SATEL NETCO Design USER GUIDE v1.14.0 for software versions 2.1.0+

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Salo, FINLAND 2025

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NodeJs - http://www.nodejs.org/

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1 INTRODUCTION

SATEL Oy is a Finnish electronics and Telecommunications Company specializing in the design and manufacture of wireless data communication products. SATEL designs, manufactures and sells radio modems intended for use in applications ranging from data transfer to alarm relay systems. End users of SATEL products include both public organizations and private individuals.

SATEL Oy is the leading European manufacturer of radio modems. SATEL radio modems have been certified in most European countries and in many non-European countries.

1.1 Terms and abbreviations

Term or Abbreviation	Description
CU	Central unit. With SATEL's SATELLAR family of products means the Central unit (subunit), which runs Linux and provides the Ethernet and IP-connectivity as well as in some cases the display and keyboard.
Synchronization	In this document means the procedures in which settings (configuration) data in the NETCO database and the external world is exchanged by means of supported data transfer methods. This 'data transfer' can be either real time communication using some communication protocol or by means of files. The goal of synchronization is that in the end on synchronization the NETCO's configuration database has the same values and state as is in the files or device.
RU	Radio unit. SATELLARS and all radio-modems manufactured by SATEL Oy have a radio unit (subunit) which provides the actual long range narrow band RF-communications capability.
GUID	Globally unique ID specified in RFC4122 http://www.ietf.org/rfc/rfc4122.txt

1.2 Description of the product

SATEL NETCO Design is a collection of services for network design and management. It can be installed to a Windows PC. The user interface of the product is web-browser-based and can therefore be used both locally and remotely.

NETCO Design supports designing of Internet Protocol (IP) based networks consisting of radio modems of the SATELLAR product family, as well as generic IP network components such as switches and routers.

NETCO Design allows manual control of all settings of the radio modems, and also includes features to automatically generate settings such as protocol addresses and routing tables to

facilitate the rapid deployment of devices. NETCO Design is also used to directly transfer the managed settings to the actual devices (via Synchronization), with no need to manually enter settings using the device's own user interface. Synchronization is supported for SATEL-manufactured products.

1.3 Technical information (NETCO Design only)

<table>
<tr><th>Aspect</th><th>Information</th></tr>
<tr><td>Supported client browsers</td><td>Mozilla Firefox (for the best security and privacy) or Google Chrome (for fastest performance).</td></tr>
<tr><td>Supported OS-platforms</td><td>Windows 10 and Windows 11 64-bit with Microsoft .NET Framework 4.6.2 or newer installed.</td></tr>
<tr><td>List of free Open source software included</td><td>NodeJs – application engine (redistributed)
MongoDB – database engine (redistributed)
wget.exe - HTTP(S) client application (redistributed)
curl.exe - HTTP(S) client application (redistributed)
7zip.exe - .zip file compression and decompression (redistributed)
fabric.js - HTML5 canvas library (redistributed)
jquery - javascript application engine (redistributed)</td></tr>
<tr><td>License</td><td>Read the up-to-date license text from the Installer.
NETCO Design are copyright ©2013-2025 SATEL Oy, Finland. All other rights reserved by SATEL Oy.</td></tr>
<tr><td>Minimum and recommended computer specs for the server and UI displays</td><td>
<table>
<tr><th>Aspect</th><th>Minimum</th><th>Recommended</th></tr>
<tr><td>Disk space</td><td>6GB</td><td>20GB+</td></tr>
<tr><td>RAM</td><td>4GB</td><td>8GB+</td></tr>
<tr><td>OS and CPU bit width</td><td>64-bit</td><td>64-bit</td></tr>
<tr><td>CPU speed</td><td>2.5GHz+</td><td>3.5GHz</td></tr>
<tr><td>CPU cores</td><td>2</td><td>4+</td></tr>
<tr><td>Display (for browser)</td><td>4:3 1280x1024
16:9 1400x900 +</td><td>16:9 FullHD 27”</td></tr>
</table>
</td></tr>
<tr><td>Firewall requirements</td><td>See the following chapter about “Firewall requirements”</td></tr>
</table>

1.4 Firewall requirements

Table 1 Firewall requirements (outbound)

Direction	Outbound
IP protocol	TCP
Ports	80. 443
IP-address	online.satel.com (https://online.satel.com)
Purpose	Checking and updating software

The above firewall ports (80,443) should be open for the most secure and best and easiest user experience during the software updates using the online-method.

Table 2 Firewall requirements (inbound)

Direction	Inbound
IP protocol	TCP
Port	8080 (Default port. You can modify or may have modified this during installation)
IP-address	<the IP address of computer where NETCO is installed>
Purpose	Using NETCO's WEB-based user interface with HTTP-protocol

The above firewall port needs to be open, if NETCO is installed into a server computer (such as virtual private server) and WEB access must be possible from one or more workstations. Inbound firewall requirement is not relevant, when using NETCO in the same machine into which it is installed.

Warning! You should not allow access to NETCO's WEB-based user interface directly from the Internet. If you need to access NETCO from the Internet, then the recommended procedure is to use secure VPN tunnel to the LAN, from which there is access to the NETCO WEB server.

2 INSTALLING AND UPDATING IN MS WINDOWS

2.1 Installing the software to the host

SATEL NETCO Design for Windows is delivered as an easy setup executable, which guides you through the setup process. You only need to run the setup once when initially installing the NETCO Design for Windows for the first time.

Although installation is possible without Internet connection, SATEL strongly recommends installing the system with Internet connection for the best experience. That way it is also possible to immediately check for new software updates.

After installation, remember to check for Updates first! You might have installed the newest version, but since we are constantly developing NETCO Design there is a good chance that there is already a defect fix or enhancement update available. Note that the easiest way to check updates is online mode, which on the other hand requires Internet-connectivity and the related firewall ports are open. For more information about the required firewall settings, see the earlier chapter "Firewall requirements".

2.2 Updating the installed software

NETCO Design software will be updated regularly as new Design or SATEL Product features arise. Full support for the newest product features requires that you have the Design updates installed from the same period of time.

SATEL recommends having Internet-connectivity during checking updates for the easiest experience, in which case the checking, downloading and running update can happen automatically. If you are using NETCO Design in a high security environment without Internet connection, you can also use the manual update method.

To start checking for updates, go to the Admin tools –section in the main menu and select "Update NETCO". If an update is available, you can still choose whether to apply or cancel that update.

NOTE! NETCO exports all your networks to C:\ProgramData\Satel\NETCO\backups folder before the update start.

3 USER INTERFACE

The user interface can be accessed using a web browser by default in the address http://localhost:8080/netco/login.
Alternatively, in MS Windows you can use Start Menu shortcut “Open NETCO” which will open the user interface using the default browser.
Please note, that NETCO user interface color scheme can be different for different NETCO variants.

3.1 Login page

The login page is used to enter the username and password credentials.

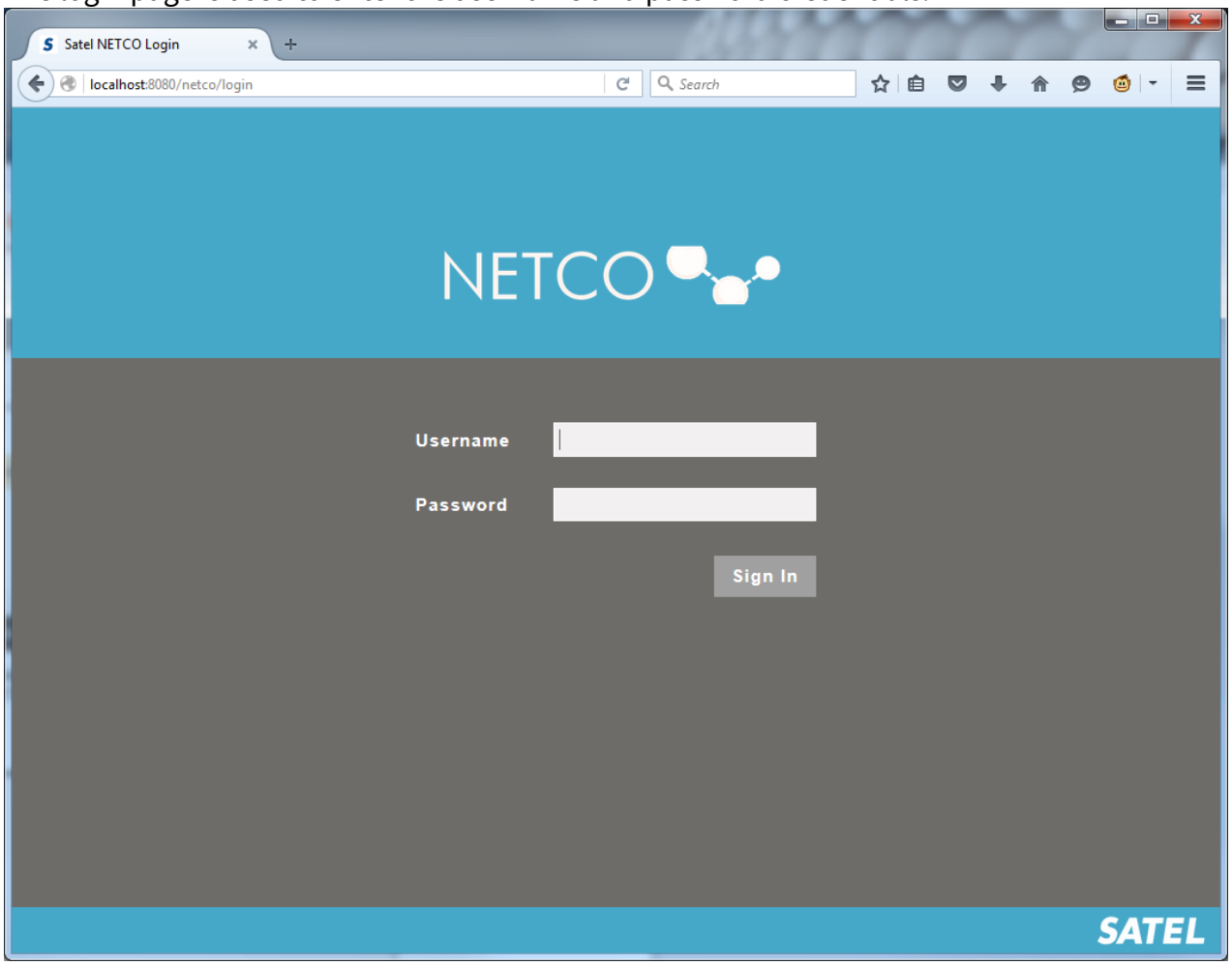


Image 1: Login page

The default username is “admin” and the password is “admin”. Alternatively, “user1” and “pass1” also work. “Admin” user can edit, add and delete User Groups and individual users via the “User Management network”, available from the networks drop-down menu.
Select “Sign in” to continue.

3.2 Welcome page

The welcome page is only shown on first startup of NETCO Design (or after rebooting the PC). It can later be accessed from the “About->Welcome page” menu.
The welcome page contains generic information about NETCO Design. Select “Open NETCO” to continue to the Network page.

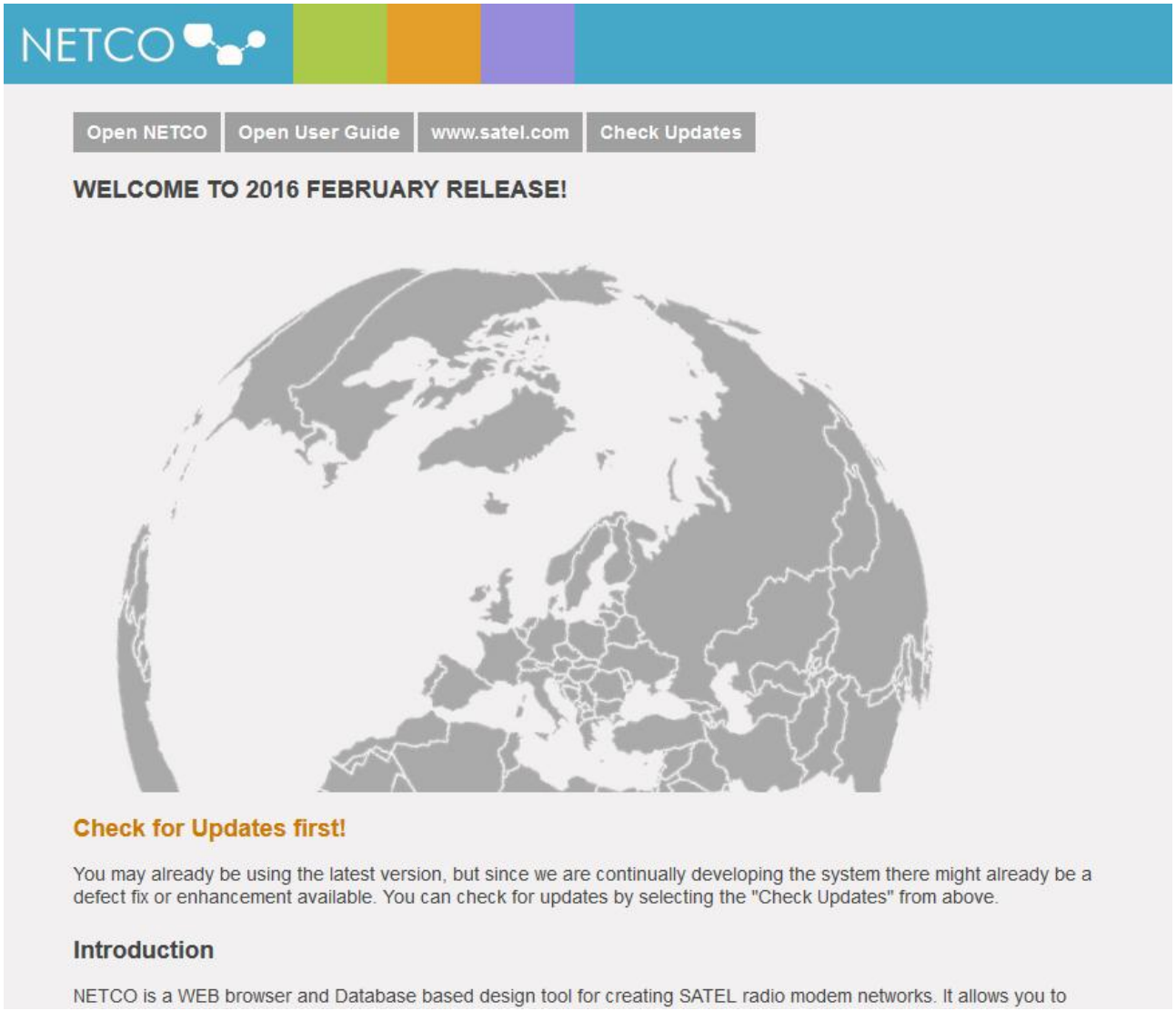


Image 2: Welcome page

3.3 System Info page

The System Info page is accessible from ‘About’ section of Main Menu.
The page contains:

- System performance index
- Info and status of NETCO services
- Info and status of all Networks created in NETCO Design

3.4 Network page

The Network-page is currently the main page where network design and synchronization can be performed. When no Networks have yet been created the main page will look like Image 3. At this point you may create a new network by selecting one of the network templates.

