

# **NETBAS CIM-export**

## Equipment Profile

30.06.2015



## Table of Contents

<b>Equipment profile .....</b>	<b>3</b>
Data .....	3
Voltage levels.....	3
General classes .....	3
Terminal .....	3
ConnectivityNode.....	4
BaseVoltage .....	4
Location.....	4
PositionPoint.....	4
CoordinateSystem.....	5
ACLineSegment .....	5
EnergyConsumer class .....	6
UsagePoint class.....	6
Substation .....	6
Substation class.....	7
VoltageLevel class .....	7
Bay class .....	7
BusbarSection class.....	8
Switching device classes .....	8
PetersenCoil class .....	9
PowerTransformer class .....	9
PowerTransformerEnd .....	9
RatioTapChanger class .....	10



# Equipment profile

This document describes the Equipment Profile for exporting NETBAS data to CIM XML. The profile is based on CIM 16. The aim of this export is to represent the grid's function and not the individual assets.

This is an export started as a job for the entire NETBAS database, and not individual changes/deltas done in the NETBAS Archive.

## Data

Exporting data from NETBAS to CIM XML is a process of translating one model to another. The NETBAS model has through the years been used in different ways to represent the grid. This export is based on that data is represented in the way described in NETBAS Best Practice 2.1. Data quality in NETBAS is essential to achieve a consistent CIM-extract.

Bays as represented in CIM is not a part of the NETBAS model. The Bays that will be available through this export is therefore only made for the export itself, and cannot be seen as objects to be referred back to NETBAS.

## Voltage levels

This equipment profile describes the grid without reference to any specific voltage levels.

## General classes

### Terminal

Attributes	
mRID	Global Unique ID - owned by NETBAS
sequenceNumber	The orientation of the terminal connections for a multiple terminal conducting equipment. The sequence numbering starts with 1 and additional terminals should follow in increasing order. The first terminal is the "starting point" for a two terminal branch.
Relations	
ConnectivityNode	The connectivity node to which this terminal connects with zero impedance
ConductingEquipment	The conducting equipment of the terminal. Conducting equipment have terminals that may be connected to other conducting equipment terminals via connectivity nodes or topological nodes.



## ConnectivityNode

Attributes		
mRID	Global Unique ID - owned by NETBAS	

## BaseVoltage

There exists a BaseVoltage object for every voltage level. These levels are based on the registered voltage levels in the NETBAS database.

Attributes		
mRID	Global Unique ID - owned by NETBAS	
nominalVoltage	Voltage Level	

## Location

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

Attributes		
mRID	Global Unique ID - owned by NETBAS	
mainAddress	Compound type.	COMPONENT-ADDRESS
Relations		
CoordinateSystem	Coordinate system used to describe position points of this location.	

## PositionPoint

Attributes		
mRID	Global Unique ID - owned by NETBAS	
sequenceNumber	Zero-relative sequence number of this point within a series of points.	
xPosition	X axis position	
yPosition	Y axis position	
zPosition	Z axis position	



Relations		
Location	Location described by this position point	

## CoordinateSystem

Coordinate reference system.

Attributes		
mRID	Global Unique ID - owned by NETBAS	
crsUrn	A Uniform Resource Name (URN) for the coordinate reference system (crs) used to define 'Location.PositionPoints'.	

## ACLineSegment

Cables and overhead lines

Attributes		
mRID	Global Unique ID - owned by NETBAS	
name	Name for linesegment	SERVICE-NUMBER
length	Length (meter)	LENGTH [METER]
bOch	Zero sequence shunt (charging) susceptance, uniformly distributed, of the entire line section.	CAPACITANCE-TO-EARTH * 2 * Pi * 50 [SIEMENS]
bch	Positive sequence shunt (charging) susceptance, uniformly distributed, of the entire line section. This value represents the full charging over the full length of the line.	CAPACITANCE-PER-PHAS * 2 * Pi * 50 [SIEMENS]
r	Positive sequence series resistance of the entire line section	RESISTANCE [OHM]
X	Positive sequence series reactance of the entire line section	REACTANCE [OHM]
rO	Zero sequence series resistance of the entire line section	ZERO-SEQUENCE-RESIST [OHM]



xO	Zero sequence series reactance of the entire line section	ZERO-SEQUENCE-REACT [OHM]
<b>Relations</b>		
PSRType	There must always exist a relation to one of the following PSRTypes, Cable or OverheadLine	
BaseVoltage	Relation to BaseVoltage.	
Location	Relation to own instance of Location.	

### EnergyConsumer class

Represents a point in the network (ConductingEquipment) that zero or more UsagePoints are related to.

<b>Attributes</b>	
mRID	Global Unique ID - owned by NETBAS
<b>Relations</b>	
Location	Relation to own instance of Location with X and Y coordinates as a minimum
0..* UsagePoint	Relation to all installations (with the EAN-number) connected to this point in the network.

### UsagePoint class

<b>Attributes</b>	
mRID	Global Unique ID - owned by NETBAS
name	18 digits EAN-number.
<b>Relations</b>	
ConductingEquipment	Relation to a conducting equipment part of the electrical network. Will normally be an energy consumer, but can also be another kind of conducting equipment

### Substation

The substation class is used to model both substations, towers and cable boxes. A mandatory relation to PSRType is used to tell which of the above mentioned types a particular substation object represents.

Regarding towers, it's important that these are modelled as a substation if more than 2 lines go into them, regardless of switching equipment in the tower or not.

The CIM-standard does not dictate how the hierarchy of the substation should be built.



