European Network of
Transmission System Operators
for Electricity

REMEDIAL ACTION PROFILE SPECIFICATION

2023-05-10

APPROVED DOCUMENT
VERSION 2.2

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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

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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_NC22v95_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/2.2
- Version info: 2.2.0
- Prior version: http://entsoe.eu/ns/CIM/RemedialAction-EU/2.1
- 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.

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.

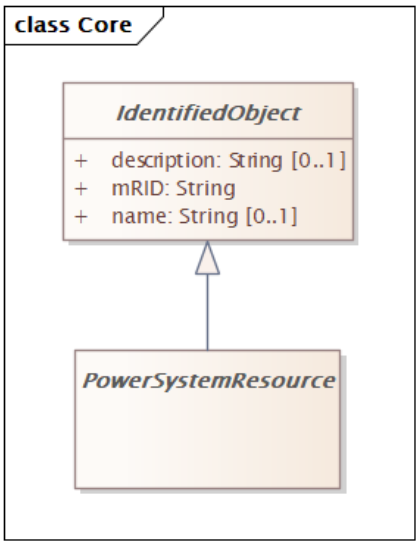
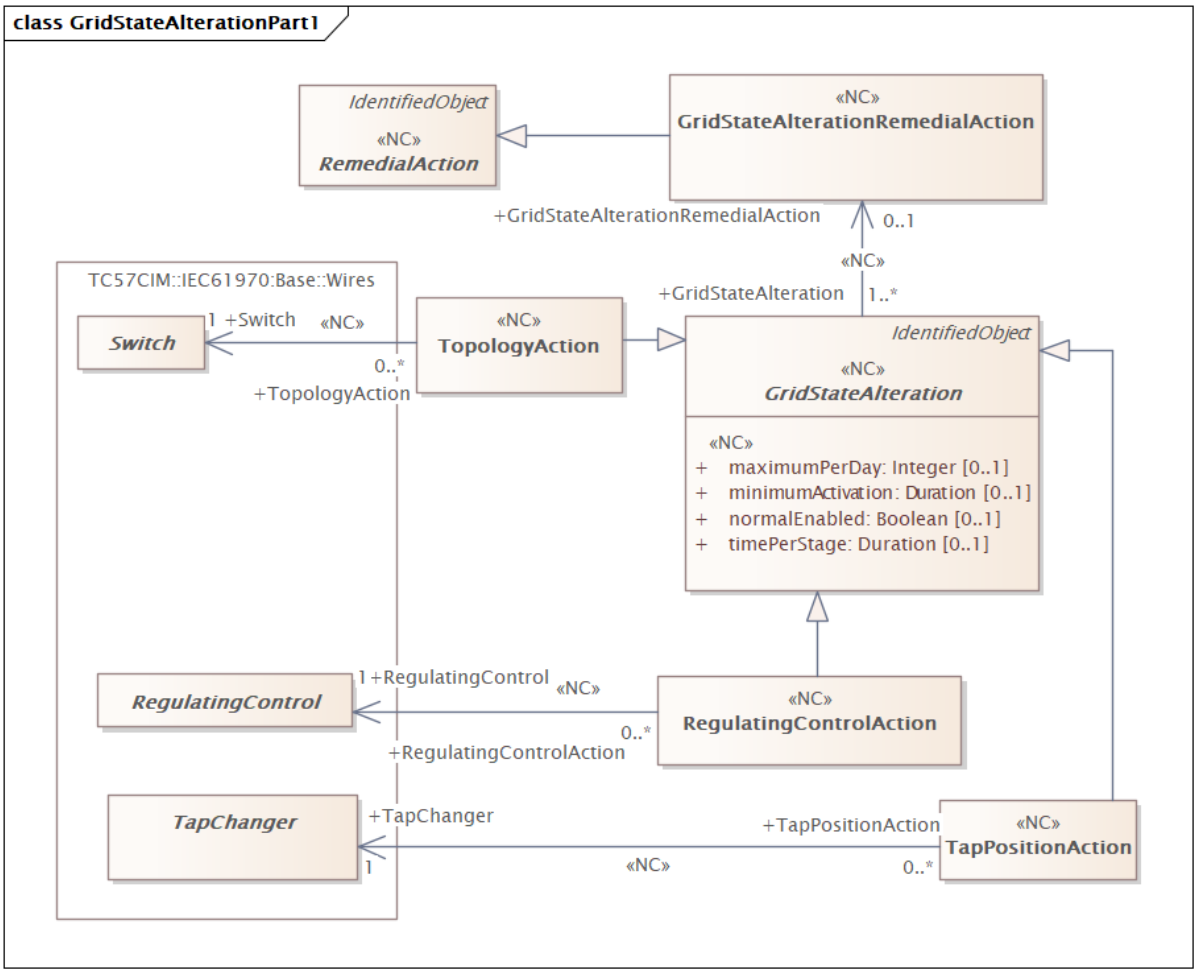


