ARCTEQ®
PART OF ENSTO GROUP

AQtivate 200

Configuration tool

Instruction manual

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1 Document information

1.1 Version 2 revision notes

Revision	2.00
Date	7 June.2019
Changes	• Updated the look and presentation of the manual.
Revision	**2.01**
Date	21 October 2019
Changes	• Content completely rewritten to improve grammar and readability. • Improved images. • Updated the AQ-210 series logic editor descriptions and images to match the new logic editor. • Added the relay communication menu descriptions. • Added the descriptions for miscellaneous tools: Calibrations, clear matrix, DI configurator, GC-30 configurator.
Revision	**2.02**
Date	3 June 2021
Changes	• Grammar and readability improved further. • Added the measurement bar description to the mimic editor manual. • Improved images. • Added more descriptions to many topics. • Added the Modbus Gateway tool description. • Replaced the old IEC 61850 editor description with the new IEC 61850 editor description.
Revision	**2.03**
Date	21 June 2022
Changes	• Improved descriptions generally in many chapters. • Improved the readability of a lot of drawings and images. • Added the HMI view-menu description. • Updated the IEC 61850 editor description. • Added the description for how to set the number of decimals for measurements in the mimic editor. • Restructured the logic editor descriptions. • Restructured the Modbus Gateway descriptions.
Revision	**2.04**
Date	3 May 2023
Changes	• Updated the Arcteq logo on the cover and the whole manual visually. • Added the safety information chapter and updated all notes within the document accordingly. • Added internal hyperlinks throughout the document. • Updated the Wizard chapters and added links to their complete instruction booklets.

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1.2 Version 1 revision notes

Revision	1.00
Date	12 October 2012
Changes	• *(N/A)*
Revision	**1.01**
Date	25 February 2013
Changes	• Added the FTP description and the time settings. • Updated the "Tools" menu and the "Print" menu descriptions. • Added the firmware upgrade. • Added the safe setting mode description.
Revision	**1.02**
Date	16 May 2013
Changes	• Added the front panel connection image. • Updated the device connections. • Updated the event history. • Added the alarm events. • Added the description of the ability to compare .aqs files.
Revision	**1.03**
Date	11 September 2014
Changes	• Added the descriptions for the following topics: AQS-generator, Signal swap, Find signal usage, Project editor, Carousel designer, Timers, IEC 61850 setting, Uploading language files, User levels, Firmware upgrade, AQviewer. • Updated the descriptions for the following topics: Mimic editor, Logic editor, Settings, Disturbance recorder.
Revision	**1.04**
Date	20 February 2015
Changes	• Added the instructions for adding an option card.
Revision	**1.05**
Date	24 April 2015
Changes	• Added the SPA and DNP protocol tools. • Added the configuration change log.
Revision	**1.06**
Date	12 August 2015
Changes	• Updated the following topics: Tools menu, Commands menu, Logic editor, Mimic editor. • Added the following topics: Write to relay, Trafo Wizard, Update manager.
Revision	**1.07**

Date	09 November 2015
Changes	• Improved and added images to many chapters. • The order of the chapters improved. • Overall revising of the look and readability of the manual. • Added hyperlinks to various webpages in relevant chapters.
Revision	1.08
Date	6 September 2016
Changes	• Further improvement on readability. • Updated some images. • Added hyperlinks to other documents.
Revision	1.09
Date	12 January 2018
Changes	• Added the AQ 250 series mimic, logic and carousel designer descriptions. • Updated the hyperlinks to fit the new Arcteq website.
Revision	1.10
Date	24 May 2018
Changes	• AQ-250 logic editor description revised.
Revision	1.11
Date	20 August 2018
Changes	• AQ-250 mimic editor description revised.
Revision	1.12
Date	10 September 2018
Changes	• AQ-250 logic editor description additions.
Revision	1.13
Date	10 December 2018
Changes	• Added the carousel designer for AQ 250 series units. • Added the DI-configurator description. • Added the GC-30 configurator description. • Updated the AQ-250 mimic editor description. • Added the IEC-101/104 and IEC-103 map view descriptions.

1.3 Safety information

This document contains important instructions that should be saved for future use. Read the document carefully before installing, operating, servicing, or maintaining this equipment. Please read and follow all the instructions carefully to prevent accidents, injury and damage to property.

Additionally, this document contains four (4) types of special messages to call the reader's attention to useful information as follows:

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NOTICE!
"Notice" messages indicate relevant factors and conditions to the the concept discussed in the text, as well as to other relevant advice.

CAUTION!
"Caution" messages indicate a potentially hazardous situation which, if not avoided, **could** result in minor or moderate personal injury, in equipment/property damage, or software corruption.

WARNING!
"Warning" messages indicate a potentially hazardous situation which, if not avoided, **could** result in death or serious personal injury as well as serious damage to equipment/property.

DANGER!
"Danger" messages indicate an imminently hazardous situation which, if not avoided, **will** result in death or serious personal injury.

These symbols are added throughout the document to ensure all users' personal safety and to avoid unintentional damage to the equipment or connected devices.

Please note that although these warnings relate to direct damage to personnel and/or equipment, it should be understood that operating damaged equipment may also lead to further, indirect damage to personnel and/or equipment. Therefore, we expect any user to fully comply with these special messages.

2 Introduction

The AQtivate 200 software tool is a program used for making configurations for Arcteq AQ 200 series protection and control devices. AQtivate can be used for both reading and writing configurations to AQ 200 devices. AQtivate is also capable of loading disturbance recordings from the device. These recordings can be further evaluated by using the AQviewer program (included in the AQtivate 200 software suite).

Device settings are stored as a single ".aqs" file, which includes all the user settable configurations (protection, measurement, communication, logics, etc.). These .aqs files can be saved and stored on a hard drive. Configuration can be done both online and offline. The AQ 200 series devices store all settings and disturbance recordings in a permanent flash memory.

AQtivate 200 can be run by any Windows 7/8/10/11 version. It can be downloaded free of charge from the Arcteq website (http://arcteq.fi/documents-and-software/).

NOTICE!
Please note that downloading the software requires that you register to the Arcteq website. This is also free of charge.

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3 Getting started

Making a connection to an AQ 200 series device requires a free Ethernet port in your PC and a standard straight connection RJ-45 cable. Please make sure that your firewall and anti-virus protections allow AQtivate to connect and freely use the Ethernet ports of the PC.

3.1 Installing the AQtivate setting tool

First, launch the "AQtivate Offline Installer". If you do not have the AQtivate installer, you can download it for free from Arcteq's website (https://www.arcteq.fi/documents-and-software/).

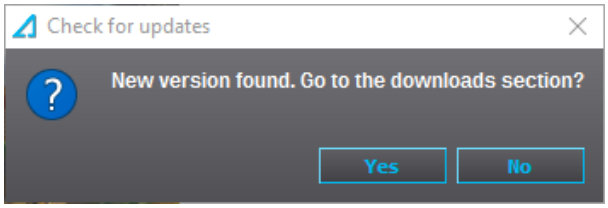
Next, select the installer language and follow the step-by-step instructions to install the software.

NOTICE!
Please note that some firewall softwares may detect AQtivate 200 and prevent the installation. In this case, either select the option "Allow connection" (if one is provided) or manually set the AQtivate 200 software to the list of whitelisted programs.

3.2 Updating the AQtivate setting tool

When the installed AQtivate version is too old for the firmware in the device, it may be necessary to update the setting tool software. You can check the tool's version at *Help → Check for updates*. If there is no need to update, a pop-up window appears telling you that "The current version is the newest". However, if an update is needed AQtivate will ask if you want to go to downloads section (see the figure below).

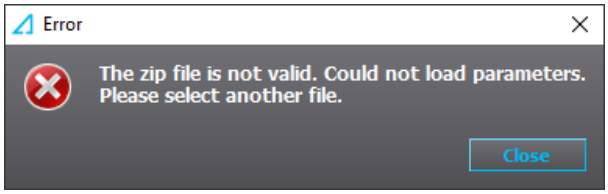
Figure. 3.2 - 1. Finding a newer version of AQtivate.



Clicking "Yes" will take you to the Arcteq website where you will be able to download the latest version. Logging in is required to download the software. If you do not have an account, you can create one at arcteq.fi for free.

Another common sign indicating that you are running an old AQtivate version is receiving an error message saying that the zip file is not valid (see the image below). In this case the installed AQtivate version is too old for the configuration file you are attempting to open and a newer version of the setting tool is needed. Check the tool's version and follow the instructions as described above.

Figure. 3.2 - 2. "Zip file is not valid" error message.



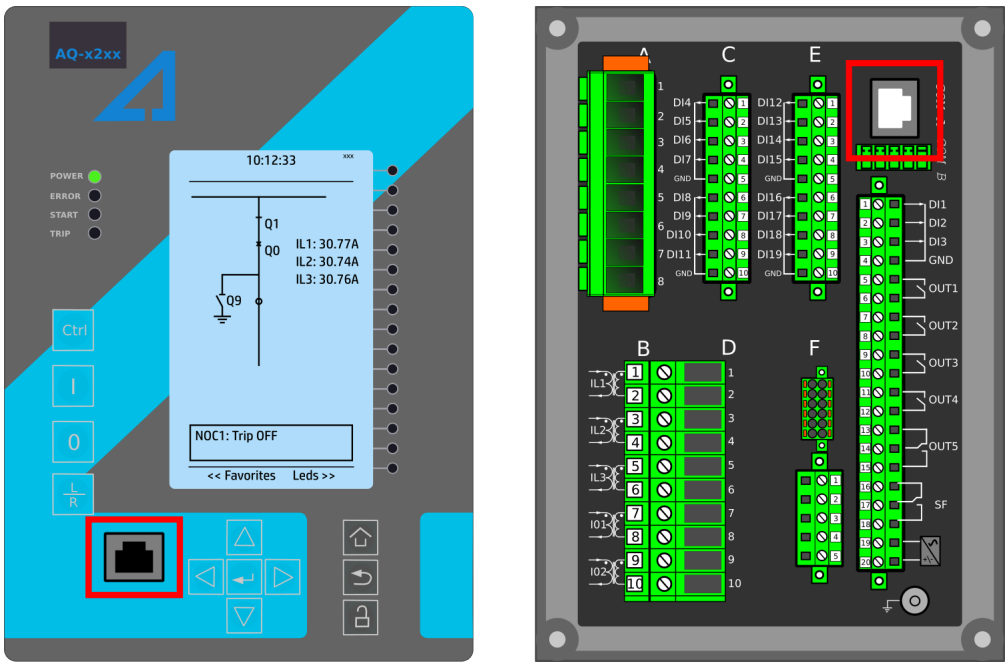
3.3 Connecting to device with AQtivate

In order to connect to a device with the AQtivate 200 setting tool, the following ports in the firewall must be open: 20, 21 and 1551. If the connection to the device fails, please check the settings of your firewall and anti-virus softwares, and use the troubleshooting chapters at the end of this manual(How to allow inbound pingand Allow AQtivate through firewall) for additional instructions on how to do this.

3.3.1 Device IP addresses

AQ 200 series devices are equipped with two RJ-45 ports: one is located in the front panel, and another one in the back. Both can be used to connect the device with AQtivate.

Figure. 3.3.1 - 3. Locations of the ports in AQ 200 series devices (left: front port; right: back port).

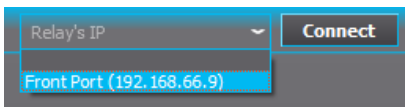


Front port (DHCP server)

The front port of the device has a fixed IP address (192.168.66.9) and an in-built DHCP server capability. This means that a local PC will get the required IP address automatically from the device. If the PC is unable to automatically connect to the device through the front port, please change the IP address of the PC ethernet port manually to the same area (192.168.66.x).

To connect to the device's front port, click on the drop-down menu at the middle of the main tool bar, select "Front Port" and press the "Connect" button.

Figure. 3.3.1 - 4. Connecting to a device via its front port.



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Back port

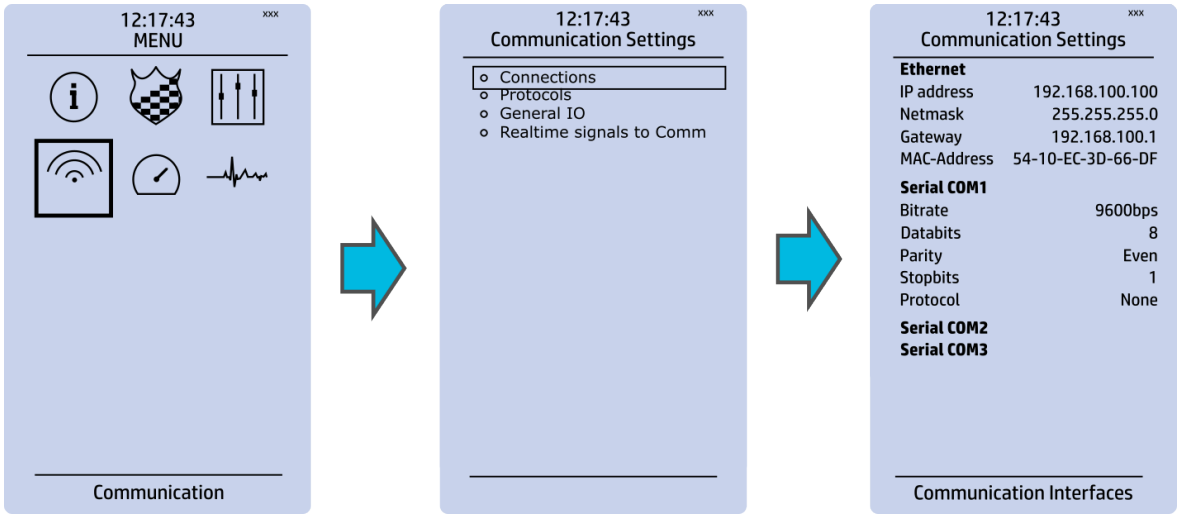
The IP address of the device's back port is set by the user and can be found by going to *Communication → Connections*. The settings found under this tab define the rear Ethernet communication of the device.

> NOTICE!
> The usability of the two ports differs in two ways: any firmware upgrading is only possible through the back port, and communication protocols only work through the back port. You can find more detailed instructions for firmware upgrading in the Updating firmware main chapter and its subchapters.

3.3.2 Setting the Ethernet ports IP address for communication through the back port

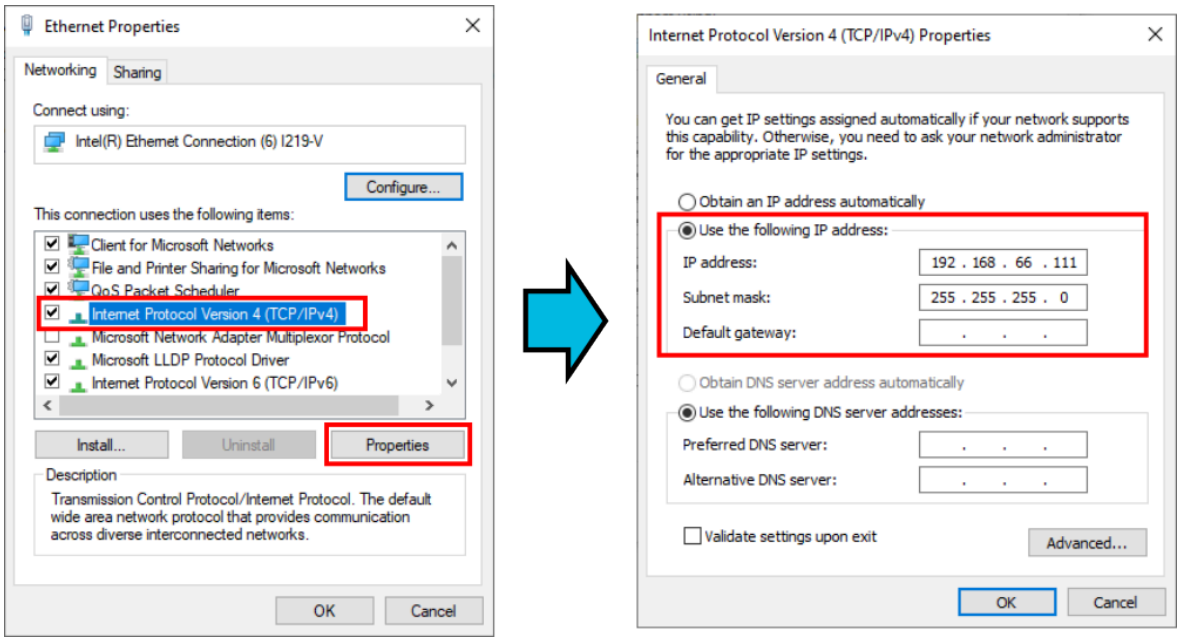
You can set the IP addresses in the device by going to *Communication → Connections* (see the figure below). The settings found under "Ethernet" section define the back panel Ethernet IP address.