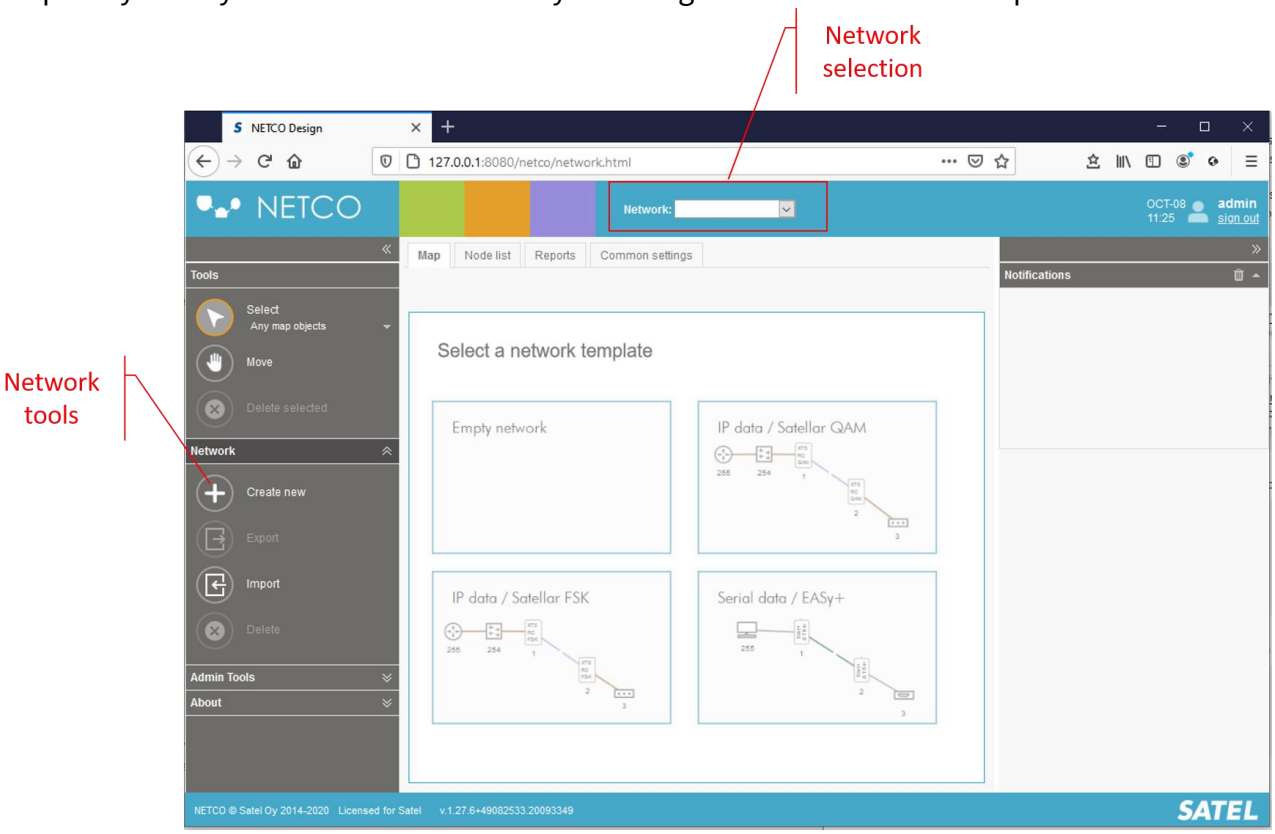


Image 3: Network page with no networks

After at least one network has been created, the network page will appear as Image 4.
If you want to create another network, select “Create new” from Network Tools.

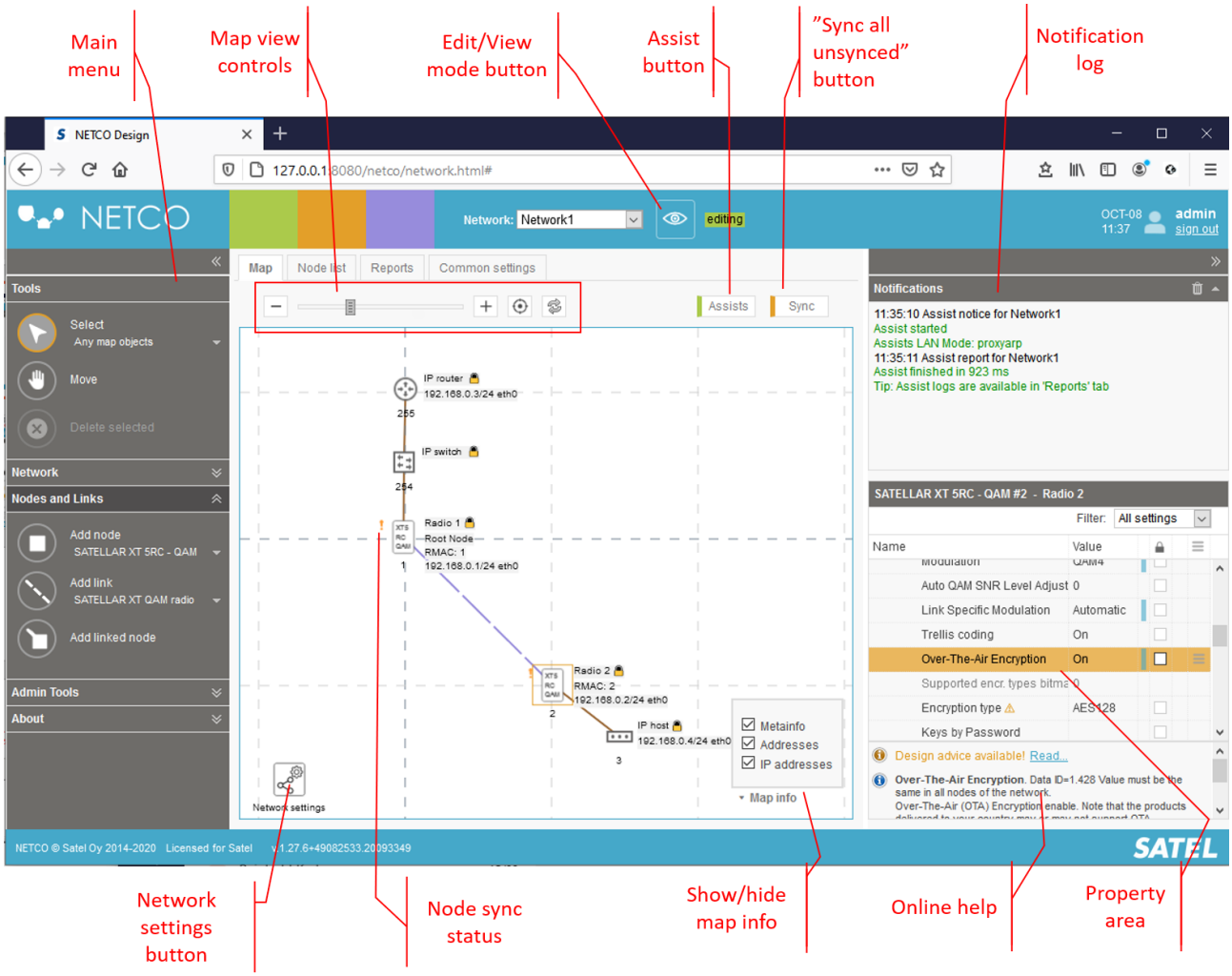


Image 4: Network page with one or more networks

3.4.1 Main menu functions

Start or Stop editing

These buttons, located at the center top area of the view, are used to toggle the editing or viewing mode. In Viewing mode, no changes can be made to the network, other than moving and zooming the map view. In editing mode all settings can be changed, and Assists can be run.

Tools – Select

Select (click) this icon to enable selection mode. Using the arrow cursor, you can select map objects (nodes or links). You can also move nodes if the network is in edit mode. You can choose

which types of objects to select from the drop-down list. This is especially useful if you select a group of objects and you wish to only select links OR nodes, not both.

Tools – move

Select this icon to activate the move tool. You may then drag the whole map easily to view different areas of a map that are otherwise too big to fit the screen, for example.

Network – Create new

Select this icon to instantly create a new Network and switch the view to it.

Network – Export

Select this icon to export selected Network elements (objects) to a NETCO transport file. You can use this even in Viewing mode. The file format is NETCO System specific network data transport format and data is presented in automation-friendly JSON text. Text encoding is UTF-8. Export and Import combination can be used as an external file backup and these can be used to move information between sites or for example to provide information for SATEL tech support.

Export options:

- **Optimized Settings Data** – recommended for most cases. Exported data is optimized for faster processing while importing the transport file. The transport file will contain only node settings that have been modified from their default values.
- **Full Settings Data** – can be used, for example, for exporting out of NETCO Design. Transport file will include all settings of the network nodes, that will cause longer importing time.
- **Include confidential data** – if checked, confidential settings (e.g. encryption keys) will be included to the transport file.
- **All Network Objects** – All nodes and links of the network will be included to the transport file
- **Selected only** – only selected nodes and links will be included to the transport file

NOTE: you can export all your networks by command “Export NETCO networks” in Windows Start menu. The network files will be saved to C:\ProgramData\Satel\NETCO\backups

Network – Import

Select this icon to import a network into NETCO. Three file types are accepted:

- **NETCO transport file** (.json) — a file exported earlier from NETCO using the Export function.
- **SATEL NMS PC project file** (.saxd) — a project file created with SATEL NMS PC software.
- **SATELLINE SaTerm project file** (.spf) — a project file created with SATELLINE SaTerm software.

Import procedure

1. Click the Import icon. The Import dialog opens.
2. Click **Browse** and select the file.
3. NETCO reads the file and displays a summary showing the number of nodes, links, and settings found, together with any warnings about data that could not be converted.
    - If a .saxd file contains more than one network, a list of available networks is shown. Select the one you want to import before continuing.
4. Choose the import method:
    - **Restore network from the file** — the network is imported with its original GUIDs, network name, and synchronisation state. NETCO checks whether any GUID in the file conflicts with a GUID already in the database. If a conflict is detected, the import is cancelled and you are asked to remove the conflicting node or network first. See chapter 4.2.7 for more information about GUIDs.
    - **Create new network using the file as a template** — new GUIDs are generated for all nodes and read-only settings are discarded. Use this option when you want to start a fresh network design based on an existing file, without carrying over any synchronisation history.
5. Click **OK** to start the import.
6. If the currently open network is empty, the imported nodes and links are added to it directly. If the network already contains nodes, a new empty network is created first and the content is imported there.
7. Any warnings produced during the import are shown in the Notification panel. Review them to check whether any nodes or settings were skipped due to unsupported device types or unrecognised parameters.

Network – Delete

Select this icon to delete the currently visible network from the database. (Even in View mode). All information about the network will be removed from the database. NETCO Design will ask you to confirm the deletion.

Network – Synchronize selected

Select this icon to start the Synchronization process for *all selected synchronizable nodes*. Currently only nodes representing SATEL products can be synchronized. The synchronization process is explained in detail in chapter 5.

Network – Radio Connection Test

See chapter 6. RADIO CONNECTION TEST

Nodes and Links – Add node

Select this icon to activate the Add node tool. Then you can click anywhere on the map to add one node of the selected type at that location. The node type can be selected from the drop-down list below the “Add node” text.
Node types currently supported:

- SATEL-EASy+ (400 MHz) – a Satel radio modem EASy+ 403-473- MHz with the 'Radio Compatibility Mode' setting configured to a mode that supports Source Routing. For details on Source Routing support, refer to the product User Guide.
- SATEL-EASy+ (400 MHz/3AS NMS) - a Satel radio modem EASy+ 403-473- MHz in 3AS NMS compatibility mode.
- SATEL-EASy+ (300 MHz) – a Satel radio modem EASy+ 320-380- MHz with the 'Radio Compatibility Mode' setting configured to a mode that supports Source Routing. For details on Source Routing support, refer to the product User Guide.
- SATEL-EASy+ (300 MHz/3AS NMS) - a Satel radio modem EASy+ 320-380- MHz in 3AS NMS compatibility mode.
- SATEL-EASy+ USB/ETH/BT (400 MHz) – a Satel radio modem EASy+ USB/ETH/BT 403-473- MHz with the 'Radio Compatibility Mode' setting configured to a mode that supports Source Routing. For details on Source Routing support, refer to the product User Guide.
- SATEL-EASy+ USB/ETH/BT (400 MHz/3AS NMS) - a Satel radio modem EASy+ USB/ETH/BT 403-473- MHz in 3AS NMS compatibility mode.
- SATEL-EASy Pro+ (400 MHz) – a Satel radio modem EASy Pro+ 403-473- MHz with the 'Radio Compatibility Mode' setting configured to a mode that supports Source Routing. For details on Source Routing support, refer to the product User Guide.
- SATEL-EASy Pro+ (400 MHz/3AS NMS) - a Satel radio modem EASy Pro+ 403-473- MHz in 3AS NMS compatibility mode

- SATELLAR XT 5RC-QAM – a SATEL radio modem consisting of a CU and a RU
- SATEL XPRS Optimum RC – a SATEL radio modem consisting of a CU and a RU
- SATELLAR XT 5RC-FSK – a SATEL radio modem consisting of a CU and a RU
- SATELLAR XT 5R-QAM – a SATEL radio modem consisting of a RU only
- SATELLAR XT 5R-FSK – a SATEL radio modem consisting of a RU only
- SATELLAR 1DS – a SATEL radio modem consisting of a RU only
- SATELLAR 2DS – a SATEL radio modem consisting of a CU and a RU
- SATELLAR 20DS – a SATEL radio modem consisting of a CU and a RU

- SATELLINE 3AS NMS – a SATEL radio modem

- SATELLINE 3AS Epic NMS – a SATEL radio modem
- SATELLINE 3AS VHF – a SATEL radio modem

- SATELLINE-3AS – a SATEL radio modem, multiple firmware versions (fw1.07 - fw3.63). Configured and synchronized via SATEL Remote API protocol.
- SATELLINE-3AS EPIC – a SATEL radio modem, multiple firmware versions (fw2.12 - fw3.63). Configured and synchronized via SATEL Remote API protocol.
- SATELLINE-EASy - a SATEL radio modem, multiple firmware versions. Configured and synchronized via SATEL Remote API protocol.
- SATELLINE-M3-TR1 - a SATEL radio modem. Configured and synchronized via SATEL Remote API protocol.
- SATELLINE-EASy Pro 25W - a SATEL radio modem. Configured and synchronized via SATEL Remote API protocol.
- SATELLINE-EASy Pro 35W – a SATEL radio modem. Configured and synchronized via SATEL Remote API protocol.

- Generic IP host – a node representing any device that typically has a single IP address and no routing capability, a polled device for example. (No synchronization in NETCO)
- Generic IP router – a node representing an IP router. (No synchronization in NETCO)
- Generic IP switch – a node representing an IP/Ethernet switch or hub. (No synchronization in NETCO)
- Generic Serial RTU – a node representing a Serial RTU. No synchronization in NETCO
- Generic Serial MUX – a node representing a Serial MUX. No synchronization in NETCO
- Generic Polling Master – a node representing a Polling Master. No synchronization in NETCO
- VRRP Station – a node representing virtual redundant routing protocol setup of two radio modems. SATELLAR nodes can be connected to VRRP station with VRRP association link.
- Generic folder 1 – a node for storing any miscellaneous text information you wish, not representing any actual device.