### Substation class

Attributes		
mRID	Global Unique ID - owned by NETBAS	
name	Service-number	SERVICE-NUMBER
description	Description - e.g. name of location etc.	KOMTYP
Relations		
PSRType	There must always exist a relation to one of the following PSRTypes: PrimarySubstation, SecondarySubstation, Tower, CableBox	
Location	Relation to own instance of Location.	

### VoltageLevel class

A substation with transformers should always have two or more VoltageLevel objects underneath it.

A cable box, tower (without transformers) and substations without transformers, should always have one VoltageLevel object.

Attributes		
mRID	Global Unique ID - owned by NETBAS	
name	Human readable name for VoltageLevel.	
Relations		
Substation	The substation containing the voltage level.	
BaseVoltage	Relation to existing BaseVoltage object. Important for the systems to know the voltage level.	

### Bay class

Bay is used to group equipment together. Not always aligns with real life — e.g. breaker sitting on a tower or equipment in a cable box. Bay is not registered as a persistent object in NETBAS, and the exported bays are made for the export exclusively.

Attributes		
mRID	Global Unique ID - owned by NETBAS	



name	Short description.	
description	Description	
<b>Relations</b>		
VoltageLevel	The voltage level containing the bay.	

### BusbarSection class

Busbar

<b>Attributes</b>		
mRID	Global Unique ID - owned by NETBAS	
name	Uniquely named in Substation	
<b>Relations</b>		
VoltageLevel	The voltage level that contains the component	

### Switching device classes

Breaker (NB: Circuit breaker), LoadBreaker (NB: Load-break switch), Disconnecter (NB: Disconnecter), Fuse (NB: Fuse) and GroundDisconnecter (NB: Grounding switch).

<b>Attributes on all switching devices</b>		
mRID	Global Unique ID - owned by NETBAS	
name	If multiple switching devices is contained within a Bay, then they must have a unique name.	SERVICE-NUMBER
normalOpen	Should always be set. The NETBAS is master.	SERVICE-POSITION
ratedCurrent	Used for calculation purpose.	RATED-CURRENT
breakingCapacity	For breakers.	BREAKING-CAPACITY
<b>Relations</b>		
Bay	The Bay that contains the component.	





### PetersenCoil class

Must be connected to the PowerTransformer. The terminal on the Coil must be set.

Attributes	
mRID	Global Unique ID - owned by NETBAS.
name	Name
r	<i>Nominal resistance of device.</i>
mode	The mode of operation of the Petersen coil (fixed, manual or automaticPositioning).
norminalU	The nominal voltage for which the coil is designed.
Relations	
Bay	The Bay that contains the component.

### PowerTransformer class

Attributes		
mRID	Global Unique ID - owned by NETBAS	
name	Service-number	SERVICE-NUMBER
Relations		
Substation	Transformatorstationen som transformeren tilhører. <i>The substation that contains the transformer.</i>	

### PowerTransformerEnd

Represent a transformer winding. The attributes are collected from the corresponding transformer.

Attributes	
mRID	Global Unique ID - owned by NETBAS
endNumber	Number for this transformer end, corresponding to the end's order in the power transformer vector group or phase angle clock number. Highest voltage winding should be I. Each end



within a power transformer should have a unique subsequent end number. Note the transformer end number need not match the terminal sequence number.

ratedU	Rated voltage: phase-phase for three-phase windings, and either phase-phase or phase-neutral for single-phase windings. A high voltage side, as given by TransformerEnd. endNumber, shall have a ratedU that is greater or equal than ratedU for the lower voltage sides.	Distribution transformer, two-winding transformer:  RATED-VOLTAGE-PRIM [VOLT] RATED-VOLTAGE-SEC [VOLT]  Three-winding transformer:  RATED-VOLT—PRIM [VOLT] RATED-VOLT—SEK [VOLT] RATED-VOL—TERT [VOLT]
ratedS	Normal apparent power rating. The attribute shall be a positive value. For a two-winding transformer the values for the high and low voltage sides shall be identical.	Distribution transformer, two-winding transformer:  RATED-CAPACITY [VA]  Three-winding transformer:  PRIM-RATEDCAPACITY [VA] SEK-RATED-CAPACITY [VA] TERT-RATED-CAPACITY [VA]
<b>Relations</b>		
PowerTransformer	Relation to the transformer where the end is located.	
Terminal	It's important that a relation exist from PowerTransformerEnd to the Terminal sitting on the PowerTransformer.	
BaseVoltage	Relation to BaseVoltage.	

### RatioTapChanger class

TapChanger for changing the voltage. These are only exported for Primary Substations.

#### Attributes

mRID	Global Unique ID - owned by NETBAS	
------	------------------------------------	--



stepVoltageIncrement	Tap step increment, in per cent of nominal voltage, per step position	STEP-SIZE
highStep	Highest possible tap step position, advance from neutral. The attribute shall be greater than lowStep	NO-OF-TAPPING-STEPS
lowStep	Lowest possible tap step position, retard from neutral	minus NO-OF-STEPS-NEG-REG
neutralStep	The neutral tap step position for this winding. The attribute shall be equal or greater than lowStep and equal or less than highStep	0
neutralU	Voltage at which the winding operates at the neutral tap setting	RATED-VOLTAGE-PRIM
normalStep	The tap step position used in “normal” network operation for this winding. For a “fixed” tap changer indicates the current physical tap setting. The attribute shall be equal or greater than lowStep and equal or less than highStep.	$(\text{TAP-CHANGER-POSITION} \text{ minus } \text{RATED-VOLTAGE-PRIM}) / (\text{STEP-SIZE}/100 * \text{RATED-VOLTAGE-PRIM})$