



European Network of  
Transmission System Operators  
for Electricity

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# GRID DISTURBANCE PROFILE SPECIFICATION

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2026-09-10

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ICTC APPROVED  
VERSION 1.1.3

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- **MAY:** This word, or the adjective "OPTIONAL", means that an item is truly optional.

## Revision History

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## 1 Introduction

The grid disturbance profile is a profile to exchange a list of already occurred grid disturbances, faults, outages and interruptions. A grid disturbance is defined as “Automatic, unintended, or manual undeferrable switching of breakers as a result of faults in the power grid”.

The grid disturbances are input data that describe incidents in the power grid. This input data is used for statistical purposes and for Probabilistic Risk Assessment (PRA) pursuant to CSAM Article 44.

## 2 Application profile specification

### 2.1 Version information

The content is generated from UML model file CIM17-2\_CGMES31v01\_PROF-20v03\_NC25v25\_MS10v12\_DES10v01.qea.

This edition is based on the IEC 61970 UML version “”, dated “”.

- Title:
- Keyword:
- Description:
- Version IRI:
- Version info:
- Prior version:
- Conforms to:
- Identifier:

### 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}”

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 CSA profiles, CSA 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.

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

162

163

## 164 2.3 Profile constraints

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

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

### 170 • C:452:ALL:NA:datatypes

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

### 173 • R:452:ALL:NA:exchange

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

### 176 • R:452:ALL:NA:exchange1

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

### 182 • R:452:ALL:NA:exchange2

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

### 191 • R:452:ALL:NA:exchange3

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

### 195 • R:452:ALL:NA:exchange4

196 From the standpoint of the model import used by a data recipient, the document  
197 describes a subset of the CIM that importing software shall be able to interpret in order  
198 to import exported models. Data providers are free to exceed the minimum requirements  
199 described herein as long as their resulting data files are compliant with the CIM Schema  
200 and the conventions established in Clause 5. The document, therefore, describes  
201 additional classes and class data that, although not required, exporters will, in all  
202 likelihood, choose to include in their data files. The additional classes and data are  
203 labelled as required (cardinality 1..1) or as optional (cardinality 0..1) to distinguish them

- 204 from their required counterparts. Please note, however, that data importers could  
205 potentially receive data containing instances of any and all classes described by the  
206 CIM Schema.
- 207 • R:452:ALL:NA:cardinality
- 208 The cardinality defined in the CIM model shall be followed, unless a more restrictive  
209 cardinality is explicitly defined in this document. For instance, the cardinality on the  
210 association between VoltageLevel and BaseVoltage indicates that a VoltageLevel shall  
211 be associated with one and only one BaseVoltage, but a BaseVoltage can be associated  
212 with zero to many VoltageLevels.
- 213 • R:452:ALL:NA:associations
- 214 Associations between classes referenced in this document and classes not referenced  
215 here are not required regardless of cardinality.
- 216 • R:452:ALL:IdentifiedObject.name:rule
- 217 The attribute “name” inherited by many classes from the abstract class IdentifiedObject  
218 is not required to be unique. It must be a human readable identifier without additional  
219 embedded information that would need to be parsed. The attribute is used for purposes  
220 such as User Interface and data exchange debugging. The MRID defined in the data  
221 exchange format is the only unique and persistent identifier used for this data exchange.  
222 The attribute IdentifiedObject.name is, however, always required for CoreEquipment  
223 profile and Short Circuit profile.
- 224 • R:452:ALL:IdentifiedObject.description:rule
- 225 The attribute “description” inherited by many classes from the abstract class  
226 IdentifiedObject must contain human readable text without additional embedded  
227 information that would need to be parsed.
- 228 • R:452:ALL:NA:uniqueIdentifier
- 229 All IdentifiedObject-s shall have a persistent and globally unique identifier (Master  
230 Resource Identifier - mRID).
- 231 • R:452:ALL:NA:unitMultiplier
- 232 For exchange of attributes defined using CIM Data Types (ActivePower, Susceptance,  
233 etc.) a unit multiplier of 1 is used if the UnitMultiplier specified in this document is “none”.
- 234 • C:452:ALL:IdentifiedObject.name:stringLength
- 235 The string IdentifiedObject.name has a maximum of 128 characters.
- 236 • C:452:ALL:IdentifiedObject.description:stringLength
- 237 The string IdentifiedObject.description is maximum 256 characters.
- 238 • C:452:ALL:NA:float
- 239 An attribute that is defined as float (e.g. has a type Float or a type which is a Datatype  
240 with .value attribute of type Float) shall support ISO/IEC 60559:2020 for floating-point  
241 arithmetic using single precision floating point. A single precision float supports 7  
242 significant digits where the significant digits are described as an integer, or a decimal  
243 number with 6 decimal digits. Two float values are equal when the significant with 7

244 digits are identical, e.g. 1234567 is equal 1.234567E6 and so are 1.2345678 and  
245 1.234567E0.

246 • C:13:GL:CoordinateSystem.crsUrn:epsg

247 CoordinateSystem.crsUrn: If not specified elsewhere, the CoordinateSystem.crsUrn  
248 uses WGS84 (latitude, longitude), i.e. urn:ogc:def:crs:EPSG::4326.

249 • C:13:GL:PositionPoint.coordinates

250 In order to support various coordinate systems, position attributes are defined as  
251 strings. It is up to the implementation to ensure to correctly parse coordinate positions  
252 as defined by the coordinate system type.

253 • R:NC:ALL:NA:serialization

254 The profiles are defined in the EnterpriseArchitect application and have multiple artifacts  
255 that describe them. The main artifacts are:

- 256 1) the EAP file (EnterpriseArchitect project file),  
257 2) the profiles' specification document and  
258 3) the application profiles (RDFS and SHACL).