Nodes and Links – Add link

Select this icon to activate the Add link tool. Then you can click two different existing nodes on the map to create a link between them. The type of link to create depends on the selection that has been made on the drop-down menu below the “Add link” text. Note that if either node does not support the type of link selected, the link cannot be created.
Link types currently supported:

- Radio Link – used to link the radio modems. NETCO selects proper radio link type automatically according to the node types. Available radio link types are:
    - SATELLAR XT QAM radio – used to link SATELLAR XT 5RC – QAM nodes
    - SATELLAR XT FSK radio – used to link two SATELLAR XT 5RC – FSK nodes

    - SATELLAR 2DS radio – used to link SATELLAR 2DS or 20DS nodes
    - SATELLINE 3AS NMS UHF radio – used to link SATELLINE 3AS NMS, SATELLINE 3AS Epic NMS and SATEL-EASy+ 3AS NMS nodes
    - SATELLINE 3AS NMS VHF radio – used to link SATELLINE 3AS NMS VHF nodes
    - SATEL Classic radio – used to link SATEL-EASy+ nodes
- Ethernet – used to link any devices nodes on the map (i.e. not including the "Generic Folder 1" node)
- Generic Serial RS-xxx – used to link any Serial nodes
- VRRP Association -used to link nodes which support VRRP functionality (SATELLAR) to VRRP Station

2. Mobile Station Link - used to connect the Source Routing master modem to a mobile station node. A mobile station is a radio modem that physically moves within the coverage area of several relay modems. Unlike fixed modems, the route to the mobile station must be configured manually in the master modem's SR Routes table. Assist validates that a locked route entry exists for the mobile station and reports an orange notification if one is found, or an error if none is configured. Mobile Station Links are displayed as dashed orange lines on the map.

There are additional restrictions on links:

- Any number of radio links are allowed between nodes, with the exception that there can be only one link between any two nodes.
- Radio links can be drawn so that they form circular routes in the map, but the Assist functions cannot yet generate meaningful PR routing tables from circular drawn routes.
- Only one Ethernet link is allowed per node, except for the Generic IP switch node. This means that to connect more than one Ethernet/IP device to a SATELLAR, for example, you must first connect the SATELLAR to a Generic IP Switch, then connect all the other IP nodes to the switch.

Nodes and Links – Add linked node

Select this icon to activate the Add linked node tool. This is a more convenient way of adding many nodes and links of the same type in succession. First click an existing node, the click the target point for the new node. The new node and a link connecting the old and new nodes are created. The types of new nodes and links are determined by the selections made under the Add node and Add link tools' drop-down lists, respectively. All the same restrictions apply to this tool as those in the Add node and Add link tools.

Admin Tools – Update NETCO

Select this button to start the NETCO Design System software update. NETCO Design will automatically check SATEL Internet servers to see if a new version of NETCO is available and then ask you if you wish to update or not. Any data in the database will not be removed. (Note

that if you choose to uninstall NETCO via the Windows Add or Remove programs function instead, the data WILL be removed!)

NOTE! NETCO exports all your networks to C:\ProgramData\Satel\NETCO\backups folder before the update starts.

Admin Tools – Backup Networks

The Backup Networks feature allows you to export all existing radio networks from the system into a single ZIP archive. This archive contains one JSON file for each network, including all configuration and topology data.
When you start the backup process:

1. The system collects all network data.
2. A ZIP file is generated and downloaded to your computer.
3. The file name will include the current date and time for easy reference (e.g., netco_networks_2025-08-12_1530.zip).

To restore networks from a backup:

1. Extract the ZIP package on your computer.
2. In the application, use the Import option.
3. Select and import the desired network JSON files one by one.

About
This toolbar page displays NETCO Design version information and license information. There is also a link to the welcome page, see 3.2, this User Guide and System Info page, see 3.3.

3.4.2 Assists button and Assist dialog

Assist dialog can be accessed by pressing the Assists button. See more information about Assists in 4.2.8 and 4.5.
Assists button color indicator informs the user about Assists run need. Green indicator means, that Assists have run successfully and no changes to nodes configuration have been made after that. Orange indicator means “Assists run needed”, i.e. either Assists have been never run or some settings have been changed after last Assists run.

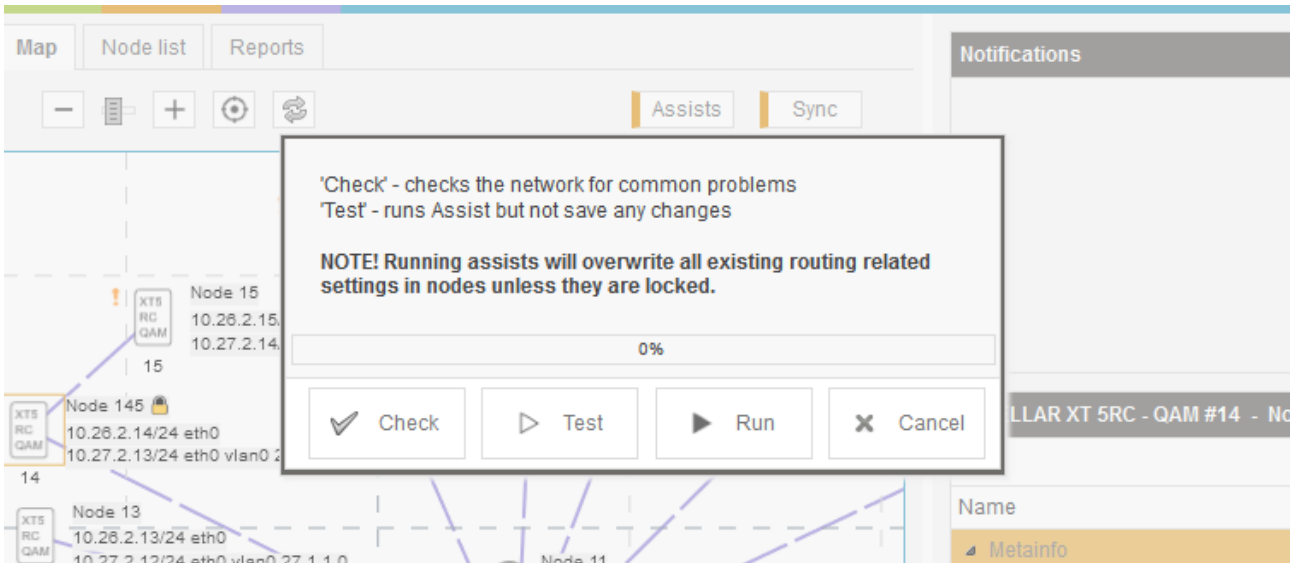
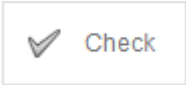


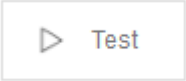
Image 5: Assist Dialog

Check



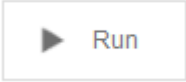
Select this button to check your network configuration for common problems, like addresses conflicts, sameness of settings that should be the same, etc.

Test run



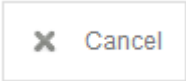
Select this button to run Assists to generate nodes settings and get Notification Log messages, but do not save any changes to the database. This is useful to test Assists without any risk of losing the current setup.

Run Assists



Select this button to run Assists and have any generated values stored into the database.

Stop/Cancel



Select this button to close the Assist dialog and stop any Assist currently running, any changes so far generated will NOT be stored into the Database.

3.4.3 Sync button

The user can initiate synchronization of all currently unsynchronized nodes of the network by selecting “Sync” button. See more information about synchronization in chapter 5.
“Sync” button color indicator informs the user about synchronization need. Green indicator means that no sync needed. Orange indicator means, that at least one node of the network is unsynchronized.

3.4.4 Map view

Network nodes and links are presented graphically in Map view.
Each node has a unique Node ID that is assigned automatically on node creation. Node ID can be changed by selection “Edit Node ID” option of node context menu.

When an address value (RMAC or terminal address) shown beside a node on the map is clicked, its decimal and hexadecimal representations are printed in the Notification panel. For example:
Node#5 address: DEC 34, HEX 0x22

Some Node properties like device name and IP address can be shown on the map beside the nodes (see Image 6. Map info). Uncheck “Show map info” checkbox to hide map info texts.
The Map info box (Image 6) contains checkboxes to control which node information is shown on the map:

- Metainfo - shows or hides device names
- Addresses - shows or hides RMAC and terminal addresses beside nodes.
- IP addresses - shows or hides IP address information beside nodes.
- Node ID - shows or hides the Node ID number below each node on the map.
- Terminals - shows or hides terminal nodes (Generic Serial RTU and Generic IP Host) on the map. Hiding terminals gives a cleaner view of the radio modem topology.

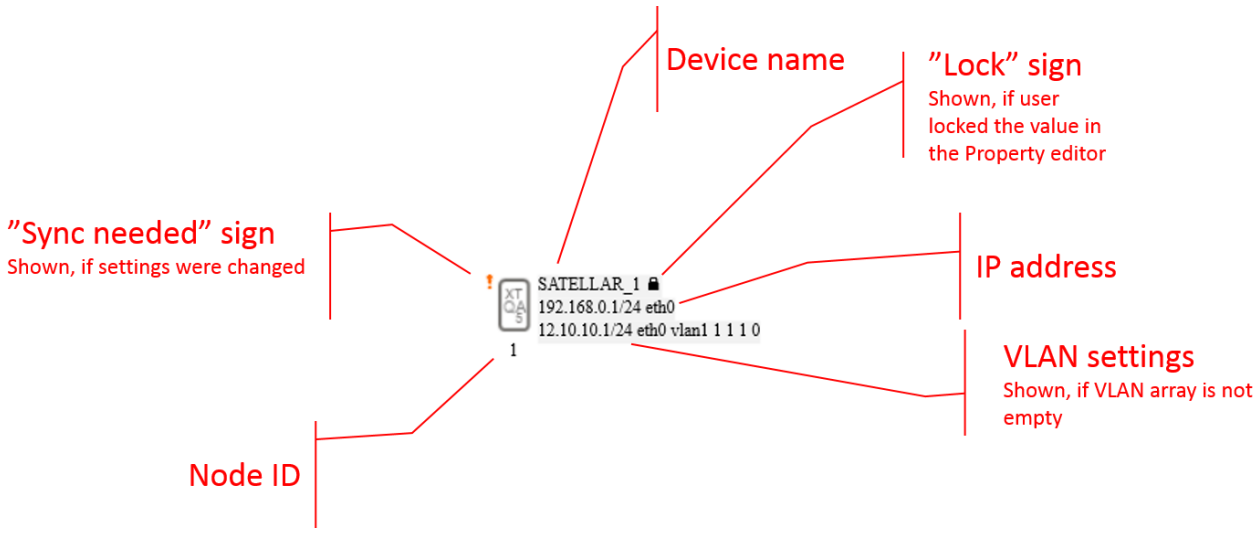


Image 6. Map info

Map view controls can be found at the top area of the map view. Use those controls to zoom, center and refresh the network.

3.4.5 Node list view

Node list is grid view containing the network nodes only. The list can be exported to a CSV format file.
A scope of the grid columns can be set with “Columns scope selector”. Three options are available:

- Compact: the node identification data (Node ID, Type, Name, RMAC, ETH MAC, IP address, Serial number, Fw-version) report is shown
- Operations: the node creation/modification time and synchronization status
- All: all node info, which includes both of above

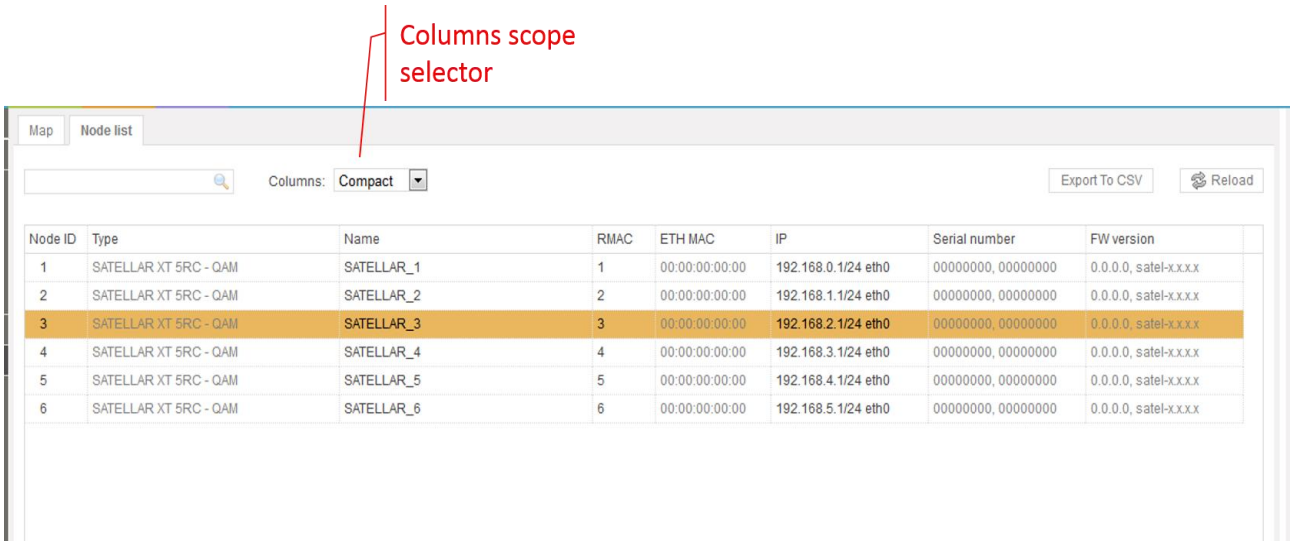


Image 7. Node list view

3.4.6 Node context menu

The same node context menu is available in both Map and Node list views. To access the context menu, select desired node and press mouse right button.

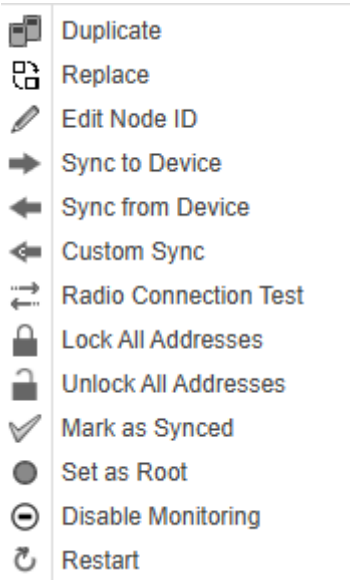


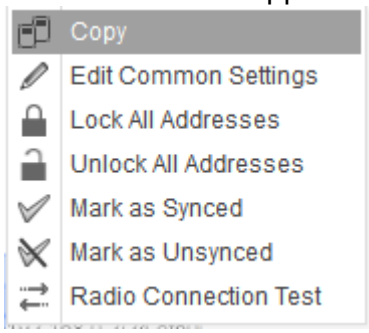
Image 8. Node context menu

Node context menu options:

- **Duplicate** – a new node of the same type will be created, and all settings will be copied to that new node.
- **Replace** - replaces the device type of the selected node with another device type while preserving the node's position, Node ID, name and other compatible settings. A dialog with a hierarchical list of available device types is shown; select the new type and confirm. Link connections are kept where the new device type supports the same link types. Only available in edit mode.
- **Edit Node ID** – the node ID can be modified by selection of this option. Node ID must be positive number and be unique in the scope of the network.
- **Sync to Device / Sync from Device** – opens a synchronization dialog for the node. See more information in chapter 5.
- **Custom Sync** – opens a custom synchronization dialog. See more information in chapter 5.8.
- **Radio Connection Test –** opens Radio Connection Test dialog. See more information in chapter 6.
- **Lock/Unlock All Addresses –** locks or unlocks addresses in the selected node, displaying the addresses for user confirmation before proceeding. Address types may include RMAC, IP, VLAN, VRRP, or Destination, depending on the product.
- **Mark as Synced / Mark as Unsynced** – this option can be used if the device was manually configured, and the user wants to mark the node correspondingly.
- **Set as Root / Unset root** – One node in the network can be marked as Root node. Root node is required by Assist, when it is generating PR and IP routes.
- **Disable/Enable Monitoring (for use in NETCO NMS)** – Select this option to disable or enable monitoring for the specified node. When monitoring is disabled, none of the node's properties are monitored, regardless of individual property monitoring settings.
- **Restart** – Restarts the device and prompts you to choose a connection method.

