

# OpenPowerNet

## Release Notes Version 1.9.2

**Institut für Bahntechnik GmbH**  
**Branch Office Dresden**

### Document No. OPN/RN/1.9.2

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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 1.9.2. 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 1.9.2 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
EFE	Engine File Editor
GUI	Graphical User Interface
NMMV	Network Model Microscopic Viewer
OCS	Overhead Catenary System
ODBC	Open Database Connectivity
OPN	OpenPowerNet
OT	OpenTrack
PDF	Portable Document Format
PSC	Power Supply Calculation
SoC	State of Charge
VLD	Voltage Limiting Device
XML	Extensible Markup Language

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## 2 List of files on DVD delivery



OPN\_InstallationInstruction\_1.9.2.pdf  
OPN\_ModellingCheckList\_1.9.2.pdf  
OPN\_ReleaseNotes\_1.9.2.pdf  
OPN\_UserManual\_1.9.2.pdf  
OpenPowerNet\my.ini  
OpenPowerNet\createUser.bat  
OpenPowerNet\OpenPowerNet-1.9.2.zip  
OpenTrack\OpenTrack.V\_1.10.2.2020-09-22.Kw29mB  
ThirdPartyPrograms\ required by OpenPowerNet, see Installation Instructions

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### 3 Main functionality

OpenPowerNet version 1.9.2 has the following main functionality:



- Calculation of AC, 2AC and DC power supply system,
- Calculation of magnetic coupling of conductors is done internally,
- Possible electrical network configurations include, but are not limited to:
  - Highspeed railway,
  - Freight railway,
  - Metro systems with OCS or 3<sup>rd</sup>/4<sup>th</sup> rail,
  - Monorail systems,
  - Tram networks,
  - Trolleybus networks,
  - Battery buses with charging station.
- AC / 2AC power supply models:
  - Transformer,
  - Converter (SFC),
  - Auto transformer,
  - Booster transformer,
- DC power supply models:
  - Rectifier/Inverter,
- Stationary 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,
- Consideration of 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 charging from regenerative braking and/or catenary,
- Evaluation of catenary-free operation,
- 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:
  - Minimum pantograph voltage,
  - Maximum touch voltage,
  - Maximum leakage current,
  - Substation:

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- Feeder current versus time and as TRLPC<sup>1</sup>,
- 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,
- Magnetic Field as flux density (B-field) and field strength (H-field),
- Conductor and connector current versus time and as TRLPC<sup>1</sup>,
- Voltage versus time and as TRLPC<sup>1</sup>,
- Energy overview,
- Vehicle specific charts,
- Vehicle specific overview

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<sup>1</sup> 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.

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## 4 Changes



### 4.1 Version 1.9.2 vs. 1.9.1

#### 4.1.1 Improved user experience

- General
  - Remove obsolete Prepared Excel Files as those analysis is available in via Selection Editor and Analysis.
  - Comment out the `tmpdir` parameter of the database configuration to simplify installation process.
  - The total size of files in the working directory is observed. In case there is less then 10GB space available on the drive then temporary files will be deleted, this may slow down the simulation but avoids aborting simulations. At least 20GB available space on the data storage of the working directory is recommended.
  - A warning is displayed if available space of the working directory data storage is less than 20GB.
- GUI
  - Analysis output folder is decorated with an additional symbol for easy recognition in project explorer.

#### 4.1.2 Bugfixes

- General
  - OpenPowerNet aborted simulation because of unexpected time values due to floating point inaccuracy in time step sizes sent by OpenTrack. Added error and warning messages for unsupported and suboptimal time step sizes.
- GUI
  - If the license dongle could not be reached when opening the preferences pages "OpenPowerNet" or "Analysis", the language setting on these pages could get destroyed and saved on clicking the apply button. This could only be fixed manually in the configuration files then. Now, in the same situation, the last configured language will be set without the possibility to change it.
  - Fix hiding of lowest Conductor in NMMV.
  - Fix Engine Editor as Unit Ws was selectable for x-axis of OCS Charge Power Limitation although it is not supported for the model.
  - Fix Selection Editor inconsistency of DropDown arrows in Vehicle Chart Types table.
- ATM
  - In some cases with weak power supply and very steep limitation curve for panto current consuming the load flow iteration could finish too early so that there was a mismatch between electrical and operational calculation of achieved traction power and effort. Message APS-I-586 (refining calculation) will be displayed in such cases.
  - When using an energy storage with charging from OCS and very steep limitation curves for panto current consumption and OCS charging power, the drive effort could be reduced in favour of OCS charging power.
  - If the attribute `maxRecoveryVoltage` for `brakeModel U_source` was set to 0 to prevent recovery to the railway network while still using the regenerative brake, e.g. to load an energy storage, the engine would be falsely calculated as if it had no power



