kV compared to the on shore station. Thus in normal operation the tap changer on the on shore station is operated with a target set point, which is in the lower parts of the dead band.
The attributes minAllowedTargetValue and maxAllowedTargetValue are not related to the attribute targetDeadband and thus they are not treated as an alternative of the targetDeadband. They are needed due to limitations in the local substation controller. The attribute targetDeadband is used to prevent the power flow from move the tap position in circles (hunting) that is to be used regardless of the attributes minAllowedTargetValue and maxAllowedTargetValue.

3.69 (NC) RegulatingControlAction

Inheritance path = GridStateAlteration : IdentifiedObject
Control action means the set point change of a regulating control power system resource in the grid model compared to the base case.
Table 87 shows all attributes of RegulatingControlAction.

Table 87 – Attributes of RemedialActionProfile::RegulatingControlAction

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 88 – Association ends of RemedialActionProfile::RegulatingControlAction with other classes

mult from	name	mult to	type	description
0..*	RegulatingControl	1..1	RegulatingControl	(NC) The regulating control which has an action.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.70 (NC) RemedialActionCostCharacteristic

Inheritance path = Curve : IdentifiedObject
The cost characteristic for a remedial action.
Table 89 shows all attributes of RemedialActionCostCharacteristic.

Table 89 – Attributes of RemedialActionProfile::RemedialActionCostCharacteristic

name	mult	type	description
y1UnitNominator	0..1	Currency	(NC) The nominator of the Y1-axis units of measure.
y1UnitDenominator	0..1	UnitSymbol	(NC) The denominator of the Y1-axis units of measure.
y1UnitDenominatorMultiplier	0..1	UnitMultiplier	(NC) The multiplier of the denominator of the Y1-axis units of measure.
curveStyle	1..1	CurveStyle	inherited from: Curve
xMultiplier	0..1	UnitMultiplier	inherited from: Curve

name	mult	type	description
xUnit	1..1	UnitSymbol	inherited from: Curve
y1Multiplier	0..1	UnitMultiplier	inherited from: Curve
y1Unit	0..1	UnitSymbol	inherited from: Curve
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 90 – Association ends of RemedialActionProfile::RemedialActionCostCharacteristic with other classes

mult from	name	mult to	type	description
0..1	RemedialAction	1..1	RemedialAction	(NC) The remedial action that has cost characteristic.

3.71 (abstract,NC) RemedialActionImpact root class

It provides the remedial action impact.
All grid alterations linked to the remedial action have to be of the same type.
Table 91 shows all association ends of RemedialActionImpact with other classes.

Table 91 – Association ends of RemedialActionProfile::RemedialActionImpact with other classes

mult from	name	mult to	type	description
0..*	RemedialAction	1..1	RemedialAction	(NC) The remedial action that has a threshold.
0..*	SystemOperator	1..1	SystemOperator	(NC) The impacted System Operator that assigns a remedial action impact.

3.72 (abstract,NC) RemedialAction

Inheritance path = IdentifiedObject
Remedial action describes one or more actions that can be performed on a given power system model situation to eliminate one or more identified breaches of constraints. The remedial action can be costly, and have a cost characteristic, or non costly.
Table 92 shows all attributes of RemedialAction.

Table 92 – Attributes of RemedialActionProfile::RemedialAction

name	mult	type	description
kind	1..1	RemedialActionKind	(NC) The kind of the remedial action.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 93 shows all association ends of RemedialAction with other classes.

Table 93 – Association ends of RemedialActionProfile::RemedialAction with other classes

mult from	name	mult to	type	description
0..*	AppointedToRegion	1..1	Region	(NC) The region in which the remedial action is appointed.
0..*	ConnectingSystemOperator	0..1	SystemOperator	(NC) System operator connected by remedial actions.

3.73 (NC) RemedialActionScheme

Inheritance path = PowerSystemResource : IdentifiedObject

Remedial Action Scheme (RAS), Special Protection Schemes (SPS), System Protection Schemes (SPS) or System Integrity Protection Schemes (SIPS).

A Remedial Action Scheme consists of one or more stages that can trigger and execute a protection action.

Table 94 shows all attributes of RemedialActionScheme.

Table 94 – Attributes of RemedialActionProfile::RemedialActionScheme

name	mult	type	description
kind	1..1	RemedialActionSchemeKind	(NC) Kind of Remedial Action Scheme.
normalArmed	1..1	Boolean	(NC) Defines the normal arming status of the remedial action scheme.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 95 – Association ends of RemedialActionProfile::RemedialActionScheme with other classes

mult from	name	mult to	type	description
0..*	GateArmed	0..1	Gate	(NC) Gate that through a gate logic and input pin defines arming of a Remedial Action Scheme.

3.74 (abstract) RotatingMachine root class

A rotating machine which may be used as a generator or motor.

3.75 (NC) RotatingMachineAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject

Rotating machine action.

Table 96 shows all attributes of RotatingMachineAction.

Table 96 – Attributes of RemedialActionProfile::RotatingMachineAction

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject

name	mult	type	description
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 97 – Association ends of RemedialActionProfile::RotatingMachineAction with other classes

mult from	name	mult to	type	description
0..*	RotatingMachine	1..1	RotatingMachine	(NC) The rotating machine that has an action.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.76 (NC) SchemeRemedialAction

Inheritance path = RemedialAction : IdentifiedObject
Schema remedial action is remedial action that involves a scheme that can include conditional logic and stages of grid alternation. The primary remedial action is the arming of these schemes, that will then perform curative remedial action when the condition is met. System Integrity Protection Scheme (SIPS) and Special Protection Scheme (SPS) are example of this.
Table 98 shows all attributes of SchemeRemedialAction.