Figure. 3.3.2 - 5. Location of the settings defining the back panel IP address.



To check your IP address range, navigate to the network settings of your programming PC. In Microsoft Windows 7 and 10 it can be found through the path pictured below.

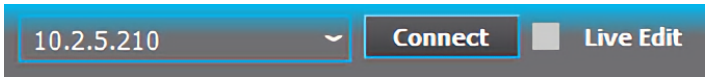
Figure. 3.3.2 - 6. Checking the IP address range in Windows 7/10.



If you have a fixed IP address, it is shown here. If you are connecting throught the front port, it is enough to select "Obtain an IP address automatically" in the network settings of your Ethernet port.

3.3.3 Connecting through the back port

Figure. 3.3.3 - 7. Connect box at the top of AQtivate software's main view.



To connect to an AQ 200 series device, type the IP address to the IP address box and then either press the Enter key or click "Connect". When you are connected to a device, the red "Offline" text at the top left corner will turn into a green "Online" text. When you are connected to a device through AQtivate, the Arcteq logo will blink on the device to indicate an active connection.

NOTICE!
Only one computer can connect to a device at one time! However, attempts to connect to a device with a second computer will not disrupt the user who connected to the device first.

NOTICE!
Connecting to a device with AQtivate through the back port does not affect the SCADA connection.

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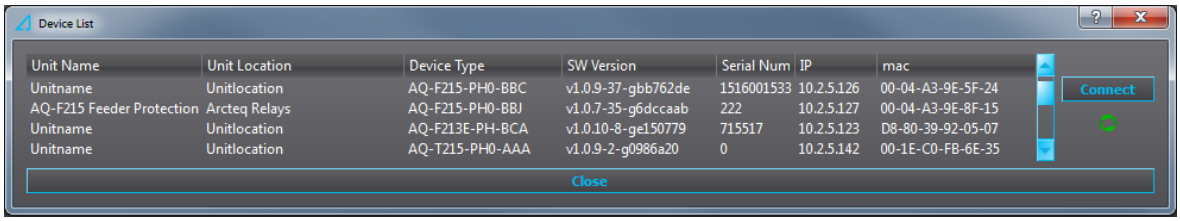
3.3.4 Device list

Figure. 3.3.4 - 8. Device list view.



Another way to connect to a device is to open the Device list from the *Tools* menu or by pressing **F11**. The resulting pop-up window shows all the available devices that are connected to the network your computer is in. Double clicking one of the devices in the list, or selecting a device and clicking the "Connect" button will close the window and connect to the selected device. If new devices are connected while the Device list is open, press the green and circular "Refresh" icon (below the "Connect" button) to make the new devices appear on the list.

NOTICE!
Some switches and firewalls may prevent AQtivate 200 from showing up on this list.

NOTICE!
If you have multiple instances of the AQtivate setting tool running at the same time, the device list will not be able to list the devices in the network.

3.3.5 Connecting by launching AQtivate through a command line

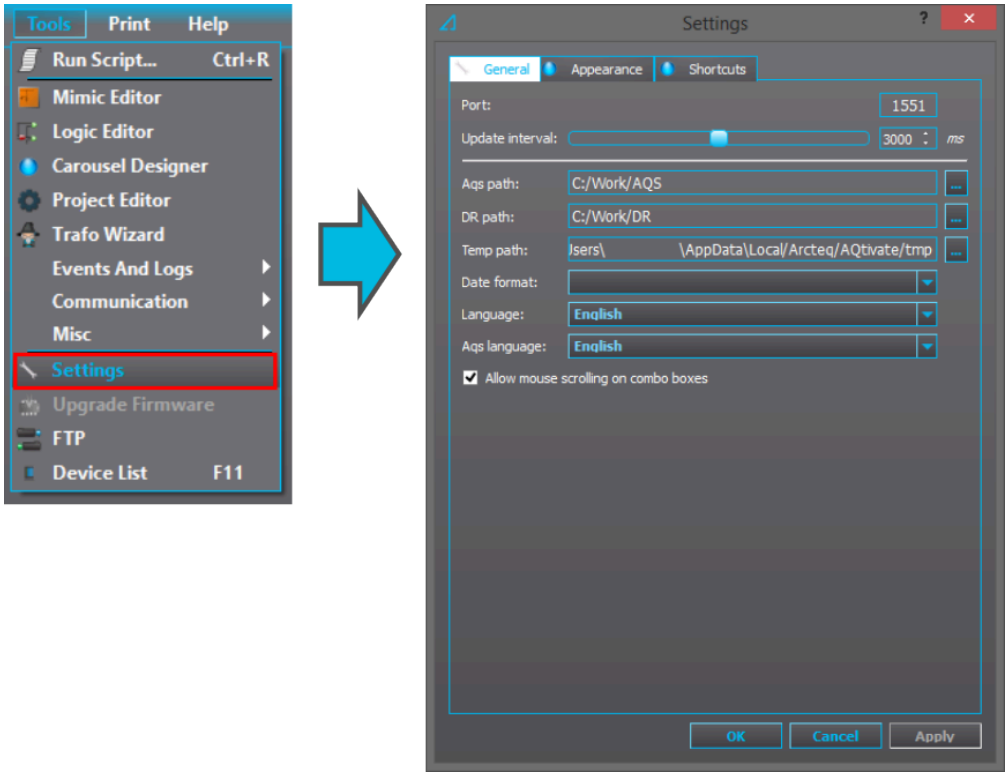
When AQtivate is launched, the software allows you to connect to a device through a command line. Open Command Prompt (type "cmd" into your PC's Search tool) and simply give the command "AQtivate.exe c- [the device's IP address]". This will launch AQtivate and attempt to connect to the device with the given IP address.

For example, if the unit's IP address is 192.168.100.100, you can connect to it when you launch AQtivate in Command Prompt by typing "AQtivate.exe -c 192.168.100.100".

3.4 Settings menu

The *Settings* menu can be found at *Tools* → *Settings*.

Figure. 3.4 - 9. Location of the *Settings* menu.



3.4.1 General

The "Aqs path" defines the location where the configuration files are saved when they are downloaded from an AQ 200 device with the "Get aqs file" command. The "DR path" defines the location where the disturbance recordings downloaded from the AQ 200 series device are saved when the device receives a "Get DR files" command.

You can select in which way the date is displayed by choosing one in the "Date format" drop-down menu. The menu has the following options for how to display the date:

- dd.MM.yyyy
- dd/MM/yyyy
- yyyy-MM-dd
- MM/dd/yyyy

Changing the "Language" changes the language of the basic AQtivate menus. Changing the "Aqs language" changes which language is used for the menus generated from the .aqs-file. English is used by default. If "Other" is selected, AQtivate will use the language that was chosen in the "Language" parameter in the *General* menu.

Checking the “Allow mouse scrolling on combo boxes” check box allows the user to change the drop-down box value by scrolling the mouse wheel when the mouse hovers over the box. In the image below this feature is enabled, and the user can scroll through all the options of the "Timesync. source" parameter. This feature is disabled by default.

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Figure. 3.4.1 - 10. The "General" tab of the Settings menu.

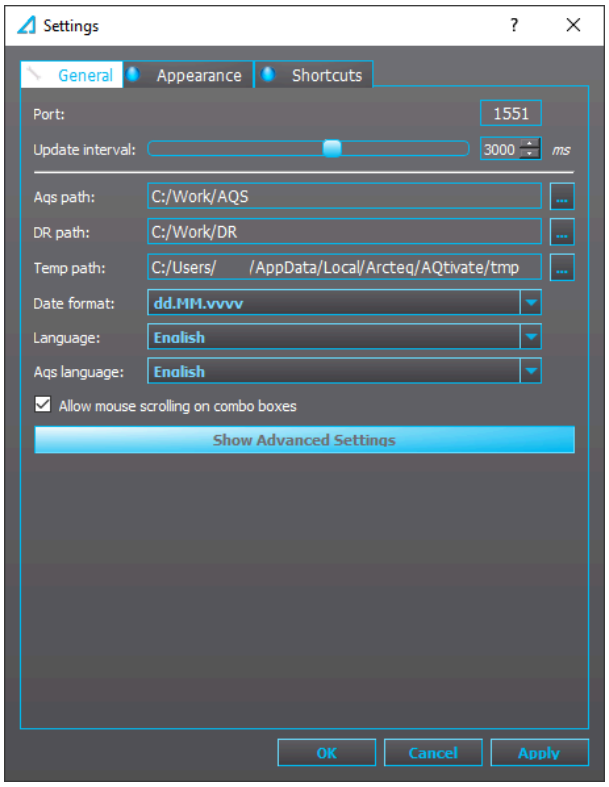
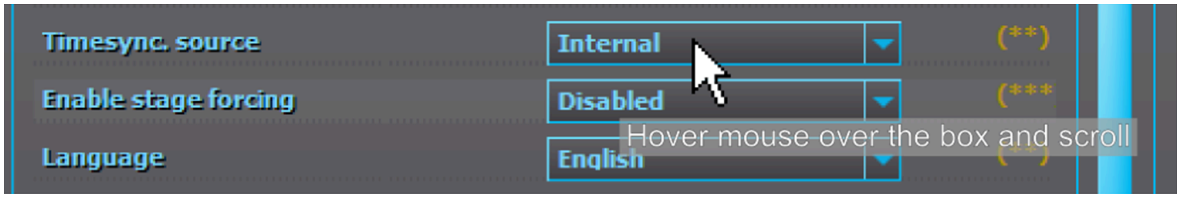


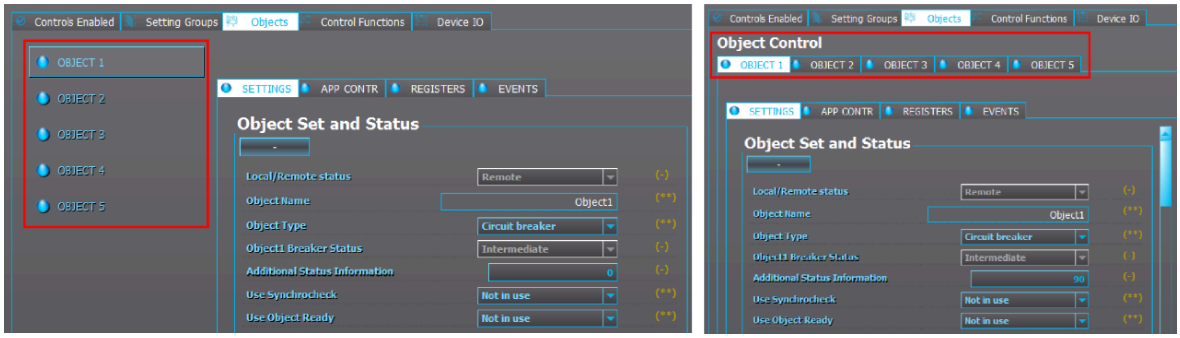
Figure. 3.4.1 - 11. Example of a drop-down menu parameter when scrolling is allowed on combo boxes in the "Settings" menu.



3.4.2 Appearance

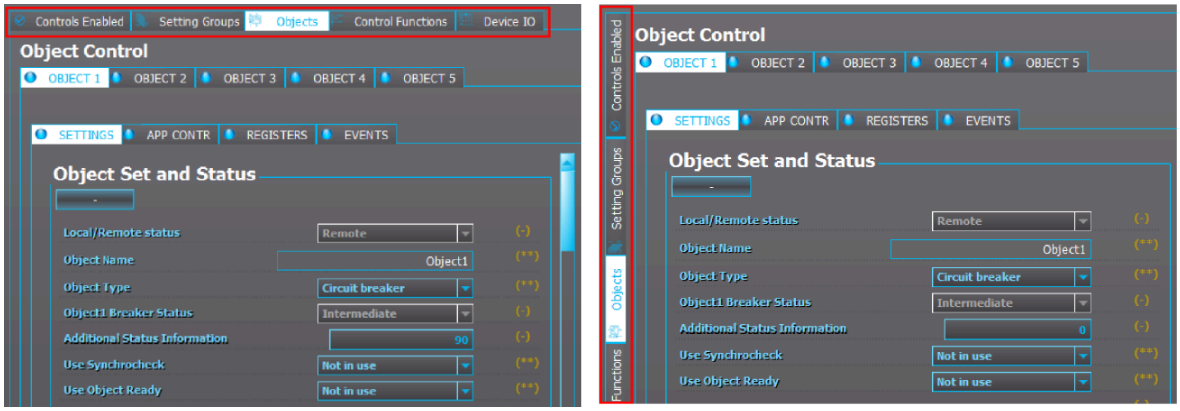
In the *Appearance* tab you can modify the appearance of AQtivate. Some users with low resolution laptops may run into situation where some of the menus do not fit in the window horizontally. You can get more space by activating the *Compressed mode:* this changes the list of submenus into tabs (see the image below).

Figure. 3.4.2 - 12. Normal menus vs. compressed menus.



Choosing the *Show horizontal tabs only* mode changes vertical tabs into horizontal tabs (see the image below).

Figure. 3.4.2 - 13. Normal tabs vs. horizontal tabs.



You can also change AQtivates's color scheme. You can select change the various color one by one, or you can select one of the three pre-made color schemes (Arcteq, Arcteq Dark, and Cool Grey).

NOTICE!
Please note that changing the appearance settings requires that you reopen the .aqs file for the changes to take effect.