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supply. This setup will directly force the engine to I\_source now, which would be the result anyways.

- For engines with energy storage charging from OCS and very restrictive recovery current limit (like 0A) it could happen that the iteration failed for timesteps where there actually is energy consumption.
- PSC
  - Warning message about parallel connector was displayed during simulation, but not when loading the model into NMMV or Selection-Editor.
  - Allow to define switching times in Switch-File up to 99:59:59.9, as it was possible before to 1.9.0. Please note, the hours are counted from 00:00:00. This means 25:00:00 is the 01:00:00 of the second day.
  - Fix recording order of voltage and currents into database, before it could happen to have the recording NOT in time step order. This made the simulation unusable for the analysis.
- Analysis
  - Fix AnalysisPreset.xsd to enable input suggestions for all Boolean attributes.
  - Creating the energy output table for substations with BusbarConnector or AdditionalLoad and a timestep width different from 1s would fail with error INT-E-543 (Number of summed up values is invalid).
  - An invalid item entry in the selection for Lines could lead to the common function (min or max) was not detected which would result in shorter file name and chart title, but longer legend entries.

#### 4.1.3 OpenTrack

- Update to 1.10.2 (2020-09-22)
  - Fix the effort requests during dynamic braking.
  - Fix a peak in effort request for the very first time step of a train that is already driving.

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## 4.2 Version 1.9.1 vs. 1.9.0

### 4.2.1 Bugfixes

- NMMV
  - Loading a project file that includes a substation without any power supply (e.g. switch station) would result in an empty NMMV tab.

## 4.3 Version 1.9.0 vs. 1.8.1

### 4.3.1 Improved user experience



- General
  - The Project-File will now be validated against its schema before loading it into the viewer or simulation. This will improve early detection of input errors and make sure that the Project-File is compatible to the current version of OPN.
  - Performance improvements with the interface to OpenTrack and connection to the license dongle.
- GUI
  - When starting the OPN simulation server using the button or context menu and the attribute “databaseSchema” is used in the selected project file, the dialogue “Create new OpenPowerNet database” will appear automatically to allow the user to create the desired database schema. If there is a schema with the same name already, the user will be prompted to either delete the previous data or keep the data and add the new data behind. It is recommended to write each simulation to a separate database.
  - Added a context menu entry for folders in the Project Explorer that will allow setting the particular folder as output directory for the Automatic Analysis Tool.
  - The link to the Automatic Analysis output folder, that will be created next to the particular Selection-File when starting the output creation, will now be named based on the name of the Selection-File followed by the actual folder name in brackets. Example: Selection-File-Name(projectID -yymmdd-hhmm)
  - The Excel executable path in the Analysis preferences should now be found automatically.
  - The default data storage type for Analysis will now be SSD. Please make sure to change this to HDD, if you still use one, to omit a performance hit.
  - UTF-8 will be set as default text file encoding now.
- NMMV
  - Added a reload button to NMMV that will allow to reload and redraw the network model after the Project-File has been modified. There is no need to close and reopen the viewer tab anymore.

### 4.3.2 Changes to OpenTrack-OpenPowerNet interface

Starting from OpenTrack 1.9.5.2019-04-08, the cosimulation interface has changed slightly. OpenTrack will not wait anymore to receive the ready4Simulation request from OpenPowerNet. If a newer OT is used together with an older OPN, the OT host and port settings in OPN should be changed to use OPN server host and port as destination to prevent error messages. If an older OT is used together with a newer OPN, it might be necessary to press pause and start in the OT simulation controller.