Table 98 – Attributes of RemedialActionProfile::SchemeRemedialAction

name	mult	type	description
kind	1..1	RemedialActionKind	(NC) inherited from: RemedialAction
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 99 – Association ends of RemedialActionProfile::SchemeRemedialAction with other classes

mult from	name	mult to	type	description
0..*	AppointedToRegion	1..1	Region	(NC) inherited from: RemedialAction
0..*	ConnectingSystemOperator	0..1	SystemOperator	(NC) inherited from: RemedialAction

3.77 (abstract,NC) SetPointAction

Inheritance path = GridStateAlteration : IdentifiedObject
Setpoint action.
Table 100 shows all attributes of SetPointAction.

Table 100 – Attributes of RemedialActionProfile::SetPointAction

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration

name	mult	type	description
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 101 – Association ends of RemedialActionProfile::SetPointAction with other classes

mult from	name	mult to	type	description
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.78 (abstract) ShuntCompensator root class

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 bPerSection indicates that the compensator is a reactor. ShuntCompensator is a single terminal device. Ground is implied.

3.79 (NC) ShuntCompensatorModification

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
Shunt compensator action.
Table 102 shows all attributes of ShuntCompensatorModification.

Table 102 – Attributes of RemedialActionProfile::ShuntCompensatorModification

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 103 – Association ends of RemedialActionProfile::ShuntCompensatorModification with other classes

mult from	name	mult to	type	description
0..*	ShuntCompensator	1..1	ShuntCompensator	(NC) The ShuntCompensator that is associated with an action.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.80 (NC) SolarRadiationDepedencyCurve root class

A curve or functional relationship between

- the solar radiation independent variable (X-axis), and
- relative dependent (Y-axis) variables.

3.81 (NC) Stage

Inheritance path = IdentifiedObject

Stage of a remedial action scheme.

Table 104 shows all attributes of Stage.

Table 104 – Attributes of RemedialActionProfile::Stage

name	mult	type	description
priority	1..1	Integer	(NC) The priority of the stage. 0 = do not care (default) 1 = highest priority. 2 is less than 1 and so on. A stage with higher priority needs be activated before a lower stage can be activated.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 105 – Association ends of RemedialActionProfile::Stage with other classes

mult from	name	mult to	type	description
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) The GridStateAlterationCollection which belongs to the Stage.
1..*	RemedialActionScheme	1..1	RemedialActionScheme	(NC) The remedial action scheme that has a stage.

3.82 (NC) StageTrigger

Inheritance path = IdentifiedObject

Stage that is triggered either by TriggerCondition or by gate condition within a stage.

Table 106 shows all attributes of StageTrigger.

Table 106 – Attributes of RemedialActionProfile::StageTrigger

name	mult	type	description
normalArmed	1..1	Boolean	(NC) The default/normal value used when other active signal/values are missing.
priority	1..1	Integer	(NC) Priority of trigger. 0 = don t care (default) 1 = highest priority. 2 is less than 1 and so on. A trigger with the highest priority will trigger first.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 107 – Association ends of RemedialActionProfile::StageTrigger with other classes

mult from	name	mult to	type	description
0..*	GateComCondition	0..1	Gate	(NC) The gate that is the input pin which defines a communication condition.

mult from	name	mult to	type	description
0..*	GateArmed	0..1	Gate	(NC) The gate that is the input pin which defines arming of the StageTrigger.
0..*	GateTrigger	0..1	Gate	(NC) The gate that is the input pin which triggers the protective reactions.
1..*	Stage	1..1	Stage	(NC) The stage that has this stage trigger.

3.83 (NC) StaticRangeSchedule

Inheritance path = RangeSchedule : GenericValueSchedule : BaseIrregularTimeSeries : BaseTimeSeries : IdentifiedObject

Defines the static range, which means that this is the minimum and/or maximum of an attribute value. The value of the schedule will replace the value of the attribute to which the schedule refers to.

For instance for a tap changer related grid state alteration for a particular point in time, if TapChanger.lowStep is to be restricted, the value of the schedule will represent that new TapChanger.lowStep.

Table 108 shows all attributes of StaticRangeSchedule.

Table 108 – Attributes of RemedialActionProfile::StaticRangeSchedule

name	mult	type	description
valueKind	1..1	ValueOffsetKind	(NC) inherited from: RangeSchedule
generatedAtTime	0..1	DateTime	inherited from: BaseTimeSeries
interpolationKind	0..1	TimeSeriesInterpolationKind	inherited from: BaseTimeSeries
kind	0..1	BaseTimeSeriesKind	inherited from: BaseTimeSeries
method	0..1	String	inherited from: BaseTimeSeries
percentile	0..1	Integer	inherited from: BaseTimeSeries
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 109 – Association ends of RemedialActionProfile::StaticRangeSchedule with other classes

mult from	name	mult to	type	description
0..*	GridStateAlteration	1..1	GridStateAlteration	(NC) The grid state alteration which has static range.
0..*	PropertyReference	1..1	PropertyReference	(NC) The property reference for this static schedule.

3.84 (abstract) StaticVarCompensator root class

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.

3.85 (NC) StaticVarCompensatorAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject

Static Var compensator action.

Table 110 shows all attributes of StaticVarCompensatorAction.

Table 110 – Attributes of RemedialActionProfile::StaticVarCompensatorAction

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 111 – Association ends of RemedialActionProfile::StaticVarCompensatorAction with other classes

mult from	name	mult to	type	description
0..*	StaticVarCompensator	1..1	StaticVarCompensator	(NC) The StaticVarCompensator which is associated with an action.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.86 (Description) Substation root class

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.

3.87 (abstract) Switch root class

A generic device designed to close, or open, or both, one or more electric circuits. All switches are two terminal devices including grounding switches. The ACDCTerminal.connected at the two sides of the switch shall not be considered for assessing switch connectivity, i.e. only Switch.open, .normalOpen and .locked are relevant.

3.88 (abstract,NC) SystemOperator root class

System operator.

3.89 (abstract) TapChanger root class

Mechanism for changing transformer winding tap positions.