259 Due to the complexity of the profiles, there are various cross profile associations that,  
260 from profiling and profile maintenance point of view, it is not practical to include the  
261 complete inheritance structure in all profiles. If this is done the documentation provided  
262 for all profiles would also include duplicated information on the description of classes  
263 defined in other profiles. The following cases are often observed in profiles:

- 264 ○ Case 1: An association end refers to an abstract class  
265 ○ Case 2: An abstract class (stereotyped with "Description") has an association  
266 (direction to another class)  
267 ○ Case 3: An abstract class (not stereotyped with "Description") has an  
268 association (direction to another class)  
269 ○ Case 4: An abstract class has attributes and subclasses are not in the profile

270 In all cases, the datasets shall only include the subtypes of the abstract classes with  
271 the related properties (i.e. association or attributes) defined in the profile. The  
272 information is taken from either canonical model or the profiles where complete  
273 (expected) inheritance structure for the related abstract class is described. SHACL  
274 based constraints include constraints only for the concrete classes that are subtypes of  
275 the abstract class in the profile, and this can be used to inform which are the concrete  
276 classes expected in a dataset that conforms to this profile.

277 It should be taken into account that this approach deviates from MVAL5 (IEC 61970-  
278 600-1:2021), which creates multiple inheritance at serialization. For instance, with this  
279 more explicit exchange the serialization of the association between abstract class  
280 Equipment and abstract class Circuit for a PowerTransformer will be serialized as  
281 follows:

- 282 ○ for association

283 <cim:PowerTransformer rdf:about="\_c328f787-bc17-47ad-a59f-6ba7133340d0">

284 <nc:Equipment.Circuit rdf:resource="#\_9ced16ac-d076-4ef9-a241-a998a579e77b"/>

285 </cim:PowerTransformer>

- 286 ○ for attribute

287 <cim:ACLineSegment rdf:about="\_04f681aa-6999-4fb3-9775-acaa5eb7ceff">

288           <cim:Equipment.inService>true</cim:Equipment.inService>

289           </cim:ACLineSegment>

290           The usage of rdf:ID or rdf:about depends on the stereotype of the class. rdf:about is  
291           used if the class has the stereotype "Description".

292           An example of not allowed serialization, as the Equipment is an abstract class

293           <cim:Equipment rdf:about="\_c328f787-bc17-47ad-a59f-6ba7133340d0">

294           <nc:Equipment.Circuit rdf:resource="#\_9ced16ac-d076-4ef9-a241-a998a579e77b"/>

295           </cim:Equipment>

296

297

## 298   **2.4   Metadata**

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

305   The header vocabulary contains all attributes defined in IEC 61970-552. This is done only for  
306   the purpose of having one vocabulary for header and to ensure transition for data exchanges  
307   that are using IEC 61970-552:2016 header. This profile does not use IEC 61970-552:2016  
308   header attributes and relies only on the extended attributes.

### 309   **2.4.1   Constraints**

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

- 312       •   R:CSA:ALL:wasAttributedTo:usage

313           The prov:wasAttributedTo should normally be the "X" EIC code of the actor or their URI  
314           (prov:Agent).

315

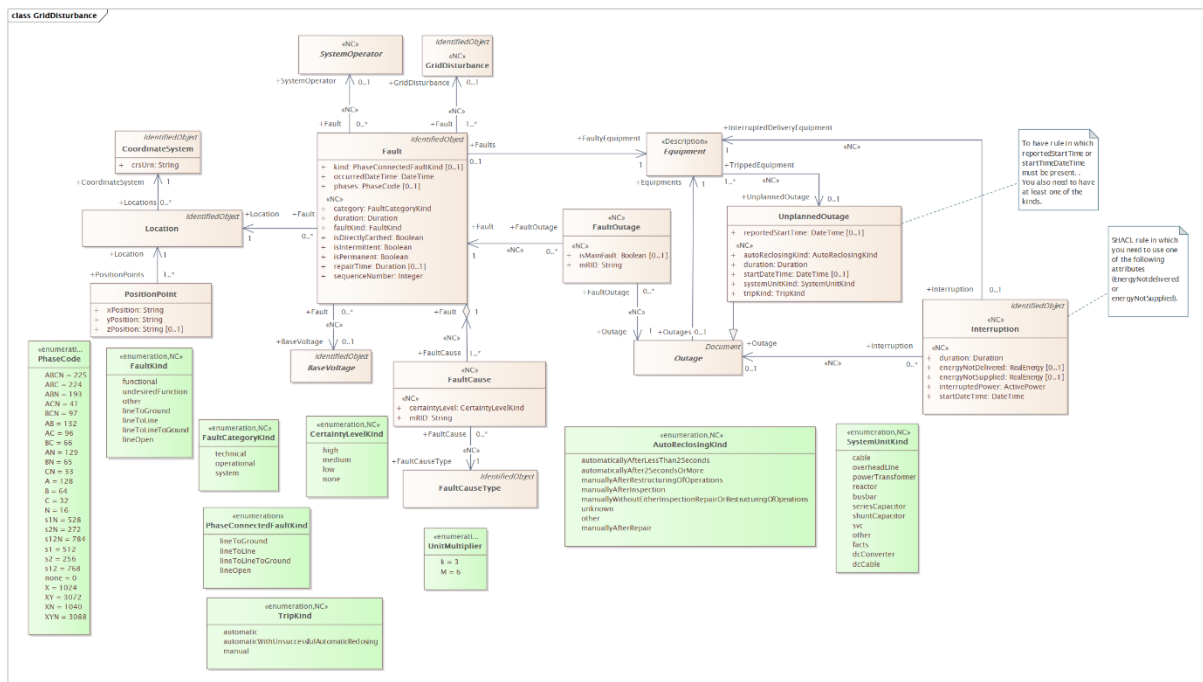
### 316   **2.4.2   Reference metadata**

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

## 325   **3   Detailed Profile Specification**

### 326   **3.1   General**

327   This package contains the grid disturbance profile.



**Figure 1 – Class diagram GridDisturbanceProfile::GridDisturbance**

Figure 1: The diagram shows grid disturbance related classes.