The change should improve stability of the communication during simulation start and makes the reverse connection from OPN to OT obsolete.



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OpenPowerNet 1.9.2 is released together with OpenTrack version 1.10.2 (2020-09-22).

### 4.3.3 Bugfixes

- General
  - If parsing of project files failed, the next simulation runs within the same OPN Server instance could fail too, although the files were fixed.
- PSC
  - The results for an almost overloaded power supply system were not reproduceable for multiple timesteps with identical effort requests as the initial current angle at engine pantograph was taken from the last simulation timestep. Furthermore, the initial engine current value was calculated based on the nominal voltage of the network. The initial engine current value and angle are now calculated based on an additional no-load network calculation at the beginning of each timestep. The fix causes slightly different results within the defined tolerances and a different number of iteration steps.
  - A power supply will not be considered anymore during evaluation of wire use (power supply indication) if one of the connectors to OCS or rails busbar has an open switch. This prevents some unnecessary iteration attempts that would ultimately fail.
  - When a constant voltage engine was powered off inside an actual network with power supply, an iteration failure would occur.
- NMMV
  - The wire use was not evaluated after shifting switch as defined in the optional switch state file. This could lead to wrong display of available power supply.
  - Cancelling model open/reload wizard would open an empty editor.
- Analysis
  - Add another index to database table enginedata to fix bad performance of output creation for U\_Panto with Automatic Analysis. The database schema version has changed to version 22.
  - Output for lines: The conductor current sum output was missing the value for the last conductor section if min/max positions were limited in the selection. It was instead mapped to km 0+000.
  - Substation and energy overview: No-load losses were missing in "Losses in traction power supplies" and "Total energy at national power grid" for TwoWindingTrafo and ThreeWindingTrafo.

## 5 Known restrictions

OpenPowerNet is tested with OpenTrack version 1.10.2 (2020-09-22) 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.

## 6 Version of corresponding documentation

The following table lists the version of the documents related to OpenPowerNet 1.9.2.

Document	Version
Installation Instruction	1.9.2
User Manual	1.9.2

## 7 Known issues

The following table contains all known but unsolved issues.

ID	Summary	Status
371	<p>When using larger time steps other than 1s or 0.5s, 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.</p> <p>Workaround 1: Always use 1s or 0.5s simulation time steps, which is recommended for best performance and accuracy anyways.</p> <p>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 .....</p> <p>The simulation will be terminated by OpenPowerNet in case of OpenTrack requests outside of the time raster.</p>	Can't be solved.
582	Creation of magnetic field image and vehicle histogram needs the desired character set to be used for output set as system locale as Matlab plot functions do not handle unicode characters.	Can't be solved.
n/a	Due to a limitation of the Excel VB interface, placement of the footer logo is limited to particular language editions. If you should face the corresponding warning message, please install the english edition and/or report the displayed code to the developers! The preset attribute "footerLogoFormatCode" under Settings/Excel may be modified to use the proper VB format code.	Can't be solved.
n/a	Due to a limitation of the Excel VB interface, sheet names must not use international character sets. Therefore all sheet names will be created in English.	Can't be solved.
n/a	Warning message PRE-W-506 might be displayed on localised systems. This happens due to a limitation of the Excel VB interface, if the printer can not be set correctly. Technical background: As Excel sets the page size of new sheets according to the current printer, a printer with proper setup has to be selected before creating output. This is normally achieved using "Microsoft XPS" printer. If it fails, the user has to take care, that the system default printer is configured as desired. The warning message may be ignored in this case.	Can't be solved.
n/a	Vehicles, charts for all courses with multiple time windows: As data is written to the sheet sorted by engine first and timestep second, the chart series in a subchart can not be limited as easy as if sorted by timestep and therefore will contain time data from other subcharts. The axis scaling will be set correctly though.	Can't be solved.
OPN-13883	While merging with attribute mergeNetwork="false" the model parsing might fail with error message INT-E-353 as the network is still evaluated and checking references to master network.	Open

**END OF DOCUMENT**