3.90 (NC) TapPositionAction

Inheritance path = GridStateAlteration : IdentifiedObject

Tap position action represents a change of a tap changer position in the grid model compared to the base case.

Table 112 shows all attributes of TapPositionAction.

Table 112 – Attributes of RemedialActionProfile::TapPositionAction

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 113 – Association ends of RemedialActionProfile::TapPositionAction with other classes

mult from	name	mult to	type	description
0..*	TapChanger	1..1	TapChanger	(NC) The tap changer that has a tap position action associated.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.91 (abstract) Terminal

Inheritance path = ACDCTerminal : IdentifiedObject
An AC electrical connection point to a piece of conducting equipment. Terminals are connected at physical connection points called connectivity nodes.
Table 114 shows all attributes of Terminal.

Table 114 – Attributes of RemedialActionProfile::Terminal

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

3.92 (NC) TopologyAction

Inheritance path = GridStateAlteration : IdentifiedObject
Topology action means the connection or disconnection of a switch in the grid model compared to the base case.
Table 115 shows all attributes of TopologyAction.

Table 115 – Attributes of RemedialActionProfile::TopologyAction

name	mult	type	description
timeToImplement	1..1	Duration	(NC) inherited from: GridStateAlteration
normalEnabled	1..1	Boolean	(NC) inherited from: GridStateAlteration
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 116 – Association ends of RemedialActionProfile::TopologyAction with other classes

mult from	name	mult to	type	description
0..*	Switch	1..1	Switch	(NC) The switch that has a topology action associated.
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration
0..*	RemedialAction	1..1	RemedialAction	(NC) inherited from: GridStateAlteration

3.93 (NC) TriggerCondition

Inheritance path = IdentifiedObject

The condition that triggers a remedial action scheme.

Table 117 shows all attributes of TriggerCondition.

Table 117 – Attributes of RemedialActionProfile::TriggerCondition

name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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

Table 118 – Association ends of RemedialActionProfile::TriggerCondition with other classes

mult from	name	mult to	type	description
0..*	GateTrigger	1..1	Gate	(NC) The gate that is the condition for the trigger.
0..*	RemedialActionScheme	1..1	RemedialActionScheme	(NC) The remedial action scheme that has the trigger condition.

3.94 (NC) BaseTimeSeriesKind enumeration

Kind of time series.

Table 119 shows all literals of BaseTimeSeriesKind.

Table 119 – Literals of RemedialActionProfile::BaseTimeSeriesKind

literal	value	description
forecast		Time series is forecast data. The values represent the result of scientific predictions based on historical time stamped data.
hindcast		Time series is hindcast data. The value represent probable past (historic) condition given by calculation done using actual values. For instance, determine the among of wind based on the energy produced by wind. However, hindcast is typical the result of a simulated forecasts for historical periods.
schedule		Time series is schedule data. The values represent the result of a committed and plan forecast data that has been through a quality

literal	value	description
		control and could incur penalty when not followed.
actual		Time series is actual data. The values represent measured or calculated values that represent the actual behaviour.

3.95 (NC) CalculationKind enumeration

Kind of calculation operation that can be done to Measurement.
Table 120 shows all literals of CalculationKind.

Table 120 – Literals of RemedialActionProfile::CalculationKind

literal	value	description
summation		Summation operation on the input values (operands).
multiplication		Multiplication operation on the input values (operands).
division		Division operation on the input values (operands).
squareRoot		Square root operator - only one input value (operands).

3.96 Currency enumeration

Monetary currencies. ISO 4217 standard including 3-character currency code.
Table 121 shows all literals of Currency.

Table 121 – Literals of RemedialActionProfile::Currency

literal	value	description
AED	784	United Arab Emirates dirham.
AFN	971	Afghan afghani.
ALL	008	Albanian lek.
AMD	051	Armenian dram.
ANG	532	Netherlands Antillean guilder.
AOA	973	Angolan kwanza.
ARS	032	Argentine peso.
AUD	036	Australian dollar.
AWG	533	Aruban florin.
AZN	944	Azerbaijani manat.
BAM	977	Bosnia and Herzegovina convertible mark.
BBD	052	Barbados dollar.
BDT	050	Bangladeshi taka.
BGN	975	Bulgarian lev.
BHD	048	Bahraini dinar.
BIF	108	Burundian franc.
BMD	060	Bermudian dollar (customarily known as Bermuda dollar).
BND	096	Brunei dollar.

literal	value	description
BOB	068	Boliviano.
BOV	984	Bolivian Mvdol (funds code).
BRL	986	Brazilian real.
BSD	044	Bahamian dollar.
BTN	064	Bhutanese ngultrum.
BWP	072	Botswana pula.
BYR	974	Belarusian ruble.
BZD	084	Belize dollar.
CAD	124	Canadian dollar.
CDF	976	Congolese franc.
CHF	756	Swiss franc.
CLF	990	Unidad de Fomento (funds code), Chile.
CLP	152	Chilean peso.
CNY	156	Chinese yuan.
COP	170	Colombian peso.
COU	970	Unidad de Valor Real.
CRC	188	Costa Rican colon.
CUC	931	Cuban convertible peso.
CUP	192	Cuban peso.
CVE	132	Cape Verde escudo.
CZK	203	Czech koruna.
DJF	262	Djiboutian franc.
DKK	208	Danish krone.
DOP	214	Dominican peso.
DZD	012	Algerian dinar.
EEK	233	Estonian kroon.
EGP	818	Egyptian pound.
ERN	232	Eritrean nakfa.
ETB	230	Ethiopian birr.
EUR	978	Euro.
FJD	242	Fiji dollar.
FKP	238	Falkland Islands pound.
GBP	826	Pound sterling.
GEL	981	Georgian lari.
GHS	936	Ghanaian cedi.
GIP	929	Gibraltar pound.
GMD	270	Gambian dalasi.
GNF	324	Guinean franc.
GTQ	320	Guatemalan quetzal.
GYD	328	Guyanese dollar.
HKD	344	Hong Kong dollar.