Figure 1 – Class diagram RemedialActionProfile::Core

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



508

509 **Figure 2 – Class diagram RemedialActionProfile::GridStateAlterationPart1**

510 Figure 2: This diagram contains extended classes for the purpose of the remedial action data
511 exchange.

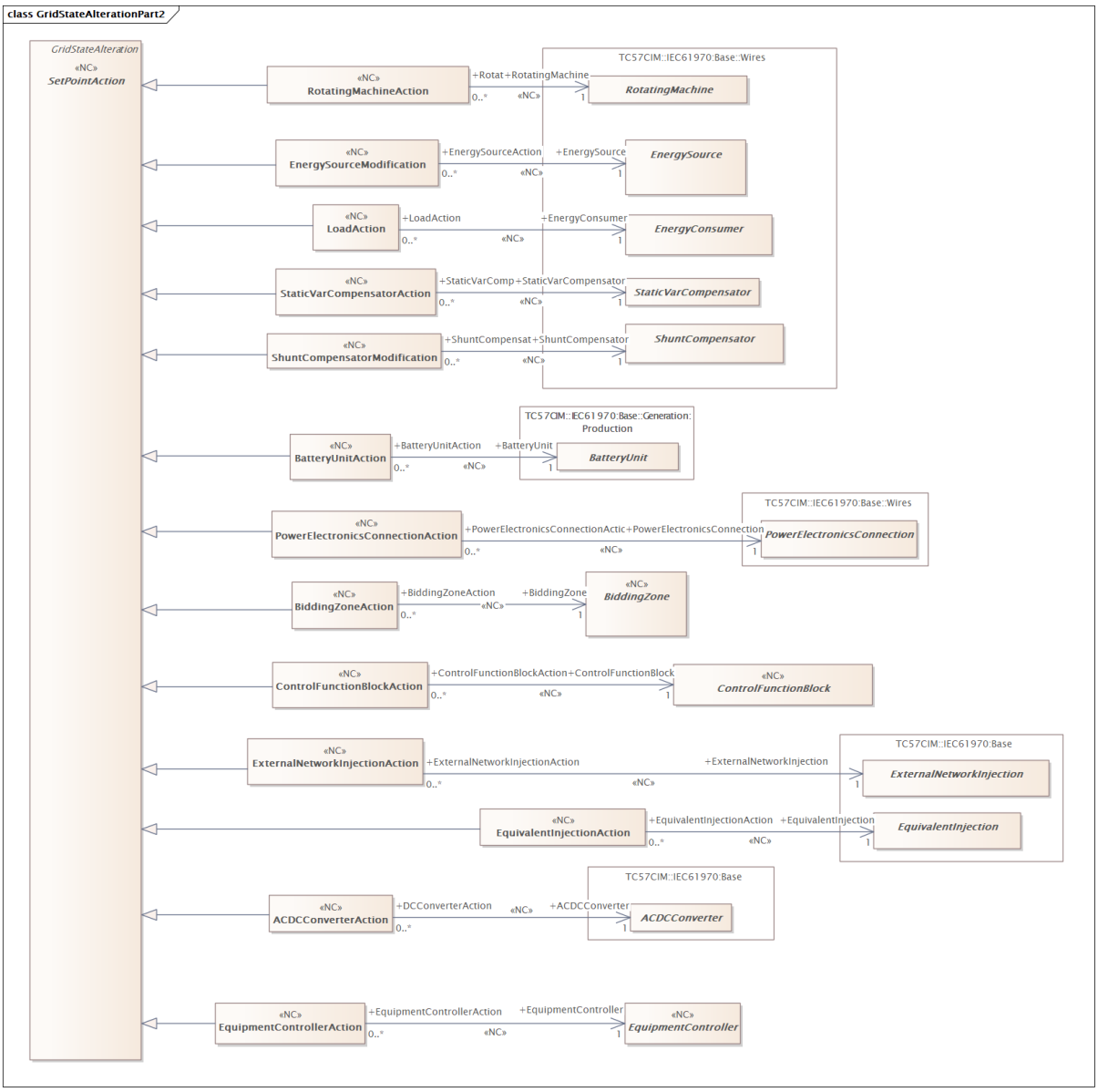


Figure 3 – Class diagram RemedialActionProfile::GridStateAlterationPart2

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

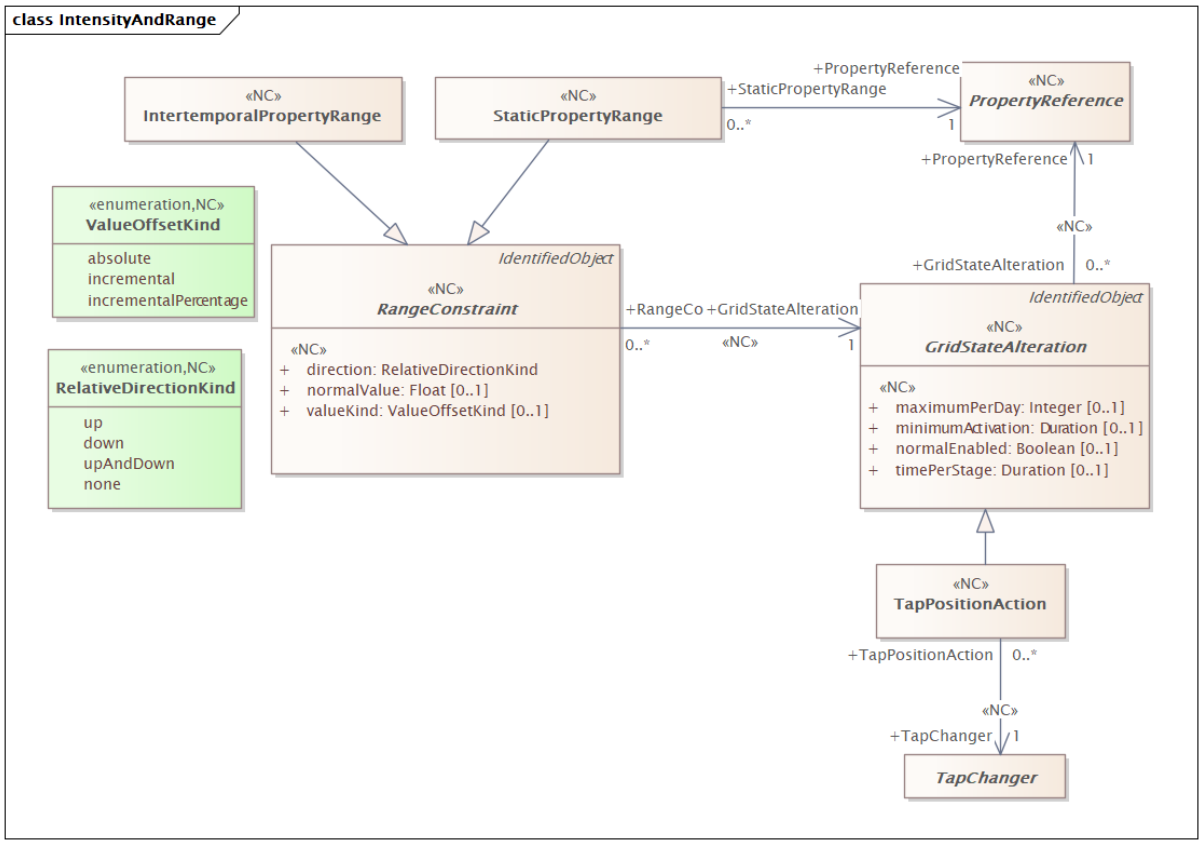


Figure 4 – Class diagram RemedialActionProfile::IntensityAndRange

Figure 4: This diagram contains extended classes related to the modelling of static, dynamic ranges and intensity.

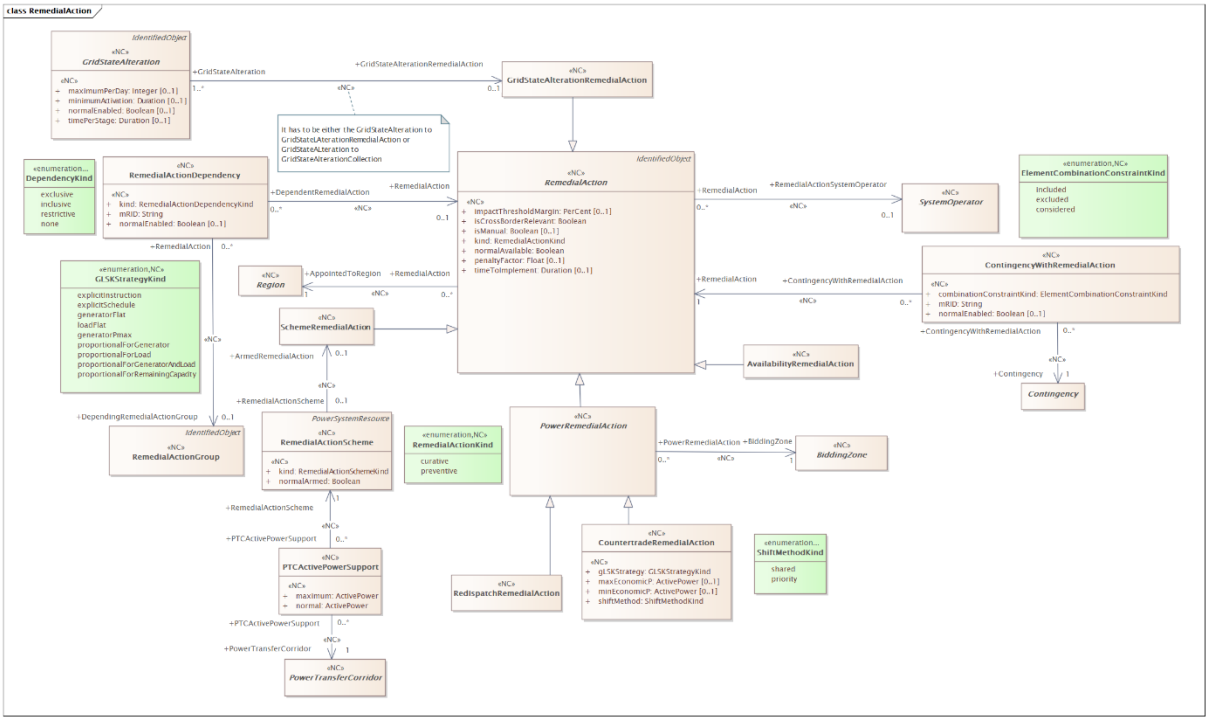


Figure 5 – Class diagram RemedialActionProfile::RemedialAction

Figure 5: The diagram contains main classes related to the remedial action.