3.4.7 Group selection context menu

If to select multi nodes in the Map view and press mouse right button, then Group selection context menu will appear.



Group selection context menu options:

- **Copy –** temporary copies selected nodes and links to let them be pasted later to the same network or to another network. Pasting can be done by pressing a mouse right button on empty map area and selecting one of the Paste options:
    - **Paste with Settings –** previously copied nodes and links will be added to the network and identical settings will be assigned to the nodes. NOTE! GUIDs, Read-only settings (i.e. settings that can be read only from the device), Synchronization status and settings locks are not copied in this case.
    - **Paste as New –** previously copied nodes and links will be added to the network, but their settings will remain default as if you add new node.
- **Edit Common Settings –** Displays common settings for selected nodes in the Property view. Common settings are settings that must/should have the same value in all nodes of the network. Once the user edits the setting there, the new value will be updated in all selected nodes.
- **Lock/Unlock All Addresses –** locks or unlocks addresses in the selected nodes, displaying the addresses for user confirmation before proceeding. Address types may include RMAC, IP, VLAN, VRRP, or Destination, depending on the product.
- **Mark as Synced / Mark as Unsynced** – this option can be used if the devices were manually configured, and the user wants to mark the nodes correspondingly.

3.4.8 Property tree editor

Each node (including the network settings node or icon) contains properties, which you can edit. On device nodes, such as the various SATELLAR nodes, practically all properties correspond directly to a setting of the actual radio modem. On Generic IP nodes the properties are more like information and parameters to or from NETCO Assists, or for your own convenience.
The Network Settings node's properties control the Assist function and also include connection settings for synchronization of devices.

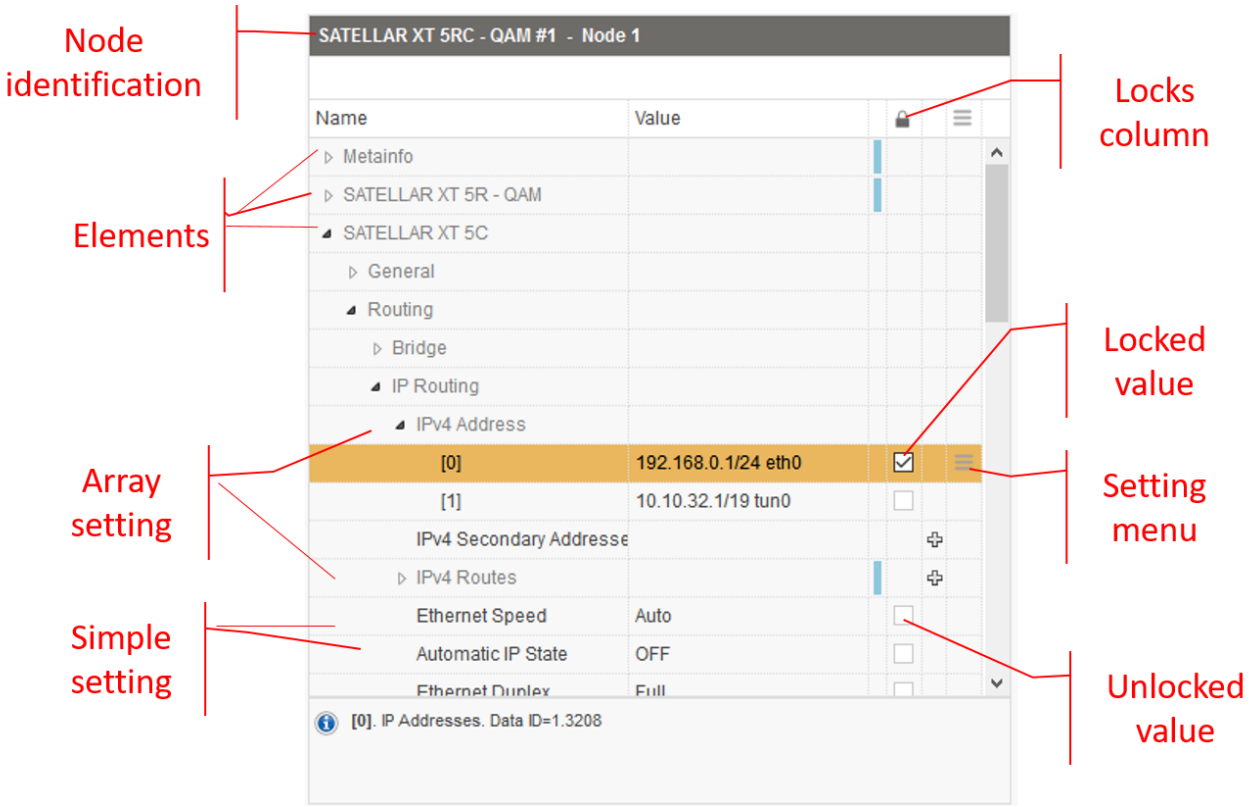


Image 9: Property editor

The property tree editor (Image 9: Property editor) is a hierarchical representation of the settings in a node. You can open and close the branches of the tree by clicking on the small arrow icons ▷ and ◢.
SATELLAR nodes consist of three elements: Metainfo, Radio Unit and Central Unit. Opening an element will show the setting categories (folders), which are the same categories as appear in the SATELLAR Web interface and User Manual. Opening the categories will reveal the settings. Some settings are arrays that contain multiple values. In this case the main setting will appear empty, and the values will be revealed by clicking the arrow symbol.

Editing a value

Settings may be edited by clicking on the values in the Value column. NETCO will validate the value while you type so you know when the value format is correct.
To add an item to an array-type setting, click the small plus icon ✚. To remove a row from an array, click the minus icon ▭.

Locked values

The properties managed by Assist are automatically locked whenever a value of such a property is edited by you. NETCO marks it as **locked,** and it will not be changed by NETCO Assists while it is locked. To unlock a value and allow NETCO Assists to modify it again, uncheck the checkbox in the locking column (to the right from the value).

In addition, values edited by the user, will be marked by an orange rectangle. Values changed by NETCO (e.g. generated by NETCO Assist or received from Device during synchronization) will be marked with a blue rectangle.

Multiple node editing
You may also edit multiple nodes at the same time. Just select the nodes you wish to edit from the map by drawing a selection rectangle using the selection tool. Then a combined view of the selected nodes will appear on the property tree editor. If you then edit a value, all the selected nodes will receive the same value. This is especially useful for editing radio settings.

Set to all compatible
A setting menu option "Set to all compatible" sets the current value to all similar elements in the Network. The option is also working for whole folder. This is especially useful for modifying settings that should be equal in all nodes of a network, e.g. radio settings.

3.4.9 Reports

In 'Reports' tab view you can get information about changes made to the network nodes.

- '**Changes Since Last Sync**' – Displays a list of all settings that were modified after the node was last synchronized with the device.
- '**All Changes**' – Displays a list of all settings that were ever modified from their default value.
- '**Assist Logs'** – Displays all Assist reports ever done for the network. This feature is available in NETCO v1.20.x+, this means that no logs will be displayed for Assist runs done with older NETCO versions

3.4.10 Common Settings

Common settings are settings that must/should have the same value in all nodes of the network. Once the user edits some setting in that view, the value will be automatically updated in all nodes of the network.
If you want all new nodes, which you will add to the network, have automatically the values specified in Common Settings grid, then you should set a checkbox "**Apply to new nodes**" on (it is on by default). If the checkbox is set off, then new nodes will have default settings.

4 NETWORK MANAGEMENT

The main purpose of NETCO Design services is to make the management of your network's settings as easy and safe as possible. NETCO Design will help you by automatically assigning working settings to your devices, or alternatively allow you to manage all settings manually. If you prefer, you can even control some settings manually while others are validated and/or automatically assigned by NETCO Assist functions.

4.1 Quick Overview

Using NETCO Design can be very simple. A basic workflow example:

- Start NETCO Design
- Create a new network
- Add nodes and radio links between them
- Edit common settings
- Select the Run Assists button and NETCO Design will generate routing settings
- Synchronize your devices
- Use Radio Connection Test to check connection to the devices

This will provide a working, if basic, network of SATELLAR devices using default radio settings. In practice however, it will be necessary to input your radio frequency and other radio-related settings as well as IP addresses. We will discuss the workflow in more detail below in chapter 4.5.

4.2 List of features

This is an overview of the major features of NETCO Design

4.2.1 User management

NETCO Design has a built-in User Management (UM) system. See a separate chapter about User Management.

4.2.2 Database

NETCO Design uses a database to store its internal data, including all information about the networks.

4.2.3 Web-browser interface

NETCO Design is controlled using a browser-based interface. The browser communicates with a server component running (typically) in the same machine.
In MS Windows you can use Start Menu shortcut "Open NETCO" which will open the user interface using the default browser.
Supported browsers are Mozilla Firefox and Google Chrome.

4.2.4 Multiple networks

Multiple networks can be created and managed. Networks can also be renamed and deleted. The currently shown network can be selected from a drop-down menu at the top of the Web Interface.

4.2.5 Map-based editing of nodes and links

An intuitive map view of the network is provided. Controls for zooming and panning the map make it easy to manage even large networks.

4.2.6 List of nodes

Alternatively, to the map view, a searchable list of network nodes can be used to quickly find the correct device in large networks.

4.2.7 GUIDs

GUID means globally unique ID that is specified by IETF RFC4122:
http://www.ietf.org/rfc/rfc4122.txt
NETCO creates automatically a metainfo setting 'GUID' for each new Node and Network.
It also controls the uniqueness of GUIDs when a network is being imported from the file.

4.2.8 Network Design Assists

The Assist system significantly speeds network design and deployment by automating the work of calculating IP addresses, routing tables etc. It works by taking the current network and additional parameters and then generates routing settings for all the devices in the network. The results are stored directly into the settings of the device nodes in the NETCO Design database. (A separate synchronization step is required before the actual devices start working). You can manually override any IP address of any device in the network and let NETCO Design generate the rest automatically. In the event of IP or LAN address conflicts, NETCO Design will print out a warning or error.

4.2.9 Sending settings to devices

Also called synchronization, this feature makes sure all NETCO Design-managed settings are correctly stored into your devices without needing to use any management interfaces (such as web pages) of the devices manually.

4.3 Workflow

The typical workflow to design a network using NETCO Design is as follows:

1. Acquire all required information about your network, including radio frequency, bandwidth and maximum TX Power, as well as IP settings you need to use.
2. Design the network by drawing nodes and links on the network map.
3. Open Common Settings tab view and adjust radio settings.
4. Select the Network Settings icon and choose suitable values for Design Assistance settings.
5. Run Assists by clicking on the assist icon

to automatically generate routing settings.

We recommend familiarizing yourself with the workflow, especially the Assist functions, by designing some practice networks before designing your actual network.

4.4 Managing settings manually

Some settings need to be entered manually. At minimum, these include the radio settings.

To enter settings manually, select one or more nodes from the map and use the Property editor (see chapter 3.4.2) or open Common settings tab view to enter the needed values.

NOTE: In case you need to manually modify settings that are also managed by Assist, such as adding Link Quality values into PR routing tables, follow this procedure:

1. Draw your network as usual
2. Run Assists
3. Modify (e.g. Link Quality) values (see product user guide for details)
4. In case you need to run Assists again, please unlock any PR routing tables you have modified manually to allow Assist to modify them, then run the above procedure again.

4.5 Automatic network design using Assists

NETCO Design is capable of assisting users in the most laborious and error-prone tasks of network design.

Currently NETCO Design Assist can perform the following tasks:

- Generating node Names based on a template.
- Assigning unique Radio Medium Access Control (RMAC) addresses to each Radio Unit (RU) in the network.
- Generating Source routing table and Packet Filters
- Generating Packet Routing (PR) tables for each RU.
- Generating Internet Protocol (IP) addresses for the radio-side interfaces of each Central Unit (CU).
- Generating IP routing tables so all CUs can route IP traffic to each other.
- Generating IP addresses for Ethernet (eth0) interfaces of CUs, as well as user's routers and other IP devices, based on a choice of network LAN mode, either Routed, Proxy ARP or Bridge mode.
- Also generate all necessary routing tables in Routed, Proxy ARP or Bridge mode based on information given.
- Generate VLAN settings and tables in Routed, Proxy ARP or Bridge modes, if required.
- Generating VRRP settings

While generating these settings, the Assist feature also allows users to manually override any and all IP addresses and other settings by a locking mechanism. Assist will give an error message if any user-entered settings would result in conflicts and cause a non-working network to be defined.

4.5.1 Assist logs

All changes made by Assists to network nodes settings are listed in Notifications panel.
Assist logs journal is also available in 'Reports' tab by selecting 'Show Assist Logs' (see 3.4.9 Reports)

4.5.2 Accessing Assist settings

Settings and parameters controlling the Assist functions are in the Network Settings, accessible by selecting the network settings icon. The Assist settings can be found under the Design Assistance heading, which can be opened by clicking the arrow button ▷ .
The settings are listed below, with explanations. Default values are printed in **bold.**

4.5.3 RMAC assist

These settings control how radio unit RMAC addresses are generated.

- RMACs: **ON**/OFF
- RMAC settings – Start: **1.** First numeric value to assign as RMAC address. Change this to instruct NETCO to assign RMAC addresses starting from an address other than 1.
- Assignment Mode: Consecutive Safe **/** Rebuild Consecutive / **Node ID**. *Node ID* means each RU will receive RMAC equal to its NETCO Design Node ID. *Consecutive Safe* mode assigns RMAC addresses beginning from start, and increasing the value by one for each RU, but will not change an RMAC address once it has been assigned. *Rebuild Consecutive* will re-assign RMAC addresses.

4.5.4 Protocol Mode

Choose the radio communication mode, and which type of routing tables are generated. Note that Internet Protocol (IP) requires that this setting be in Packet Routing mode.

- **Transparent**: Settings for transparent radio communication will be generated.
- **Source Routing**: Source routing tables will be generated in the Master Modem and the selected Packet Filters saved to the Master Modem. See details in 4.5.10 Source Routing Assist
- **Packet Routing**: Packet Routing tables will be generated for all modems. IP traffic is possible.

4.5.5 PR settings (XPRS only)

These settings control how NETCO Design Assist generates Packet Routing routes for SATEL Radio Units.

- PR Settings – Mode: **Tree/**All. Select the route generation method (see below).
- Root Node: **1.** Set the root node id for Tree mode. (See below). If a SATELLAR modem with this node ID does not exist in the network, an error occurs during Assist run. (unless Mode is set to All)

- RSSI RMAC: OFF/**ON.** When ON, Assist will set the RSSI RMAC setting for all modems in such a way that the RSSI reading in the Satellar CU display will only show an RSSI value received from the next upstream device. For example, a slave modem will display signal strength of transmissions received from the repeater or master only.