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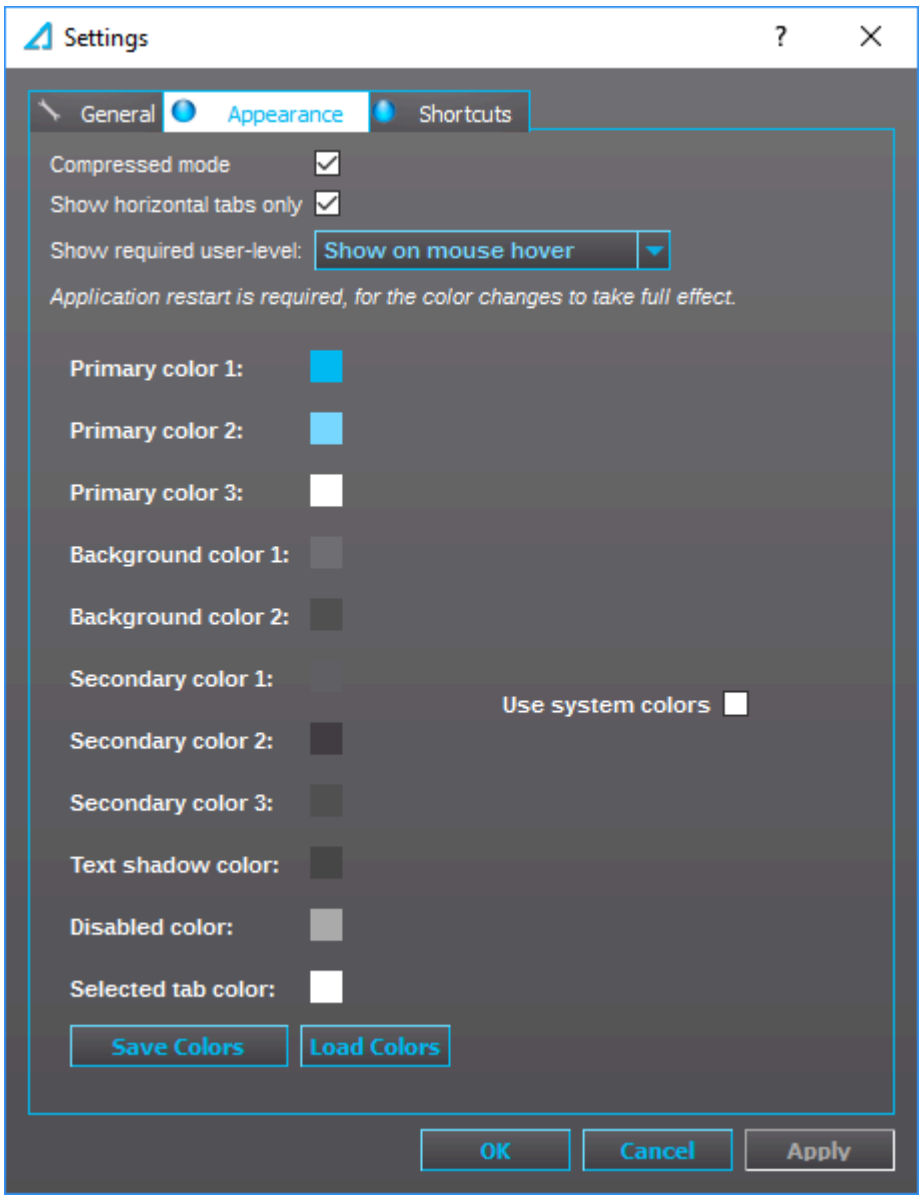
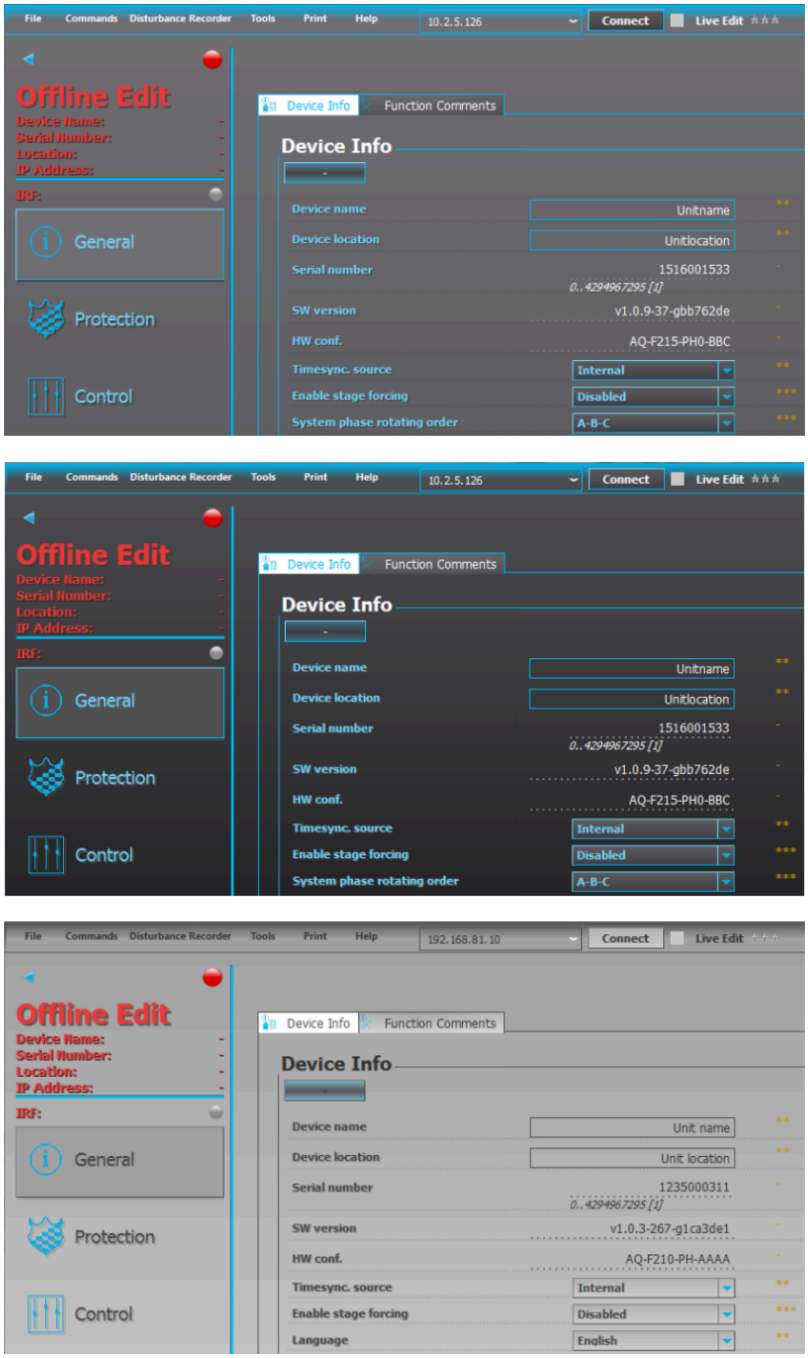
Figure. 3.4.2 - 14. Changing the software's appearance settings.



To select one of the pre-made color themes, click "Load colors" and select the scheme from the AQtivate 200 install folder (by default the path is C:\Program Files (x86)\Arcteq\AQtivate\color_themes). The images below show what these pre-made color schemes look like.

Figure. 3.4.2 - 15. The three pre-made color schemes (top: Arcteq; middle: Arcteq Dark; bottom: Cool Gray).



In *Show the required user level* you can change how the required user level is shown by selecting from the three display options: "Don't show", "Show on mouse hover", and "Show".

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Figure. 3.4.2 - 16. The three options for showing the required user level.

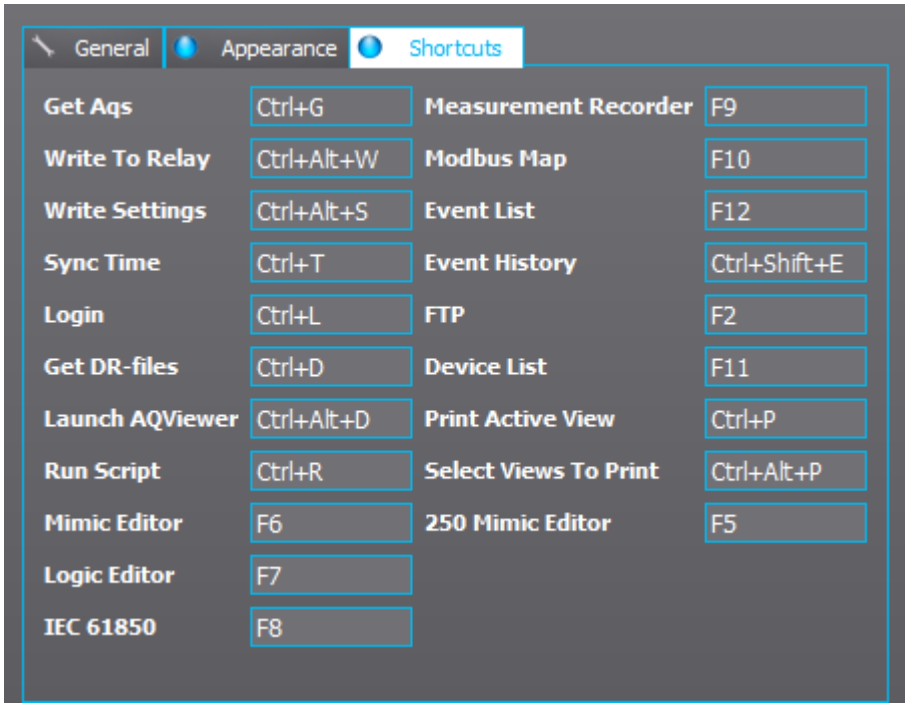
You can also quickly change between the color scheme of the *Appearance* tab or the Windows colors (see the image below).

Figure. 3.4.2 - 17. “Use system colors” setting ON/OFF.

3.4.3 Shortcuts

In the *Shortcuts* tab, you can can edit the various menu shortcuts. The default shortcuts are presented in the image below.

Figure. 3.4.3 - 18. Default shortcuts.



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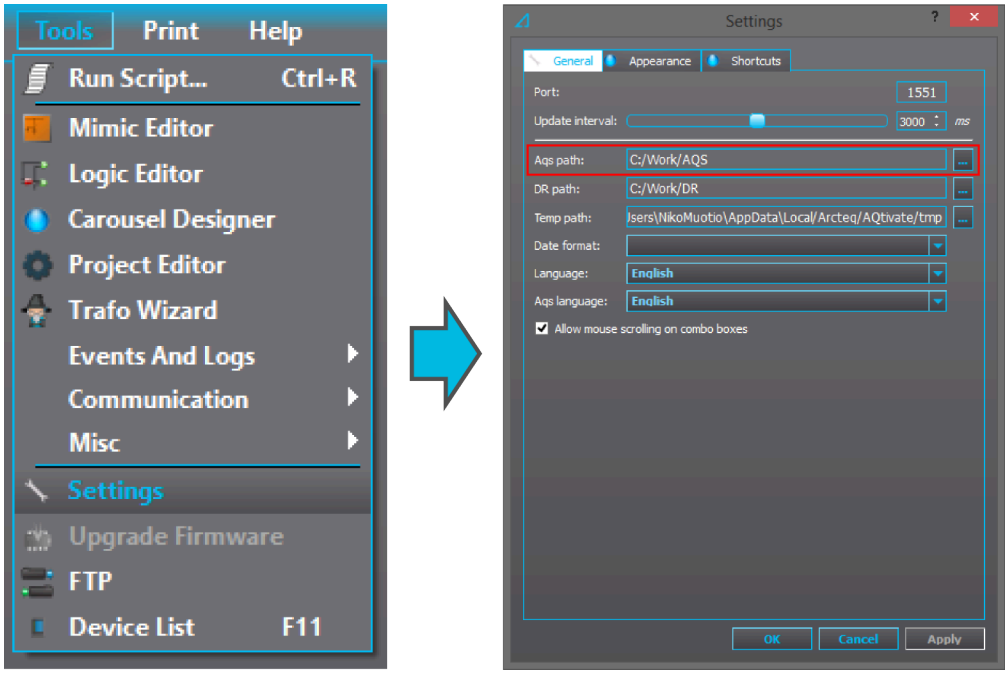
4 Managing .aqs files

4.1 Reading .aqs setting files from the device

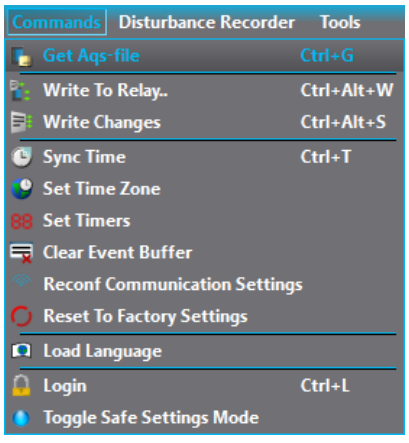
With AQtivate you can download existing .aqs files from the device and they can be stored on a hard drive. You can determine where the .aqs files are saved by going to *Tools* → *Settings* and setting the *Aqs path* parameter to your liking (see the image below). By default, the .aqs files are saved to the AppData/Local/Arcteq folder.

Figure. 4.1 - 19. Determining where .aqs files are saved.



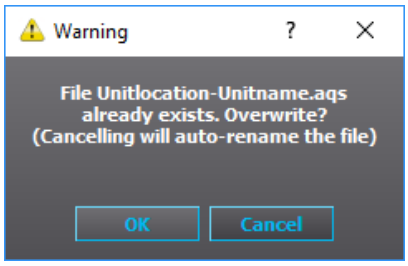
To download a device's settings to the AQtivate setting tool, connect to the device and go to *Commands* → *Get aqs-file* (or press Ctrl+G). Wait for the program to load the file.

Figure. 4.1 - 20. Downloading an .aqs file.



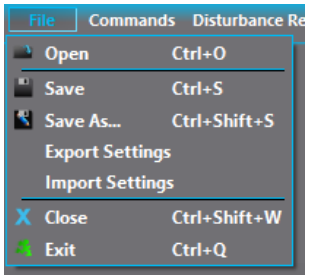
When downloading an .aqs file from a device, if an .aqs file with the same file name already exists in the specified folder, AQtivate asks the user whether the loaded file will overwrite the original (click "OK"), or whether the loaded file will automatically be renamed and the original preserved (click "Cancel").

Figure. 4.1 - 21. File name contradition has occurred when saving an .aqs file.



4.2 Opening and saving .aqs files

Figure. 4.2 - 22. "File" menu for opening and saving .aqs files.



You can open an .aqs file from the PC's hard drive by using the command *File → Open*. The .aqs files can be found by following the path determined in the *Settings* menu or somewhere else on the PC's hard drive. To save an .aqs file click *File → Save* or *File → Save as*.

4.3 Uploading .aqs files to the device

You can upload an .aqs file that is currently open to the relay. First make sure that the connection to the device has been established, and then use the menu command *Commands → Write to relay* and select all components you want to upload. Then wait for the program to finish processing the command.

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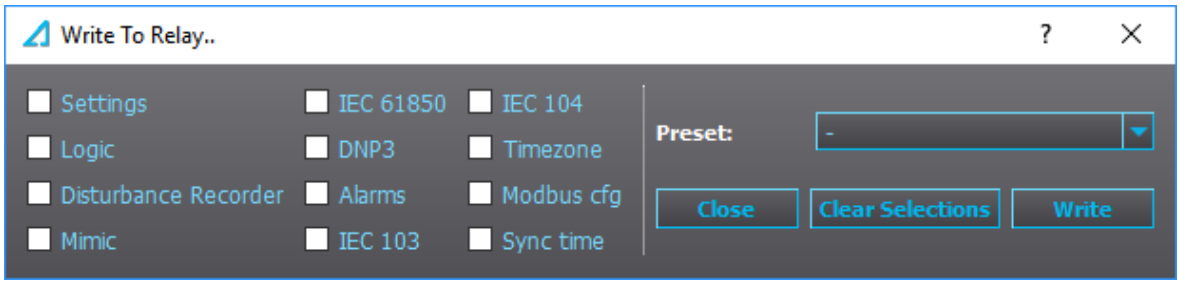
5 Uploading configurations

There are several ways to write changes you have made to your device configuration. The two most common ways are *Write to relay* and *Write changes*.

5.1 Write to relay

The following window appears when you click on the *Write to relay* command (in *Commands* menu). In order to be able to open this window, you need to have a connection to a device.

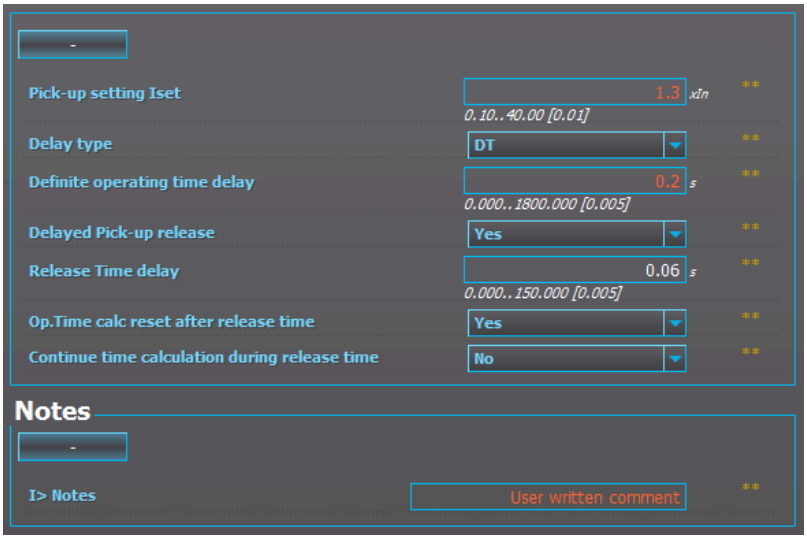
Figure. 5.1 - 23. Options when writing to a device.



By clicking the various boxes you can choose which parts of the configuration you want to upload. You can also opt to use one of the presets (*Configuration* or *Everything*). The following list explains what each of these configuration boxes does.

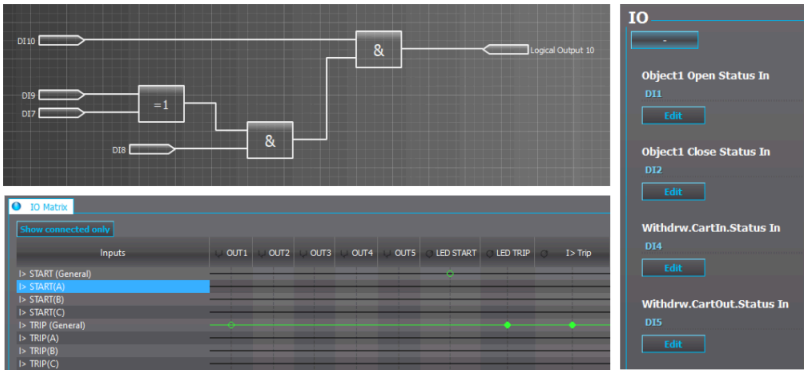
- Settings: Includes all parameter values. Parameter values include e.g. protection pick-up levels, trip delay times, LED/DI/DO namings, IP settings, etc.

Figure. 5.1 - 24. Contents of the "Settings" option.



- Logic: Includes configurations made to the matrix, the control blocks and the logic editor.

Figure. 5.1 - 25. Contents of the "Logic" option.



- Disturbance recorder: Turns on the uploaded disturbance recorder settings set at *Monitoring → Disturbance recorder*. Uploading disturbance recorder settings requires that logic and parameters are also uploaded.
- Mimic: Uploads the mimic and the carousel designs to the device in use at *Tools → Mimic editor* and *Tools → Carousel designer*.
- IEC61850: Uploads the .CID file currently in use at *Tools → Communication → IEC61850.*
- DNP3: Uploads the DNP3 settings currently in use at *Tools → Communication → DNP3.*
- Alarms: Uploads the alarms settings at *Tools → Events and logs → Set alarm events.*
- IEC103: Uploads the IEC103 settings currently in use at *Tools → Communication → IEC103.*
- IEC104: Uploads the IEC101/IEC104 settings currently in use at *Tools → Communication → IEC101/IEC104.*
- Modbus cfg: Uploads the custom modbus configurations set up at *Tools → Communication → Modbus map.*
- Sync time: Syncs the device clock to the time on the connected PC. If either serial time sync or NTP time sync is in use, these remain in use.