### 3.2 (abstract) BaseVoltage

Inheritance path = [IdentifiedObject](#)

Defines a system base voltage which is referenced.

Table 1 shows all attributes of BaseVoltage.

**Table 1 – Attributes of GridDisturbanceProfile::BaseVoltage**

| name        | mult | type                   | description                                      |
|-------------|------|------------------------|--------------------------------------------------|
| description | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |
| mRID        | 1..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |
| name        | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |

### 3.3 CoordinateSystem

Inheritance path = [IdentifiedObject](#)

Coordinate reference system.

Table 2 shows all attributes of CoordinateSystem.

**Table 2 – Attributes of GridDisturbanceProfile::CoordinateSystem**

| name    | mult | type                   | description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------|------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| crsUrns | 1..1 | <a href="#">String</a> | A Uniform Resource Name (URN) for the coordinate reference system (crs) used to define 'Location.PositionPoints'.<br><br>An example would be the European Petroleum Survey Group (EPSG) code for a coordinate reference system, defined in URN under the Open Geospatial Consortium (OGC) namespace as: urn:ogc:def:crs:EPSG::XXXX, where XXXX is an EPSG code (a full list of codes can be found at the EPSG Registry web site <a href="http://www.epsg-registry.org/">http://www.epsg-registry.org/</a> ). To define the coordinate system |

| name        | mult | type                   | description                                                                                                                                                                                                              |
|-------------|------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             |      |                        | as being WGS84 (latitude, longitude) using an EPSG OGC, this attribute would be urn:ogc:def:crs:EPSG::4236.<br>A profile should limit this code to a set of allowed URNs agreed to by all sending and receiving parties. |
| description | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a>                                                                                                                                                                         |
| mRID        | 1..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a>                                                                                                                                                                         |
| name        | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a>                                                                                                                                                                         |

### 3.4 (abstract) Document

Inheritance path = [IdentifiedObject](#)

Parent class for different groupings of information collected and managed as a part of a business process. It will frequently contain references to other objects, such as assets, people and power system resources.

Table 3 shows all attributes of Document.

**Table 3 – Attributes of GridDisturbanceProfile::Document**

| name        | mult | type                   | description                                      |
|-------------|------|------------------------|--------------------------------------------------|
| description | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |
| mRID        | 1..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |
| name        | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |

### 3.5 Fault

Inheritance path = [IdentifiedObject](#)

Abnormal condition causing current flow through conducting equipment, such as caused by equipment failure or short circuits from objects not typically modelled (for example, a tree falling on a line).

Table 4 shows all attributes of Fault.

**Table 4 – Attributes of GridDisturbanceProfile::Fault**

| name             | mult | type                                    | description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------|------|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| kind             | 0..1 | <a href="#">PhaseConnectedFaultKind</a> | The kind of phase fault.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| phases           | 0..1 | <a href="#">PhaseCode</a>               | The phases participating in the fault. The fault connections into these phases are further specified by the type of fault.                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| occurredDateTime | 1..1 | <a href="#">DateTime</a>                | The date and time at which the fault occurred.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| duration         | 1..1 | <a href="#">Duration</a>                | (NC) The duration of the fault.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| repairTime       | 0..1 | <a href="#">Duration</a>                | (NC) Time from when repair commences, including necessary troubleshooting, until the unit's function(s) has (have) been resumed and the unit is ready for operation.<br>Note 1: repair time is registered only for permanent faults and does not include administrative delays (voluntary waiting time). However, any preparations necessary to carry out repairs, for example the collection or ordering of spare parts, waiting for spare parts or transport, are included in the repair time.<br>Note 2: the repair time is zero if a fault is left unrepaired deliberately. |

| name              | mult | type                              | description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------|------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   |      |                                   | Note 3: this definition differs from the IEC 192-07-19 definition by also including the preparation time necessary to carry out the repairs mentioned in note 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| sequenceNumber    | 1..1 | <a href="#">Integer</a>           | (NC) A chronological serial number indicating the order of the faults related to the grid disturbance.<br>Primary faults have fault ID "1", and secondary/latent faults have fault ID "2" or more.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| category          | 1..1 | <a href="#">FaultCategoryKind</a> | (NC) The fault category.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| faultKind         | 1..1 | <a href="#">FaultKind</a>         | (NC) One fault can consist of several fault types. If a fault consists of several fault types, the most significant fault type is used.<br>In case of developing faults, that is in faults changing from one type to another, the final type is given.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| isDirectlyEarthed | 1..1 | <a href="#">Boolean</a>           | (NC) Whether the power system is directly earthed (true) or compensated (false).<br>Usually optional for faults on units with reactive compensation with voltages lower than 100 kV.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| isIntermittent    | 1..1 | <a href="#">Boolean</a>           | (NC) The kind of occurrence of the fault. It is either intermittent (true) or non-intermittent (false).<br>An intermittent fault is a recurring fault in the same unit and in the same place and for the same reason which repeats itself before it becomes necessary to carry out any repairs or eliminate the cause [8].<br>A non-intermittent fault occurs only once.<br>Note 1: a fault which repeats itself after an inspection, which did not result in the fault being pinpointed or repaired, is not considered an intermittent fault. A fault like this is considered as the beginning of a grid disturbance every time the fault occurs.<br>Note 2: one example of an intermittent fault is galloping lines.<br>Note 3: when deciding whether a fault is intermittent or not, one should consider more of the cause, location and consequence of the fault and not on the time between the faults. An intermittent fault is counted as one fault. However, all individual caused outages are connected to this fault.<br>Note 4: there is no standard for the required timespan between intermittent faults. Some system operators use 2 hours. |
| isPermanent       | 1..1 | <a href="#">Boolean</a>           | (NC) Whether the fault is a permanent (true) or a temporary (false) fault.<br>A permanent fault is a fault that will remain unless it is removed by some intervention.<br>Note 1 to entry: The "intervention" may be modification or maintenance.<br>Note 2: a permanent fault requires repair or adjustment before the unit is ready for operation. For example, the resetting of computers is considered as repair work and a switch in the wrong position is considered as a permanent fault. Signal acknowledgement is not considered as repair work.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

| name        | mult | type                   | description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------|------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             |      |                        | <p>Note 3: the duration of the disconnection is irrelevant when determining if a fault is permanent or not.</p> <p>A temporary fault is a fault where the unit or component is undamaged and is restored to service by switching operations without repair but possibly with on-site inspection.</p> <p>Note 1: a temporary fault does not require measures other than the reconnection of circuit breakers, replacement of fuses or signal acknowledgement.</p> <p>Note 2: the duration of the disconnection is irrelevant when determining if a fault is temporary or not. If, for example, a fault results in long-term disconnection and (on-site) inspection cannot pinpoint its source, the fault is considered to be temporary as no repairs are carried out.</p> |
| description | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| mRID        | 1..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| name        | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