literal	value	description
HNL	340	Honduran lempira.
HRK	191	Croatian kuna.
HTG	332	Haitian gourde.
HUF	348	Hungarian forint.
IDR	360	Indonesian rupiah.
ILS	376	Israeli new sheqel.
INR	356	Indian rupee.
IQD	368	Iraqi dinar.
IRR	364	Iranian rial.
ISK	352	Icelandic króna.
JMD	388	Jamaican dollar.
JOD	400	Jordanian dinar.
JPY	392	Japanese yen.
KES	404	Kenyan shilling.
KGS	417	Kyrgyzstani som.
KHR	116	Cambodian riel.
KMF	174	Comoro franc.
KPW	408	North Korean won.
KRW	410	South Korean won.
KWD	414	Kuwaiti dinar.
KYD	136	Cayman Islands dollar.
KZT	398	Kazakhstani tenge.
LAK	418	Lao kip.
LBP	422	Lebanese pound.
LKR	144	Sri Lanka rupee.
LRD	430	Liberian dollar.
LSL	426	Lesotho loti.
LTL	440	Lithuanian litas.
LVL	428	Latvian lats.
LYD	434	Libyan dinar.
MAD	504	Moroccan dirham.
MDL	498	Moldovan leu.
MGA	969	Malagasy ariary.
MKD	807	Macedonian denar.
MMK	104	Myanma kyat.
MNT	496	Mongolian tugrik.
MOP	446	Macanese pataca.
MRO	478	Mauritanian ouguiya.
MUR	480	Mauritian rupee.
MVR	462	Maldivian rufiyaa.
MWK	454	Malawian kwacha.

literal	value	description
MXN	484	Mexican peso.
MYR	458	Malaysian ringgit.
MZN	943	Mozambican metical.
NAD	516	Namibian dollar.
NGN	566	Nigerian naira.
NIO	558	Cordoba oro.
NOK	578	Norwegian krone.
NPR	524	Nepalese rupee.
NZD	554	New Zealand dollar.
OMR	512	Omani rial.
PAB	590	Panamanian balboa.
PEN	604	Peruvian nuevo sol.
PGK	598	Papua New Guinean kina.
PHP	608	Philippine peso.
PKR	586	Pakistani rupee.
PLN	985	Polish zloty.
PYG	600	Paraguayan guaraní.
QAR	634	Qatari rial.
RON	946	Romanian new leu.
RSD	941	Serbian dinar.
RUB	643	Russian rouble.
RWF	646	Rwandan franc.
SAR	682	Saudi riyal.
SBD	090	Solomon Islands dollar.
SCR	690	Seychelles rupee.
SDG	938	Sudanese pound.
SEK	752	Swedish krona/kronor.
SGD	702	Singapore dollar.
SHP	654	Saint Helena pound.
SLL	694	Sierra Leonean leone.
SOS	706	Somali shilling.
SRD	968	Surinamese dollar.
STD	678	São Tomé and Príncipe dobra.
SYP	760	Syrian pound.
SZL	748	Lilangeni.
THB	764	Thai baht.
TJS	972	Tajikistani somoni.
TMT	934	Turkmenistani manat.
TND	788	Tunisian dinar.
TOP	776	Tongan pa'anga.
TRY	949	Turkish lira.

literal	value	description
TTD	780	Trinidad and Tobago dollar.
TWD	901	New Taiwan dollar.
TZS	834	Tanzanian shilling.
UAH	980	Ukrainian hryvnia.
UGX	800	Ugandan shilling.
USD	840	United States dollar.
UYU	858	Uruguayan peso.
UZS	860	Uzbekistan som.
VEF	937	Venezuelan bolívar fuerte.
VND	704	Vietnamese Dong.
VUV	548	Vanuatu vatu.
WST	882	Samoan tala.
XAF	950	CFA franc BEAC.
XCD	951	East Caribbean dollar.
XOF	952	CFA Franc BCEAO.
XPF	953	CFP franc.
YER	886	Yemeni rial.
ZAR	710	South African rand.
ZMK	894	Zambian kwacha.
ZWL	932	Zimbabwe dollar.

3.97 CurveStyle enumeration

Style or shape of curve.
Table 122 shows all literals of CurveStyle.

Table 122 – Literals of RemedialActionProfile::CurveStyle

literal	value	description
constantYValue		The Y-axis values are assumed constant until the next curve point and prior to the first curve point.
straightLineYValues		The Y-axis values are assumed to be a straight line between values. Also known as linear interpolation.

3.98 (NC) TimeSeriesInterpolationKind enumeration

Kinds of interpolation of values between two time point.
Table 123 shows all literals of TimeSeriesInterpolationKind.

Table 123 – Literals of RemedialActionProfile::TimeSeriesInterpolationKind

literal	value	description
none		No interpolation is applied. The value is considered NULL.
zero		The value between two time points is set to zero.
previous		The value between two time points is set to previous value.

literal	value	description
next		The value between two time points is set to next value.
linear		Linear interpolation is applied for values between two time points.

3.99 (NC) GateLogicKind enumeration

Define the different logical operations.
Table 124 shows all literals of GateLogicKind.

Table 124 – Literals of RemedialActionProfile::GateLogicKind

literal	value	description
and		A logical AND operation. True when all inputs are true.
or		A logical OR operation. True when one or more inputs are true.
nor		A logical NOR operation. False when one or more inputs are true.
nand		A logical NAND operation. False when all inputs are true.
not		A logical NOT operation. Only one input and true input will give false out and false in will give true out. An inverter.
xnor		A logical XNOR operation. The function is the inverse of the exclusive OR (XOR) gate. All input false or true will give true. Otherwise false.
xor		A logical XOR operation. All input false or true will give false. Otherwise true.