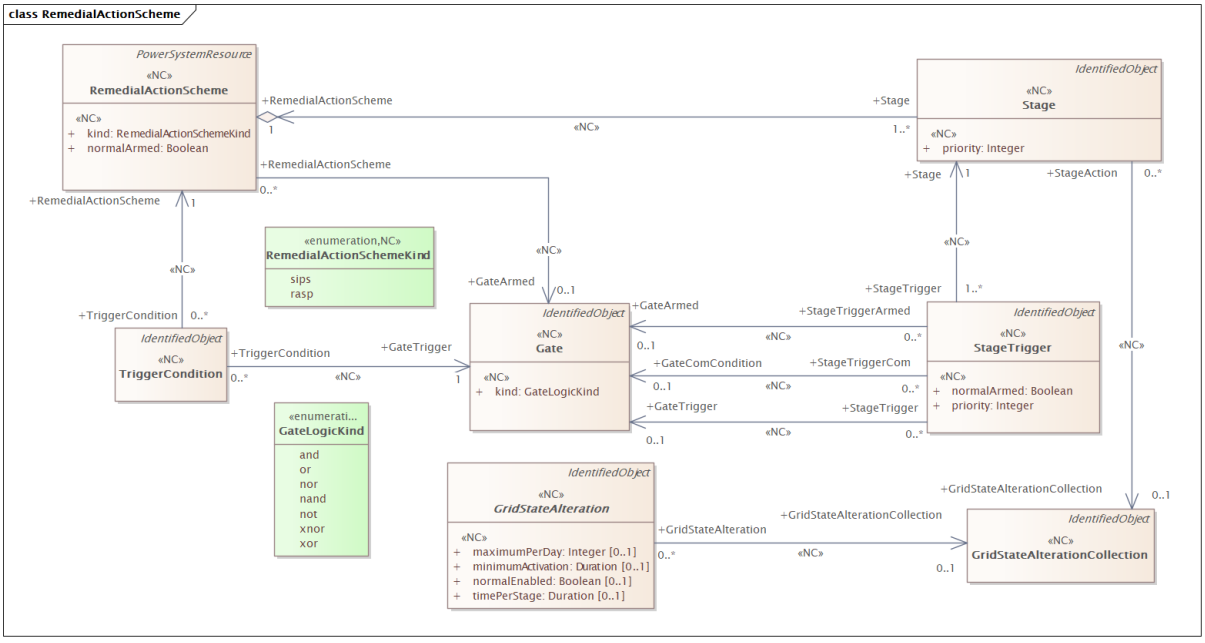


Figure 6 – Class diagram RemedialActionProfile::RemedialActionScheme

Figure 6: The diagram shows remedial action scheme related classes.

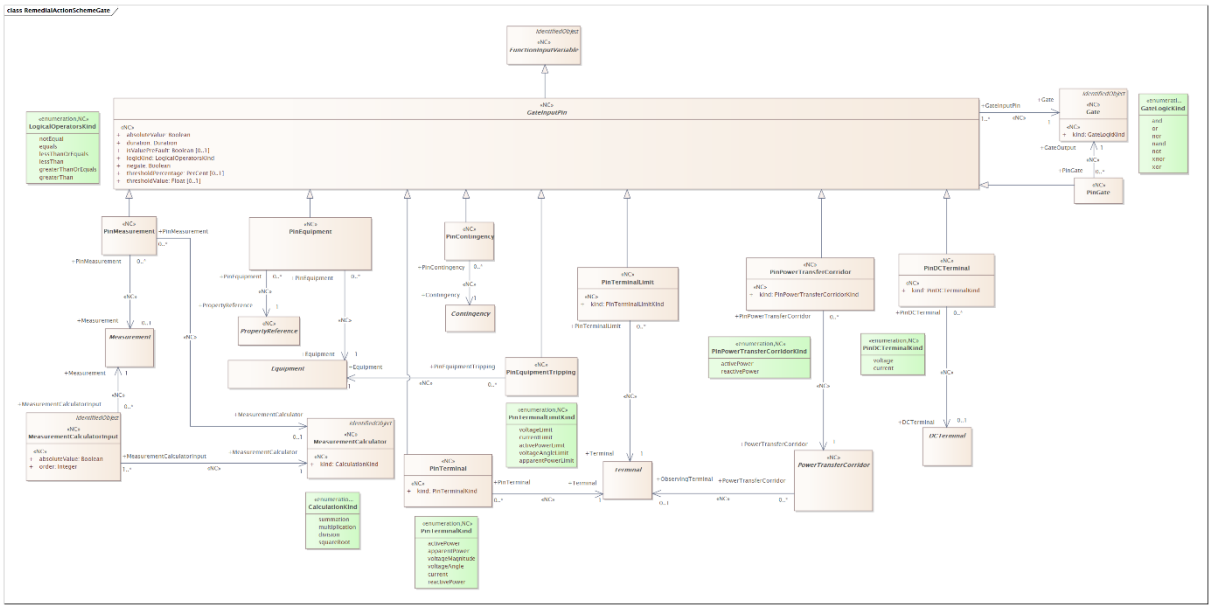


Figure 7 – Class diagram RemedialActionProfile::RemedialActionSchemeGate

Figure 7: The diagram shows remedial action scheme gate 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
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 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.

mult from	name	mult to	type	description
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(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 cancels or reschedules 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
penaltyFactor	0..1	Float	(NC) inherited from: RemedialAction
isCrossBorderRelevant	1..1	Boolean	(NC) inherited from: RemedialAction
isManual	0..1	Boolean	(NC) inherited from: RemedialAction
timeToImplement	0..1	Duration	(NC) inherited from: RemedialAction
impactThresholdMargin	0..1	PerCent	(NC) inherited from: RemedialAction
normalAvailable	1..1	Boolean	(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..*	RemedialActionSystemOperator	0..1	SystemOperator	(NC) inherited from: RemedialAction

3.6 (abstract) BatteryUnit root class

An electrochemical energy storage device.

3.7 (NC) BatteryUnitAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
Battery unit setpoint action.
Table 6 shows all attributes of BatteryUnitAction.

Table 6 – Attributes of RemedialActionProfile::BatteryUnitAction

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 7 shows all association ends of BatteryUnitAction with other classes.

Table 7 – 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.
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration

3.8 (abstract,NC) BiddingZone root class

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.

3.9 (NC) BiddingZoneAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
Bidding zone set point action.
Table 8 shows all attributes of BiddingZoneAction.

Table 8 – Attributes of RemedialActionProfile::BiddingZoneAction

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 9 shows all association ends of BiddingZoneAction with other classes.

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

mult from	name	mult to	type	description
0..*	BiddingZone	1..1	BiddingZone	(NC) The bidding zone that has this bidding zone action.
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration

3.10 (NC) CountertradeRemedialAction

Inheritance path = PowerRemedialAction : 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 10 shows all attributes of CountertradeRemedialAction.

Table 10 – Attributes of RemedialActionProfile::CountertradeRemedialAction

name	mult	type	description
gLSKStrategy	1..1	GLSKStrategyKind	(NC) Generating and load shift keys strategy gives instruction on how the value (Active power) is going to be distributed inside the relevant bidding zone.
shiftMethod	1..1	ShiftMethodKind	(NC) Shift method used for the countertrade action.
maxEconomicP	0..1	ActivePower	(NC) Maximum high economic active power limit, that should not exceed the maximum operating active power limit.
minEconomicP	0..1	ActivePower	(NC) Low economic active power limit that shall be greater than or equal to the minimum operating active power limit.
kind	1..1	RemedialActionKind	(NC) inherited from: RemedialAction
penaltyFactor	0..1	Float	(NC) inherited from: RemedialAction
isCrossBorderRelevant	1..1	Boolean	(NC) inherited from: RemedialAction
isManual	0..1	Boolean	(NC) inherited from: RemedialAction
timeToImplement	0..1	Duration	(NC) inherited from: RemedialAction
impactThresholdMargin	0..1	PerCent	(NC) inherited from: RemedialAction
normalAvailable	1..1	Boolean	(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 11 shows all association ends of CountertradeRemedialAction with other classes.

Table 11 – Association ends of RemedialActionProfile::CountertradeRemedialAction with other classes

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

3.11 (abstract) Contingency root class

An event threatening system reliability, consisting of one or more contingency elements.

3.12 (NC) ContingencyWithRemedialAction root class

Combination of a contingency and a remedial action. ContingencyWithRemedialAction shall not be instantiated for preventive RemedialAction (RemedialAction.kind equals RemedialActionKind.preventive).
Table 12 shows all attributes of ContingencyWithRemedialAction.

Table 12 – Attributes of RemedialActionProfile::ContingencyWithRemedialAction

name	mult	type	description
mRID	1..1	String	(NC) 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.
combinationConstraintKind	1..1	ElementCombinationConstraintKind	(NC) Defines the combination constraint of the Contingency and Remedial Action. If included, this remedial action can only be applied for this contingency. Else if excluded, this remedial action should not be used for this contingency. Else if considered, this remedial action can be considered for this contingency.
normalEnabled	0..1	Boolean	(NC) If true, the contingency with remedial action is enabled, otherwise it is disabled under normal operating conditions.

