OpenPowerNet

Release Notes Version 1.5.3

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Document No. OPN/RN/1.5.3

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1 Introduction

1.1 Overview

The purpose of this document is to describe the changes and the status of OpenPowerNet version 1.5.3. The document contains:

- List of delivered files on DVD,
- Description of the main functionality,
- Any restrictions known,
- List of corresponding documentation and
- Known issues.

1.2 Configuration

See document Installation Instruction version 1.5.3 for required third-party software versions.

1.3 Acronyms and abbreviations

The following abbreviations are used within this document.

Abbreviation	Description
2AC	2 Phase AC
AC	Alternating Current
ATM	Advance Train Module
DC	Direct Current
DVD	Digital Versatile Disk
GUI	Graphical User Interface
ODBC	Open Database Connectivity
PSC	Power Supply Calculation

2 List of files on DVD delivery

```
OPN_InstallationInstruction_1.5.3.pdf
OPN_ReleaseNotes_1.5.3.pdf
OPN_UserManual_1.5.3.pdf
OpenPowerNet\my.ini
OpenPowerNet\createUser.bat
OpenPowerNet\OpenPowerNet-1.5.3.zip
OpenTrack\OpenTrack.V_1.7.5.2014-10-21.zip
ThirdPartyPrograms\ required by OpenPowerNet, see Installation Instructions
update\
```

3 Main functionality

OpenPowerNet version 1.5.3 has the following main functionality:

- Calculation of AC, 2AC and DC power supply system,
- Calculation of magnetic coupling of conductors is done internally,
- AC / 2AC power supply models:
  - o Transformer,
  - o Auto transformer,
  - o Booster transformer,
- DC power supply models:
  - o Rectifier,
  - o Energy storage for stabilisation of line voltage and energy saving
- Voltage limiting device model to limit the touch voltage.
- Calculation of tractive effort with retroactive effect to the railway operation simulator OpenTrack,
- Calculation regenerative braking,
- Consideration of tractive and braking current limitation,
- Consideration of power factor at vehicle pantograph,
- Calculation of electrical engines with single or multiple propulsion systems,
- Division of power consumption for multiple Train Operating Companies,
- Evaluation of engine energy storage,
- Consideration of coasting behaviour of the courses,
- Consideration of changing train mass at station stops,
- Calculation of short circuit currents,
- Quick evaluation of network structure using constant current engine model,
- Visualisation of results using prepared Excel-Files and
- Visualisation of results using the automated analysis of the Analysis Tool generating Excel and PDF files for:
  - o Minimum pantograph voltage,
  - o Maximum touch voltage,
  - o Maximum leakage current,
  - o Substation:
    - Feeder current versus time and as TRLPC[1],
    - Busbar voltage versus time
    - Power (P,Q,S) versus time and as TRLPC for input, output and total (per substation and total of all substations of a network),
    - Power factor versus time
  - o Magnetic Field as flux density (B-field) and field strength (H-field),

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[1] The **T**ime-**R**ated **L**oad **P**eriods **C**urve (TRLPC) shows the maximum or minimum of a set of varying window-size averages where the window time duration is defined by the x-axis value.

- o Conductor and connector current versus time and as TRLPC[1]
- o Voltage versus time and as TRLPC[1]
- o Energy overview
- o Vehicle specific overview

4 Changes since version 1.5.2

- **General:**
  - Optimised algorithm for regenerative braking to reduce the number of iteration steps. This should lead to shorter calculation time especially in DC networks using brake model U_source. Additionally, the behaviour when aborting energy recovery due to missing consumer was fixed for some cases, also auxiliary power should not get limited anymore if not necessary (message ATM-I-009 would indicate such limitation).
    - When comparing the results with previous versions, small deviations in the division of energy regeneration might get visible when using brake model I_source, especially for DC networks with rectifiers. When using brake model U_source, the regenerated energy at pantograph could generally be slightly higher now!
    - To get the same results as in previous version, please activate the setting "Use ATM-PSC iteration previous to 1.5.3" in the preferences to activate the "compatibility mode", at the cost of lower simulation speed! This setting will be removed in future version 1.6.
    - NEW DEFAULT: DC engines use recoveryMode="U_source", AC engines use recoveryMode="I_source" if not defined (not for compatibility mode).
    - NEW DEFAULT: All engines use retryRecovery="true" if not defined (not for compatibility mode).
  - Engines outside of network are now written to enginedata database table too with network ID 0 and without voltage and current. Results that do not depend on an electrical network, like speed and effort, may be analysed using prepared Excel files. Automatic Analysis tool will not show them as output is created network wise.
  - Remove leading and trailing spaces in LineID and TrackID from OpenTrack. There might have been tricky "out of network" errors due to OpenTrack not showing these characters in Edge Inspector.
  - Removed some message output for better overview.
  - Some debug output was created although it had been disabled globally in the preferences.
  - Bugfixes:
    - Message recording caused crash when exception occurred during recording.
    - OpenTrack sometimes stalled when finish the simulation with OPN.
    - Other minor fixes.
- **Database:**
  - Database schema name may now contain ".".
  - The database parameter max_allowed_packet increased to 100M.
- **ATM:**
  - Display WARNING ATM-W-001 about negative voltage only if current iteration is > 90% of maximum allowed ATM-PSC iterations.