3.100 (NC) ImpactAgreementKind enumeration

The impact agreement for the remedial action.
Table 125 shows all literals of ImpactAgreementKind.

Table 125 – Literals of RemedialActionProfile::ImpactAgreementKind

literal	value	description
noAgreement		No agreement is reached on the qualitative impact of a remedial action.
never		An agreement is reached that a remedial action is never impacting.
always		An agreement is reached that the remedial action is always impacting whichever the intensity.

3.101 (NC) LogicalOperatorsKind enumeration

Kinds of logical operators for comparison.
Table 126 shows all literals of LogicalOperatorsKind.

Table 126 – Literals of RemedialActionProfile::LogicalOperatorsKind

literal	value	description
notEqual		Not equal (unlike) comparison operation.

literal	value	description
equals		Equals (like) comparison operation.
lessThanOrEquals		Less than or equals comparison operation.
lessThan		Less than comparison operation.
greaterThanOrEquals		Greater than or equals comparison operation.
greaterThan		Greater than comparison operation.

3.102 (NC) PinDCTerminalKind enumeration

The kind of quantities that can serve as an input value for the DCTerminal pin.
Table 127 shows all literals of PinDCTerminalKind.

Table 127 – Literals of RemedialActionProfile::PinDCTerminalKind

literal	value	description
voltage		Direct current voltage in the DCTerminal.
current		Direct current in the DCTerminal.

3.103 (NC) PinTerminalKind enumeration

The kind of quantities that can serve as an input value for the pin.
Table 128 shows all literals of PinTerminalKind.

Table 128 – Literals of RemedialActionProfile::PinTerminalKind

literal	value	description
activePower		Active power on the Terminal.
apparentPower		Apparent power on the Terminal.
voltageMagnitude		Voltage magnitude on the Terminal.
voltageAngle		Voltage angle on the Terminal.
current		Current on the Terminal.
reactivePower		Reactive power on the Terminal.

3.104 (NC) PinPowerTransferCorridorKind enumeration

The kind of quantities that can serve as an input value for the PowerTransferCorridor pin.
Table 129 shows all literals of PinPowerTransferCorridorKind.

Table 129 – Literals of RemedialActionProfile::PinPowerTransferCorridorKind

literal	value	description
activePower		Active power in the branch group.
reactivePower		Reactive power in the branch group.

3.105 (NC) PinTerminalLimitKind enumeration

The kind of limits that can serve as an input value for the pin.
Table 130 shows all literals of PinTerminalLimitKind.

Table 130 – Literals of RemedialActionProfile::PinTerminalLimitKind

literal	value	description
voltageLimit		The voltage limit is an input value.

literal	value	description
currentLimit		The current limit is an input value.
activePowerLimit		The active power limit is an input value.
voltageAngleLimit		The voltage angle limit is an input value.
apparentPowerLimit		The apparent power limit is an input value.

3.106 (NC) RelativeDirectionKind enumeration

Kinds of direction of the manual frequency restoration reserves action.
Table 131 shows all literals of RelativeDirectionKind.

Table 131 – Literals of RemedialActionProfile::RelativeDirectionKind

literal	value	description
up		Up signifies that the available power can be used by the Purchasing area to increase energy.
down		Down signifies that the available power can be used by the Purchasing area to decrease energy.
upAndDown		Up and Down signifies that the UP and Down values are equal.

3.107 (NC) RemedialActionKind enumeration

The different kinds for a remedial action.
Table 132 shows all literals of RemedialActionKind.

Table 132 – Literals of RemedialActionProfile::RemedialActionKind

literal	value	description
curative		Remedial action is curative.
preventive		Remedial action is preventive.
curativeAndPreventive		Remedial action is curative and preventive.

3.108 (NC) RemedialActionSchemeKind enumeration

Classification of Remedial Action Scheme.
Table 133 shows all literals of RemedialActionSchemeKind.

Table 133 – Literals of RemedialActionProfile::RemedialActionSchemeKind

literal	value	description
sips		System Integrity Protection Scheme (SIPS). The triggering conditions are met through field measurements.
rasp		Remedial Action Schema Plan (RASP). The triggering conditions are met through calculation.

3.109 UnitSymbol enumeration

The derived units defined for usage in the CIM. In some cases, the derived unit is equal to an SI unit. Whenever possible, the standard derived symbol is used instead of the formula for the derived unit. For example, the unit symbol Farad is defined as "F" instead of "CPerV". In cases where a standard symbol does not exist for a derived unit, the formula for the unit is used as the unit symbol. For example, density does not have a standard symbol and so it is represented

as "kgPerm3". With the exception of the "kg", which is an SI unit, the unit symbols do not contain multipliers and therefore represent the base derived unit to which a multiplier can be applied as a whole.

Every unit symbol is treated as an unparseable text as if it were a single-letter symbol. The meaning of each unit symbol is defined by the accompanying descriptive text and not by the text contents of the unit symbol.

To allow the widest possible range of serializations without requiring special character handling, several substitutions are made which deviate from the format described in IEC 80000-1. The division symbol "/" is replaced by the letters "Per". Exponents are written in plain text after the unit as "m3" instead of being formatted as "m" with a superscript of 3 or introducing a symbol as in "m^3". The degree symbol "°" is replaced with the letters "deg". Any clarification of the meaning for a substitution is included in the description for the unit symbol.

Non-SI units are included in list of unit symbols to allow sources of data to be correctly labelled with their non-SI units (for example, a GPS sensor that is reporting numbers that represent feet instead of meters). This allows software to use the unit symbol information correctly convert and scale the raw data of those sources into SI-based units.

The integer values are used for harmonization with IEC 61850.

Table 134 shows all literals of UnitSymbol.