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

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

mult from	name	mult to	type	description
0..*	Contingency	1..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.

mult from	name	mult to	type	description
0..*	RemedialAction	1..1	RemedialAction	(NC) The remedial action defined for this contingency and remedial action combination.

3.13 (abstract,NC) ControlFunctionBlock root class

Control function block is a function block that contains an algorithm for controlling the equipment.

3.14 (NC) ControlFunctionBlockAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
Action for setting the control function block target values.
Table 14 shows all attributes of ControlFunctionBlockAction.

Table 14 – Attributes of RemedialActionProfile::ControlFunctionBlockAction

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 15 shows all association ends of ControlFunctionBlockAction with other classes.

Table 15 – Association ends of RemedialActionProfile::ControlFunctionBlockAction with other classes

mult from	name	mult to	type	description
0..*	ControlFunctionBlock	1..1	ControlFunctionBlock	(NC) The control function block that is associated with a ControlFunctionBlockAction.
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration

3.15 (abstract) DCTerminal root class

An electrical connection point to generic DC conducting equipment.

3.16 (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.

3.17 (abstract) EnergySource root class

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

3.18 (NC) EnergySourceModification

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject

Energy source action.

Table 16 shows all attributes of EnergySourceModification.

Table 16 – Attributes of RemedialActionProfile::EnergySourceModification

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 17 shows all association ends of EnergySourceModification with other classes.

Table 17 – 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.
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration

3.19 (abstract) Equipment root class

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

3.20 (abstract,NC) EquipmentController root class

Equipment controller is an automation function that can control one or multiple equipment function to achieve all the targets inside the given tolerance.

3.21 (NC) EquipmentControllerAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject

Action for setting the equipment controller action.

Table 18 shows all attributes of EquipmentControllerAction.

Table 18 – Attributes of RemedialActionProfile::EquipmentControllerAction

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 19 shows all association ends of EquipmentControllerAction with other classes.

Table 19 – Association ends of RemedialActionProfile::EquipmentControllerAction with other classes

mult from	name	mult to	type	description
0..*	EquipmentController	1..1	EquipmentController	(NC) Equipment controller that has associated equipment controller actions.
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration

3.22 (abstract) EquivalentInjection root class

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

3.23 (NC) EquivalentInjectionAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
Equivalent injection action.
Table 20 shows all attributes of EquivalentInjectionAction.

Table 20 – Attributes of RemedialActionProfile::EquivalentInjectionAction

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 21 shows all association ends of EquivalentInjectionAction with other classes.

Table 21 – 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.
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration

3.24 (abstract) ExternalNetworkInjection root class

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

3.25 (NC) ExternalNetworkInjectionAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
External network injection action.
Table 22 shows all attributes of ExternalNetworkInjectionAction.

Table 22 – Attributes of RemedialActionProfile::ExternalNetworkInjectionAction

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 23 shows all association ends of ExternalNetworkInjectionAction with other classes.

Table 23 – 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.
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration

3.26 (abstract,NC) FunctionInputVariable

Inheritance path = IdentifiedObject
Functional input variable defines the domain of the function.
Table 24 shows all attributes of FunctionInputVariable.

Table 24 – Attributes of RemedialActionProfile::FunctionInputVariable

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

3.27 (NC) Gate

Inheritance path = IdentifiedObject
Logical gate that supports a logical operation based on the input.
Table 25 shows all attributes of Gate.

693 **Table 25 – 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

694

695 ### 3.28 (abstract,NC) GateInputPin

696 Inheritance path = FunctionInputVariable : IdentifiedObject
697 Input pin for a logical gate. The condition described in the input pin gives a logical true or false.
698 The result from measurement and calculation are converted to a true or false.
699 Table 26 shows all attributes of GateInputPin.

700 **Table 26 – 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).
duration	1..1	Duration	(NC) The time duration for which the condition is satisfied before acting. Default is 0 seconds.
logicKind	1..1	LogicalOperatorsKind	(NC) The logical operator kind used for comparison.
negate	1..1	Boolean	(NC) Invert/negate the result of the comparison.
thresholdPercentage	0..1	PerCent	(NC) The threshold percentage that should be used for compare with the percentage change between input value and threshold value. The allowed value range is [0,100].
thresholdValue	0..1	Float	(NC) The threshold value that should be used for compare with the input value.
isValuePreFault	0..1	Boolean	(NC) Indicates if the gate input pin value is referring to the value prior to a fault (e.g. simulated by a contingency or due to a SIPS activation in a N-x-y case). If it is true, it means that the value is referring to pre-fault. If it is false or not populated, then it is post-fault.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

701
702 Table 27 shows all association ends of GateInputPin with other classes.

703 **Table 27 – 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.

704

705 ### 3.29 (Description) GeneratingUnit root class

706 A single or set of synchronous machines for converting mechanical power into alternating-
707 current power. For example, individual machines within a set may be defined for scheduling
708 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.

3.30 (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 28 shows all attributes of GridStateAlteration.

Table 28 – Attributes of RemedialActionProfile::GridStateAlteration

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) The default/normal value used when other active signal/values are missing.
maximumPerDay	0..1	Integer	(NC) Maximum number of alterations per day.
minimumActivation	0..1	Duration	(NC) Minimum time duration between activating the same grid state alteration.
timePerStage	0..1	Duration	(NC) Time to implement a stage of a grid state alteration. If a grid state alteration consists of multiple stages (e.g. A step on a power transformer), this duration comes in addition to the timeToImplement and need to be multiplied by the number of stages. A stage can also be defined as MW in the case of regulating production.
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 GridStateAlteration with other classes.

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

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

3.31 (NC) GridStateAlterationCollection

Inheritance path = IdentifiedObject

A collection of grid state alterations.

Table 30 shows all attributes of GridStateAlterationCollection.

Table 30 – 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

3.32 (NC) GridStateAlterationRemedialAction

Inheritance path = RemedialAction : IdentifiedObject

Grid state alteration remedial action describes one or many grid state alterations applied to a grid model state or a particular scenario in order to resolve one or more identified constraints.

Table 31 shows all attributes of GridStateAlterationRemedialAction.

Table 31 – Attributes of RemedialActionProfile::GridStateAlterationRemedialAction

name	mult	type	description
kind	1..1	RemedialActionKind	(NC) inherited from: RemedialAction
penaltyFactor	0..1	Float	(NC) inherited from: RemedialAction
isCrossBorderRelevant	1..1	Boolean	(NC) inherited from: RemedialAction
isManual	0..1	Boolean	(NC) inherited from: RemedialAction
timeToImplement	0..1	Duration	(NC) inherited from: RemedialAction
impactThresholdMargin	0..1	PerCent	(NC) inherited from: RemedialAction
normalAvailable	1..1	Boolean	(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 32 shows all association ends of GridStateAlterationRemedialAction with other classes.

Table 32 – 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..*	RemedialActionSystemOperator	0..1	SystemOperator	(NC) inherited from: RemedialAction

3.33 (abstract) IdentifiedObject root class

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

Table 33 shows all attributes of IdentifiedObject.

Table 33 – 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	mult	type	description
name	0..1	String	The name is any free human readable and possibly non unique text naming the object.

3.34 (NC) IntertemporalPropertyRange

Inheritance path = RangeConstraint : IdentifiedObject

It represents the intertemporal range, which means that this is the maximum change of an attribute value between two time stamps or per time unit (e.g. hour). Both up and down directions are defined by the direction attribute, i.e. There are different schedules per direction. The class is not instantiated for PropertyReference which refers to Boolean type attributes.

For instance the following example illustrates the approach:

- A tap changer related grid state alteration having two intertemporal range schedules.
- For a particular point in time, the value from up schedule is 6 and the value from down schedule is 3.
- Then, the GridStateIntensity for the same point in time cannot be more than plus 6 taps from the current, or more than minus 3 taps from the current.

Table 34 shows all attributes of IntertemporalPropertyRange.