5.2 Write changes

This window displays two values for parameters: the old value that is currently in the device, and the new value to be written to the device (see the image below). When the *Write changes* box is checked, AQtivate writes the new listed parameters. This can work as an alternative for writing parameters with "Live edit" mode on or using *Commands → Write changes* to write parameters.

The tool also recognizes when the logic or disturbance recorder settings have been changed. Activating the checkboxes selects which parts of the configuration will be written to the device.

NOTICE!
When determining changes, this tool compares the values now to what they were when the configuration was first opened (or, when changes were last written to the device). This means that if any changes were made to a configuration file during a previous session and not uploaded to the device, the *Write changes* tool does not recognize the changes and does not alert the user of the differences. In such a case, please use *Commands → Write changes* instead.

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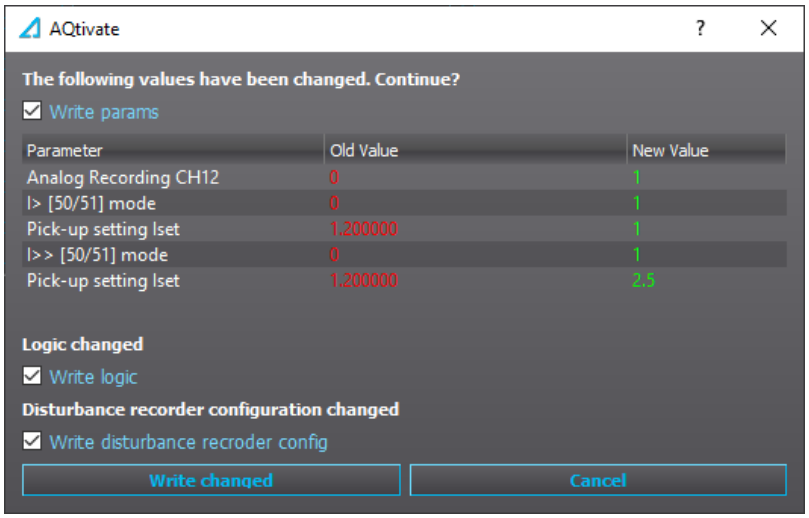
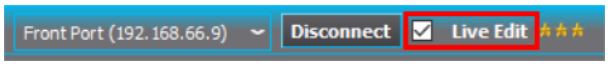
Figure. 5.2 - 26. "Write changes" showing both the old and the new values for each parameter.



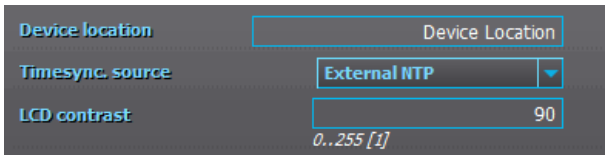
5.3 Live Edit

Figure. 5.3 - 27. Activating the Live Edit mode.



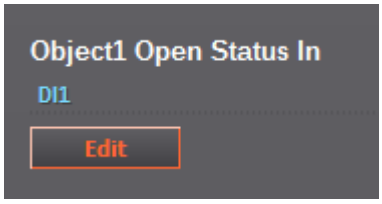
If the AQtivate setting tool is connected to the device, you can write parameter settings to the device in real time by checking the Live Edit box (as seen in the figure above). Live editing means that when you make changes to the parameters in AQtivate, they are immediately uploaded to the device. You can live edit text parameters, dropdown-box parameters and numbered parameters (see the figure below for examples of these elements).

Figure. 5.3 - 28. Examples of elements that can be edited live.



You cannot, however, edit certain other parts of the configuration such as the matrix editor, the block input and output settings, the selected input and output settings, the DR input settings, etc. When you change logic blocks, the un-synced logic blocks are highlighted with orange to remind you that they need to be uploaded to the device (see the figure below).

Figure. 5.3 - 29. An unsynced setting highlighted.



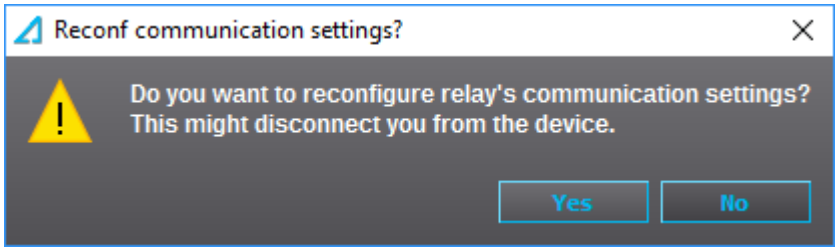
NOTICE!
When you activate the Live Edit mode, AQtivate will **download** all the parameter values that are currently in use in the device to the AQtivate software. If there are any parameters that you have changed in AQtivate software while not in Live Edit mode that you want to be included in the upload to the device, you can do so through *Commands → Write changes* or *Commands → Write to relay*.

NOTICE!
Remeber to save any changes you have not uploaded! All these changes changes to the parameters without uploading them are wiped and replaced by the parameter values that are currently in use in the device, when you activate the Live Edit mode.

5.4 Reconfiguring communication settings

When you upload new communication IP settings to the device, a prompt appears asking whether these settings will be adopted to use immediately (see the image below).

Figure. 5.4 - 30. Confirmation of taking new communication IP settings into use.



If "Yes" is selected, the new settings are adopted right away. If "No" is selected, the new IP settings will be adopted only after you have brought up the same window through AQtivate (*Commands → Reconf communication settings)* and clicked "Yes". If the unit is rebooted before the reconfiguration is done, the unit will revert back to the original IP address.

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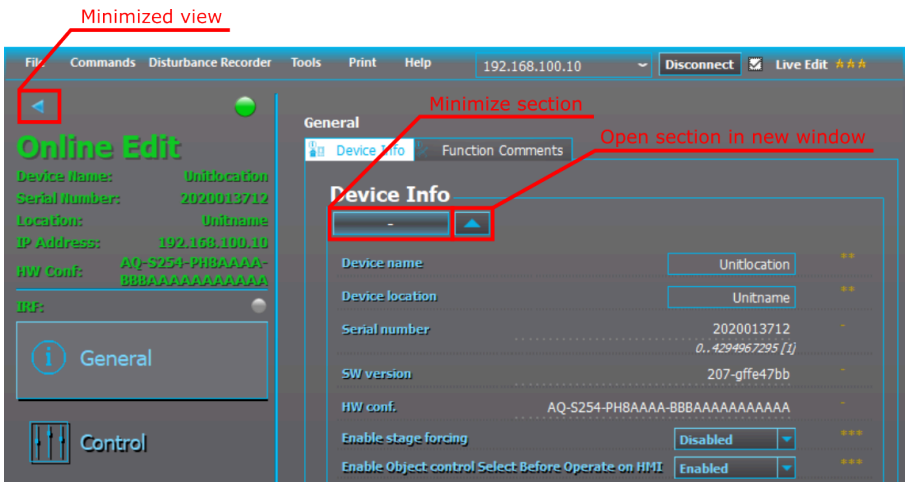
6 Online Edit menus

Figure. 6 - 31. View of the Online Edit menus.



6.1 Introduction and navigation

After you open an .aqs file, menus appear to the left side of the AQtivate window. The number of these menus depends on the device type. All the settings and values that reside under these menus can also be accessed via the device's HMI display.

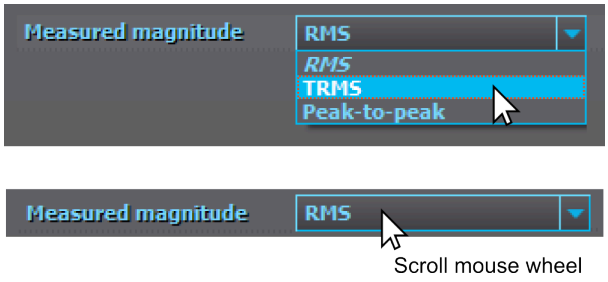
Every menu is divided into tabs which can be seen at the top of the the window right below the selected menu's title. You can change how things are displayed through the *Appearance* settings (for a more detailed description, see "Appearance" under the chapter "Getting started").

NOTICE!
This chapter is to help you to get familiar with navigating AQtivate and with setting up the device. For the complete descriptions of the various protection functions and other functions please refer to the device manuals (can be downloaded at arcteq.fi/documents-and-software/).

Drop-down menu

You can change the value of a drop-down menu by clicking it and selecting one of the options, or by placing the cursor on it and scrolling through the options with the mouse wheel (please note that this feature must be enabled first at *Tools* → *Settings* → *General* → "Allow mouse scrolling on combo boxes"). These settings can be uploaded to a device with *Commands* → *Write to relay* or *Commands* → *Write changes*. However, if the Live Edit mode is active, any changes to these settings are uploaded to the device automatically.

Figure. 6.1 - 32. Changing drop-down menu values.

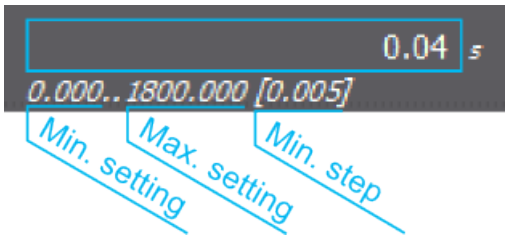


Text and number setting parameters

Text and number setting parameters can be changed by clicking on the box and writing the value or text. Press the Enter key to confirm the parameter change. To cancel the change click elsewhere without pressing Enter and the parameter will return to the original value or text.

Number setting parameters always have some limitations as to what values can be set. The range of the setting for each parameter is displayed below its text box. The minimum step for the parameter is in square brackets. For instance, in the example figure below, the unit of the parameter is seconds ("s"), the minimum setting value is 0 seconds ("0.000"), the maximum setting value is 1,800 seconds ("1800.000"), the minimum step is 0.005 seconds ("[0.005]"), and the currently used setting value is 0.04 seconds ("0.04").

Figure. 6.1 - 33. Example of a number setting parameter.



These settings can be uploaded to the device with *Commands → Write to relay* or *Commands → Write changes*. If the Live Edit mode is active, these settings are uploaded to the device automatically.

Control blocks

Control blocks control the behaviour of the device with binary signals. Click on the "Edit" button and a selection window will appear. The box at the top of the window can be used to filter the signal list to find the needed signal easier. While some control blocks allow multiple signals to be assigned to control block, some might allow only one. Use the "Clear" button to clear all selected signals. The "OK" button confirms the changes, while "Cancel" keeps the old settings.

The logic must be uploaded to the device (*Commands → Write to relay or Commands → Write changes*) for the changes made to the control blocks to take effect.

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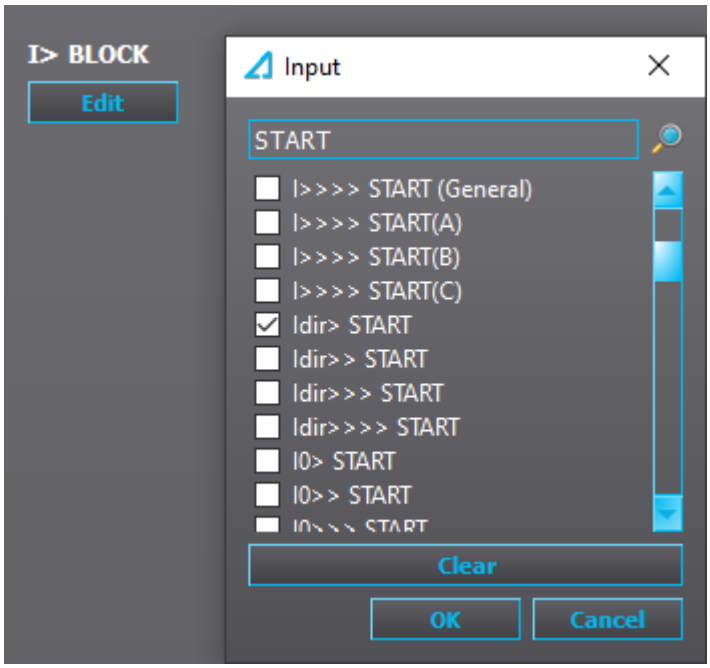
Figure. 6.1 - 34. Example of a control block.

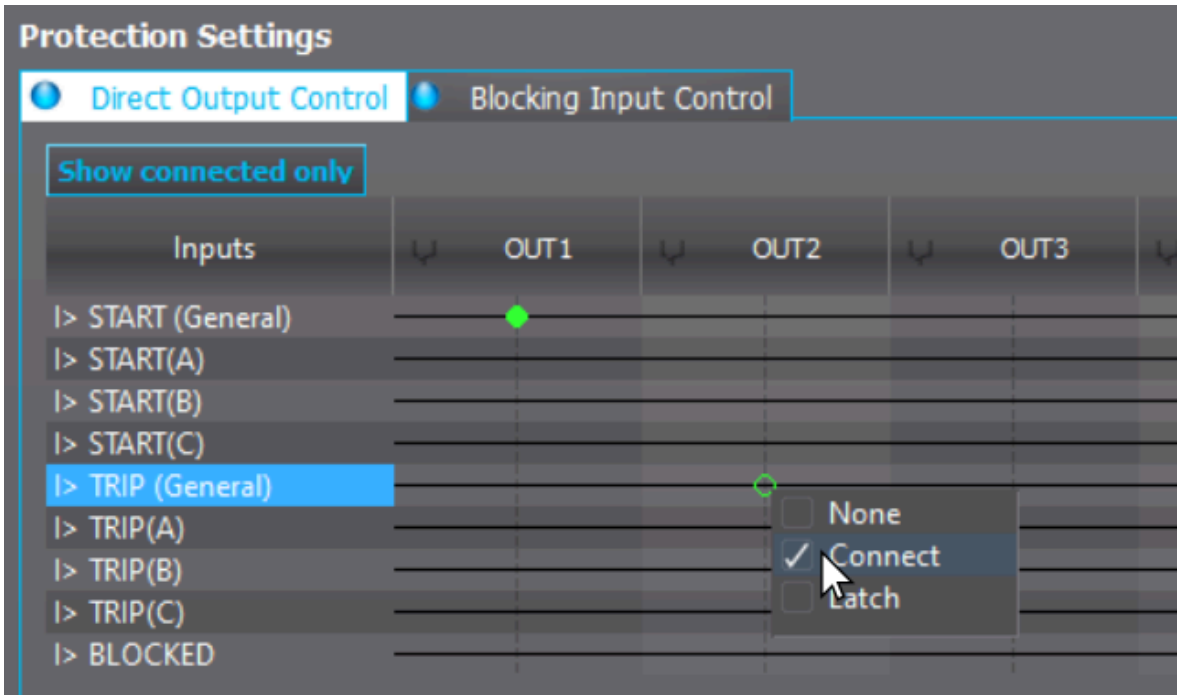


Matrix

Matrices can be used for connecting binary signals produced by the device to control either digital output contacts or to light up the LEDs. To make a connection click on the matrix and choose the type of connection needed from the list. Signals to digital outputs can be either "Connected" or "Latched". When a signal is set to "Connect", the digital output activates and deactivates with the signal. When a signal is set to "Latch", the output activates with the signal but deactivates only when a user presses the "Back" button on the devices front panel (see the individual device manuals for a description of the device's front panel configuration).