Table 134 – Literals of RemedialActionProfile::UnitSymbol

literal	value	description
none	0	Dimension less quantity, e.g. count, per unit, etc.
m	2	Length in metres.
kg	3	Mass in kilograms. Note: multiplier “k” is included in this unit symbol for compatibility with IEC 61850-7-3.
s	4	Time in seconds.
A	5	Current in amperes.
K	6	Temperature in kelvins.
mol	7	Amount of substance in moles.
cd	8	Luminous intensity in candelas.
deg	9	Plane angle in degrees.
rad	10	Plane angle in radians (m/m).
sr	11	Solid angle in steradians (m2/m2).
Gy	21	Absorbed dose in grays (J/kg).
Bq	22	Radioactivity in becquerels (1/s).
degC	23	Relative temperature in degrees Celsius. In the SI unit system the symbol is °C. Electric charge is measured in coulomb that has the unit symbol C. To distinguish degree Celsius from coulomb the symbol used in the UML is degC. The reason for not using °C is that the special character ° is difficult to manage in software.
Sv	24	Dose equivalent in sieverts (J/kg).
F	25	Electric capacitance in farads (C/V).
C	26	Electric charge in coulombs (A·s).
S	27	Conductance in siemens.
H	28	Electric inductance in henrys (Wb/A).
V	29	Electric potential in volts (W/A).
ohm	30	Electric resistance in ohms (V/A).

literal	value	description
J	31	Energy in joules (N·m = C·V = W·s).
N	32	Force in newtons (kg·m/s²).
Hz	33	Frequency in hertz (1/s).
lx	34	Illuminance in lux (lm/m²).
lm	35	Luminous flux in lumens (cd·sr).
Wb	36	Magnetic flux in webers (V·s).
T	37	Magnetic flux density in teslas (Wb/m2).
W	38	Real power in watts (J/s). Electrical power may have real and reactive components. The real portion of electrical power (I²R or VIcos(phi)), is expressed in Watts. See also apparent power and reactive power.
Pa	39	Pressure in pascals (N/m²). Note: the absolute or relative measurement of pressure is implied with this entry. See below for more explicit forms.
m2	41	Area in square metres (m²).
m3	42	Volume in cubic metres (m³).
mPers	43	Velocity in metres per second (m/s).
mPers2	44	Acceleration in metres per second squared (m/s²).
m3Pers	45	Volumetric flow rate in cubic metres per second (m³/s).
mPerm3	46	Fuel efficiency in metres per cubic metres (m/m³).
kgm	47	Moment of mass in kilogram metres (kg·m) (first moment of mass). Note: multiplier “k” is included in this unit symbol for compatibility with IEC 61850-7-3.
kgPerm3	48	Density in kilogram/cubic metres (kg/m³). Note: multiplier “k” is included in this unit symbol for compatibility with IEC 61850-7-3.
m2Pers	49	Viscosity in square metres / second (m²/s).
WPermK	50	Thermal conductivity in watt/metres kelvin.
JPerK	51	Heat capacity in joules/kelvin.
ppm	52	Concentration in parts per million.
rotPers	53	Rotations per second (1/s). See also Hz (1/s).
radPers	54	Angular velocity in radians per second (rad/s).
WPerm2	55	Heat flux density, irradiance, watts per square metre.
JPerm2	56	Insulation energy density, joules per square metre or watt second per square metre.
SPerm	57	Conductance per length (F/m).
KPers	58	Temperature change rate in kelvins per second.
PaPers	59	Pressure change rate in pascals per second.
JPerkgK	60	Specific heat capacity, specific entropy, joules per kilogram Kelvin.
VA	61	Apparent power in volt amperes. See also real power and reactive power.

literal	value	description
VAr	63	Reactive power in volt amperes reactive. The “reactive” or “imaginary” component of electrical power (VIsin(phi)). (See also real power and apparent power). Note: Different meter designs use different methods to arrive at their results. Some meters may compute reactive power as an arithmetic value, while others compute the value vectorially. The data consumer should determine the method in use and the suitability of the measurement for the intended purpose.
cosPhi	65	Power factor, dimensionless. Note 1: This definition of power factor only holds for balanced systems. See the alternative definition under code 153. Note 2 : Beware of differing sign conventions in use between the IEC and EEI. It is assumed that the data consumer understands the type of meter in use and the sign convention in use by the utility.
Vs	66	Volt seconds (Ws/A).
V2	67	Volt squared (W^2/A^2).
As	68	Ampere seconds (A·s).
A2	69	Amperes squared (A^2).
A2s	70	Ampere squared time in square amperes (A^2s).
VAh	71	Apparent energy in volt ampere hours.
Wh	72	Real energy in watt hours.
VArh	73	Reactive energy in volt ampere reactive hours.
VPerHz	74	Magnetic flux in volt per hertz.
HzPers	75	Rate of change of frequency in hertz per second.
character	76	Number of characters.
charPers	77	Data rate (baud) in characters per second.
kgm2	78	Moment of mass in kilogram square metres ($kg·m^2$) (Second moment of mass, commonly called the moment of inertia). Note: multiplier “k” is included in this unit symbol for compatibility with IEC 61850-7-3.
dB	79	Sound pressure level in decibels. Note: multiplier “d” is included in this unit symbol for compatibility with IEC 61850-7-3.
WPers	81	Ramp rate in watts per second.
lPers	82	Volumetric flow rate in litres per second.
dBm	83	Power level (logarithmic ratio of signal strength , Bel-mW), normalized to 1mW. Note: multiplier “d” is included in this unit symbol for compatibility with IEC 61850-7-3.
h	84	Time in hours, hour = 60 min = 3600 s.
min	85	Time in minutes, minute = 60 s.
Q	100	Quantity power, Q.
Qh	101	Quantity energy, Qh.
ohmm	102	Resistivity, ohm metres, (rho).