Table 34 – Attributes of RemedialActionProfile::IntertemporalPropertyRange

name	mult	type	description
direction	1..1	RelativeDirectionKind	(NC) inherited from: RangeConstraint
valueKind	0..1	ValueOffsetKind	(NC) inherited from: RangeConstraint
normalValue	0..1	Float	(NC) inherited from: RangeConstraint
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 35 shows all association ends of IntertemporalPropertyRange with other classes.

Table 35 – Association ends of RemedialActionProfile::IntertemporalPropertyRange with other classes

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

3.35 (Description) Line root class

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

3.36 (NC) LoadAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject

Load action.

Table 36 shows all attributes of LoadAction.

Table 36 – Attributes of RemedialActionProfile::LoadAction

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 37 shows all association ends of LoadAction with other classes.

Table 37 – 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.
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration

3.37 (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.

3.38 (NC) MeasurementCalculator

Inheritance path = IdentifiedObject
Result of a calculation of one or more measurement.
Table 38 shows all attributes of MeasurementCalculator.

Table 38 – 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

3.39 (NC) MeasurementCalculatorInput

Inheritance path = IdentifiedObject

Input to measurement calculation. It supports Analog, Discrete and Accumulator measurements.

Table 39 shows all attributes of MeasurementCalculatorInput.

Table 39 – 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 40 shows all association ends of MeasurementCalculatorInput with other classes.

Table 40 – 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.

3.40 (NC) PinContingency

Inheritance path = GateInputPin : FunctionInputVariable : IdentifiedObject

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

Table 41 shows all attributes of PinContingency.

Table 41 – Attributes of RemedialActionProfile::PinContingency

name	mult	type	description
absoluteValue	1..1	Boolean	(NC) inherited from: GateInputPin
duration	1..1	Duration	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	0..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	0..1	Float	(NC) inherited from: GateInputPin
isValuePreFault	0..1	Boolean	(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 42 shows all association ends of PinContingency with other classes.

818 **Table 42 – Association ends of RemedialActionProfile::PinContingency with other**
819 **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

820

821 ### 3.41 (NC) PinDCTerminal

822 Inheritance path = GateInputPin : FunctionInputVariable : IdentifiedObject
823 Input pin associated with a DCTerminal. It is used for comparison.
824 Table 43 shows all attributes of PinDCTerminal.

825 **Table 43 – 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
duration	1..1	Duration	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	0..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	0..1	Float	(NC) inherited from: GateInputPin
isValuePreFault	0..1	Boolean	(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

826
827 Table 44 shows all association ends of PinDCTerminal with other classes.

828 **Table 44 – Association ends of RemedialActionProfile::PinDCTerminal with other**
829 **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

830

831 ### 3.42 (NC) PinEquipment

832 Inheritance path = GateInputPin : FunctionInputVariable : IdentifiedObject
833 Input pin associated with an Equipment. It is used for the comparison.
834 Table 45 shows all attributes of PinEquipment.

835 **Table 45 – Attributes of RemedialActionProfile::PinEquipment**

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

name	mult	type	description
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	0..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	0..1	Float	(NC) inherited from: GateInputPin
isValuePreFault	0..1	Boolean	(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 46 shows all association ends of PinEquipment with other classes.

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

mult from	name	mult to	type	description
0..*	Equipment	1..1	Equipment	(NC) The Equipment that is used in the input pin.
0..*	PropertyReference	1..1	PropertyReference	(NC) The property reference for this pin equipment.
1..*	Gate	1..1	Gate	(NC) inherited from: GateInputPin

3.43 (NC) PinEquipmentTripping

Inheritance path = GateInputPin : FunctionInputVariable : IdentifiedObject

Input pin associated with an Equipment. It is used to determine if the equipment is tripped between two consecutive stages, i.e. the equipment is in service at pre-fault stage and it is out of service at post-fault stage.

Table 47 shows all attributes of PinEquipmentTripping.

Table 47 – Attributes of RemedialActionProfile::PinEquipmentTripping

name	mult	type	description
absoluteValue	1..1	Boolean	(NC) inherited from: GateInputPin
duration	1..1	Duration	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	0..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	0..1	Float	(NC) inherited from: GateInputPin
isValuePreFault	0..1	Boolean	(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 48 shows all association ends of PinEquipmentTripping with other classes.

Table 48 – Association ends of RemedialActionProfile::PinEquipmentTripping with other classes

mult from	name	mult to	type	description
0..*	Equipment	1..1	Equipment	(NC) Equipment that is tripped.
1..*	Gate	1..1	Gate	(NC) inherited from: GateInputPin

3.44 (NC) PinGate

Inheritance path = GateInputPin : FunctionInputVariable : IdentifiedObject
An output from one gate represents an input to another gate.
Table 49 shows all attributes of PinGate.

Table 49 – Attributes of RemedialActionProfile::PinGate

name	mult	type	description
absoluteValue	1..1	Boolean	(NC) inherited from: GateInputPin
duration	1..1	Duration	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	0..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	0..1	Float	(NC) inherited from: GateInputPin
isValuePreFault	0..1	Boolean	(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 50 shows all association ends of PinGate with other classes.

Table 50 – 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

3.45 (NC) PinMeasurement

Inheritance path = GateInputPin : FunctionInputVariable : IdentifiedObject
Input pin associated with a Measurement. It is used for comparison.
Table 51 shows all attributes of PinMeasurement.

Table 51 – Attributes of RemedialActionProfile::PinMeasurement

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

name	mult	type	description
thresholdValue	0..1	Float	(NC) inherited from: GateInputPin
isValuePreFault	0..1	Boolean	(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 52 shows all association ends of PinMeasurement with other classes.

Table 52 – 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

3.46 (NC) PinPowerTransferCorridor

Inheritance path = GateInputPin : FunctionInputVariable : IdentifiedObject
Input pin associated with a PowerTransferCorridor. It is used for comparison.
Table 53 shows all attributes of PinPowerTransferCorridor.

Table 53 – 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
duration	1..1	Duration	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	0..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	0..1	Float	(NC) inherited from: GateInputPin
isValuePreFault	0..1	Boolean	(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 54 shows all association ends of PinPowerTransferCorridor with other classes.

Table 54 – 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.

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

3.47 (NC) PinTerminal

Inheritance path = GateInputPin : FunctionInputVariable : IdentifiedObject
Input pin associated with a Terminal. It is used for comparison.
Table 55 shows all attributes of PinTerminal.

Table 55 – 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
duration	1..1	Duration	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	0..1	PerCent	(NC) inherited from: GateInputPin
thresholdValue	0..1	Float	(NC) inherited from: GateInputPin
isValuePreFault	0..1	Boolean	(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 56 shows all association ends of PinTerminal with other classes.

Table 56 – 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

3.48 (NC) PinTerminalLimit

Inheritance path = GateInputPin : FunctionInputVariable : IdentifiedObject
Input pin associated with the limits of a Terminal. It is used for comparison.
Table 57 shows all attributes of PinTerminalLimit.

Table 57 – 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
duration	1..1	Duration	(NC) inherited from: GateInputPin
logicKind	1..1	LogicalOperatorsKind	(NC) inherited from: GateInputPin
negate	1..1	Boolean	(NC) inherited from: GateInputPin
thresholdPercentage	0..1	PerCent	(NC) inherited from: GateInputPin

name	mult	type	description
thresholdValue	0..1	Float	(NC) inherited from: GateInputPin
isValuePreFault	0..1	Boolean	(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 58 shows all association ends of PinTerminalLimit with other classes.

Table 58 – 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

3.49 (abstract) PowerElectronicsConnection root class

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

3.50 (NC) PowerElectronicsConnectionAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
Power electronics setpoint action.
Table 59 shows all attributes of PowerElectronicsConnectionAction.

Table 59 – Attributes of RemedialActionProfile::PowerElectronicsConnectionAction

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 60 shows all association ends of PowerElectronicsConnectionAction with other classes.

Table 60 – 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.
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration

3.51 (abstract,NC) PowerRemedialAction

Inheritance path = RemedialAction : IdentifiedObject

Energy remedial action describes actions to rearrange power schedules.

Table 61 shows all attributes of PowerRemedialAction.