4.5.5.1 PR Route generation methods

- In **Tree** mode PR routes are generated so the Root Node can communicate with all other nodes. In contrast all the other nodes can only directly communicate with the root node, NOT with any other nodes in the "tree". (IP communication is still possible but routed via the Root). The benefit is that the number of routing table entries is minimized. In case of changes to the network (e.g. modem addition or removal), only a limited number of Radio Units need to be re-synchronized.
- In **All** mode, all nodes will receive routes to all other nodes in the network. The drawback is the large number of routes required in each Radio Unit, and the need to synchronize every Radio Unit when even a simple change (such as addition of a modem to the network) occurs.

NOTE: To use the **Link Quality** feature in devices that support **Link Specific modulation**, the **All**-mode must be chosen! See product user guide for details.

4.5.6 Radio IP assist

These settings control how central unit IP settings for the radio (tun0) interface are generated.

- Radio IP: **ON**/OFF
- Radio IP settings – Base addr: **10.10.32.0/19 tun0.** This is the LAN address of the SATELLAR CU's tun0 radio subnet. Each CU will receive an IP address from this subnet, with the individual part of the address corresponding to the RMAC address of the Radio Unit. (See SATELLAR user manual for more information.) It may become necessary in some cases to change this value if your network is using this address space for other purposes.
- Radio IP settings – Route mode: **Tree**/All. In *Tree* mode IP routes are generated from Root Node to all other nodes, and from all other nodes to root node. There will be no routes generated from remote radio station LANs to other radio station LANs, only to the root node's LAN. In *All* mode all LANs can communicate with each other.
- Radio IP settings – Root Node: **1.** The node ID of the root node, required by NETCO Design if Route mode is set to *Tree*. It must be a SATELLAR node.
- Radio IP settings – WAN target: **OFF**/ON: Set this to ON to add an additional routing table row to each SATELLAR. Limited to one additional row per modem. Note that a better way to do this is to add Generic IP Router nodes and modify their "Networks" properties, this way you can add any number of external route targets.
- Radio IP settings – WAN tgt addr: **123.123.1.0/24 192.168.1.1:** If WAN target is set to ON, this value will be added as a routing table row to each SATELLAR CU.

4.5.7 LAN assist

These settings control how XPRS product's central unit IP settings for the Ethernet (eth0) interface and the CU IP Routing tables are generated. You may choose one LAN mode for either routed, Proxy ARP or Bridge functionality. Optionally, VLANs may also be generated.
NOTE! Supported modes depend on the product.

- LAN Mode:
    - Manual
    - EASy+ ETH (single IP subnet)
    - EASy+ ETH (separate IP subnets)
    - Routed
    - Proxy ARP
    - Bridge Open
    - Bridge Restricted.

  See below for details.
- LAN Settings :
    - Addr. template: **192.168.0.0/24.** Controls address space of the LAN or LANs that are generated, depending on the chosen mode. See below for details.
    - Modem addr. offset: Satel modem IP Address offset. Use this setting to control which IP address in the ethernet LAN is assigned to the Satel modem. For example, set this value to '1' to set the first address of the LAN address space to the modem. This value cannot be larger than the LAN address space which is controlled by the subnet mask. For example, a mask of /26 indicates 6 bits are used for LAN address space, meaning values 0..63. Of these values 0 is the LAN address and 63 is the broadcast address and are forbidden. Therefore valid values for this setting would be 1..62.
    - IP Host addr. offset: **1.** By default, IP Hosts are assigned addresses from the start of the LAN address space. Change this value to start the IP Host addresses from another offset.
    - TCP Data Port - TCP Data Port for source routing.
    - VLAN Addr. template: **(XPRS only).** If one or more are given, a VLAN corresponding to each template will be created in the CUs. To add a VLAN template, click the '+' sign beside the 'VLAN Addr. template' row. By default, the template looks like this: **0.0.0.0/24 eth0 vlan0 1 0 0 0.** The IP address with mask will be used as the VLAN subnet address space. Individual CUs and IP Hosts will be assigned IP addresses from this address space, modified by the Offset value (above). The 'eth0' text should be left as is. The 'vlan0' is the name of the VLAN for information purposes only and may be changed as desired. The first number, '1' by default, is VLAN ID and it should be assigned a valid value corresponding to your network plan. The last three numbers will be overwritten and should be left as they are.

4.5.7.1 EASy+ LAN Modes

These modes are used for networks of SATEL-EASy+ ETH devices, which are connected to Polling master with Modbus TCP protocol or IP hosts.

- EASy+ ETH (separate IP subnets) - Each radio station is in different IP subnets
- EASy+ ETH (single subnet) - All stations are in same IP subnet

4.5.7.2 LAN Mode: Manual

In this mode, NETCO Design will not generate Ethernet IP Addresses for any devices.

4.5.7.3 LAN Mode: Routed

In this mode, NETCO Design will generate one LAN for each CU in the network, based on the given template. The LANs will be assigned in the order of Node ID of the CUs.
For example, if mask is /24, and IP is 192.168.0.0, LANs will be in the format192.168.1.0/24, 192.168.2.0/24 and so forth. In the first LAN, the CU will receive IP address 192.168.1.1, if the offset is 1, and 192.168.1.50 if the offset is 50.
Example 2: If mask is /29, LANs will be 192.168.0.0/29, 192.168.0.8/29, 192.168.0.16/29, etc.
Please ensure that CU offset is not too big to fit in the LAN, as limited by the mask. For example, a mask of /24 will allow device addresses in the range of *.1 to *.254.

4.5.7.4 LAN Mode: Proxy ARP

In this mode, NETCO Design will generate one LAN address space, and all CUs, IP Hosts and IP Routers will receive an IP Address from this same LAN. Additionally, SATELLAR CUs will be set into the Proxy ARP mode and all necessary routing tables generated so that all IP traffic to all defined IP Hosts and IP Routers will work. Due to the nature of the Proxy ARP mechanism, all IP addresses must be added to the routing tables, therefore, you must add all of your devices as either IP Hosts or IP Routers and ensure that NETCO Design is aware of their actual IP Addresses, either by entering them manually to each IP device, or lettings NETCO Design generate the IP addresses and then copying the settings to your devices.
SATELLAR CUs will receive IP addresses modified by the CU Offset value, all other devices will receive IP addresses starting from the first available address of the LAN.

4.5.7.5 LAN Mode: Bridge Open

In this mode, NETCO Design will generate one LAN address space in the same way as in the Proxy ARP mode. SATELLAR CU’s will be put into Bridge mode, please consult the SATELLAR user manual for details. In Bridge Open mode, all IP traffic will be transmitted via the radio interface, even unneeded traffic typically caused by Windows machines. In addition, it will take some time before ARP tables are replicated to all Central Units, which means a delay after switching on the network and before traffic will actually start working.

4.5.7.6 LAN Mode: Bridge Restricted

In this mode, NETCO Design will generate one LAN address space in the same way as in Proxy ARP and Bridge Open modes. In addition, the Bridge modules of SATELLAR CUs will be set to restricted mode and allow lists to be calculated based on IP Hosts and Routers present in the network map. Therefore, you need to add all your IP devices as either IP Host or IP Router nodes with correct addresses to the map. All other IP addresses will be blocked.

4.5.7.7 LAN Mode comparison table

This table shows how some settings behave differently in the various LAN Modes.

	Routed	Proxy ARP	Bridge open	Bridge restricted
LAN Settings – Addr. Template	CU's will keep their IP address, unless there are conflicts between addresses, in which case one of the conflicting values will be replaced by a value generated using this template. Each CU has their own LAN.	Every CU is assigned an IP address from the common LAN, governed by this setting. This happens every time Assist is run, even if there are no conflicts between the IP addresses.		
LAN Settings – CU addr. Offset	This value will be added to the LAN address for each CU that receives a generated IP Address.	CUs will be assigned IP addresses from the LAN, but this settings value is added to the LAN address, plus an increasing value per CU.		
Template and offset example template: 20.30.0.0/24 offset: *50*	CU1: 20.30.0.*50*/24 CU2: 20.30.1.*50*/24 CU3: 20.30.2.*50*/24	CU1: 20.30.0.50/24 CU2: 20.30.0.51/24 CU3: 20.30.0.52/24		

	Routed	Proxy ARP	Bridge open	Bridge restricted
Radio IP settings – WAN = ON Radio IP settings – WAN tgt addr	Each CU will receive an additional routing table entry pointing to the WAN tgt addr. (via the root node)	*Not supported* (please use the Generic IP Router nodes instead)		
LAN Settings – VLAN Addr. Template	A VLAN matching this template will be created. Each CU and IP Host will be assigned IP addresses in this VLAN. CUs will receive IP addresses modified by the CU offset, plus an increasing value per CU. The VLAN addresses will remain the same in all modes, even though the normal IP addresses will be created differently in routed vs other modes. As a result, the LAN mode may be changed but VLAN addresses will remain constant.			

4.5.8 MGMT VLAN settings (XPRS only)

These settings control how NETCO Design Assist assigns management VLANs.

4.5.8.1 VLAN ID

This setting controls which VLAN is the management VLAN. The VLAN must have been assigned previously or generated at the same time as this setting. (Please see 4.5.7.7 for details how to have NETCO Design Assist generate VLANs). This setting then marks the VLAN as a Management VLAN.

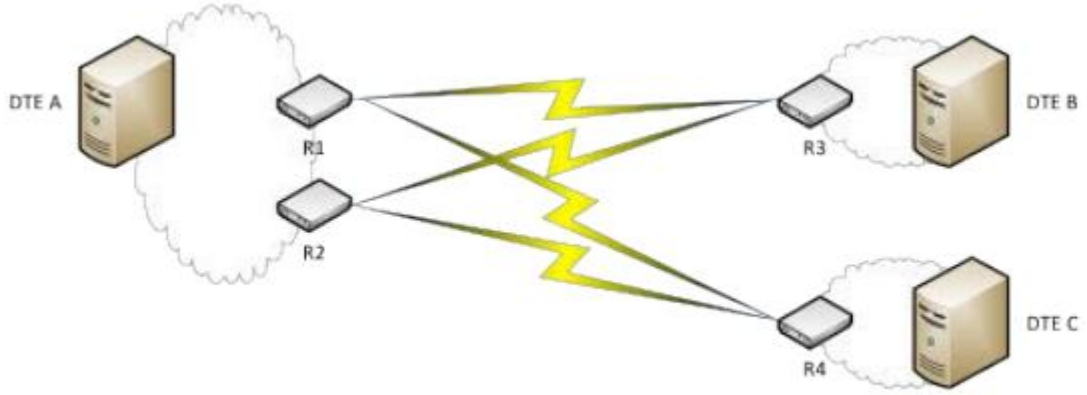
The selected VLAN IP address, identified by the VLAN ID given in this setting, will be assigned to each SATELLAR to the Service IP Addresses (Modem Settings->Services menu):

- HTTPD IP Address
- SSHD IP Address
- NMSTcpsocketd IP Address
- OSPFD IP Address

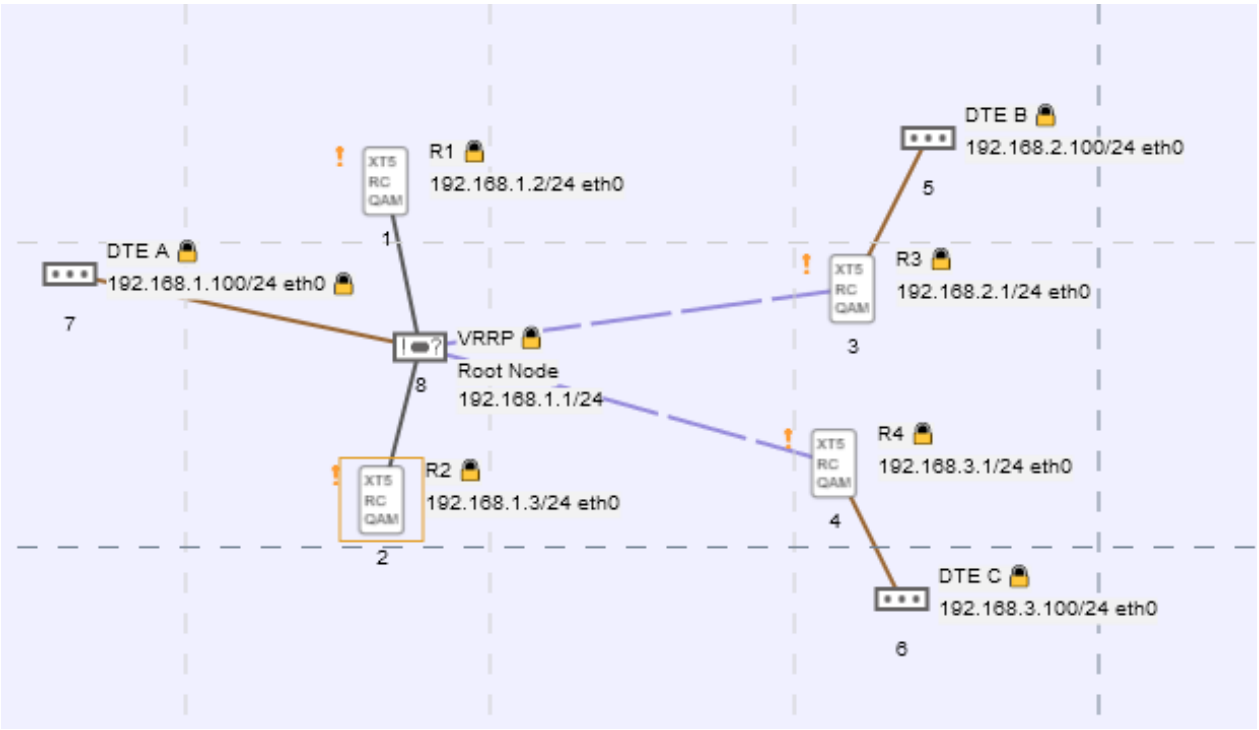
Please see the SATELLAR manual for details on how these settings control the availability of these services.

4.5.9 VRRP Assist (XPRS only)

The network with redundant master station and multiple substations



can be represented in NETCO the following way:



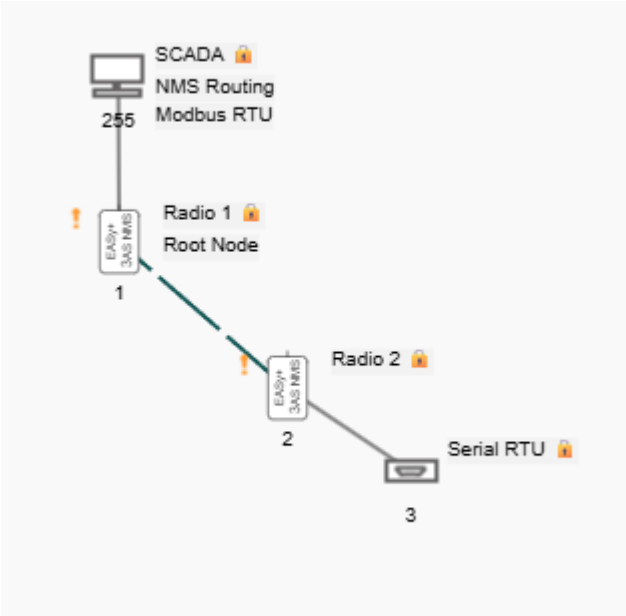
Assist will generate VRRP Routing settings in R1 and R2.
Set “VRRP Check Target Radio IP” to ON in Network settings>Design Assistance>VRRP Settings, if you want Assist to generate VRRP Check Target Radio IP in R1 and R2. Assist will assign it with address of first the nearest device (in the example above it will be IP address of R3).