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

**Table 5 – Association ends of GridDisturbanceProfile::Fault with other classes**

| mult from | name            | mult to | type                            | description                                                         |
|-----------|-----------------|---------|---------------------------------|---------------------------------------------------------------------|
| 1..*      | GridDisturbance | 0..1    | <a href="#">GridDisturbance</a> | (NC) A grid disturbance to contain all faults.                      |
| 0..*      | SystemOperator  | 0..1    | <a href="#">SystemOperator</a>  | (NC) The system operator in whose control area this fault occurred. |
| 0..*      | BaseVoltage     | 0..1    | <a href="#">BaseVoltage</a>     | (NC) The base voltage of this fault.                                |
| 0..*      | Location        | 1..1    | <a href="#">Location</a>        | Location of this fault.                                             |
| 0..1      | FaultyEquipment | 1..1    | <a href="#">Equipment</a>       | Equipment carrying this fault.                                      |

### 3.6 FaultCauseType

Inheritance path = [IdentifiedObject](#)

Type of cause of the fault.

Table 6 shows all attributes of FaultCauseType.

**Table 6 – Attributes of GridDisturbanceProfile::FaultCauseType**

| name        | mult | type                   | description                                      |
|-------------|------|------------------------|--------------------------------------------------|
| description | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |
| mRID        | 1..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |
| name        | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |

### 3.7 (abstract) IdentifiedObject root class

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

Table 7 shows all attributes of IdentifiedObject.

372

**Table 7 – Attributes of GridDisturbanceProfile::IdentifiedObject**

| name        | mult | type                   | description                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------|------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| description | 0..1 | <a href="#">String</a> | 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 | <a href="#">String</a> | 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.<br><br>For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or rdf:about attributes that identify CIM object elements. |
| name        | 0..1 | <a href="#">String</a> | The name is any free human readable and possibly non unique text naming the object.                                                                                                                                                                                                                                                                                                                           |

373

**3.8 Location**375 Inheritance path = [IdentifiedObject](#)

376 The place, scene, or point of something where someone or something has been, is, and/or will  
 377 be at a given moment in time. It can be defined with one or more position points (coordinates)  
 378 in a given coordinate system.

379 Table 8 shows all attributes of Location.

380

**Table 8 – Attributes of GridDisturbanceProfile::Location**

| name        | mult | type                   | description                                      |
|-------------|------|------------------------|--------------------------------------------------|
| description | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |
| mRID        | 1..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |
| name        | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |

381

382 Table 9 shows all association ends of Location with other classes.

383

**Table 9 – Association ends of GridDisturbanceProfile::Location with other classes**

| mult from | name             | mult to | type                             | description                                                          |
|-----------|------------------|---------|----------------------------------|----------------------------------------------------------------------|
| 0..*      | CoordinateSystem | 1..1    | <a href="#">CoordinateSystem</a> | Coordinate system used to describe position points of this location. |

384

**3.9 (abstract) Outage**386 Inheritance path = [Document](#) : [IdentifiedObject](#)

387 Document describing details of an active or planned outage in a part of the electrical network.

388 A non-planned outage may be created upon:

389 - a breaker trip,

390 - a fault indicator status change,

391 - a meter event indicating customer outage,

392 - a reception of one or more customer trouble calls, or

393 - an operator command, reflecting information obtained from the field crew.

394 Outage restoration may be performed using a switching plan which complements the outage

395 information with detailed switching activities, including the relationship to the crew and work.

396 A planned outage may be created upon:

397 - a request for service, maintenance or construction work in the field, or

- an operator-defined outage for what-if/contingency network analysis.

Table 10 shows all attributes of Outage.

**Table 10 – Attributes of GridDisturbanceProfile::Outage**

| name        | mult | type                   | description                                      |
|-------------|------|------------------------|--------------------------------------------------|
| description | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |
| mRID        | 1..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |
| name        | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |

Table 11 shows all association ends of Outage with other classes.

**Table 11 – Association ends of GridDisturbanceProfile::Outage with other classes**

| mult from | name       | mult to | type                      | description                                 |
|-----------|------------|---------|---------------------------|---------------------------------------------|
| 0..1      | Equipments | 1..1    | <a href="#">Equipment</a> | All equipments associated with this outage. |

### 3.10 PositionPoint root class

Set of spatial coordinates that determine a point, defined in the coordinate system specified in 'Location.CoordinateSystem'. Use a single position point instance to describe a point-oriented location. Use a sequence of position points to describe a line-oriented object (physical location of non-point oriented objects like cables or lines), or area of an object (like a substation or a geographical zone - in this case, have first and last position point with the same values).

Table 12 shows all attributes of PositionPoint.