Table 61 – Attributes of RemedialActionProfile::PowerRemedialAction

name	mult	type	description
kind	1..1	RemedialActionKind	(NC) inherited from: RemedialAction
penaltyFactor	0..1	Float	(NC) inherited from: RemedialAction
isCrossBorderRelevant	1..1	Boolean	(NC) inherited from: RemedialAction
isManual	0..1	Boolean	(NC) inherited from: RemedialAction
timeToImplement	0..1	Duration	(NC) inherited from: RemedialAction
impactThresholdMargin	0..1	PerCent	(NC) inherited from: RemedialAction
normalAvailable	1..1	Boolean	(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 62 shows all association ends of PowerRemedialAction with other classes.

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

mult from	name	mult to	type	description
0..*	BiddingZone	1..1	BiddingZone	(NC) The Bidding Zone where the power remedial action is done.
0..*	AppointedToRegion	1..1	Region	(NC) inherited from: RemedialAction
0..*	RemedialActionSystemOperator	0..1	SystemOperator	(NC) inherited from: RemedialAction

3.52 (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 63 shows all attributes of PowerSystemResource.

Table 63 – 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

3.53 (abstract,NC) PowerTransferCorridor root class

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 64 shows all association ends of PowerTransferCorridor with other classes.

Table 64 – 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.

3.54 (abstract,NC) PropertyReference root class

The reference to a class and one of its properties.

3.55 (NC) PTCActivePowerSupport root class

Defines the active power capability (support) of the scheme in relation to a PowerTransferCorridor.
Table 65 shows all attributes of PTCActivePowerSupport.

Table 65 – 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 66 shows all association ends of PTCActivePowerSupport with other classes.

Table 66 – 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.

3.56 (abstract,NC) RangeConstraint

Inheritance path = IdentifiedObject
Defines the rage constraint.
Table 67 shows all attributes of RangeConstraint.

956 **Table 67 – Attributes of RemedialActionProfile::RangeConstraint**

name	mult	type	description
direction	1..1	RelativeDirectionKind	(NC) Defines the direction of the attribute value referenced by the PropertyReference.
valueKind	0..1	ValueOffsetKind	(NC) Kind of value offset for the range that applies to the attribute referenced by the PropertyReference.
normalValue	0..1	Float	(NC) The normal (initial) value. The meaning of the value is defined by the attribute referenced by the PropertyReference. The value can be integer, float or boolean. In case of boolean 1 equals true and 0 equals false. If the valueKind is incremental or incrementalPercentage, then the value shall be positive (greater than zero). If the valueKind is incrementalPercentage, then the value shall be in the range [0, 100].
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

957

958 Table 68 shows all association ends of RangeConstraint with other classes.

959 **Table 68 – Association ends of RemedialActionProfile::RangeConstraint with other**
960 **classes**

mult from	name	mult to	type	description
0..*	GridStateAlteration	1..1	GridStateAlteration	(NC) The grid state alteration which has static range.

961

962 ## 3.57 (NC) RedispatchRemedialAction

963 Inheritance path = PowerRemedialAction : RemedialAction : IdentifiedObject
964 Redispatch remedial action is a remedial action that through rearranging power schedules is
965 eliminating breaches of constraints.
966 Table 69 shows all attributes of RedispatchRemedialAction.

967 **Table 69 – Attributes of RemedialActionProfile::RedispatchRemedialAction**

name	mult	type	description
kind	1..1	RemedialActionKind	(NC) inherited from: RemedialAction
penaltyFactor	0..1	Float	(NC) inherited from: RemedialAction
isCrossBorderRelevant	1..1	Boolean	(NC) inherited from: RemedialAction
isManual	0..1	Boolean	(NC) inherited from: RemedialAction
timeToImplement	0..1	Duration	(NC) inherited from: RemedialAction
impactThresholdMargin	0..1	PerCent	(NC) inherited from: RemedialAction
normalAvailable	1..1	Boolean	(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

968

969 Table 70 shows all association ends of RedispatchRemedialAction with other classes.

970 **Table 70 – Association ends of RemedialActionProfile::RedispatchRemedialAction with**
971 **other classes**

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

972

973 ### 3.58 (abstract,NC) Region root class

974 A region where the system operator belongs to.

975 ### 3.59 (abstract) RegulatingControl root class

976 Specifies a set of equipment that works together to control a power system quantity such as
977 voltage or flow.
978 Remote bus voltage control is possible by specifying the controlled terminal located at some
979 place remote from the controlling equipment.
980 The specified terminal shall be associated with the connectivity node of the controlled point.
981 The most specific subtype of RegulatingControl shall be used in case such equipment
982 participate in the control, e.g. TapChangerControl for tap changers.
983 For flow control, load sign convention is used, i.e. positive sign means flow out from a
984 TopologicalNode (bus) into the conducting equipment.
985 The attribute minAllowedTargetValue and maxAllowedTargetValue are required in the following
986 cases:
987 - For a power generating module operated in power factor control mode to specify maximum
988 and minimum power factor values;
989 - Whenever it is necessary to have an off center target voltage for the tap changer regulator.
990 For instance, due to long cables to off shore wind farms and the need to have a simpler setup
991 at the off shore transformer platform, the voltage is controlled from the land at the connection
992 point for the off shore wind farm. Since there usually is a voltage rise along the cable, there is
993 typical and overvoltage of up 3-4 kV compared to the on shore station. Thus in normal operation
994 the tap changer on the on shore station is operated with a target set point, which is in the lower
995 parts of the dead band.
996 The attributes minAllowedTargetValue and maxAllowedTargetValue are not related to the
997 attribute targetDeadband and thus they are not treated as an alternative of the targetDeadband.
998 They are needed due to limitations in the local substation controller. The attribute
999 targetDeadband is used to prevent the power flow from move the tap position in circles (hunting)
1000 that is to be used regardless of the attributes minAllowedTargetValue and
1001 maxAllowedTargetValue.

1002 ### 3.60 (NC) RegulatingControlAction

1003 Inheritance path = GridStateAlteration : IdentifiedObject
1004 Control action means the set point change of a regulating control power system resource in the
1005 grid model compared to the base case.
1006 Table 71 shows all attributes of RegulatingControlAction.

1007 **Table 71 – Attributes of RemedialActionProfile::RegulatingControlAction**

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 72 shows all association ends of RegulatingControlAction with other classes.

Table 72 – 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.
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration

3.61 (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 73 shows all attributes of RemedialAction.

Table 73 – Attributes of RemedialActionProfile::RemedialAction

name	mult	type	description
kind	1..1	RemedialActionKind	(NC) The kind of the remedial action. If curative remedial action, it is required to have an association with ContingencyWithRemedialAction. If preventive remedial action, RemedialAction class shall not have association with ContingencyWithRemedialAction.
penaltyFactor	0..1	Float	(NC) Defines the relative penalty for a given remedial action. This is a positive number greater than zero and default is one, meaning the remedial action does not have negative nor positive effect on the quality of the solution. A remedial action that provide changes in the transmission loss can have negative (Between zero and one) or positive effect (Bigger than one) given by 1 / (1 – Incremental Transmission Loss). In a similar way remedial action using generating units or compensation units can have negative or positive effect. Typical value would be between 0.8 and 1.1.
isCrossBorderRelevant	1..1	Boolean	(NC) Indicates if the remedial action is cross border relevant. True, means that the remedial action is cross border relevant.
isManual	0..1	Boolean	(NC) Indicates if the remedial action is manually executed which involves one or many actions performed by human. A SIPS remedial action cannot be manual. True, means that the remedial action is manual. False, means that the

name	mult	type	description
			remedial action is automatically executed without human communication.
timeToImplement	0..1	Duration	(NC) Time to implement a remedial action.
impactThresholdMargin	0..1	PerCent	(NC) Impact threshold margin for the use of the remedial action. Meaning that the remedial action should not be used if it cannot resolve violation with more than the given impact threshold margin. The allowed value range is [0,100].
normalAvailable	1..1	Boolean	(NC) It identifies if the remedial action is available under normal condition. True means available, False means unavailable.
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 RemedialAction with other classes.

Table 74 – 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..*	RemedialActionSystemOperator	0..1	SystemOperator	(NC) System operator operating remedial actions.