At least two Radio modems should be connected to VRRP Station node with VRRP Association Link, but not more than eight.

4.5.10 Source Routing Assist

NETCO supports two types of Source Routing: Classic Message Routing and NMS Routing. However, not all Satel devices support Source Routing. Please check in the device User Manual, what type of Source Routing it supports.
Source Routing generation has these requirements to the network designed in NETCO Design:

1. The Source Routing master modem must have an associated *Polling Master* node connected to it with a serial link.
2. Polling Master settings should be configured:
   - *Source Routing Mode* should be set either to Classic Message Routing or NMS Routing
   - For *NMS Routing* you should choose what NMS Routing protocol will be used
   - For *Classic Message Routing* you should select protocol and possibly Address Start and Address Length parameters
3. Each Slave (or substation) radio modem must have one or more *Generic RTU* nodes linked.
4. Each Generic RTU node's settings must have at least one Terminal Address.

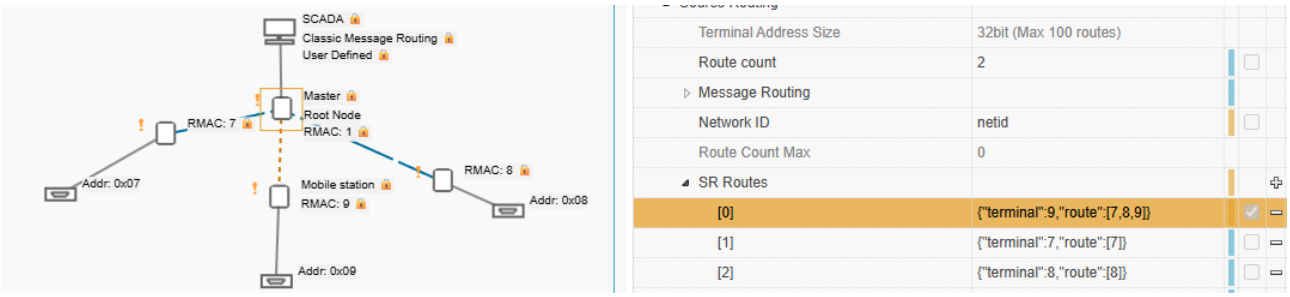


4.5.10.1 Mobile routes

Mobile station — a radio modem that, unlike fixed substations, is able to move within the coverage area of several repeaters. An example of a mobile application is a vehicle-mounted radio modem.

Mobile stations are supported in **Classic Message Routing** mode only. The route to a mobile station must be defined in a way that guarantees the operating area is maximally covered — the route lists every relay modem the mobile station may pass through as it moves. As the vehicle moves from one relay's coverage area to another, the overhop function ensures continued communication: each relay in the route re-broadcasts the packet with a small additional delay, so the mobile station can receive the packet directly from whichever relay it is currently in range of, without a collision occurring on the reply transmission. At least one radio modem in the route always receives the mobile station's own transmissions.

In NETCO, a mobile station is represented as a modem node connected to the Root node (master) with a **Mobile Station Link**. The source route for the mobile station must be entered manually in the master modem's SR Routes. Assist verifies that a route is configured and shows a warning notification if one is found, or an error if none has been entered.



4.6 Support for SATEL NMS PC and SATELLINE SaTerm Project Files

NETCO Design can import network project files created in two other SATEL configuration tools: **SATEL NMS PC** and **SATELLINE SaTerm**. This lets you migrate an existing network design into NETCO without starting from scratch.

Supported file types

- .saxd - Network project files from SATEL NMS PC
- .spf - Network project files from SATELLINE SaTerm

How to import

1. In the main menu select **Network → Import**.
2. In the import dialog, click **Browse** and select the project file (.saxd or .spf).
3. NETCO Design recognises the file type automatically, converts the data, and adds the nodes and links to the NETCO Design database.
4. Any warnings produced during the import (for example, unrecognised device types or missing settings) are shown in the Notification panel

What is imported

From a SATELLINE SaTerm project (.spf)

- Network topology: all modem nodes, their map positions, and radio links between them
- Radio settings: frequencies, output power, serial port configuration, radio address (RMAC), terminal addresses
- Source routing table of the master modem
- Terminal devices (RTUs) connected to slave modems, with their terminal addresses
- Polling Master node
- Mobile station links and their source routing entries (see chapter *Source Routing Assist* and *Mobile Station Link*)

From a SATEL NMS PC project (.saxd)

- Network topology: modem nodes, positions, and radio links
- Modem names and device roles (master, substation, repeater)
- Radio and serial port settings
- Source routing tables
- Terminal addresses and Polling Master configuration

After import

After importing, it is recommended to:

- Review the Notification panel for any warnings about settings that could not be converted.
- Verify modem names and node IDs.
- Run **Assist → Check** to validate the network design. Depending on the Assist settings, some parameters (such as RMACs or IP addresses) may be regenerated.

- For networks with mobile stations, confirm that the SR Routes entries in the master modem are present and correct before running Assist.

Note: Import from .saxd and .spf files is one-directional. NETCO can read these formats but cannot save or export to them. To export a network from NETCO, use the Export function which produces a NETCO transport file (.json).

5 SYNCHRONIZATION

Synchronization in NETCO Design means device management operations by reading or writing settings from DATABASE to DEVICE or from DEVICE to NETCO Design DATABASE.
Most common scenario in centralized management system is that the settings are first created into the DATABASE (for a node in DB, that represents the physical device), from which they are next (or later) synchronized to a physical DEVICE corresponding that node. This sync direction, also known as “downstream” direction, is considered the “normal” direction in NETCO Design too.
The other possibility is to synchronize settings from DEVICE to DATABASE (upstream sync), but in this case settings that can be written by NETCO Design network design assists will not be saved in the next assist run. Especially links and routes are subject to be overwritten. This also means that NETCO Design Network cannot be automatically discovered and created from having a connection to a field network.

NETCO Design supports remote management of supported SATEL products using wired and wireless (OTA) connections. For wired connection, serial ports (USB serial port) or Ethernet cable connection can be used and for OTA-connection, there must be a wired (or wireless, i.e. WiFi) connection to the first/closest node (typically known as a Master node or Radio network interface node), from which the traffic goes using radio protocols.

5.1 Open synchronization dialog

Once all the Nodes and Links are created and configured it’s possible to synchronize the physical devices.

It is recommended to use “Local Connection” mode, if possible (i.e. first time configuration at the office desktop), since it works even when target modem has mismatching RMAC (radio MAC address) compared to node that you are synchronizing and does not require setting up Ethernet interfaces. “Local connection” means simply that there is no radio network or intermediate Nodes between the NETCO Design and the target Node. In practice, the Nodes are configured in an office or laboratory environment by connecting them one-by-one to the same cable, which is connected to the PC running NETCO Design.
The other option “Network Connection mode” can also be used: See more in “5.2. Connecting to the device”.

To start synchronization, select the Node or Nodes you wish to synchronize and click the “Synchronize Selected” tool in the Tool area (under the Network and Sync heading).
Alternative way is selecting “Sync” button (see Image 10). It this case, all unsynchronized nodes will be automatically selected.
Individual node synchronization can be started from the node context menu (see Image 10).

Then just follow the steps provided by the synchronization wizard.

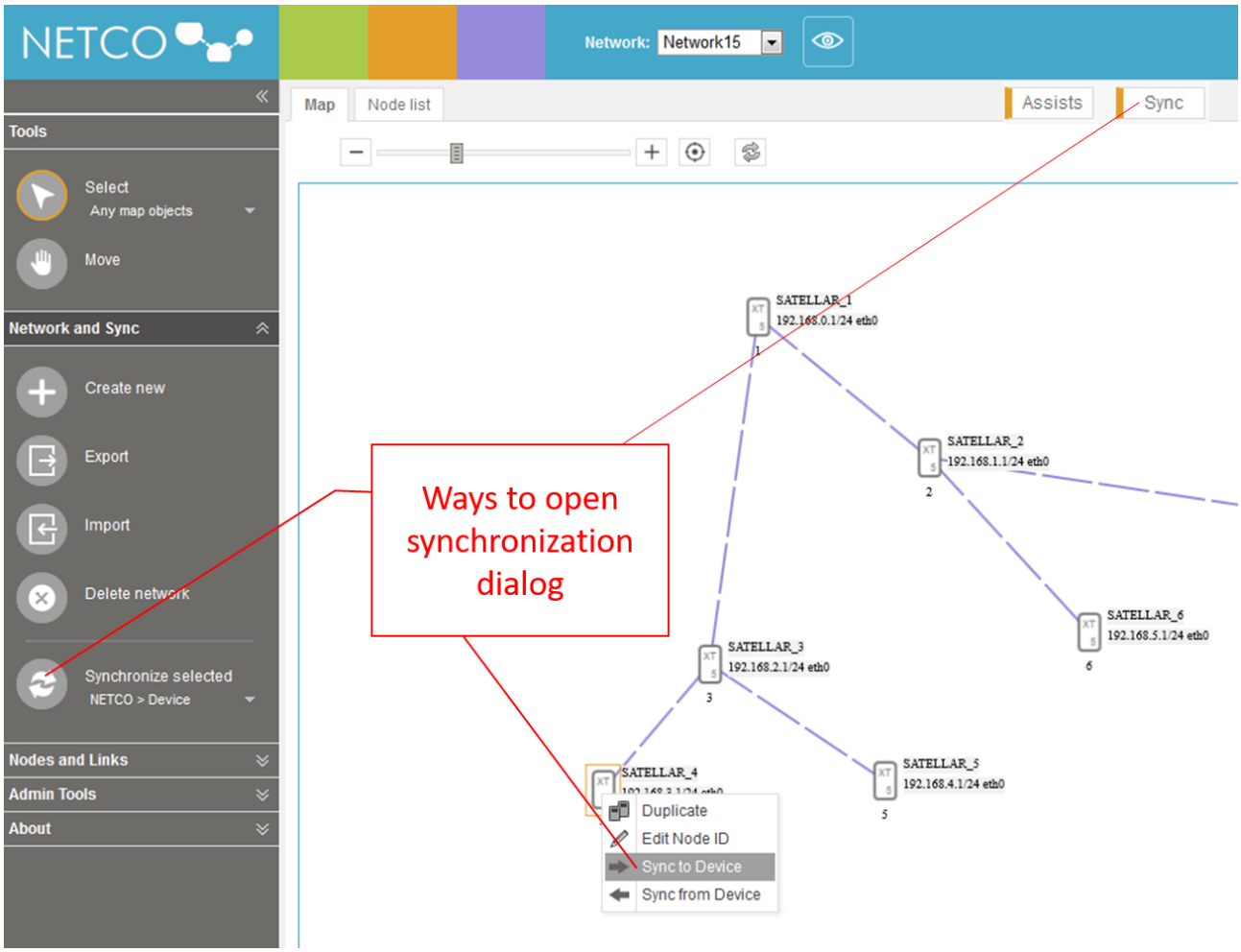


Image 10: Open synchronization dialog

5.2 Connecting to the device

The first view of synchronization wizard allows the user to select the type of connection to the device.

The following connection types are available:

- **Local connection.** The Node (Device) is connected locally (not via the radio network) to the NETCO Design and local addressing mode (i.e. local address) can be used to communicate with the device instead of its Network address (i.e. previously configured address). With Satel radio modems, the local address is equal to having RMAC=0 in the Satel NMS Protocol messages. Local connection using serial media is the most reliable way to configure Nodes (devices) because it allows the most reliable connection to change, for example target Node addresses without losing contact with the Node in the

midst of the process. Local connection to a node resembles the way how the Network Interface node is connected to the next upper layer system.
The connection string (see 5.2.1) is specified in Network settings > Local connection.

- **Network connection.** The target Node (Device) is not directly accessible i.e. is "behind" a Network Interface Node and network addressing mode (i.e. network address, RMAC > 0) must be used to communicate with the device. Network (OTA) connection requires that the network addresses of the target Node are in the same values as they are currently defined in NETCO Design because network addresses of the device are used to communicate with it. Since the network address of the device is used in communication it is possible that the connection is lost during configuration changes. This method is used for already existing and installed physical networks. It is best suited for updating individual settings but can be used also for "full sync". NOTE: Full sync using network (OTA) connection can take even 5-15 minutes to complete, depending on network topology, hop count to the target node and available band width and speed settings.
The connection string (see 5.2.1) is specified in Network settings > Network connection.

- **Custom.** The connection string (see 5.2.1) is not defined in the Network settings but should be typed manually, as well as access method and address usage can be selected.

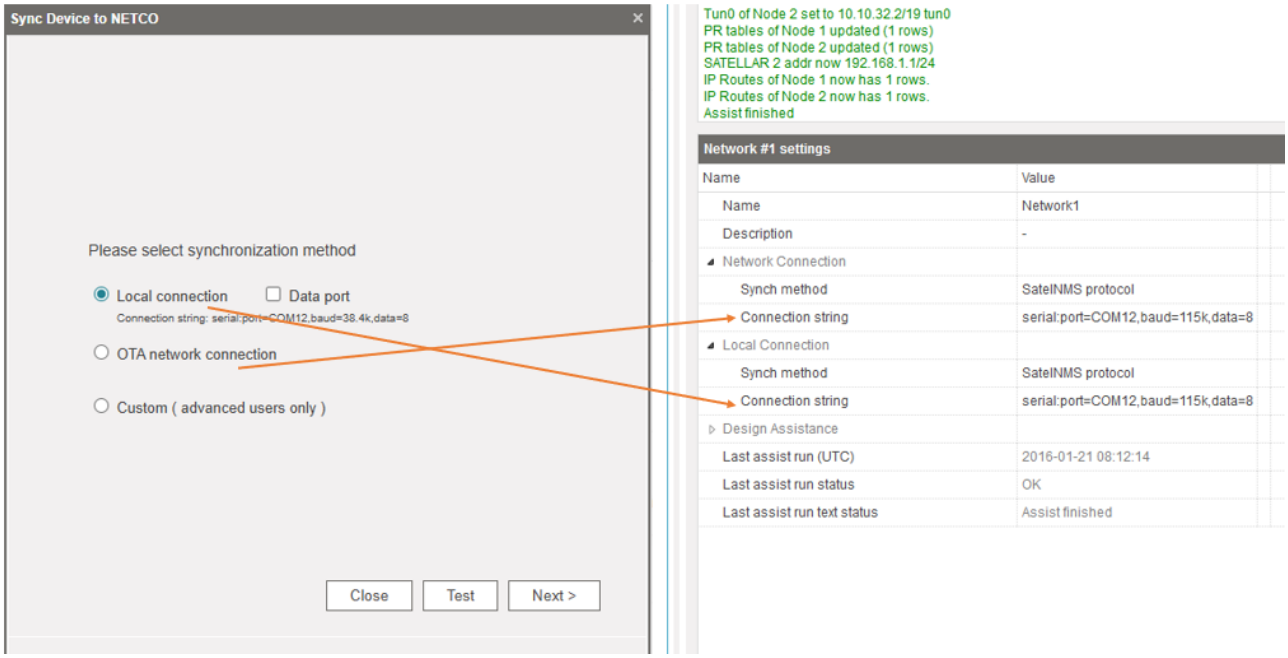


Image 11: Connection methods

5.2.1 Connection string

Each of the methods requires a media connection string, which specifies the access to the device. NETCO supports currently two different media to connect to a Node (Device) or Network.