**Table 12 – Attributes of GridDisturbanceProfile::PositionPoint**

| name      | mult | type                   | description                      |
|-----------|------|------------------------|----------------------------------|
| xPosition | 1..1 | <a href="#">String</a> | X axis position.                 |
| yPosition | 1..1 | <a href="#">String</a> | Y axis position.                 |
| zPosition | 0..1 | <a href="#">String</a> | (if applicable) Z axis position. |

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

**Table 13 – Association ends of GridDisturbanceProfile::PositionPoint with other classes**

| mult from | name     | mult to | type                     | description                                |
|-----------|----------|---------|--------------------------|--------------------------------------------|
| 1..*      | Location | 1..1    | <a href="#">Location</a> | Location described by this position point. |

### 3.11 UnplannedOutage

Inheritance path = [Outage](#) : [Document](#) : [IdentifiedObject](#)

Document describing the consequence of an unplanned outage in a part of the electrical network. For the purposes of this model, an unplanned outage refers to a state where energy is not delivered; such as, customers out of service, a street light is not served, etc.

A unplanned outage may be created upon:

- impacts the SAIDI calculation
- a breaker trip,
- a fault indicator status change,
- a meter event indicating customer outage,
- a reception of one or more customer trouble calls, or

429 - an operator command, reflecting information obtained from the field crew.  
 430 Outage restoration may be performed using a switching plan which complements the outage  
 431 information with detailed switching activities, including the relationship to the crew and work.  
 432 Table 14 shows all attributes of UnplannedOutage.

433 **Table 14 – Attributes of GridDisturbanceProfile::UnplannedOutage**

| name              | mult | type                              | description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------|------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| startDateTime     | 0..1 | <a href="#">DateTime</a>          | (NC) The date and time at which the unplanned outage occurred.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| duration          | 1..1 | <a href="#">Duration</a>          | (NC) The duration of the unplanned outage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| tripKind          | 1..1 | <a href="#">TripKind</a>          | (NC) Whether the type of the trip due to the outage was automatic, automatic with successful automatic reclosing or manual.<br><br>In case of a fault in the reclosing automatics resulting in lack of reclosing, automatic should be chosen as an alternative.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| autoReclosingKind | 1..1 | <a href="#">AutoReclosingKind</a> | (NC) The type of autoreclosing that occurred with the trip.<br><br>If high-speed automatic reclosing is successful at one end of a line, but the line needs to be reclosed manually at the other end, choose manual reclosing.<br><br>In this document, high-speed automatic reclosing refers to automatic reclosing after less than 2 seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| systemUnitKind    | 1..1 | <a href="#">SystemUnitKind</a>    | (NC) The type of system unit of the component affected by the outage.<br><br>A system unit is defined as:<br>A group of components which are delimited by one or more circuit breakers.<br><br>Note 1: the system unit concept has been defined to simplify the calculation of availability. While a system unit is always delimited by circuit breakers, an individual component may not always be. A system unit may therefore contain more than one component.<br><br>Note 2: the circuit breakers are not included in the system unit.<br><br>Note 3: a tripped element is synonymous to a tripped system unit.<br><br>Note 4: the type of a system unit is determined by its dominant component. The available system unit types are power transformer, overhead line, cable, reactor, busbar, series capacitor, shunt capacitor and SVC.<br><br>Note 5: when a system unit is no longer transporting or supplying electrical energy, the system unit is affected by an outage. The system unit is unavailable after the outage has occurred. |
| reportedStartTime | 0..1 | <a href="#">DateTime</a>          | The earliest start time of the Outage - as reported by some system or individual                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| description       | 0..1 | <a href="#">String</a>            | inherited from: <a href="#">IdentifiedObject</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| mRID              | 1..1 | <a href="#">String</a>            | inherited from: <a href="#">IdentifiedObject</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| name              | 0..1 | <a href="#">String</a>            | inherited from: <a href="#">IdentifiedObject</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

434  
 435 Table 15 shows all association ends of UnplannedOutage with other classes.

**Table 15 – Association ends of GridDisturbanceProfile::UnplannedOutage with other classes**

| mult from | name       | mult to | type                      | description                            |
|-----------|------------|---------|---------------------------|----------------------------------------|
| 0..1      | Equipments | 1..1    | <a href="#">Equipment</a> | inherited from: <a href="#">Outage</a> |

**3.12 (NC) AutoReclosingKind enumeration**

The type of autoreclosing that occurred with the trip.

If high-speed automatic reclosing is successful at one end of a line, but the line needs to be reclosed manually at the other end, choose manual reclosing.

In this document, high-speed automatic reclosing refers to automatic reclosing after less than 2 seconds.

Table 16 shows all literals of AutoReclosingKind.

**Table 16 – Literals of GridDisturbanceProfile::AutoReclosingKind**

| literal                                                          | value | description                                                                                                         |
|------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------|
| automaticallyAfterLessThan2Seconds                               |       | If the automatic reclosing was successful in 2 seconds or less.<br>Also known as "successful high-speed reclosing". |
| automaticallyAfter2SecondsOrMore                                 |       | If the automatic reclosing was successful in 2 seconds or more.<br>Also known as "successful high-speed reclosing". |
| manuallyAfterRestructuringOfOperations                           |       | If the reclosing was done manually after restructuring of operations.                                               |
| manuallyAfterInspection                                          |       | If the reclosing was done manually after inspection of the component.                                               |
| manuallyWithoutEitherInspectionRepairOrRestructuringOfOperations |       | If the reclosing was done manually without any inspections, repairs or restructurings of operations.                |
| unknown                                                          |       | If the type of auto-reclosing is unknown.                                                                           |
| other                                                            |       | If the type of auto-reclosing is not unknown but does not fit the other categories, report it as other.             |
| manuallyAfterRepair                                              |       | If the reclosing was done manually after repair.                                                                    |

**3.13 (NC) CertaintyLevelKind enumeration**

High certainty level is used when the cause of a fault is 100 % certain or when the cause is the most probable cause and potentially determined by an expert.

Table 17 shows all literals of CertaintyLevelKind.

**Table 17 – Literals of GridDisturbanceProfile::CertaintyLevelKind**

| literal | value | description                    |
|---------|-------|--------------------------------|
| high    |       | The certainty level is high.   |
| medium  |       | The certainty level is medium. |
| low     |       | The certainty level is low.    |
| none    |       | The certainty level is none.   |

**3.14 (NC) FaultCategoryKind enumeration**

Available kinds of fault categories.