3.62 (NC) RemedialActionDependency root class

Remedial action dependency is making two remedial actions depending on each other. Multiple dependency is done by multiple instances of this class. The dependency can arrive by having one of the following examples.
- The dependent remedial action is controlled by different system operator (Modeling Authority) (e.g. SIPS that goes across control area).
- The dependent remedial action is representing two or more remedial action that represent the same grid state alteration but with different modeling resolution (e.g. detail direct current model versus a simplified model).
- The remedial action can be combined with other remedial action without the need to create multiple remedial action with the same grid alteration for enabling dependency.

Table 75 shows all attributes of RemedialActionDependency.

Table 75 – Attributes of RemedialActionProfile::RemedialActionDependency

name	mult	type	description
kind	1..1	RemedialActionDependencyKind	(NC) Type of dependency between two remedial actions.
mRID	1..1	String	(NC) 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	mult	type	description
normalEnabled	0..1	Boolean	(NC) If true, the remedial action dependency with contingency shall be considered under normal operating conditions.

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

Table 76 – Association ends of RemedialActionProfile::RemedialActionDependency with other classes

mult from	name	mult to	type	description
0..*	RemedialAction	0..1	RemedialAction	(NC) Remedial action which has dependent remedial actions.
0..*	DependingRemedialActionGroup	0..1	RemedialActionGroup	(NC) Remedial action group which the remedial action is depending on.

3.63 (NC) RemedialActionGroup

Inheritance path = IdentifiedObject
Grouping of remedial actions that can be operated together.
Table 77 shows all attributes of RemedialActionGroup.

Table 77 – Attributes of RemedialActionProfile::RemedialActionGroup

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

3.64 (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 78 shows all attributes of RemedialActionScheme.

Table 78 – 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 79 shows all association ends of RemedialActionScheme with other classes.

Table 79 – 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.
0..1	ArmedRemedialAction	0..1	SchemeRemedialAction	(NC) Armed remedial action for a remedial action scheme.

3.65 (abstract) RotatingMachine root class

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

3.66 (NC) RotatingMachineAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
Rotating machine action.
Table 80 shows all attributes of RotatingMachineAction.

Table 80 – Attributes of RemedialActionProfile::RotatingMachineAction

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 81 shows all association ends of RotatingMachineAction with other classes.

Table 81 – 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.
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration

3.67 (NC) SchemeRemedialAction

Inheritance path = RemedialAction : IdentifiedObject
Scheme remedial action is remedial action that involves a scheme that can include conditional logic and stages of grid alteration. 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 82 shows all attributes of SchemeRemedialAction.

Table 82 – Attributes of RemedialActionProfile::SchemeRemedialAction

name	mult	type	description
kind	1..1	RemedialActionKind	(NC) inherited from: RemedialAction
penaltyFactor	0..1	Float	(NC) inherited from: RemedialAction
isCrossBorderRelevant	1..1	Boolean	(NC) inherited from: RemedialAction
isManual	0..1	Boolean	(NC) inherited from: RemedialAction
timeToImplement	0..1	Duration	(NC) inherited from: RemedialAction
impactThresholdMargin	0..1	PerCent	(NC) inherited from: RemedialAction
normalAvailable	1..1	Boolean	(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 83 shows all association ends of SchemeRemedialAction with other classes.

Table 83 – 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..*	RemedialActionSystemOperator	0..1	SystemOperator	(NC) inherited from: RemedialAction

3.68 (abstract,NC) SetPointAction

Inheritance path = GridStateAlteration : IdentifiedObject

Setpoint action.

Table 84 shows all attributes of SetPointAction.

Table 84 – Attributes of RemedialActionProfile::SetPointAction

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 85 shows all association ends of SetPointAction with other classes.

Table 85 – Association ends of RemedialActionProfile::SetPointAction with other classes

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

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

3.69 (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.

3.70 (NC) ShuntCompensatorModification

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject
Shunt compensator action.
Table 86 shows all attributes of ShuntCompensatorModification.

Table 86 – Attributes of RemedialActionProfile::ShuntCompensatorModification

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 87 shows all association ends of ShuntCompensatorModification with other classes.

Table 87 – 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.
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration

3.71 (NC) SolarRadiationDependencyCurve root class

A curve or functional relationship between
- the solar radiation independent variable (X-axis), and
- relative dependent (Y-axis) variables.

3.72 (NC) Stage

Inheritance path = IdentifiedObject
Stage of a remedial action scheme.
Table 88 shows all attributes of Stage.

Table 88 – 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 89 shows all association ends of Stage with other classes.

Table 89 – 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.

3.73 (NC) StageTrigger

Inheritance path = IdentifiedObject

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

Table 90 shows all attributes of StageTrigger.

Table 90 – 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 91 shows all association ends of StageTrigger with other classes.

Table 91 – 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.
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.

3.74 (NC) StaticPropertyRange

Inheritance path = RangeConstraint : IdentifiedObject

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

In case that the PropertyReference refers to Boolean type attributes, RangeConstraint.direction shall be none or upAndDown and the RangeConstraint.valueKind shall be absolute. If the direction is none then optimization of the attribute referenced by the PropertyReference is not possible if the current status is already as the value in the range. Otherwise if the direction is upAndDown, the optimization can change from true to false or vice versa independently of the initial value in the operational scenario.

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

Table 92 shows all attributes of StaticPropertyRange.

Table 92 – Attributes of RemedialActionProfile::StaticPropertyRange

name	mult	type	description
direction	1..1	RelativeDirectionKind	(NC) inherited from: RangeConstraint
valueKind	0..1	ValueOffsetKind	(NC) inherited from: RangeConstraint
normalValue	0..1	Float	(NC) inherited from: RangeConstraint
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 StaticPropertyRange with other classes.

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

mult from	name	mult to	type	description
0..*	PropertyReference	1..1	PropertyReference	Property reference for this static property range.
0..*	GridStateAlteration	1..1	GridStateAlteration	(NC) inherited from: RangeConstraint

3.75 (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.

3.76 (NC) StaticVarCompensatorAction

Inheritance path = SetPointAction : GridStateAlteration : IdentifiedObject

Static Var compensator action.

Table 94 shows all attributes of StaticVarCompensatorAction.

Table 94 – Attributes of RemedialActionProfile::StaticVarCompensatorAction

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 95 shows all association ends of StaticVarCompensatorAction with other classes.

Table 95 – 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.
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration

3.77 (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.

3.78 (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.

3.79 (abstract,NC) SystemOperator root class

System operator.

3.80 (abstract) TapChanger root class

Mechanism for changing transformer winding tap positions.

3.81 (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 96 shows all attributes of TapPositionAction.

Table 96 – Attributes of RemedialActionProfile::TapPositionAction

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration

name	mult	type	description
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 97 shows all association ends of TapPositionAction with other classes.

Table 97 – 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.
1..*	GridStateAlterationRemedialAction	0..1	GridStateAlterationRemedialAction	(NC) inherited from: GridStateAlteration
0..*	PropertyReference	1..1	PropertyReference	(NC) inherited from: GridStateAlteration
0..*	GridStateAlterationCollection	0..1	GridStateAlterationCollection	(NC) inherited from: GridStateAlteration

3.82 (abstract) Terminal root class

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

3.83 (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 98 shows all attributes of TopologyAction.

Table 98 – Attributes of RemedialActionProfile::TopologyAction

name	mult	type	description
normalEnabled	0..1	Boolean	(NC) inherited from: GridStateAlteration
maximumPerDay	0..1	Integer	(NC) inherited from: GridStateAlteration
minimumActivation	0..1	Duration	(NC) inherited from: GridStateAlteration
timePerStage	0..1	Duration	(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 99 shows all association ends of TopologyAction with other classes.

Table 99 – 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.

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

3.84 (NC) TriggerCondition

Inheritance path = IdentifiedObject

The condition that triggers a remedial action scheme.

Table 100 shows all attributes of TriggerCondition.

Table 100 – 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 101 shows all association ends of TriggerCondition with other classes.

Table 101 – 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.

3.85 (NC) CalculationKind enumeration

Kind of calculation operation that can be done to Measurement.

Table 102 shows all literals of CalculationKind.

Table 102 – 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).

3.86 Currency enumeration

Monetary currencies. ISO 4217 standard including 3-character currency code.

Table 103 shows all literals of Currency.

1228 **Table 103 – 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.
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.

literal	value	description
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.
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.

literal	value	description
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.
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.

literal	value	description
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.
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.