You can use serial media i.e. (USB) serial port connection or TCP socket media i.e. with Ethernet/IP connection.

Connection string format is specified in the Table 3.

Note:
- Serial port parameters are optional, i.e. if a parameter is missing from the connection string, then its default value is applied.
- Connection string should not contain spaces

Connection string examples:

serial:port=COM22,baud=115200
sockettcp:ip=192.168.0.68,port=55555

Table 3: Connection string

Serial port			
Format	serial:port=<serial_port_name>[,<param_name>=<value>,…]		
Parameters	Name	Value format	Default value
	port	port name, e.g. COM1	-
	baud	Baud rate in one of the following formats: 115000 or 115.2k or 115k2 or 115k	9600
	data or databits	7, 8 or 9	8
	stop or stopbits	0, 1, 1.5 or 2	1
	parity	none, odd or even	n
	hs or handshake	None, RequestToSend, RequestToSendXOnXOff or XonXOff	None
	rts	true or false	true
	dtr	true or false	true
TCP socket			
Format	sockettcp:ip=<ip_address>,port=<port>		
Parameters	Name	Value format	Default value
	ip	IP address	127.0.0.1

	port	port	8181

5.2.2 Testing the media connection

Selected media connection string can be tested by selecting the “Test” button.
Note that only serial port or TCP socket existence is tested, not communication with the device.

5.2.3 Data port

Enable this checkbox if your device is connected through Data port. By doing so, NETCO DESIGN will automatically switch the device to programming mode before proceeding with synchronization.

5.3 Device identification

Once connection method is selected, click “Next” button to go to the next view where nodes can be selected and synchronized one-by-one (see Image 12).

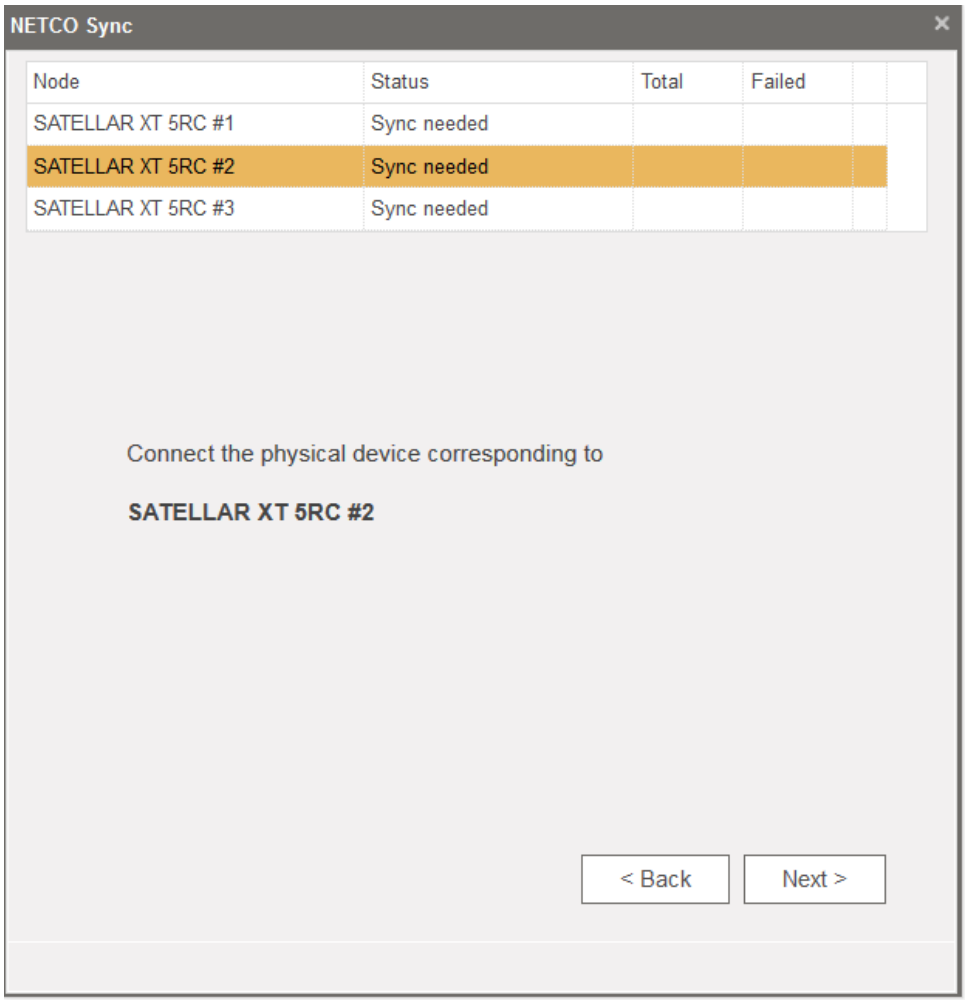


Image 12: Node selection

Select a Node from the list, make sure that the physical device associated with the Node is completely booted and properly connected. Select the “Next” button to start communication with device. Typically, if connection succeeds to locally connected device and the device was ready, the identification phase lasts about 2 seconds.

If identification fails, an error message will be displayed. Possible reasons of failure:

- The connected device has not booted completely yet.
- There is no connection to the device because of wrong media connection string parameters or due to other connection problems between NETCO Design and the device.
- Connected device and selected NETCO Design node are inconsistent to each other (different types).

In all cases above, synchronization is not possible.

If identification succeeds, synchronization wizard displays device info (see Image 13).

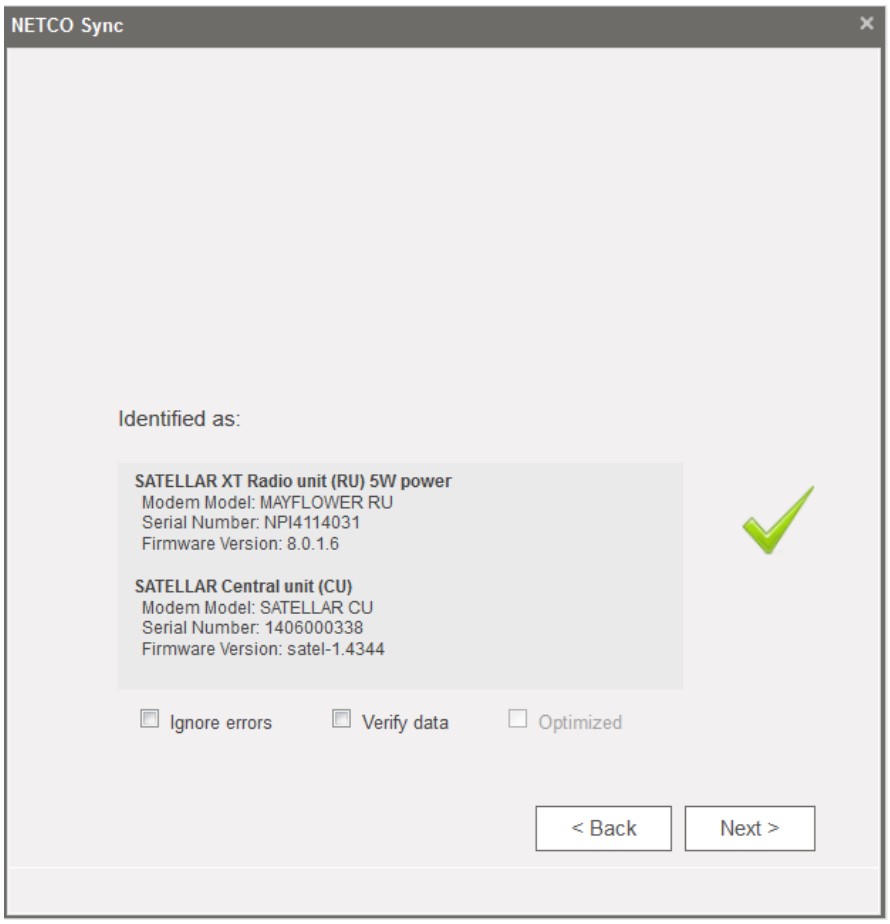


Image 13: Identification succeeded

If during identification are detected situations that user should pay attention to, warning message will be displayed to help the user to avoid human mistakes. Those possible situations are:

- Connected device has been already synchronized with another NETCO Design node
- Selected NETCO Design node has been already synchronized with another device

5.4 Synchronization options

Once identification succeeded, settings can be transferred to/from device.
The following synchronization options are available (see Image 13):

- **Ignore errors.** If the checkbox is checked, the synchronization would continue regardless of number of errors. Allowed number of errors is limited by two. If the checkbox is unchecked and the limit of errors is reached, then synchronization is aborted.
- **Verify data.** This option is applicable for downstream (i.e. from NETCO to Device) synchronization only. If the checkbox is checked, then all settings written to the device are read back and values are compared to the values from NETCO DB.

- **Optimized.** This option is applicable for downstream (i.e. from NETCO to Device) synchronization only and enabled if the Node was fully and successfully synchronized previously and there are no local changes detectable in the device. If the checkbox is checked, then NETCO will write only settings that have been changed after that last successful synchronization. This way synchronization will happen more quickly. SATELLAR products support detecting local changes efficiently and therefore they support optimized synchronization with NETCO Design. Optimized synchronization is especially useful feature when using Network Connection with existing network and when the changes to network configuration is mainly managed by NETCO Design.

5.5 Synchronization procedure

Synchronization is started by selecting the “Next” button. Progress bar is shown on the screen.

The synchronization procedure depends on selected synchronization direction:

- **Upstream** (from Device to NETCO Design): all readable device settings are fetched from the device and saved into the NETCO database. If all readable settings are saved successfully to NETCO DB, then the node sync status will be set to “Synced”, i.e. . If any error occurred, then the sync status remains “sync needed”, i.e.

- During **Downstream** (from NETCO Design to Device) synchronization NETCO performs a sequence of steps:

    1. All read-only settings (e.g. for SATELLAR read-only settings are Serial Number, Modem Model, etc.) are fetched from the device and saved into the NETCO database
    2. All writable settings are copied from NETCO Design database and written to the device.
    3. Product type specific commands, such as “save new configuration” and to “take new configuration in use” are sent to the device. The order of synchronization for each device subunit, or sub-device (like in SATELLAR there are subunits RU and CU) depends on the Connection method. NETCO Design decides the correct update order based on selected connection method so that the farthest subunit (or device) is configured first and the nearest subunit (or device) last. Selecting the wrong Connection method can result errors during synchronization.
    4. Read configuration hash value from the device and save it to NETCO DB. That value will be used at the next synchronization (in identification phase) to verify that the device settings have not been changed.
    5. If no error occurred by this phase, then the node sync status is set to “Synced”, i.e. , otherwise, the sync status remains “sync needed”, i.e. .
    6. Read “Post sync” settings from the device. This step is device specific. “Post sync” settings are settings that should be read after synchronization, for

example, because the device internally updated them during downstream synchronization, e.g. Encryption Keys Hash.

7. Send “Sync sub-units” command, which forces the device to synchronize its sub-units’ settings, for example, to display up-to-date information on device’s display. This step is also device specific.

NOTE: Any error that happened during step 6 or 7, will not affect to the node sync status.

5.6 Synchronization results

Once the synchronization is done, a notification about synchronization result is shown to the user. The wizard goes back to Node selection view, where next node in the list is selected (see Image 14). For just synchronized Node status, total amount of settings and number of failed settings are displayed in the Node grid. Detailed synchronization results can be checked by selecting the “info” icon (see Image 14).
Later, after the synchronization wizard is closed, detailed synchronization results are available in “Node List” tab view.

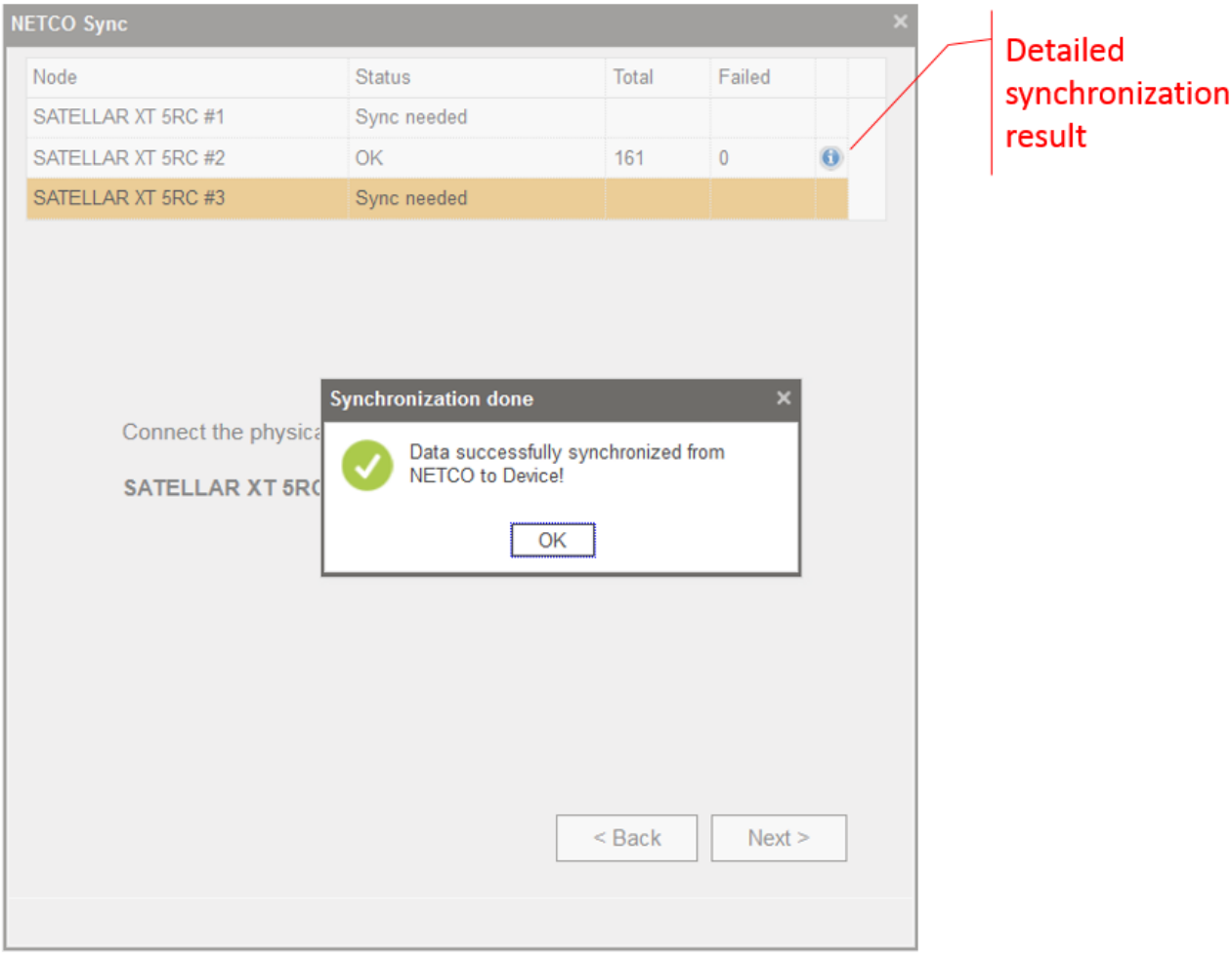


Image 14: Synchronization result

5.7 Mark as synchronized / unsynchronized

A node can be manually marked as synchronized or unsynchronized. Usually, it is needed for the case when NETCO Node and the related device were manually synchronized or for some specific cases, when user wants to avoid full synchronization.
Unsynchronized nodes are marked with exclamation sign on the map or “Sync needed” text in “Sync status” column of Node list grid.
To mark an unsynchronized node as synchronized, select the node either in Map view or in Node list, open the context menu by mouse right click and select “Mark as Synced” item.