literal	value	description
APerm	103	A/m, magnetic field strength, amperes per metre.
V2h	104	Volt-squared hour, volt-squared-hours.
A2h	105	Ampere-squared hour, ampere-squared hour.
Ah	106	Ampere-hours, ampere-hours.
count	111	Amount of substance, Counter value.
ft3	119	Volume, cubic feet.
m3Perh	125	Volumetric flow rate, cubic metres per hour.
gal	128	Volume in gallons, US gallon (1 gal = 231 in3 = 128 fl ounce).
Btu	132	Energy, British Thermal Units.
l	134	Volume in litres, litre = dm3 = m3/1000.
lPerh	137	Volumetric flow rate, litres per hour.
lPerl	143	Concentration, The ratio of the volume of a solute divided by the volume of the solution. Note: Users may need use a prefix such a 'µ' to express a quantity such as 'µL/L'.
gPerg	144	Concentration, The ratio of the mass of a solute divided by the mass of the solution. Note: Users may need use a prefix such a 'µ' to express a quantity such as 'µg/g'.
molPerm3	145	Concentration, The amount of substance concentration, (c), the amount of solvent in moles divided by the volume of solution in m³.
molPermol	146	Concentration, Molar fraction, the ratio of the molar amount of a solute divided by the molar amount of the solution.
molPerkg	147	Concentration, Molality, the amount of solute in moles and the amount of solvent in kilograms.
sPers	149	Time, Ratio of time. Note: Users may need to supply a prefix such as 'µ' to show rates such as 'µs/s'.
HzPerHz	150	Frequency, rate of frequency change. Note: Users may need to supply a prefix such as 'm' to show rates such as 'mHz/Hz'.
VPerV	151	Voltage, ratio of voltages. Note: Users may need to supply a prefix such as 'm' to show rates such as 'mV/V'.
APerA	152	Current, ratio of amperages. Note: Users may need to supply a prefix such as 'm' to show rates such as 'mA/A'.
VPerVA	153	Power factor, PF, the ratio of the active power to the apparent power. Note: The sign convention used for power factor will differ between IEC meters and EEI (ANSI) meters. It is assumed that the data consumers understand the type of meter being used and agree on the sign convention in use at any given utility.
rev	154	Amount of rotation, revolutions.
kat	158	Catalytic activity, katal = mol / s.
JPerkg	165	Specific energy, Joules / kg.
m3Uncompensated	166	Volume, cubic metres, with the value uncompensated for weather effects.

literal	value	description
m3Compensated	167	Volume, cubic metres, with the value compensated for weather effects.
WPerW	168	Signal Strength, ratio of power. Note: Users may need to supply a prefix such as 'm' to show rates such as 'mW/W'.
therm	169	Energy, therms.
onePerm	173	Wavenumber, reciprocal metres, (1/m).
m3Perkg	174	Specific volume, cubic metres per kilogram, v.
Pas	175	Dynamic viscosity, pascal seconds.
Nm	176	Moment of force, newton metres.
NPerm	177	Surface tension, newton per metre.
radPers2	178	Angular acceleration, radians per second squared.
JPerm3	181	Energy density, joules per cubic metre.
VPerm	182	Electric field strength, volts per metre.
CPerm3	183	Electric charge density, coulombs per cubic metre.
CPerm2	184	Surface charge density, coulombs per square metre.
FPerm	185	Permittivity, farads per metre.
HPerm	186	Permeability, henrys per metre.
JPermol	187	Molar energy, joules per mole.
JPermolK	188	Molar entropy, molar heat capacity, joules per mole kelvin.
CPerkg	189	Exposure (x rays), coulombs per kilogram.
GyPers	190	Absorbed dose rate, grays per second.
WPersr	191	Radiant intensity, watts per steradian.
WPerm2sr	192	Radiance, watts per square metre steradian.
katPerm3	193	Catalytic activity concentration, katals per cubic metre.
d	195	Time in days, day = 24 h = 86400 s.
anglemin	196	Plane angle, minutes.
anglesec	197	Plane angle, seconds.
ha	198	Area, hectares.
tonne	199	Mass in tons, "tonne" or "metric ton" (1000 kg = 1 Mg).
bar	214	Pressure in bars, (1 bar = 100 kPa).
mmHg	215	Pressure, millimetres of mercury (1 mmHg is approximately 133.3 Pa).
M	217	Length, nautical miles (1 M = 1852 m).
kn	219	Speed, knots (1 kn = 1852/3600) m/s.
Mx	276	Magnetic flux, maxwells (1 Mx = 10-8 Wb).
G	277	Magnetic flux density, gausses (1 G = 10-4 T).
Oe	278	Magnetic field in oersteds, (1 Oe = (103/4p) A/m).

literal	value	description
Vh	280	Volt-hour, Volt hours.
WPerA		Active power per current flow, watts per Ampere.
onePerHz		Reciprocal of frequency (1/Hz).
VPerVAr		Power factor, PF, the ratio of the active power to the apparent power. Note: The sign convention used for power factor will differ between IEC meters and EEI (ANSI) meters. It is assumed that the data consumers understand the type of meter being used and agree on the sign convention in use at any given utility.
ohmPerm	86	Electric resistance per length in ohms per metre ((V/A)/m).
kgPerJ		Weight per energy in kilograms per joule (kg/J). Note: multiplier “k” is included in this unit symbol for compatibility with IEC 61850-7-3.
JPers		Energy rate in joules per second (J/s).