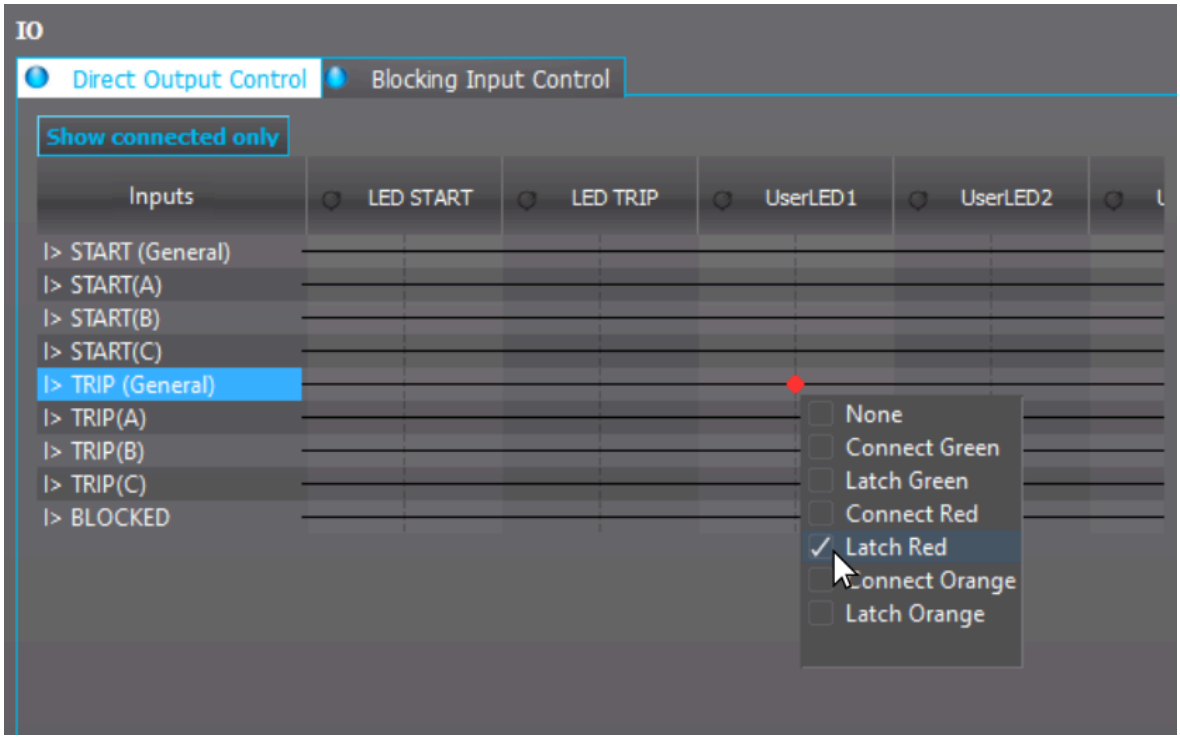
Please note that devices in the AQ 210 series and devices in the AQ 250 series have different matrix settings. The digital output signals and LEDs in AQ 210 series devices follow the same operation logic as previously described: they can be set to either "Connect" or "Latched", and their color can be either green or yellow (selected from *Control → Device IO → LED Settings → LED Color Settings*).

Figure. 6.1 - 35. Example of connecting signals in AQ 210 series devices.



The digital output signals in AQ 250 series devices follow the same programming logic as AQ 210 devices, but their LEDs are set differently: the color of the user LED is defined when the signals are connected (see the figure below).

Figure. 6.1 - 36. Example of connecting signals in AQ 250 series devices.



The logic must be uploaded to the device (*Commands → Write to relay or Commands → Write changes*) for the changes made to the matrix to take effect.

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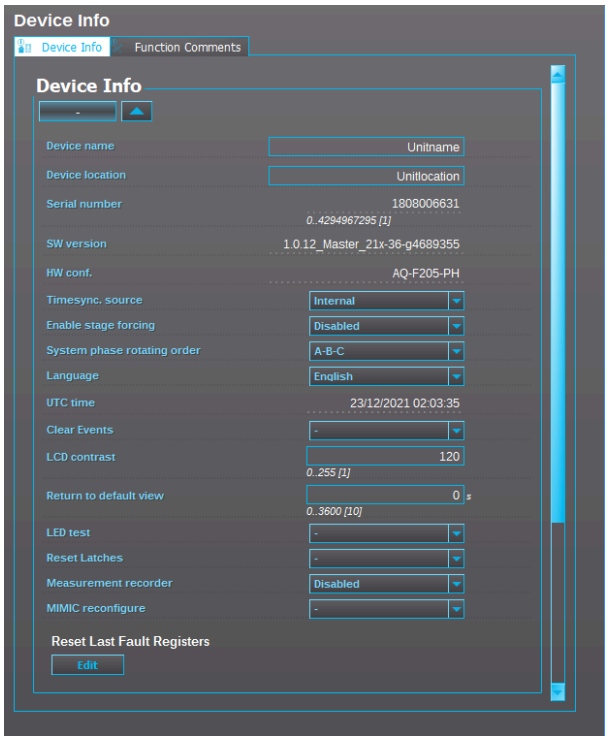
6.2 General menu

Figure. 6.2 - 37. "Device info" tab in the General menu.



The *General* menu's *Device info* tab consists of basic information about the device:

- Device name: The unit name set by the user. This name will be included in the .aqs configuration file name when the file is loaded from the device.
- Device location: The unit location set by the user. This name will be included in the .aqs configuration file name when the file is loaded from the device.
- Serial number: Unique serial number for identification purposes. Does not inhibit you from loading the same file to another unit with the same hardware and software.
- SW version: The software version in use.
- HW conf.: The hardware configuration. Hardware and software order code of the unit.

The tab also has some basic settings available:

- Timesync. source: Chooses whether the internal clock is used or whether the time is synchronized via NTP or a serial protocol (see the section "Commands menu" and its subsection "Time settings").
- Enable stage forcing: (See the section "Stage forcing" below.)
- Enable object control confirmation: When enabled, the device asks for confirmation after a control command has been given to an object through the HMI mimic before executing the command.
- System phase rotating order at the moment: Displays the system phase rotating order used at this moment. Can be either A-B-C or A-C-B.
- System phase rotating order setting: Sets the system phase rotating order.
- Language: Chooses the language used by the device (see the section "Commands menu" and its subsection "Uploading language files").
- UTC time: Time of the device's clock in UTC format (Coordinated Universal Time).
- Clear events: Clears events recorded into device.
- LCD contrast: Adjusts the contrast of the liquid-crystal display (LCD). Available in the AQ-210 series devices.

- Display brightness: Adjusts the screen brightness to be brighter (up to 8) or dimmer (down to 0). By default it is at 4. NB! Available only in AQ 250 series devices.
- Return to default view: The time (in seconds) how long it takes for the device to return to the default view from the mimic view. If the delay is set to 0 s (as is the default), the device will not go back to the mimic view automatically.
- Reset latches: An alternative to using the Back button in the front panel of the device. Resets all activated lacthed signals.
- Measurement recorder: Enables Measurement recorder function. See chapter Measurement recorder for detailed information about the function.
- I/O Default object selection: Defines which object open/close status I and 0 button LEDs follow in the front panel of the device.

Figure. 6.2 - 38. Checking the function states in the General menu while in Live Edit mode.

If the Live Edit mode is activate, you can quickly check the state of the protection stages and the status of the objects in use from the *Protection*, *Control* and *Monitor* profiles at the bottom of the *General* menu.

Stage forcing

In AQ 200 series devices you can test the protection system's logic and operation by controlling the state of the protection functions manually without feeding any current or voltage into the device. To enable stage forcing, set the "Enable stage forcing" to "Enabled" in the *General* menu. After stage forcing has been enabled, you can control the status of a protection function (Normal, Start, Trip, Blocked, etc.) in the *Info* tab of any protection function. The figure below shows an example of stage forcing with the I> function.

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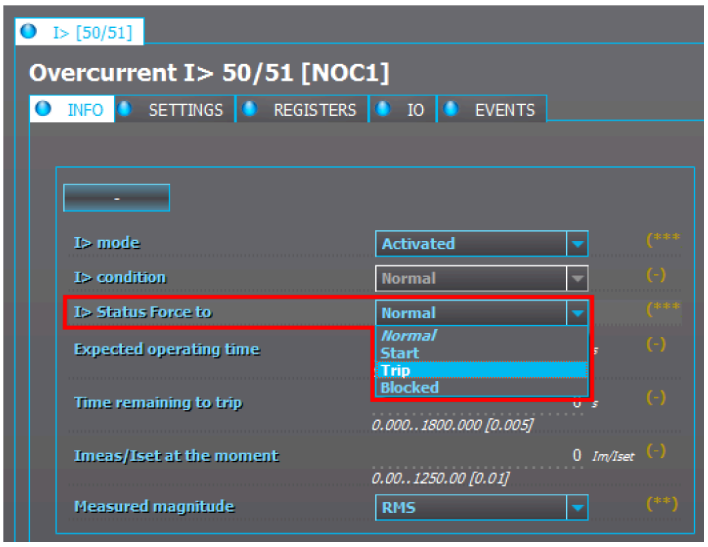
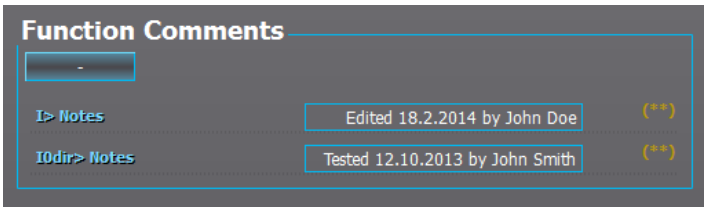
Figure. 6.2 - 39. Example of stage forcing.



NOTICE!
Protection functions remain operational while stage forcing is enabled. Please disable stage forcing in the *General* menu to ensure the device's normal operation after testing.

Function comments

Figure. 6.2 - 40. Examples of function comments.



You can write comments for activated functions in the *Function comments* tab in the *General* menu. For example, you can write notes when you parameters were last changed (see the figure above). You can also write comments in the functions' own *Settings* menu.

6.3 Protection menu

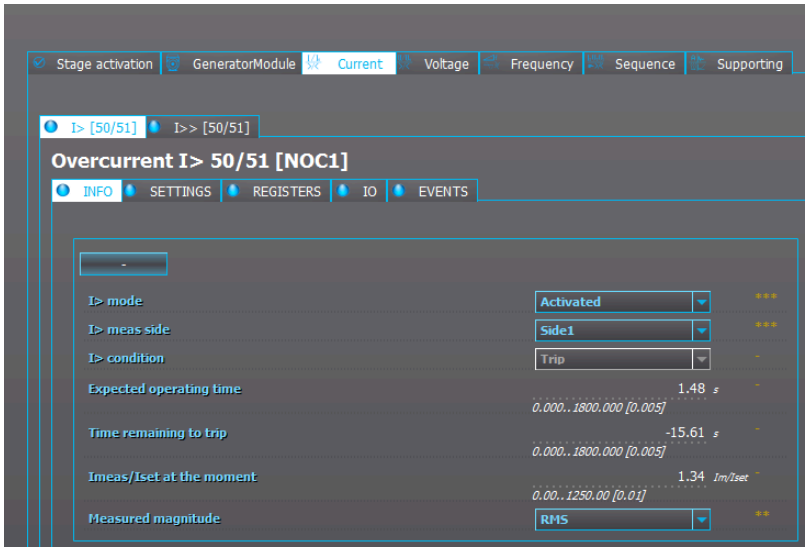
Figure. 6.3 - 41. Protection menu.

The *Stage activation* tab is the main tab in the *Protection* menu. Here you can activate and disable protection functions. The available protection functions in the configuration depend on the device type. After you have activated a function, its parameters and other information can be found by navigating to its tab. For example, if you activated the *I>* function (the overcurrent function) found listed under "Current stages" in the stage activation menu, you are able to access its settings from the *Current* menu. Each activated function has the following tabs: "Info", "Settings", "Registers", "IO", and "Events".

Info tab

After a function has been activated, opening the function's menu automatically opens into the function's *Info* tab. The *Info* tab displays information related to the function such as statistics on starts and trips, measurements and the active settings. Additionally, this is where you can control status forcing if stage forcing has been enabled in the *General* menu.

Figure. 6.3 - 42. "Info" tab.



- Setting control from comm bus: Some functions allow you to enable setting changes through a remote connection (SCADA).
- Meas. side: If the unit has more than one current measurement card, some functions may require you to choose which card the device supervises.
- Condition: Displays the status of the function if the Live Edit mode is activated. Otherwise, it displays the status of the function when the .aqs file was saved.
- Phases condition: Some functions display status of each phase (start and trip).
- Expected operating time: Displays the expected operating time with the measured values at that time. Especially useful when testing inverse curve delays.
- Time remaining to trip: Displays how much time remains to the next trip with the currently measured values.
- X_{meas}/X_{set} at the moment: Displays the ratio between the measured value and the set operating level at that moment. When the measured value is exactly at the operating level, a value of 1.00 is displayed for X_{meas}/X_{set}.
- Measured magnitude: Some functions give you the option of choosing the measured magnitude (usually this is a choice between RMS values, TRMS values and peak-to-peak values).

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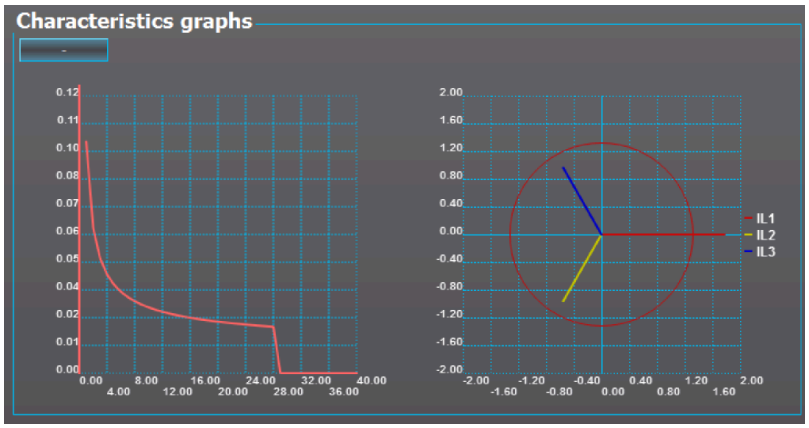
Figure. 6.3 - 43. Example of characteristics graphs.

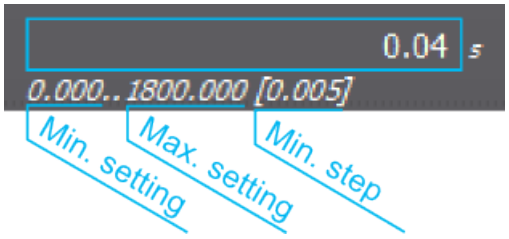


The "Characteristics graphs" section of the *Info* menu is found in most of the protection functions. The graph gives us useful information on the settings currently in use. If the Live Edit mode is activated, the graph also shows us visual information of the function's status at that moment. In the figure above is an example of characteristics graphs: the graph on the left shows the time delay settings, while the one on the right shows a vector graph of the measured currents vs. the pick-up level.

Settings tab

You can change the settings of the function in the *Settings* tab. The range of the setting for each parameter is displayed below its text box. The minimum step for the parameter is in square brackets. For instance, in the example figure below, the unit of the parameter is seconds ("s"), the minimum setting value is 0 seconds ("0.000"), the maximum setting value is 1,800 seconds ("1800.000"), the minimum step is 0.005 seconds ("0.005"), and the currently used setting value is 0.04 seconds ("0.04").

Figure. 6.3 - 44. Example of a setting parameter.

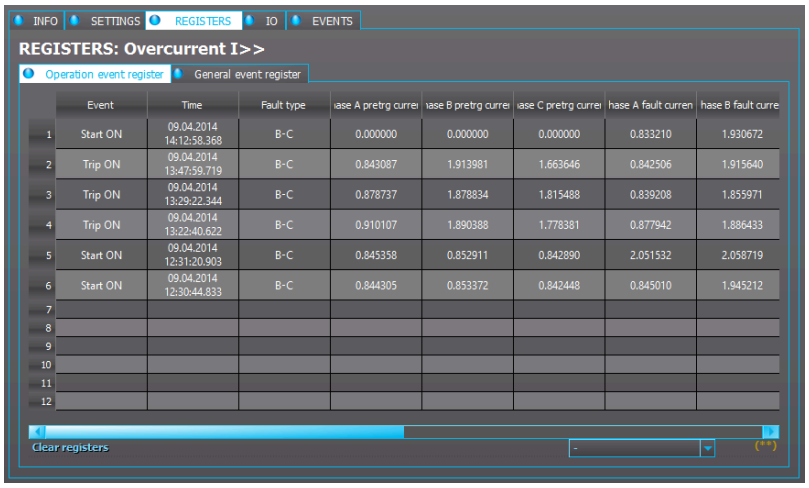


NOTICE!

You can find the instructions for setting up each individual protection function from the device's manual, under the section describing the protection function in question. The latest manuals can be downloaded at arcteq.fi/documents-and-software/.

Registers tab

Figure. 6.3 - 45. Operation event registers in the "Registers" tab.



	Event	Time	Fault type	ase A pretrg curre	ase B pretrg curre	ase C pretrg curre	hase A fault curren	hase B fault curre
1	Start ON	09.04.2014 14:12:58.368	B-C	0.000000	0.000000	0.000000	0.833210	1.930672
2	Trip ON	09.04.2014 13:47:59.719	B-C	0.843087	1.913981	1.663646	0.842506	1.915640
3	Trip ON	09.04.2014 13:29:22.344	B-C	0.878737	1.878834	1.815488	0.839208	1.855971
4	Trip ON	09.04.2014 13:22:40.622	B-C	0.910107	1.890388	1.778381	0.877942	1.886433
5	Start ON	09.04.2014 12:31:20.903	B-C	0.845358	0.852911	0.842890	2.051532	2.058719
6	Start ON	09.04.2014 12:30:44.833	B-C	0.844305	0.853372	0.842448	0.845010	1.945212
7								
8								
9								
10								
11								
12								

The *Registers* tab contains two views: *Operation event register* and *General event register*. *Operation event register* displays information about the function's alarms and trips. The tab only displays the measurement values that are relevant to the actual function. Each function registers its operation into the last twelve (12) time-stamped registers. The values recorded into registers contain information such as the time stamp, the fault type, the pre-triggering measurement value, the fault measurement value, etc. You can find a more detailed explanation of what each of the register columns records in the device's manual (under the selected protection function's chapter, in the section titled "Events and registers"). The manuals can be downloaded from arcteq.fi/documents-and-software/.