5.8 Custom synchronization

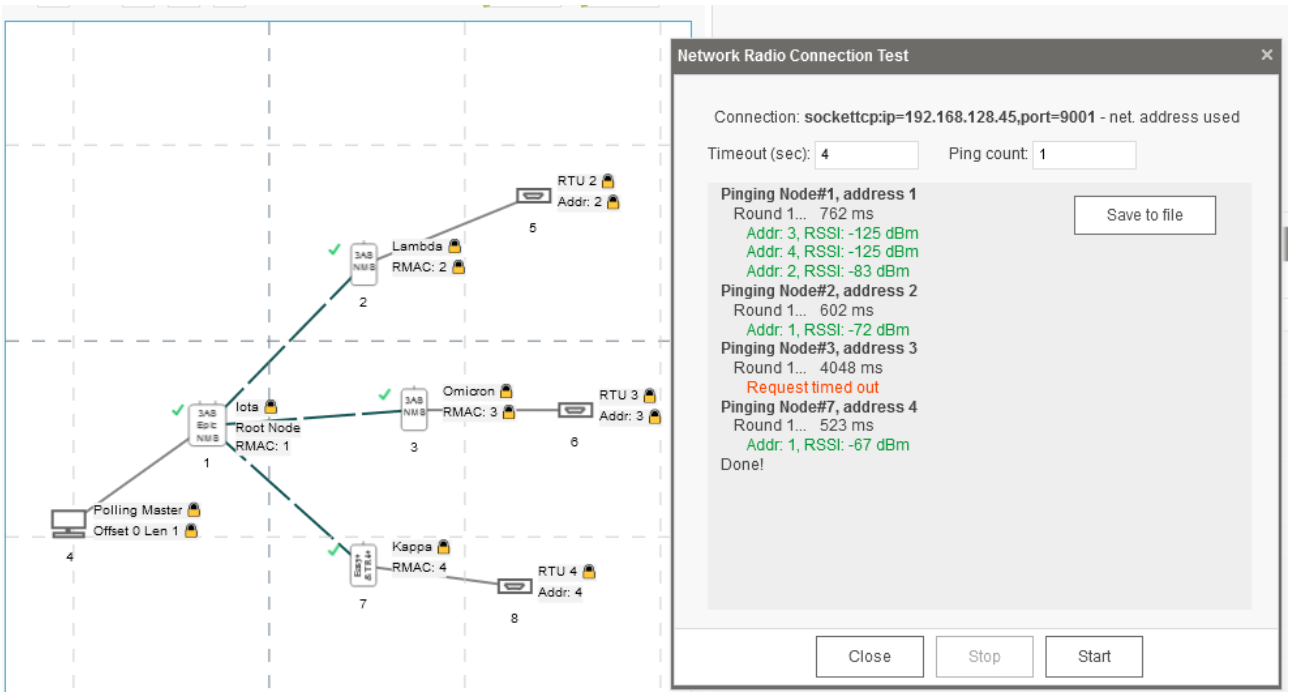
Custom synchronization dialog can be opened from the node context menu. It allows to read specific settings from the device. User should provide a comma-separated Data ID (NMS ID) list

of the settings to be read from the device. Data ID can be found from Help text area under Properties View.

6 RADIO CONNECTION TEST

You can test your network with the Radio Connection Test feature. If you want to test connections to all devices of the network, then open a Radio Connection Test dialog from Network Tools. If you need to test one or several devices only, then select an option “Radio Connection Test” from node or group context menu.
After you select a connection string to the Root (master) node of the network, you will see a dialog as shown below:

You can specify a timeout for one NMS request and number of requests sent to each node. After pressing “Start” button, NETCO will send NMS commands to all the nodes and print out RSSI and SNR value for the radio links. Note, that SNR value is available for SATELLARs devices only.
An example of Radio Connection Test result is shown on the picture below. As you can see, the node Omicron (Node#3) can’t be reached, but other nodes have been responding successfully. The test printout can be saved to the text file by pressing “Save to file” button.


RTU 2
Addr: 2
5
Lambda
RMAC: 2
2
Iota
Root Node
RMAC: 1
1
Omicron
RMAC: 3
3
RTU 3
Addr: 3
6
Polling Master
Offset 0 Len 1
4
Kappa
RMAC: 4
7
RTU 4
Addr: 4
8
Network Radio Connection Test
Connection: sockettcp:ip=192.168.128.45,port=9001 - net. address used
Timeout (sec): 4
Ping count: 1
Save to file
Pinging Node#1, address 1
Round 1... 762 ms
Addr: 3, RSSI: -125 dBm
Addr: 4, RSSI: -125 dBm
Addr: 2, RSSI: -83 dBm
Pinging Node#2, address 2
Round 1... 602 ms
Addr: 1, RSSI: -72 dBm
Pinging Node#3, address 3
Round 1... 4048 ms
Request timed out
Pinging Node#7, address 4
Round 1... 523 ms
Addr: 1, RSSI: -67 dBm
Done!
Close
Stop
Start

7 USER MANAGEMENT

7.1 General description

User Management in NETCO Design covers the User accounts and User groups within one installed NETCO system.

NETCO user management is by nature “role based security”, since user’s rights depend on the group the user is associated with. A user that is not associated (linked) to any group is considered to have no access to the system.

User management has been implemented as a special “User management network” in the system. This allows easy to understand graphical presentation and visual editing of user groups and user. The User management network is edited the same way as device networks: you can add or remove User group “nodes” and user “nodes”, and you can associate users to groups using membership links, just like you would connect physical devices using Ethernet or radio links. As mentioned earlier, a user “node” that has no link (association) to any group, is considered to be not part of the active accounts i.e. has no access to the system.

7.2 Limitations

Each user can be associated to only one (1) user group.

Changes in user group rights take effect on individual user only from the next user login following the change.

When a NETCO Design version which has User management feature included starts in a computer for the first time, it will, in addition to creating the User management network, also create computer (and installation) unique cryptographic material (salt), which is used in generating hashes related to storing passwords in database, and in the future, also for network devices.

The previously mentioned User management related ‘cryptographic material’ (salts) is saved as a part of the user management network, but it is also saved into separate files as a backup measure. If the user management network is deleted on purpose or accidentally and it should be created again (NETCO Design will automatically create it, if it is missing), this same material would be read from files. This allows recovering the material, which is needed for allowing system access and for creating password has materials, which are compatible with the system before disaster.

7.3 Automatic creation of User management network and users

Whenever NETCO Design is starting, it checks that the following minimum requirements are met. If any of these is missing, it will create them as needed:

- Administrators group
- Admin user ('admin')
- Admin user is associated to Administrators group with membership link.

When NETCO Design with User management feature starts for the first time, it will additionally create Designers group, Operators group and Viewers group, and assign one user for each group. These additional groups are just for examples, and if they are not needed, it is safe to delete all other groups and users, except the Administrators' group and admin user in it.

The created example groups have same usernames and passwords, which have been built-in in NETCO since the first versions:

Table of default groups and users in them

User group	**User name**	**User password (default)**	**Comment**
Administrators Group	admin	admin	(!) Must always exist. Only members of this group can see the UM network and edit users and groups. Automatically created if deleted.
Network Designers	user1	pass1	Just a demo group
Network Operators	user2	pass2	Just a demo group
Viewer	viewer	viewer	Just demo group (!)No create or edit rights at all.

(!) It is strongly recommended that all passwords are changed and unneeded accounts are disconnected from their groups (or even deleted), when deploying NETCO to company LAN or similar.

8 Troubleshooting

8.1 Unresponsive or mixed state User interface

Follow these steps until the problem gets fixed

1) Make sure you use a recent browser version of Mozilla Firefox or Google Chrome and update as necessary.
2) Usually pressing F5 (Refresh) while the browser window is the focus window helps.
3) Try closing all the web browser windows and restarting the web browser.
4) Try restarting the NETCO System. This includes restarting NETCO Design Windows background services. User Windows 7 (or newer) Start menu shortcuts to do this. Start by typing “netco” and wait until appropriate option (“Restart NETCO background services”) becomes available.
5) Try restarting the computer which is running the NETCO System, whether it is a server or your local machine.
6) If NETCO Design Web-interface is available, use the Admin Tools -> Update NETCO option to check for updates.

8.2 WEB browser shows “Unable to connect” or “The connection has timed out”

If after installation the section 6.1 operations don’t help and you cannot connect to the NETCO Design web interface, then the reason might be also a special case of port conflict, which was not possible to detect during installation. In this case you can try modifying the NETCO web server’s port to a free one. A good choice might be for example 8082 instead of the default 8080.

In a typical installation to default location in Windows 7 or newer the path of the file you need to edit is this:

```
C:\Program Files (x86)\Satel\NETCO\webui_0\config.json
```

Unless your user account has administrator rights or even if you do, you must first set security permissions of the file to allow you, or everybody, to edit it. This happens by selecting the file, then making a right mouse click and going to “Security” tab. Select “Edit” there, then your user name or “Users” and in the bottom box of checkboxes, allow “Modify”-rights and select “Apply”. After this you should be able to open the above file for editing the WEB port number.

The file is a JSON-format text file, where one of the settings keys is named “frontend_port”. Change the number following this key for example from “8080” into “8082” and Save the file.

After this, restart the NETCO Design services (Start menu, “netco” -> restart) or restart the machine and you should be able to log in using the new port number: i.e. 8082
http://localhost:8082/netco/login

(!) Note: if the WEB server port is changed manually like this, then the “Open NETCO” shortcut in the Windows Start-menu is not updated to use the new port for opening the web-browser. To do this, find this option in the Windows Start menu and then select “Open file location”. After this, edit the port number in the file and save it.

8.3 Running NETCO Design diagnostics for SATEL inspection

If none of the previous steps help, you can generate a diagnostic package and send it to SATEL for diagnosis. The NETCO diagnostic package will contain the database and log files that may reveal the nature of the problem.

To run the diagnostics and to generate the diagnostic package file, go to the Windows Start-menu and type “netco”.
You should soon be offered a choice “run NETCO diagnostics”. Select this option and once you have downloaded and saved the newest diagnostic ZIP-file, you should contact SATEL Technical support along with description and preferably screenshots of the problem.

9 APPENDIX

10 VERSION HISTORY

Version history:

Version:	Date: (d,m,y)	Remarks:
0.5	22.01.2016	First public version
0.6	25.01.2016	- Reference to Synchronization chapter was corrected - Irrelevant text and chapters were removed
0.7	25.01.2016	More content to 2.1 installing and 2.2. updating. “Main page” -> “Network page”.
0.7.1	25.01.2016	Minor fixes and improvements
0.7.2	25.01.2016	Logo added
0.7.3	27.01.2016	5.2 Reference error fix: removed failing reference.
0.8.0	04.02.2016	Chapter 2: Firewall requirements and information about License update added
0.8.1	04.02.2016	Updated Login-page and Welcome page screenshots. Added notice about of “LAN Mode: Routed” case in which the root node’s Ethernet LAN is not set by the design assists. Added description of Term “Synchronization” in NETCO context.
0.8.2	10.02.2016	Added description of differences between LAN Modes
0.8.3.	18.02.2016	Changed the definition of synchronization in the Terms and Abbreviations
0.9.0	04.03.2016	Updated screenshots. Export-Import added. Added Troubleshooting section 6. Added reminder to check for updates right after initial installation. Added Technical information chapter
0.9.1	05.03.2016	Modified Firewall-section to have both outbound and inbound requirements with explanations and warnings. Moved Technical information and Firewall requirements to Introduction chapter.
0.9.2	07.03.2016	Removed mention of assist from selected nodes editor description
0.10.0	04.04.2016	Troubleshooting: Added chapter about solving “unable to connect”
0.11.0	24.04.2016	Added chapter: “Replacing the license key”. Renamed chapter: “Updating the license” to “Updating the current license”.
1.0.0	26.08.2016	Added chapters: - Mark as synchronized / unsynchronized - Network views Screen shots and icons updated Assist tool bar changed to Assist Dialog
1.1.0	30.08.2016	Enhanced Troubleshooting section about “unable to connect”.
1.3.0	03.11.2016	Added information about running “run NETCO diagnostics” to Troubleshooting section
1.4.0	13.12.2016	User Management section added
1.5.0	09.10.2017	Updated Satel->SATEL in many places. Added minimum browser UI display specs. Added default user table for UM section. Added Management (MGMT) VLAN section.
1.6.0	10.10.2017	Firewall requirements: Added firewall outbound ports requirements of allowing also port 443 for https

1.6.1	15.11.2017	Updated system requirements to Technical Information table
1.6.2	24.05.2018	Changed all “NETCO” referring to “NETCO Design” to emphasize that this document focuses to NETCO Design only.
1.7.0	02.08.2018	Updated UI screenshots. Added new features description.
1.7.1	08.08.2018	Added a note to Chapter 4.4 detailing how to modify settings that were originally created by Assist and a note to Chapter 4.5.4.1 reminding users to use PR routing in “All” mode in case Link Specific Modulation is used.
1.7.2	22.08.2018	Assist Logs in Reports tab
1.8.0	03.12.2018	VRRP network example
1.8.1	18.01.2019	Group selection context menu added
1.8.2	08.08.2019	More info added to Synchronization chapter
1.8.3	03.02.2020	A chapter “Locked values” was modified
1.9.0	08.10.2020	Added description for Radio Connection Test, Common settings tab view, Custom Synchronization. Updated UI screenshots.
1.9.1	16.02.2021	Minor fixes to terminology and updates to technical information
1.9.2	14.09.2021	Message Routing added to Source Routing chapter
1.9.3	15.02.2022	Notes about automatically exported networks were added to Update process description
1.9.4	20.10.2023	Windows 11 was added to supported OS-platforms
1.10.0	07.01.2025	Add EASy+ USB/ETH/BT device
1.11.0	25.06.2025	Remove license update chapter as license period is not limited any more
1.12.0	12.08.2025	Add “Admin Tools – Backup Networks ” chapter
1.13.0	24.11.2025	Add “Data port” chapter Add missing items of the node context menu Add EASy+ LAN Modes
1.14.0	04.06.2026	Added SATELLINE remote API product families to the node type list. Added Mobile Station Link to the link type list. Added description of the Replace option to the node context menu. Added description of address click feature to the Map view section: clicking an RMAC or terminal address shows its DEC/HEX value in the Notification panel. Added description of Map info box checkboxes: Node ID and Terminals. Added mobile station note to the Source Routing Assist section. Rewrote the Network – Import chapter to cover all three supported file types: NETCO transport file (.json), SATEL NMS PC project file (.saxd), and SATELLINE SaTerm project file (.spf). Added a new chapter “Support for SATEL NMS PC and SATELLINE SaTerm Project Files”