Table 18 shows all literals of FaultCategoryKind.

**Table 18 – Literals of GridDisturbanceProfile::FaultCategoryKind**

| literal     | value | description                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| technical   |       | A fault due to a technical error.                                                                                                                                                                                                                                                                                                                                                                                                                              |
| operational |       | A fault due to a temporary human error.<br>Note 1: incorrect operation is considered a fault in a component, or in other words, the incorrect operation is attributed to the unit which has been operated incorrectly.                                                                                                                                                                                                                                         |
| system      |       | A fault due to off-nominal parameters, exceeding of regulated norms and standards, or exceeding protection limits.<br>Note 1: Typical examples of system fault causes are high/low frequency, power oscillations, overload, overvoltage, undervoltage or high harmonic content in voltage or current. Common causes for system faults are significant changes in load or generation and switching of lines or transformers with following change of load flow. |

**3.15 (NC) FaultKind enumeration**

One fault can consist of several fault types. If a fault consists of several fault types, the most significant fault type is used.

In case of developing faults, that is in faults changing from one type to another, the final type is given.

Table 19 shows all literals of FaultKind.

**Table 19 – Literals of GridDisturbanceProfile::FaultKind**

| literal            | value | description                                                                                                                                                                                                                                                                                                                                               |
|--------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| functional         |       | The components main function failed to occur.                                                                                                                                                                                                                                                                                                             |
| undesiredFunction  |       | If the component's main function occurred correctly but had an undesired result, that is, the fault.<br>Is only stated if the component is a circuit breaker, disconnector or control system.                                                                                                                                                             |
| other              |       | For example, geomagnetic currents, SSR, capacitor bank imbalances, bad contact, overheating.                                                                                                                                                                                                                                                              |
| lineToGround       |       | The fault connects the indicated phases to ground. The line to line fault impedance is not used and assumed infinite. The full ground impedance is connected between each phase specified in the fault and ground, but not between the phases.                                                                                                            |
| lineToLine         |       | The fault connects the specified phases together without a connection to ground. The ground impedance of this fault is ignored. The line to line impedance is connected between each of the phases specified in the fault. For example three times for a three phase fault, one time for a two phase fault. A single phase fault should not be specified. |
| lineToLineToGround |       | The fault connects the indicated phases to ground and to each other. The line to line                                                                                                                                                                                                                                                                     |

| literal  | value | description                                                                                                                                                                                                                                                                                                          |
|----------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |       | impedance is connected between each of the phases specified in the fault in a full mesh. For example three times for a three phase fault, one time for a two phase fault. A single phase fault should not be specified. The full ground impedance is connected between each phase specified in the fault and ground. |
| lineOpen |       | The fault is when the conductor path is broken between two terminals. Additional coexisting faults may be required if the broken conductor also causes connections to grounds or other lines or phases.                                                                                                              |

466

467 **3.16 PhaseCode enumeration**

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

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

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

478 Table 20 shows all literals of PhaseCode.

479

**Table 20 – Literals of GridDisturbanceProfile::PhaseCode**

| literal | value | description                         |
|---------|-------|-------------------------------------|
| ABCN    |       | Phases A, B, C, and N.              |
| ABC     |       | Phases A, B, and C.                 |
| ABN     |       | Phases A, B, and neutral.           |
| ACN     |       | Phases A, C and neutral.            |
| BCN     |       | Phases B, C, and neutral.           |
| AB      |       | Phases A and B.                     |
| AC      |       | Phases A and C.                     |
| BC      |       | Phases B and C.                     |
| AN      |       | Phases A and neutral.               |
| BN      |       | Phases B and neutral.               |
| CN      |       | Phases C and neutral.               |
| A       |       | Phase A.                            |
| B       |       | Phase B.                            |
| C       |       | Phase C.                            |
| N       |       | Neutral phase.                      |
| s1N     |       | Secondary phase 1 and neutral.      |
| s2N     |       | Secondary phase 2 and neutral.      |
| s12N    |       | Secondary phases 1, 2, and neutral. |
| s1      |       | Secondary phase 1.                  |
| s2      |       | Secondary phase 2.                  |

| literal | value | description                                  |
|---------|-------|----------------------------------------------|
| s12     |       | Secondary phase 1 and 2.                     |
| none    |       | No phases specified.                         |
| X       |       | Unknown non-neutral phase.                   |
| XY      |       | Two unknown non-neutral phases.              |
| XN      |       | Unknown non-neutral phase plus neutral.      |
| XYN     |       | Two unknown non-neutral phases plus neutral. |

### 3.17 PhaseConnectedFaultKind enumeration

The type of fault connection among phases.

Table 21 shows all literals of PhaseConnectedFaultKind.

**Table 21 – Literals of GridDisturbanceProfile::PhaseConnectedFaultKind**

| literal            | value | description                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| lineToGround       |       | The fault connects the indicated phases to ground. The line to line fault impedance is not used and assumed infinite. The full ground impedance is connected between each phase specified in the fault and ground, but not between the phases.                                                                                                                                                             |
| lineToLine         |       | The fault connects the specified phases together without a connection to ground. The ground impedance of this fault is ignored. The line to line impedance is connected between each of the phases specified in the fault. For example three times for a three phase fault, one time for a two phase fault. A single phase fault should not be specified.                                                  |
| lineToLineToGround |       | The fault connects the indicated phases to ground and to each other. The line to line impedance is connected between each of the phases specified in the fault in a full mesh. For example three times for a three phase fault, one time for a two phase fault. A single phase fault should not be specified. The full ground impedance is connected between each phase specified in the fault and ground. |
| lineOpen           |       | The fault is when the conductor path is broken between two terminals. Additional coexisting faults may be required if the broken conductor also causes connections to grounds or other lines or phases.                                                                                                                                                                                                    |

### 3.18 (NC) SystemUnitKind enumeration

A system unit is defined as:

A group of components which are delimited by one or more circuit breakers.