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3.87 (NC) DependencyKind enumeration

Kind of dependency between remedial actions.
Table 104 shows all literals of DependencyKind.

Table 104 – Literals of RemedialActionProfile::DependencyKind

literal	value	description
exclusive		Remedial actions are exclusive depending on each other. e.g. Only one of the remedial actions can be selected at the same time.
inclusive		Remedial actions are inclusive depending on each other. e.g. Both remedial action need to be picked if one of them is needed.
restrictive		Remedial actions are restrictive depending on each other. The need to include or to exclude might depend on the model. e.g. In the case of simplified DC model and detailed DC model. In the case where the simplified remedial action is used but not the remedial action for the detail model and opposite for the DC model.
none		Remedial actions are not depending on each other. However, the two remedial actions should be evaluated together.

3.88 (NC) ElementCombinationConstraintKind enumeration

Kind of constraint for an element combination.
Table 105 shows all literals of ElementCombinationConstraintKind.

Table 105 – Literals of RemedialActionProfile::ElementCombinationConstraintKind

literal	value	description
included		Element combination is included.
excluded		Element combination is excluded.
considered		Element combination can be considered.

3.89 (NC) GateLogicKind enumeration

Define the different logical operations.
Table 106 shows all literals of GateLogicKind.

Table 106 – 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.

literal	value	description
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.

3.90 (NC) GLSKStrategyKind enumeration

Kind of generating and load shift keys strategy.
Table 107 shows all literals of GLSKStrategyKind.

Table 107 – Literals of RemedialActionProfile::GLSKStrategyKind

literal	value	description
explicitInstruction		The distribution is done according to the individual participation factor on the unit.
explicitSchedule		The distribution is explicitly done according to the GLSK Energy Bid Schedule.
generatorFlat		Flat adjustment on all active generators.
loadFlat		Flat adjustment on all active loads.
generatorPmax		The distribution is relative to the maximum p of the generator.
proportionalForGenerator		The distribution is proportional to the generator active power in the given case.
proportionalForLoad		The distribution is proportional to the load active power in the given case.
proportionalForGeneratorAndLoad		The distribution is proportional to the generator and load active power in the given case.
proportionalForRemainingCapacity		The distribution is proportional to the remaining capacity for generators in the given case.

3.91 (NC) LogicalOperatorsKind enumeration

Kinds of logical operators for comparison.
Table 108 shows all literals of LogicalOperatorsKind.

Table 108 – Literals of RemedialActionProfile::LogicalOperatorsKind

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

3.92 (NC) PinDCTerminalKind enumeration

The kind of quantities that can serve as an input value for the DCTerminal pin.
Table 109 shows all literals of PinDCTerminalKind.

Table 109 – Literals of RemedialActionProfile::PinDCTerminalKind

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

3.93 (NC) PinPowerTransferCorridorKind enumeration

The kind of quantities that can serve as an input value for the PowerTransferCorridor pin.
Table 110 shows all literals of PinPowerTransferCorridorKind.

Table 110 – Literals of RemedialActionProfile::PinPowerTransferCorridorKind

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

3.94 (NC) PinTerminalKind enumeration

The kind of quantities that can serve as an input value for the pin.
Table 111 shows all literals of PinTerminalKind.

Table 111 – 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.

3.95 (NC) PinTerminalLimitKind enumeration

The kind of limits that can serve as an input value for the pin.
Table 112 shows all literals of PinTerminalLimitKind.

Table 112 – Literals of RemedialActionProfile::PinTerminalLimitKind

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

3.96 (NC) RelativeDirectionKind enumeration

Kinds of direction of the manual frequency restoration reserves action.
Table 113 shows all literals of RelativeDirectionKind.

Table 113 – 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 both up and down values are equal.
none		There is no direction.

3.97 (NC) RemedialActionDependencyKind enumeration

Kind of dependency between remedial actions.
Table 114 shows all literals of RemedialActionDependencyKind.

Table 114 – Literals of RemedialActionProfile::RemedialActionDependencyKind

literal	value	description
exclusive		Remedial actions are exclusive depending on each other. e.g. Only one of the remedial actions can be selected at the same time.
inclusive		Remedial actions are inclusive depending on each other. e.g. Both remedial action need to be picked if one of them is needed.
restrictive		Remedial actions are restrictive depending on each other. The need to include or to exclude might depend on the model. e.g. In the case of simplified DC model and detailed DC model. In the case where the simplified remedial action is used but not the remedial action for the detail model and opposite for the DC model.
none		Remedial actions are not depending on each other. However, the two remedial actions should be evaluated together.

3.98 (NC) RemedialActionKind enumeration

The different kinds for a remedial action.
Table 115 shows all literals of RemedialActionKind.

Table 115 – Literals of RemedialActionProfile::RemedialActionKind

literal	value	description
curative		Curative remedial action means a remedial action that is the result of an operational planning process and is activated straight subsequent to the occurrence of the respective contingency for compliance with the (N-1) criterion, taking into account transitory admissible overloads and their accepted duration.
preventive		Preventive remedial action means a remedial action that is the result of an operational planning process and needs to be activated prior to the investigated timeframe for compliance with the (N-1) criterion.

3.99 (NC) RemedialActionSchemeKind enumeration

Classification of Remedial Action Scheme.
Table 116 shows all literals of RemedialActionSchemeKind.

Table 116 – 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 or manual intervention.

3.100 (NC) ShiftMethodKind enumeration

Kind of shift method. Describes the way a power schedule should be distributed amongst production and consumption. e.g. Type of generating and load shift key.
Table 117 shows all literals of ShiftMethodKind.

Table 117 – Literals of RemedialActionProfile::ShiftMethodKind

literal	value	description
shared		Power schedule shift (distribution) is done by a shared fraction e.g. A two unit with the participation factor 60 and 40 will distribute a 10 MW schedule by 6 and 4 MW.
priority		Power schedule shift (distribution) is done by a shared fraction prioritizing the unit e.g. A two unit with the participation factor 60 and 40 will distribute a 10 MW increased schedule by first filling the highest participation factor (priority) until max economy power or maximum power allowed by the unit before it starts filling the next on the list. e.g. The unit with 60 will be getting its maximum shared first. The same logic applies with reducing the schedule. e.g. The 60 participation factor unit will be reduced to its min economy factor or minimum power.

3.101 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 118 shows all literals of UnitSymbol.

Table 118 – Literals of RemedialActionProfile::UnitSymbol

literal	value	description
none	0	Dimension less quantity, e.g. count, per unit, etc.
s	4	Time in seconds.
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.
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.

3.102 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 119 shows all literals of UnitMultiplier.

Table 119 – Literals of RemedialActionProfile::UnitMultiplier

literal	value	description
none	0	No multiplier or equivalently multiply by 1.
M	6	Mega 10**6.

3.103 (NC) ValueOffsetKind enumeration

The kind of the value offset.

Table 120 shows all literals of ValueOffsetKind.

Table 120 – Literals of RemedialActionProfile::ValueOffsetKind

literal	value	description
absolute		Value of the range constraint is replacing the attribute value referenced by the PropertyReference in a determined operational scenario.
incremental		Value of the range constraint is incrementing the attribute value referenced by the PropertyReference in a determined operational scenario.
incrementalPercentage		Value of the range constraint is incrementing in percentage the attribute value referenced by the PropertyReference in a determined operational scenario.

3.104 ActivePower datatype

Product of RMS value of the voltage and the RMS value of the in-phase component of the current.
Table 121 shows all attributes of ActivePower.

Table 121 – Attributes of RemedialActionProfile::ActivePower

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

3.105 PerCent datatype

Percentage on a defined base. For example, specify as 100 to indicate at the defined base.
Table 122 shows all attributes of PerCent.

Table 122 – 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)

3.106 ReactivePower datatype

Product of RMS value of the voltage and the RMS value of the quadrature component of the current.
Table 123 shows all attributes of ReactivePower.

Table 123 – Attributes of RemedialActionProfile::ReactivePower

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

3.107 Seconds datatype

Time, in seconds.
Table 124 shows all attributes of Seconds.

Table 124 – 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)

3.108 Boolean primitive

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

3.109 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.

3.110 Float primitive

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

3.111 Integer primitive

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

3.112 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.