- Bugfix: Auxiliary power of trailer defined in OpenTrack was used even if attribute useAuxPower of the active propulsion was set to false.

- **PSC:**

  - Added optional attribute "allowGaps" to definition of Leakage element in XML Project-File. This may be used to suppress the error message about missing conductor if needed by the model.

  - Allow definition of busbar in substation without connector to line but busbar connector only.

  - Changed attribute "km" at element ConnectorSlice/Position to mandatory.

  - Bugfixes:

    - Fixed handling of Leakage elements that would lead to slightly higher admittance. In some cases this may result in higher rail-earth potential!

    - PSC crashed when recording large models. The database parameter max_allowed_packet increased to 100M.

    - PSC showed warning PRJ-W-032 for parallel connector when using 2 VLD elements between the same nodes. This is suppressed now for VLD as it is intended for the standard case.

    - PSC showed error INT-E-137 "NULL == lDatabase!" after simulation when not recording to database.

    - Check for positive connector length did not work as expected.

    - PSC crashed some times when using RAM limit of more than 2047MB because of the B value exceeds the int limit.

- **GUI:**

  - Bugfix: Selection-Editor: Got error message "Table 'pscresults.sim' doesn't exist" if database schema pscresults does not exist.

- **PSC Viewer:**

  - Bugfix: Tracks are now drawn in the same order as in the project file.

- **Analysis Tool:**

  - Analysis handles now also *.emf footer logo pictures.

  - Output for lines, leakage current: Now using default unit mA/m, may be changed back to A/km or A/m in preset if necessary.

  - Output for lines: Added columns to datasheet for pantograph voltage that show course ID, engine index and timestep of engine that caused the minimum or maximum voltage at the particular location.

  - Output for energy overview: Added possibility to output mechanical energy of the vehicles (traction, braking, braking achieved through regeneration). This has to be enabled in preset by setting the attribute "use" of the corresponding row item to "true" under TableTypes/Energy/TableType/Section/E_Vehicles.

  - Presets: Now it is possible to define different substructure in common "ItemDefs" element and under chart items. This allows more comfortable usage of "ItemRefs", see preset for charts for line for an example.

  - Ask user before enabling database keys while simulation is still running.

  - Fixed calculation of I_Leakage (chart for lines) with output mode HDD and multiple network time definitions with gap.

  - Fixed output creation for line charts with conductor switch in ContactWire.

- Fixed output creation for line charts with double rail and gap or isolator in at least one rail.
- Fixed output creation for split f(t) charts (e.g. more than 3 h) with label or line items. Labels are now created next to the second or second last drawn value for better visibility.
- Fixed output creation for VLD with only one state change.
- Fixed handling of missing database values.

5 Known restrictions

OpenPowerNet is tested with OpenTrack version 1.7.5 (2014-10-21) and should only be used with this version.

OpenPowerNet is a single user application. It is not tested to use the same database for multiple users at the same time.

The Engine-File uses the RailML rollingstock schema version 1.03 with OpenPowerNet specific extensions and is therefore not 100% compatible with the mentioned version 1.03.

6 Version of corresponding documentation

The following table lists the version of the documents related to OpenPowerNet 1.5.3.

Document	Version
Installation Instruction	1.5.3
User Manual	1.5.3

7 Known issues

The following table contains all known but unsolved issues.

ID	Summary	Status
371	When using larger time steps other than 1s, OpenTrack sends the requests not for all courses in the same time raster but OpenPowerNet is designed to calculate always in the same time raster. Workaround 1: Use always 1s simulation time steps. Workaround 2: Set all times within OpenTrack in the raster according to the selected simulation time step, e.g. for 3s time step only time hh:mm:00, hh:mm:03, hh:mm:06 ….. The simulation will be terminated by OpenPowerNet in case of OpenTrack requests outside of the time raster.	Can't be solved.
458	The information of split, merged and connected courses is not available in OpenPowerNet. Therefore the engine energy storage of an engine will be reset to the initial values even if the new course is connected with the previous course and the two courses represent the same physical train.	Open
582	Creation of magnetic field image needs the desired character set to be used for output set as system locale as Matlab plot functions do not handle unicode characters.	Open