3.110 UnitMultiplier enumeration

The unit multipliers defined for the CIM. When applied to unit symbols, the unit symbol is treated as a derived unit. Regardless of the contents of the unit symbol text, the unit symbol shall be treated as if it were a single-character unit symbol. Unit symbols should not contain multipliers, and it should be left to the multiplier to define the multiple for an entire data type. For example, if a unit symbol is "m2Pers" and the multiplier is "k", then the value is k(m**2/s), and the multiplier applies to the entire final value, not to any individual part of the value. This can be conceptualized by substituting a derived unit symbol for the unit type. If one imagines that the symbol "Þ" represents the derived unit "m2Pers", then applying the multiplier "k" can be conceptualized simply as "kÞ".
For example, the SI unit for mass is "kg" and not "g". If the unit symbol is defined as "kg", then the multiplier is applied to "kg" as a whole and does not replace the "k" in front of the "g". In this case, the multiplier of "m" would be used with the unit symbol of "kg" to represent one gram. As a text string, this violates the instructions in IEC 80000-1. However, because the unit symbol in CIM is treated as a derived unit instead of as an SI unit, it makes more sense to conceptualize the "kg" as if it were replaced by one of the proposed replacements for the SI mass symbol. If one imagines that the "kg" were replaced by a symbol "Þ", then it is easier to conceptualize the multiplier "m" as creating the proper unit "mÞ", and not the forbidden unit "mkg".
Table 135 shows all literals of UnitMultiplier.

Table 135 – Literals of RemedialActionProfile::UnitMultiplier

literal	value	description
y	-24	Yocto 10**-24.
z	-21	Zepto 10**-21.
a	-18	Atto 10**-18.
f	-15	Femto 10**-15.
p	-12	Pico 10**-12.
n	-9	Nano 10**-9.
micro	-6	Micro 10**-6.
m	-3	Milli 10**-3.
c	-2	Centi 10**-2.
d	-1	Deci 10**-1.
none	0	No multiplier or equivalently multiply by 1.

literal	value	description
da	1	Deca 10**1.
h	2	Hecto 10**2.
k	3	Kilo 10**3.
M	6	Mega 10**6.
G	9	Giga 10**9.
T	12	Tera 10**12.
P	15	Peta 10**15.
E	18	Exa 10**18.
Z	21	Zetta 10**21.
Y	24	Yotta 10**24.

3.111 (NC) ValueOffsetKind enumeration

The kind of the value offset.
Table 136 shows all literals of ValueOffsetKind.

Table 136 – Literals of RemedialActionProfile::ValueOffsetKind

literal	value	description
absolute		Absolute value.
incremental		Incremental value.

3.112 ActivePower datatype

Product of RMS value of the voltage and the RMS value of the in-phase component of the current.
Table 137 shows all attributes of ActivePower.

Table 137 – Attributes of RemedialActionProfile::ActivePower

name	mult	type	description
multiplier	0..1	UnitMultiplier	
unit	0..1	UnitSymbol	(const=W)
value	0..1	Float	

3.113 PerCent datatype

Percentage on a defined base. For example, specify as 100 to indicate at the defined base.
Table 138 shows all attributes of PerCent.

Table 138 – Attributes of RemedialActionProfile::PerCent

name	mult	type	description
value	0..1	Float	Normally 0 to 100 on a defined base.
unit	0..1	UnitSymbol	(const=none)
multiplier	0..1	UnitMultiplier	(const=none)

3.114 ReactivePower datatype

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

Table 139 shows all attributes of ReactivePower.

Table 139 – Attributes of RemedialActionProfile::ReactivePower

name	mult	type	description
value	0..1	Float	
unit	0..1	UnitSymbol	(const=VAr)
multiplier	0..1	UnitMultiplier	

3.115 Seconds datatype

Time, in seconds.
Table 140 shows all attributes of Seconds.

Table 140 – Attributes of RemedialActionProfile::Seconds

name	mult	type	description
value	0..1	Float	Time, in seconds
unit	0..1	UnitSymbol	(const=s)
multiplier	0..1	UnitMultiplier	(const=none)

3.116 Boolean primitive

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

3.117 Date primitive

Date as "yyyy-mm-dd", which conforms with ISO 8601. UTC time zone is specified as "yyyy-mm-ddZ". A local timezone relative UTC is specified as "yyyy-mm-dd(+/-)hh:mm".

3.118 DateTime primitive

Date and time as "yyyy-mm-ddThh:mm:ss.sss", which conforms with ISO 8601. UTC time zone is specified as "yyyy-mm-ddThh:mm:ss.sssZ". A local timezone relative UTC is specified as "yyyy-mm-ddThh:mm:ss.sss-hh:mm". The second component (shown here as "ss.sss") could have any number of digits in its fractional part to allow any kind of precision beyond seconds.

3.119 Duration primitive

Duration as "PnYnMnDTnHnMnS" which conforms to ISO 8601, where nY expresses a number of years, nM a number of months, nD a number of days. The letter T separates the date expression from the time expression and, after it, nH identifies a number of hours, nM a number of minutes and nS a number of seconds. The number of seconds could be expressed as a decimal number, but all other numbers are integers.

3.120 Float primitive

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

3.121 Integer primitive

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

3.122 (profcim) IRI primitive

An IRI (Internationalized Resource Identifier) within an RDF graph is a Unicode string that conforms to the syntax defined in RFC 3987.
The primitive is serialized as rdf:resource in RDFXML.
IRIs in the RDF abstract syntax must be absolute, and may contain a fragment identifier.
IRI equality: Two IRIs are equal if and only if they are equivalent under Simple String Comparison according to section 5.1 of [RFC3987]. Further normalization must not be performed when comparing IRIs for equality.

IRIs are a generalization of URIs [RFC3986] that permits a wider range of Unicode characters. Every absolute URI and URL is an IRI, but not every IRI is an URI. When IRIs are used in operations that are only defined for URIs, they must first be converted according to the mapping defined in section 3.1 of [RFC3987]. A notable example is retrieval over the HTTP protocol. The mapping involves UTF-8 encoding of non-ASCII characters, %-encoding of octets not allowed in URIs, and Punycode-encoding of domain names.

3.123 String primitive

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

Annex A (informative): Sample data

A.1 General

This Annex is designed to illustrate the profile by using fragments of sample data. It is not meant to be a complete set of examples covering all possibilities of using the profile. Defining a complete set of test data is considered a separate activity to be performed for the purpose of setting up interoperability testing and conformity related to this profile.

A.2 Sample instance data

Test data files are available in the CIM EG SharePoint.