When you open an .aqs configuration that has been downloaded from the device, AQtivate displays the registers recorded to the .aqs at the moment of downloading. If the Live Edit mode has been activated, AQtivate displays the registers in real time.

To clear the registers, select "Clear" in the "Clear registers" drop-down menu that is located below the table.

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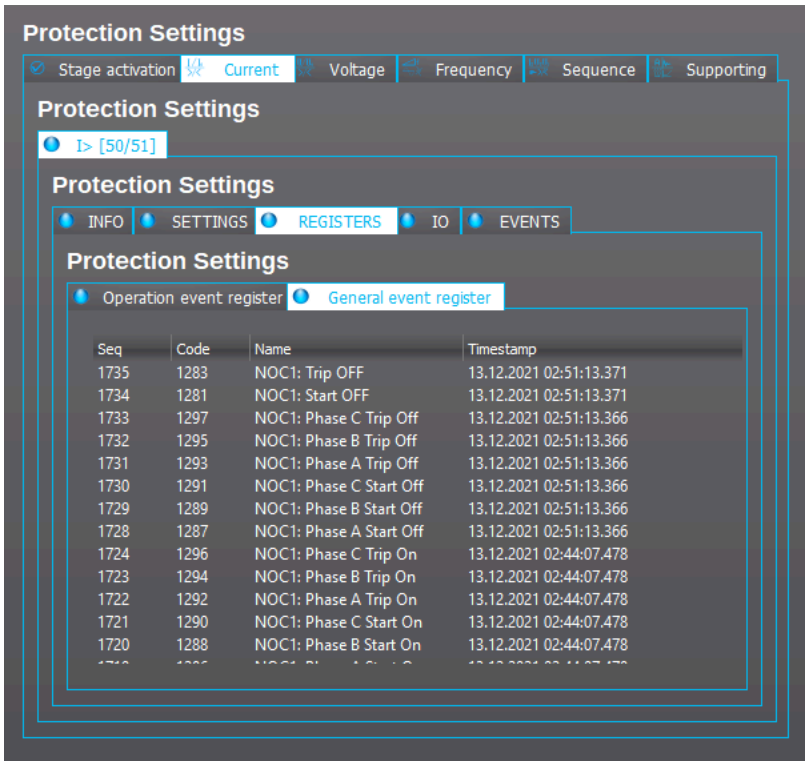
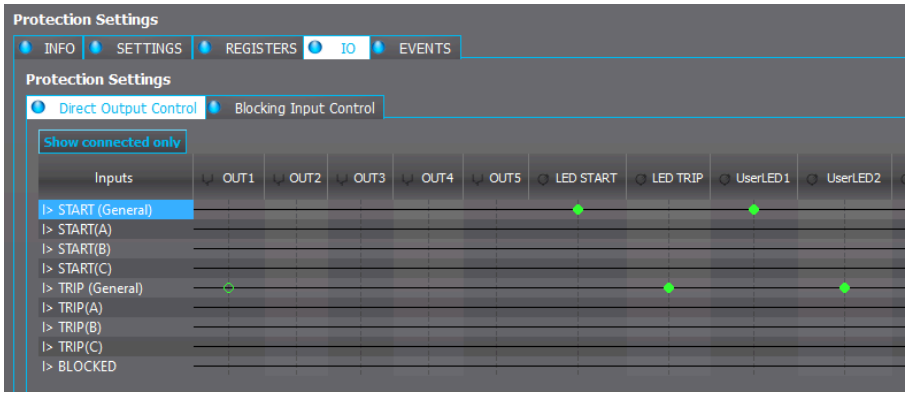
Figure. 6.3 - 46. General event registers in the "Registers" tab.



General event register displays events recorded by the function. The device records any event that has been activated in the *Events* tab. These events can be also viewed at *Tools → Events and logs → Event history*.

I/O tab

Figure. 6.3 - 47. Direct output controls in the "IO" tab.

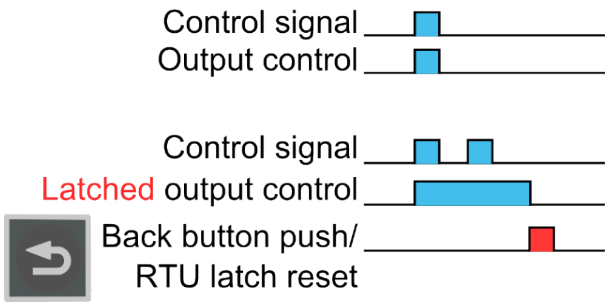


The *I/O* tab is divided between the *Direct output control* tab and the *Blocking input control* tab.

In *Direct output control* the function's output signals can be used to switch output the statuses of signals and user LEDs ON or OFF. The available output signals vary depending on the function. The matrix has two kinds of connections for output contacts: "Connected" and "Connected and latched". The connected output is activated (or released) when the input is activated (or released). Similarly, the latched connection output signal is activated when the input is activated; however, the output remains active until it is cleared manually from the device's panel by pressing the **Back** button. A latched signal can also be reset by a remote terminal unit. The figure below describes the difference between normal and latched signals.

Click on the crossing point of an input signal and an output signal to make a connection. Then choose "None", "Connect", or "Latch".

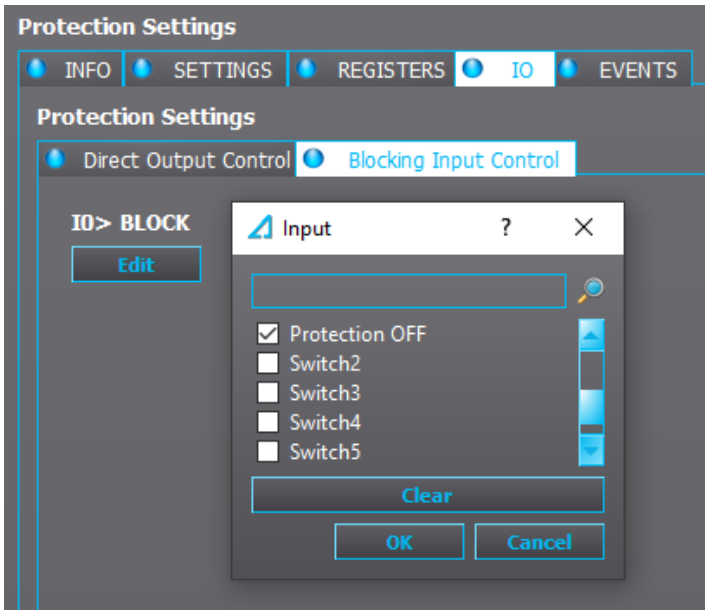
Figure. 6.3 - 48. Behaviour of normal and latched signals.



In AQ 250 series devices you can choose the color of the LED when making the matrix connection. The available colors are green, red and orange.

When the matrix has been configured, upload the logic with *Commands → Write to relay*.

Figure. 6.3 - 49. Blocking input controls in the "IO" tab.



The *Blocking input control* tab is used to determine which signals block the function. By default no signals block any function. Click *Edit* at the bottom of the window to set the blocking signals of the function. A list of different signals appears. In the example image above, we are setting up signals that would block the I0> (earth fault) function. The *Protection OFF* signal (a renamed, programmable control switch) is connected which means that whenever this signal is true, the I0> stage is blocked. The logic must be uploaded to the device (*Commands → Write to relay*) for the changes to take effect.

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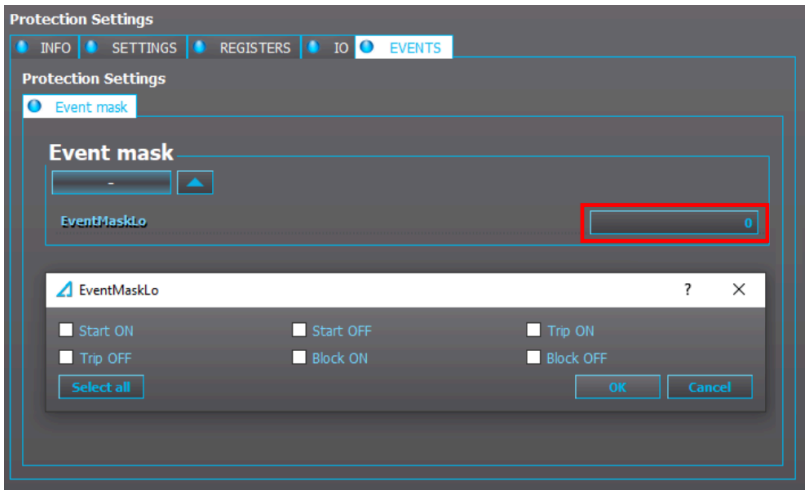
Events tab

Figure. 6.3 - 50. "Events" tab.



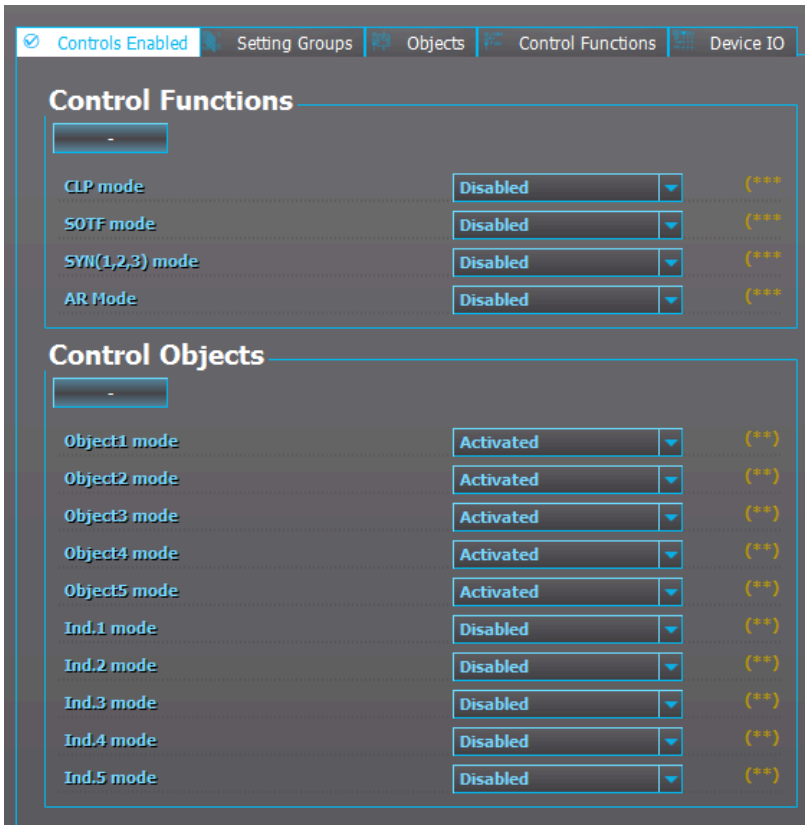
You can select which events are recorded into the *Event history* by setting the *Event mask* dialog. To set the *Event mask* dialog, click on the number box. A pop-up window appears where you can select which event types are recorded. After this the recorded events will show up in the *Event history* (*Tools → Events and logs → Event history* or the shortcut Ctrl+Shift+E). The recorded events can also be checked in the HMI if the *Events* screen has been applied to the carousel (see *Tools → Carousel Designer* for more information).

6.4 Control menu

6.4.1 Controls enabled

The *Controls enabled* tab is the main view of the *Control* menu, and it is used to activate and disable control functions, controllable objects and indicators. Once the functions are activated they can be adjusted in the *Control functions* tab. Objects and indicators can be adjusted in the *Objects* tab.

Figure. 6.4.1 - 51. "Controls enabled" tab.

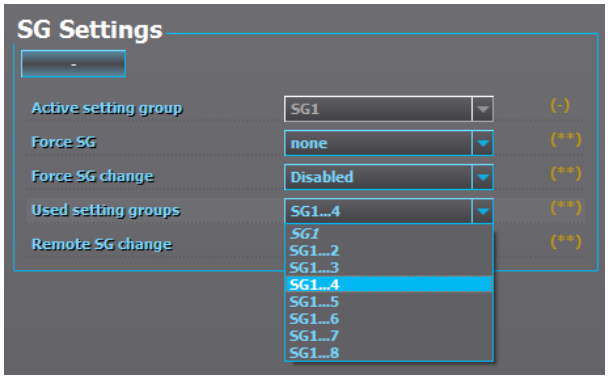


6.4.2 Setting groups

In the *Setting groups* tab you can set the number of setting groups used, determine which signals set the setting groups on, and force a setting group change. The "SG local select" subsection determines which digital inputs or logical signals set the setting groups on. The new setting group configuration must be uploaded to the device (*Commands* → *Write to relay*) for the changes to take effect.

For example, let us set the "Used setting groups" from "SG1" to "SG1...4" (see the figure below).

Figure. 6.4.2 - 52. Changing the setting group to SG1..4.



Let us see what happened to the menu of a protection function (e.g. *Protection* → *Overcurrent* → *Settings*). As can be seen in the figure below, there are now four setting groups available. Note that when new setting groups are added, the parameter settings may not be the same as in the default "SG1". When a new setting group has been added for the first time, it appears with the default settings.

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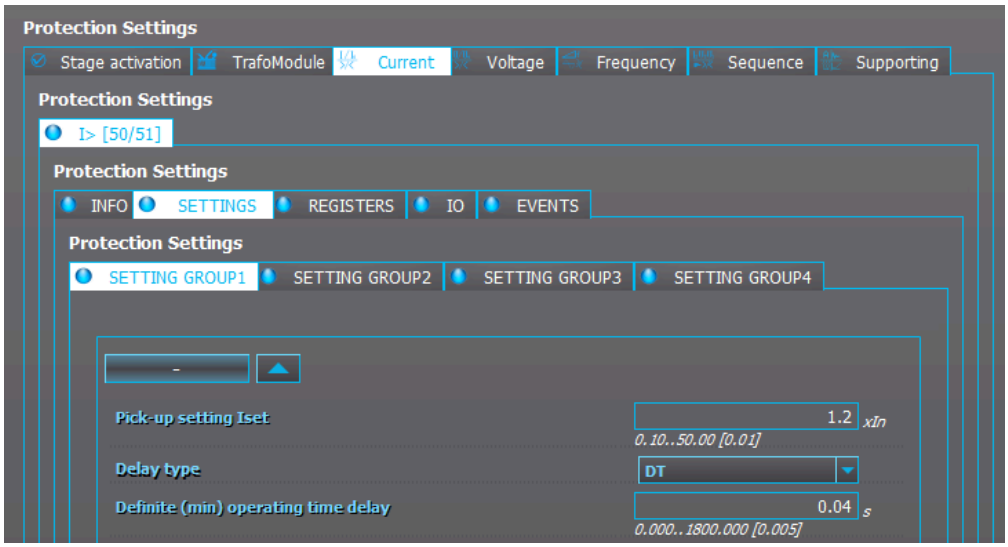
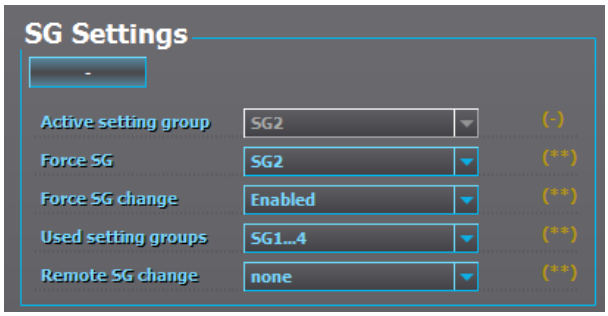
Figure. 6.4.2 - 53. Four available setting groups.