Note 1: the system unit concept has been defined to simplify the calculation of availability. While a system unit is always delimited by circuit breakers, an individual component may not always be. A system unit may therefore contain more than one component.

Note 2: the circuit breakers are not included in the system unit.

Note 3: a tripped element is synonymous to a tripped system unit.

Note 4: the type of a system unit is determined by its dominant component. The available system unit types are power transformer, overhead line, cable, reactor, busbar, series capacitor, shunt capacitor and SVC.

Note 5: when a system unit is no longer transporting or supplying electrical energy, the system unit is affected by an outage. The system unit is unavailable after the outage has occurred.

499 Table 22 shows all literals of SystemUnitKind.

500 **Table 22 – Literals of GridDisturbanceProfile::SystemUnitKind**

| literal          | value | description                                                              |
|------------------|-------|--------------------------------------------------------------------------|
| cable            |       | If the main function of the system unit is cable.                        |
| overheadLine     |       | If the main function of the system unit is overhead line.                |
| powerTransformer |       | If the main function of the system unit is power transformer.            |
| reactor          |       | If the main function of the system unit is reactor.                      |
| busbar           |       | If the main function of the system unit is busbar.                       |
| seriesCapacitor  |       | If the main function of the system unit is series capacitor.             |
| shuntCapacitor   |       | If the main function of the system unit is shunt capacitor.              |
| svc              |       | If the main function of the system unit is static var compensator (SVC). |
| other            |       | If it is of other kind.                                                  |
| facts            |       | If the main function of the system unit is FACTS.                        |
| dcConverter      |       | If the main function of the system unit is DCCConverter.                 |
| dcCable          |       | If the main function of the system unit is DCCable.                      |

501

### 502 3.19 (NC) TripKind enumeration

503 Whether the type of the trip due to the outage was automatic, automatic with successful  
504 automatic reclosing or manual.

505 In case of a fault in the reclosing automatics resulting in lack of reclosing, automatic should be  
506 chosen as an alternative.

507 Table 23 shows all literals of TripKind.

508 **Table 23 – Literals of GridDisturbanceProfile::TripKind**

| literal                                     | value | description                                                                                                                                                                                                                               |
|---------------------------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| automatic                                   |       | The trip that resulted in the outage was automatic.<br>In case of a fault in the reclosing automatics resulting in lack of reclosing, automatic should be chosen as an alternative.                                                       |
| automaticWithUnsuccessfulAutomaticReclosing |       | The trip that resulted in an outage was correctly initiated but the automatic reclosing was unsuccessful.<br>In case of a fault in the reclosing automatics resulting in lack of reclosing, automatic should be chosen as an alternative. |
| manual                                      |       | The trip that resulted in the outage was manually cleared.                                                                                                                                                                                |

509

### 510 3.20 UnitMultiplier enumeration

511 The unit multipliers defined for the CIM. When applied to unit symbols, the unit symbol is  
512 treated as a derived unit. Regardless of the contents of the unit symbol text, the unit symbol  
513 shall be treated as if it were a single-character unit symbol. Unit symbols should not contain  
514 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 "P" represents the derived unit "m2Pers", then applying the multiplier "k" can be conceptualized simply as "kP".

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 "P", then it is easier to conceptualize the multiplier "m" as creating the proper unit "mP", and not the forbidden unit "mkg".

Table 24 shows all literals of UnitMultiplier.

**Table 24 – Literals of GridDisturbanceProfile::UnitMultiplier**

| literal | value | description       |
|---------|-------|-------------------|
| k       |       | Kilo $10^{**3}$ . |
| M       |       | Mega $10^{**6}$ . |

### 3.21 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 25 shows all literals of UnitSymbol.

**Table 25 – Literals of GridDisturbanceProfile::UnitSymbol**

| literal | value | description                                                                                                                                                                                                              |
|---------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| W       |       | Real power in watts (J/s). Electrical power may have real and reactive components. The real portion of electrical power ( $I^2R$ or $VI\cos(\phi)$ ), is expressed in Watts. See also apparent power and reactive power. |
| Wh      |       | Real energy in watt hours.                                                                                                                                                                                               |

**3.22 ActivePower datatype**

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

Table 26 shows all attributes of ActivePower.

**Table 26 – Attributes of GridDisturbanceProfile::ActivePower**

| name       | mult | type                           | description |
|------------|------|--------------------------------|-------------|
| multiplier | 0..1 | <a href="#">UnitMultiplier</a> |             |
| unit       | 0..1 | <a href="#">UnitSymbol</a>     |             |
| value      | 0..1 | <a href="#">Float</a>          |             |

**3.23 RealEnergy datatype**

Real electrical energy.

Table 27 shows all attributes of RealEnergy.

**Table 27 – Attributes of GridDisturbanceProfile::RealEnergy**

| name       | mult | type                           | description |
|------------|------|--------------------------------|-------------|
| multiplier | 0..1 | <a href="#">UnitMultiplier</a> |             |
| unit       | 0..1 | <a href="#">UnitSymbol</a>     |             |
| value      | 0..1 | <a href="#">Float</a>          |             |

**3.24 Boolean primitive**

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

**3.25 DateTime primitive**

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

**3.26 Duration primitive**

Duration as "PnYnMnDnHnMnS" 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.

**3.27 Float primitive**

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

**3.28 Integer primitive**

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

**3.29 String primitive**

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

**3.30 (abstract,Description) Equipment root class**

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

Table 28 shows all association ends of Equipment with other classes.

**Table 28 – Association ends of GridDisturbanceProfile::Equipment with other classes**

| mult from | name            | mult to | type                            | description                                            |
|-----------|-----------------|---------|---------------------------------|--------------------------------------------------------|
| 1..*      | UnplannedOutage | 0..1    | <a href="#">UnplannedOutage</a> | (NC) The outage this tripped breaker is involved with. |

**3.31 (NC) FaultCause root class**

Fault cause.

Table 29 shows all attributes of FaultCause.