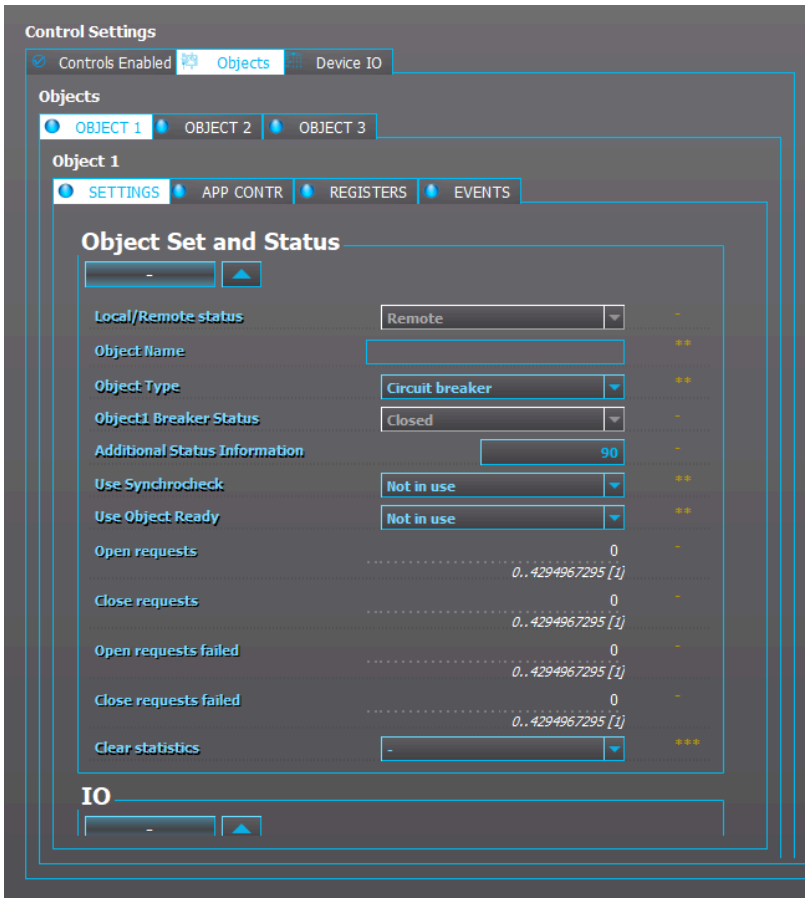
You can bypass the setting group selection logic and force the activation of a wanted setting group. This is useful, for instance, during commissioning where the tester is not able to activate the signals which would set the desired setting group into use. In the figure below, "Force SG change" has been enabled and the desired setting group ("Force SG") has been set to "SG2".

Figure. 6.4.2 - 54. Example of forced setting group change.



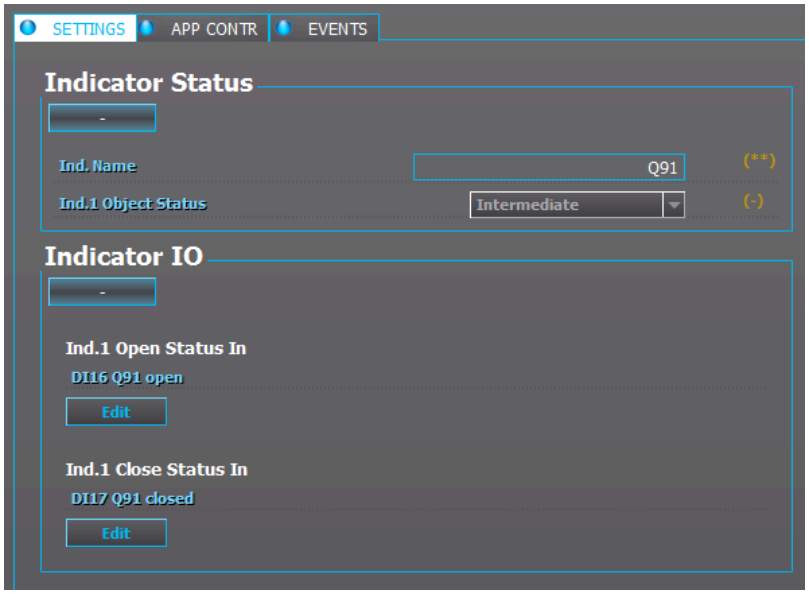
6.4.3 Objects

Figure. 6.4.3 - 55. "Objects" tab.



The *Objects* tab is used for setting up circuit breakers and disconnectors as well as their status information and control. An object can be applied to the HMI mimic view after it has been set up.

Figure. 6.4.3 - 56. Example of indicators.



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Some devices also have indicators: they can display the state of a switch but cannot receive any open or closed signals.

NOTICE!
For a more detailed description on how to setup objects, please check the device's own manual at www.arcteq.fi/documents-and-software/.

6.4.4 Control functions

This tab is used for setting up the control functions activated in the *Controls enabled* tab. You set up control functions in the same way you set up protection functions.

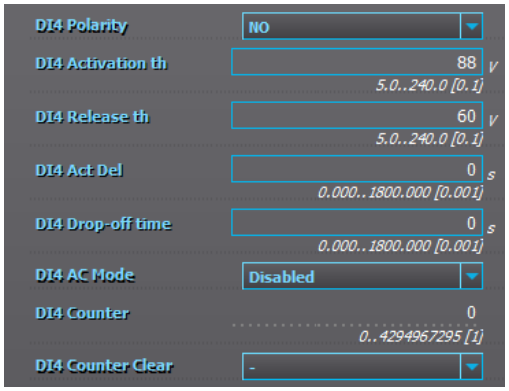
6.4.5 Device I/O tab

Digital input and output settings

The *Digital input settings* include the following digital input settings (see the figure below):

- the polarity,
- the activation and release threshold voltage levels,
- the activation and de-activation delays,
- DI AC mode enables and disables the 30-ms delay that accounts for alternating current.

Figure. 6.4.5 - 57. Digital input settings.



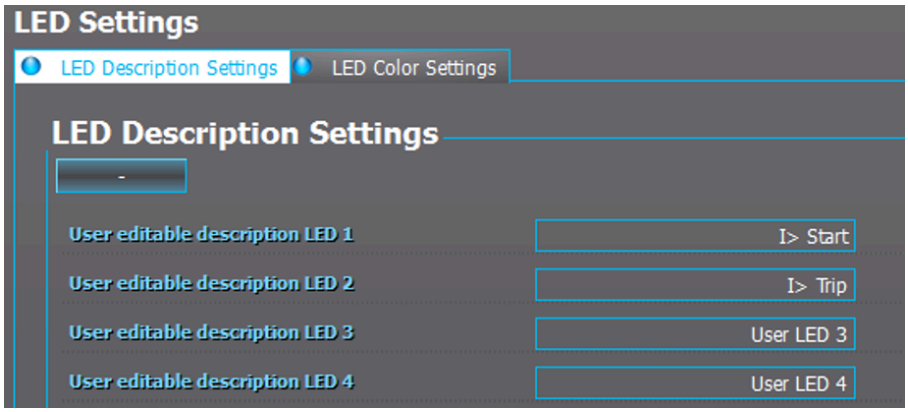
The *Digital output settings* are for setting the outputs between normally open (NO) and normally closed (NC).

You can change the descriptions of both inputs and outputs; this helps you differentiate the various signals from one another when making configurations.

LED settings

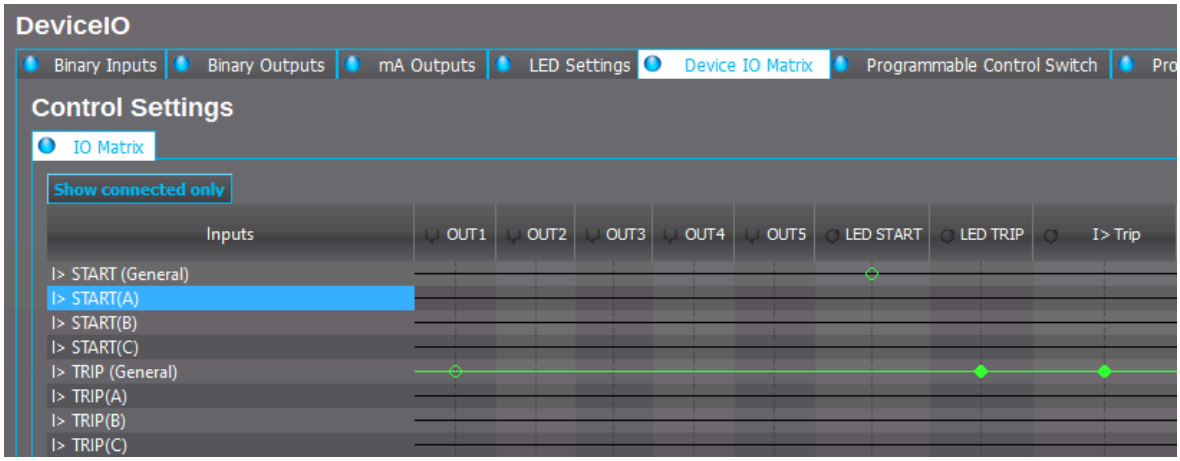
In the LED settings you can change the descriptions of the user LEDs (see the figure below). Additionally, you can set the color of those LEDs (green or yellow) when configuring AQ 210 series units. In AQ 250 series units the color of the LED is chosen when you connect signals to the LEDs in the matrix. The color priority defines which color is lit up if two or three colors are activated for the same LED.

Figure. 6.4.5 - 58. LED settings.



Device I/O matrix

Figure. 6.4.5 - 59. Example of a full I/O matrix.



The *Device I/O matrix* tab displays the full I/O matrix of the device (see the figure above). Any I/O connections made to any of the functions can also be seen here. Additionally, whenever connections are made in the I/O matrix table, those changes can be seen in the function's I/O matrix table (*Protection* → the function's *I/O* tab). When the Live Edit mode is on, the status of an active signal is displayed with a green line (see the image above).

Whenever changes are made to the *Device I/O matrix*, the logic in the device is no longer up to date. The logic needs to be updated into the device so that the changes take effect (*Commands* → *Write to relay*).

The available output signals vary depending on the device type.

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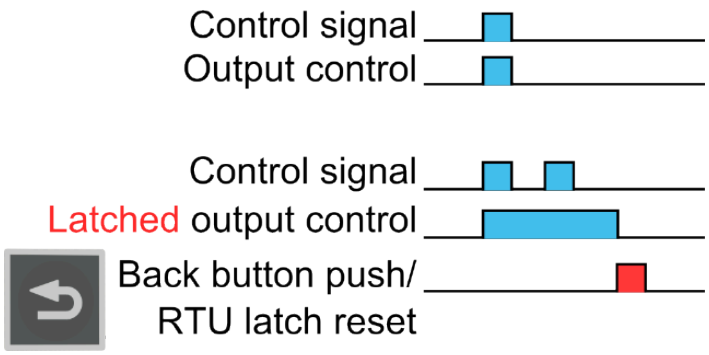
Figure. 6.4.5 - 60. Behaviour of normal and latched signals.



The matrix has two kinds of connections for output contacts: "Connected" and "Connected and latched". The connected output is activated (or released) when the input is activated (or released). Similarly, the latched connection output signal is activated when the input is activated; however, the output remains active until it is cleared manually from the device's panel by pressing the Back button. A latched signal can also be reset by a remote terminal unit. The figure above describes the difference between normal and latched signals.

Click on the crossing point of an input signal and an output signal to make a connection. Then choose "None", "Connect", or "Latch".

When configuring the LED assignments of an AQ 210 series device, you can set the color of the LED in *Control → Device I/O → LED settings*. However, in AQ 250 series devices you can choose the color of the LED when making the matrix connection. The available colors are green, red and orange. If two or more signals are attempting to activate different colors to the same LED, the displayed color depends on the priority that you have set in *Control → Device I/O → LED settings*.

6.5 Communication menu

The *Communication* menu is used for setting up the basic settings for connecting to unit with setting tool and RTUs.

6.5.1 Connections

The *Connections* tab consists of the Ethernet IP address settings and the RS-485 serial communication settings, both located in the back panel.

Ethernet

The Ethernet IP address settings define what IP address the Ethernet port uses. If an Ethernet-based communication protocol is used, this IP address is used for that as well. Additionally, this section displays the device's MAC address. You can enable Ethernet-based communication protocols (such as IEC 61850, Modbus TCP, etc.) at *Communications → Protocols*.

Virtual Ethernet

The Virtual Ethernet enables the device to be connected to multiple different networks simultaneously via one physical Ethernet connection. The Virtual Ethernet has its own separate IP address and network configurations. All Ethernet-based protocol servers listen for client connections on the IP addresses of both the physical Ethernet and the Virtual Ethernet.

You can enable the Virtual Ethernet connection in the *Virtual Ethernet* section. You can also edit its IP address, netmask, and gateway there.

Serial COMx

In this section you can define the basic settings used by the serial communication ports. You can select the serial communication protocol if one is used by this port. Further communication protocol settings can be done at *Communications → Protocols*.

6.5.2 Protocols

The *Protocols* tab mostly consists of communication protocol enabling, slave addresses, measurement intervals etc. The exact settings available depend on the communication protocol.

NTP

If NTP time synchronization is used, the server and client settings are defined here. Please note that in order to use time synchronization with NTP, the "Timesync. source" parameter in the *General* menu should be set to "External NTP". When the device time is synchronized, the "NTP quality for events" parameter in this tab changes from "Not synchronized" to "Synchronized".

IEC 61850/GOOSE

This tab is used as a starting point for configuring IEC 61850 settings. The settings include the enabling of IEC 61850 and/or GOOSE subscription, GOOSE input settings and measurement deadbands. After these have been set up, further settings can be done via *Tools* in the AQtivate main toolbar (*Tools → Communication → IEC 61850)*.

Modbus/TCP

In this tab you can only enable the Modbus/TCP protocol and define the IP port for the communication. All further settings can be done via *Tools* in the AQtivate main toolbar (*Tools → Communication → Modbus map)*.

Modbus/RTU

In this tab you can only set up the Modbus/RTU slave address. You can enable the Serial Modbus/RTU at *Communication → Connections*. All further settings can be done via *Tools* in the AQtivate main toolbar (*Communication → Modbus map)*.

IEC 103

In this tab you can only set up the slave address and the measurement update interval. You can enable the IEC 103 protocol at *Communication → Connections*. All further settings can be done via *Tools* in the AQtivate main toolbar *(Tools → Communication → IEC 103)*.

IEC 101/104

The standards IEC 60870-5-101 and IEC 60870-5-104 are closely related, as both are derived from the IEC 60870-5 standard.

On the physical layer IEC 101 uses serial communication, whereas IEC 104 uses Ethernet communication. If the IEC 101 protocol is used, it can be activated at *Communication → Connections*. If the IEC 104 protocol is used, it can be activated at *Communication → Protocols → IEC 101/104* (i.e. this tab). Both IEC 101 and IEC 104 share the measurement deadband settings and the scaling coefficients. All further settings can be done via *Tools* in the AQtivate main toolbar (*Tools → Communication → IEC101/IEC104 Map*).

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SPA

In this tab you can only set up the SPA address and choose whether or not time synchronization is used. You can enable SPA at *Communication → Connections*. The SPA map can be found at *Tools → Communication → SPA map* through AQtivate's main toolbar. The SPA event list can be found at *Tools → Events and logs → Event list*.

DNP3

DNP3 is supported in both the serial mode and the TCP (Ethernet) mode. To use DPN3 in the serial mode, it must be activated at *Communication → Connections*. If DNP3 is used in the TCP mode, it must be activated at *Communication → Protocols → DNP3*. Further settings can be found at *Tools → Communication → DNP*.

Modbus I/O

The *Modbus I/O* tab is used for RTD and mA measurements with external ADAM modules connected to the RS-485 port. Using ADAM modules requires that the Modbus I/O protocol is selected at *Communication → Connections*.

6.5.3 General I/O

The *General I/O* tab has twelve (12) fault registers that can be set up to record the following signals:

- I>, I>>, I>>> and I>>>> (non-directional overcurrent) fault values of each phase individually.
- Io>, Io>>, Io>>> and Io>>>> (non-directional earth fault) residual current values.
- Id>, Id>>, Id>>> and Id>>>> (directional overcurrent) fault values of each phase individually.
- Iod>, Iod>>, Iod>>> and Iod>>>> (directional earth fault) residual current values.
- FLX (fault locator) value.

Each of these can be set to be triggered by the TRIP signal, by the START signal, or by both START and TRIP signals. These registers can be read through SCADA for fault analyzing.

6.5.4 Real-time signals to communication

Real-time signals to communication can be used by "Fast Modbus" to report measurement values quickly to Modbus. There are eight (8) channels available in this function. The measurements are categorized under "Currents", "Voltages", "Powers", "Impedance (ZRX) and admittance (YGB)" and "Others".

For example, if the 9^{th} harmonic of the IL2 current measurement needs to be reported to SCADA, simply set the magnitude of one of the channels as "Currents" and "IL2 9.h". After setup this function reports these measurements to SCADA.