**Table 29 – Attributes of GridDisturbanceProfile::FaultCause**

| name           | mult | type                               | description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|------|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| certaintyLevel | 1..1 | <a href="#">CertaintyLevelKind</a> | (NC) The degree of certainty of which the cause of a fault is determined by a user.<br><br>Note 1: the used certainty levels are low, medium and high. High certainty level is used when the cause of a fault is 100 % certain or when the cause is the most probable cause and potentially determined by an expert. Medium certainty level is used when the cause of the fault is very probable but there is not enough evidence to fully support the claim. Low certainty level is used when there is some idea of what the cause could be with the help of, for example, the fault details or expert knowledge.<br><br>Note 2: the fault cause 'unknown' is used if no other fault cause can be chosen by any degree of certainty. |
| mRID           | 1..1 | <a href="#">String</a>             | (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.<br><br>For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or rdf:about attributes that identify CIM object elements.                                                                                                                                                                                                                                                                                                                    |

Table 30 shows all association ends of FaultCause with other classes.

**Table 30 – Association ends of GridDisturbanceProfile::FaultCause with other classes**

| mult from | name           | mult to | type                           | description                                                          |
|-----------|----------------|---------|--------------------------------|----------------------------------------------------------------------|
| 1..*      | Fault          | 1..1    | <a href="#">Fault</a>          | (NC) The fault defined for this fault and cause combination.         |
| 0..*      | FaultCauseType | 1..1    | <a href="#">FaultCauseType</a> | (NC) The fault and cause combination to be simulated for this cause. |

**3.32 (NC) FaultOutage root class**

Association class for relating one fault and one outage.

Table 31 shows all attributes of FaultOutage.

604

**Table 31 – Attributes of GridDisturbanceProfile::FaultOutage**

| name        | mult | type                    | description                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------|------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| isMainFault | 0..1 | <a href="#">Boolean</a> | (NC) If true the fault outage is the main fault.                                                                                                                                                                                                                                                                                                                                                                   |
| mRID        | 1..1 | <a href="#">String</a>  | (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.<br><br>For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or rdf:about attributes that identify CIM object elements. |

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Table 32 shows all association ends of FaultOutage with other classes.

607

**Table 32 – Association ends of GridDisturbanceProfile::FaultOutage with other classes**

| mult from | name   | mult to | type                   | description                                                            |
|-----------|--------|---------|------------------------|------------------------------------------------------------------------|
| 0..*      | Fault  | 1..1    | <a href="#">Fault</a>  | (NC) The fault defined for this combination of a fault and an outage.  |
| 0..*      | Outage | 1..1    | <a href="#">Outage</a> | (NC) The outage defined for this combination of a fault and an outage. |

608

609

**3.33 (NC) GridDisturbance**

610

Inheritance path = [IdentifiedObject](#)

611

Automatic, unintended, or manual undeferrable switching of breakers as a result of faults in the power grid.

612

613

Table 33 shows all attributes of GridDisturbance.

614

**Table 33 – Attributes of GridDisturbanceProfile::GridDisturbance**

| name        | mult | type                   | description                                      |
|-------------|------|------------------------|--------------------------------------------------|
| description | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |
| mRID        | 1..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |
| name        | 0..1 | <a href="#">String</a> | inherited from: <a href="#">IdentifiedObject</a> |

615

616

**3.34 (NC) Interruption**

617

Inheritance path = [IdentifiedObject](#)

618

Disappearance of the supply voltage at a delivery point.

619

Table 34 shows all attributes of Interruption.

620

**Table 34 – Attributes of GridDisturbanceProfile::Interruption**

| name               | mult | type                       | description                                                                                                                                            |
|--------------------|------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| startDateTime      | 1..1 | <a href="#">DateTime</a>   | (NC) The date and time at which the interruption occurred.                                                                                             |
| duration           | 1..1 | <a href="#">Duration</a>   | (NC) The duration of the interruption.                                                                                                                 |
| energyNotDelivered | 0..1 | <a href="#">RealEnergy</a> | (NC) The estimated energy which would have been delivered through the delivery point if no interruption and no transmission restrictions had occurred. |

| name              | mult | type                        | description                                                                                                                             |
|-------------------|------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| energyNotSupplied | 0..1 | <a href="#">RealEnergy</a>  | (NC) The estimated energy which would have been supplied to end-users if no interruption and no transmission restrictions had occurred. |
| interruptedPower  | 1..1 | <a href="#">ActivePower</a> | (NC) The estimated power that was delivered through the delivery point when the interruption occurred.                                  |
| description       | 0..1 | <a href="#">String</a>      | inherited from: <a href="#">IdentifiedObject</a>                                                                                        |
| mRID              | 1..1 | <a href="#">String</a>      | inherited from: <a href="#">IdentifiedObject</a>                                                                                        |
| name              | 0..1 | <a href="#">String</a>      | inherited from: <a href="#">IdentifiedObject</a>                                                                                        |

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

**Table 35 – Association ends of GridDisturbanceProfile::Interruption with other classes**

| mult from | name                         | mult to | type                      | description                                                                                                                                                           |
|-----------|------------------------------|---------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0..1      | InterruptedDeliveryEquipment | 1..1    | <a href="#">Equipment</a> | (NC) The delivery point (equipment) that is affected by the interruption. It is an equipment, power transformer or busbar in the grid where electricity is exchanged. |
| 0..*      | Outage                       | 0..1    | <a href="#">Outage</a>    | (NC) One outage may have multiple interruptions.                                                                                                                      |

### 3.35 (abstract,NC) SystemOperator root class

A power system operation post responsible for performing and coordinating the real-time and planning functions required to maintain the secure, reliable, and efficient operation of the power system within a defined operational scope.

Note: SystemOperator represents the execution of power system operational responsibilities in practice. While the operational post exists independently at the ecosystem level, SystemOperator identifies the specific agent fulfilling that responsibility at a given time. The operational scope may correspond to a control area, network, voltage domain, or other defined boundary.