6.6 Measurement menu

The *Measurement* menu is used for setting up current and voltage transformer scaling and for observing different measurements and phasors. The following lists all possible measurement options; the device type in use determines which of them are available:

- Transformers (CT & VT)
- Frequency
- RTD and mA inputs
- RTD
- AI (mA, DI volt) scaling

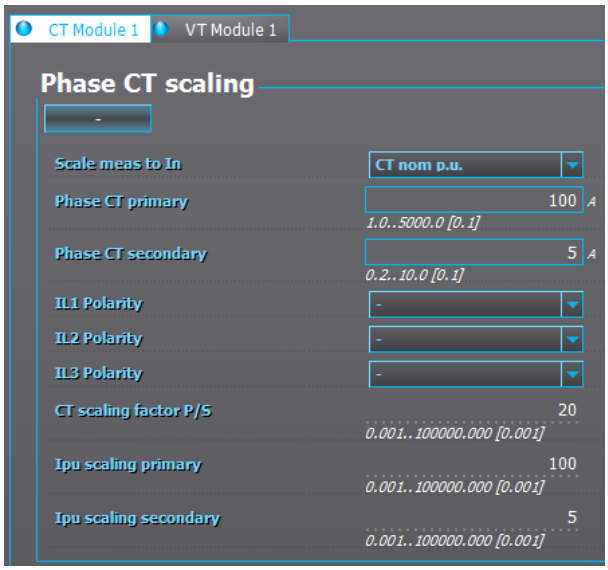
- Current measurement
- Current component measurement
- Voltage measurement
- Power and energy measurements
- Impedance calculations
- Admittance calculations
- Phasors

Additionally, the final tab (*Measurements update*) allows for the setting of the update interval of various measurements.

NOTICE!
This chapter goes through the first two measurement options, as they are the most relevant to the configuration of AQ 200 series devices. If you wish to read a more detailed and technical explanation of these as well as of the other measurements, please refer to the "Measurements" chapter of the individual device's manual (can be downloaded at arcteq.fi/documents-and-software/).

CT module

Figure. 6.6 - 61. Example of a CT module tab.



The *CT module* tab is for setting up the current transformers' primary and secondary nominal currents as well as the polarities of the channels. By default, the per-unit value of current-based protection functions is scaled from the current transformers' primary nominal current. The nominal current value can also be set by selecting the "Object In p.u." option for "Scale meas. to In" and then giving a current value to "Nominal current In". A more detailed description of current measurement can be found in the device manual.

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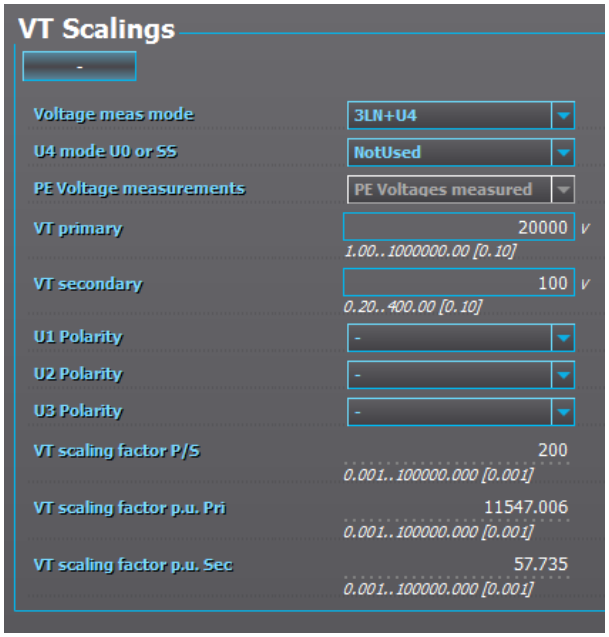
IM00037

VT module

Figure. 6.6 - 62. Example of a VT module tab.

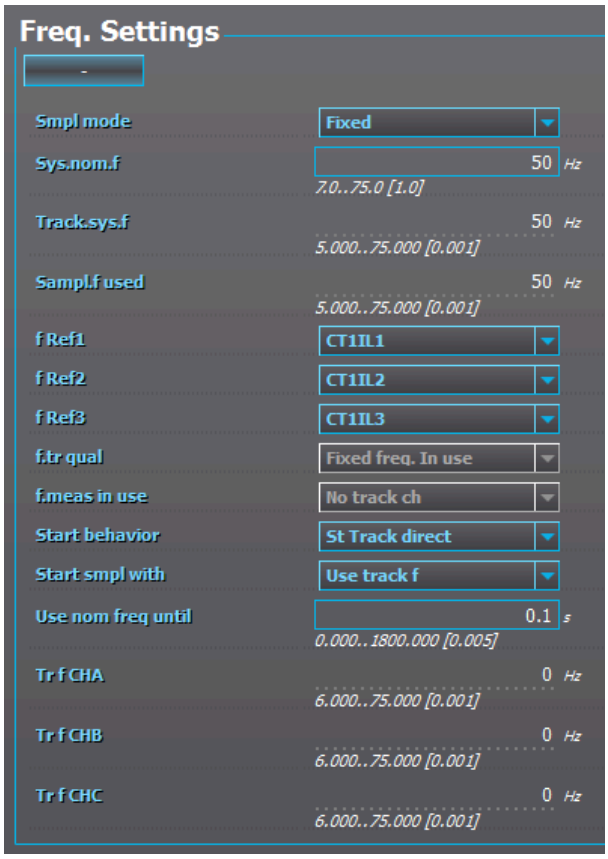


The *VT module* tab is used to set up the nominal values of voltage transformers. The only difference to current transformer settings is that you can choose from three different measurement modes (3LN+U4, 3LL+U4, or 2LL+U3+U4. Depending on which measurement mode is chosen, you can activate U3, U4 or both channels for residual voltage measurement or for synchro-checking. You can also activate the voltage memory in this tab. A more detailed voltage measurement description can be found in the device manual.

Frequency

In the *Frequency* tab you select the sampling mode which determines which frequency setting is used in calculations, "Fixed" or "Tracking". If set to "Fixed", the calculations that need frequency are based on the value given in the "Sys. nom. f." (that is, the system nominal frequency) parameter; by default it is 50 Hz. If the sampling mode is set to "Tracking", the frequency will be tracked by referencing the chosen channels in "f. Refx" (that is, the frequency reference x). A more detailed frequency measurement description can be found in the device manual.

Figure. 6.6 - 63. "Frequency" tab.



6.7 Monitoring menu

Enabling and setting monitoring functions

The enabling and setting of monitoring functions is done the same way as with control functions and protection functions. The *Monitors enabled* tab lists the monitoring functions that the device in question has and with the drop-down menu you can activate them at will. In the *Monitor functions* tab you can select a monitoring function and view its information and edit its settings.

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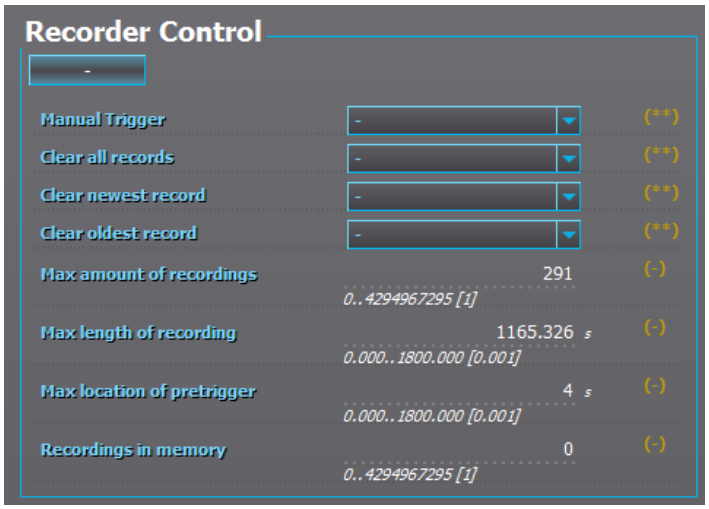
Disturbance recorder

Figure. 6.7 - 64. General settings for the disturbance recorder.



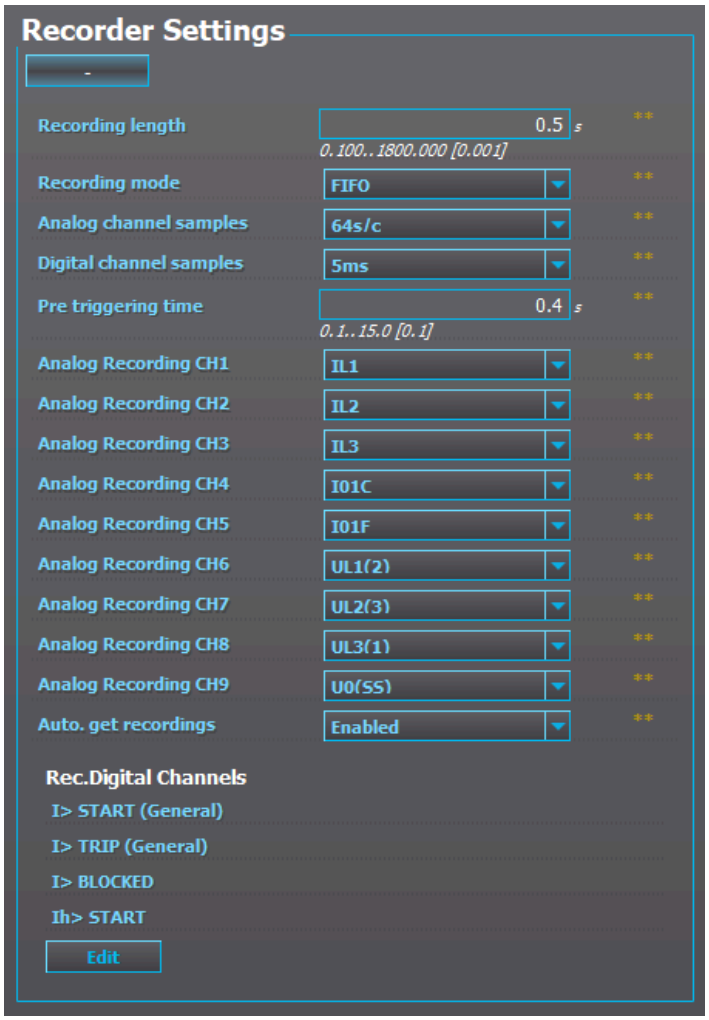
The parameter settings for the disturbance recording are done in *Monitoring → Disturbance REC*. When the disturbance recorder has been configured, the *Recorder Control* section displays the following: the maximum number of recordings that can be recorded into the memory, the maximum length of a recording, the maximum length of a pre-trigger recording as well as the recordings currently in memory. The table below presents some examples of how many recordings fit into a device's memory with different settings.

Table. 6.7 - 1. Examples of the number of recordings that fit into device memory with different settings.

	Example 1	Example 2	Example 3
Samples per cycle	64	64	64
Analog channels	8	8	8
Digital channels	24	24	24
Record duration	5 s	10 s	60 s
Total number of recordings	100	52	8

NOTICE!
When setting the "Recording length", its value should not exceed the value of "Max. length of recording".

Figure. 6.7 - 65. Channel settings for the disturbance recorder.



In the example figure above the Disturbance recorder records 64 samples per cycle from the chosen nine analog channels (IL1, IL2, IL3, I01C, I01F, UL1, UL2, UL3, U0). It also records the state of the four chosen digital channels (I>START, I>TRIP, I> BLOCKED and Ih> START).

If there is a disturbance recording in the memory, you can retrieve it by clicking *Disturbance recorder* on the AQtivate main toolbar and selecting "Get DR file" from the drop-down menu. This loads the DR file as a .zip file to the folder you have set for disturbance recordings in *Tools → Settings*. If "Auto. get recording" has been enabled, the recordings are sent to the devices FTP server; from there the recordings can be loaded with SCADA.

Any distrubance recording file in COMTRADE format can be evaluated by launching the AQviewer software (installed with AQtivate). It can be opened by clicking *Disturbance recorder* on the AQtivate main toolbar and selecting "Launch AQviewer" from the drop-down menu.

When uploading disturbance recorder parameters and logic changes to the device, you also need to write the "Disturbance recorder" settings (*Commands → Write to relay*).

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Device diagnostics

Table. 6.7 - 2. Setting parameters for device diagnostics.

Name	Range	Step	Default	Description
Diagnostic alarm status	0: Temp. out of range 1: Voltage out of range 2: HW configuration invalid 3: Relay output failure 4...9: Option card A...F alarm 10. GOOSE invalid	-	-	Displays the status of the diagnostic alarm.
Clear diagnostic alarm	0: - 1: Clear	-	0: -	Clears the diagnostic alarms.
Protection constants calculated	0: Not calculated 1: Calculated	-	-	Indicates whether or not protection constants are calculated.
Internal temperature	0.0...200.0 °C	0.1 °C	-	Displays the internal temperature of the device.
Internal voltage (24 V/24 C max/ 24 V min/24 V deviation)	0.0...50.0 V	0.1 V	-	Displays the internal voltage of the device: the nominal, the maximum, the minimum, and the deviation.
Full system reset	0: - 1: Reset	-	0: -	Resets the whole system of an AQ 200 series device.
Protection system reset	0: - 1: Reset	-	0: -	Resets the protection system.
Reset is pending	0.0...60.0 s	0.1 s	-	When a full system reset or a protection system reset command has been given, a countdown start. When the countdown reaches zero, the AQ 200 series device resets.
Baseboard card revision	$0...2^{32} - 1$	1	-	Displays the revision of baseboard card.
Baseboard card serial number	0×0...0×FFFFFFFF	0×1	-	Displays the serial number of the baseboard card.
CPU serial number	0×0...0×FFFFFFFF	0×1	-	Displays the serial number of the device's CPU. You can have up to four (4) CPUs; the serial number of each is displayed on its own row.

Name	Range	Step	Default	Description
Slot x card type	0: Reserved 1: Display 2: Current measurement 3: Voltage measurement 4: Digital input 5: Output relay 6: Arc 7: Communication 8: mA output 9: mA input 10: RTD input 11: Low energy analog 12: Digital input 13: U0 measurement 14: LC Ethernet 15: RJ 45 Ethernet 16: ST Ethernet	-	0: Reserved	Displays the card type of the selected slot (A...N).
Slot x card revision	$0...2^{32} - 1$	1	-	Displays the card revision of the selected slot (A...N).
Slot x card serial number	0×0...0×FFFFFFFF	0×1	-	Displays the card serial number of the selected slot (A...N).
Internal relay fault status	0: Storage error 1: Logic file missing 2: Acquisition unit error 3: Measurement config error 4: Relay hardware setup error 5: System overload error 6: Not configured yet 7: Firmware upgrade done 8: Slot supervision error 9: Software inconsistency error 10: Safe setting mode active	-	-	Displays the internal relay fault status of the device.
Clear fault status	0: - 1: Clear	-	0: -	Clears the (internal relay fault status.

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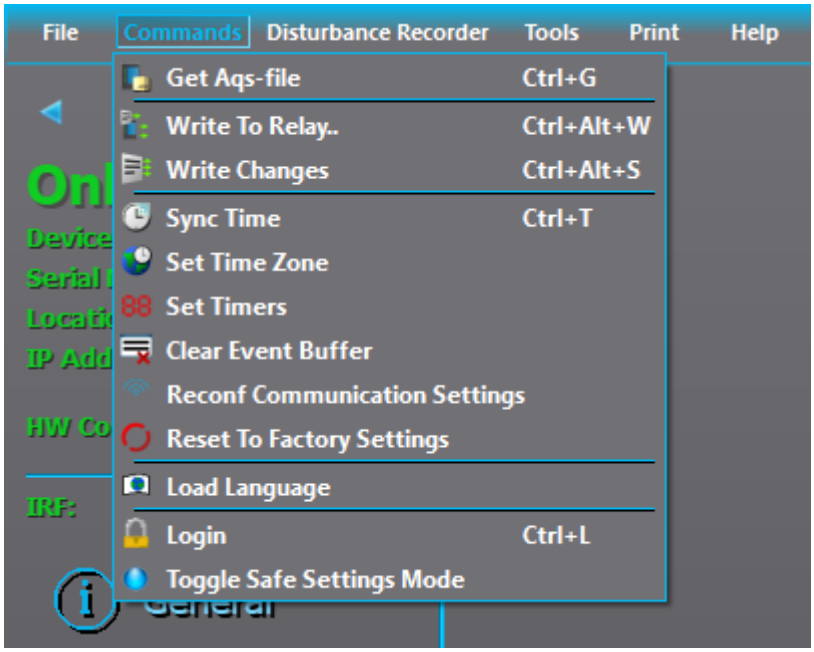
Name	Range	Step	Default	Description
Option card health status	0: Baseboard fault 1: Card slot A fault 2: Card slot B fault 3: Card slot C fault 4: Card slot D fault 5: Card slot E fault 6: Card slot F fault	-	-	Indicates if fault on any of the cards have been detected
Logic state	0: Setup 1: Stopped 2: Running 3: Error	-	-	Indicates the status of logic.
Gates usage	0.0...100.0	0.1	-	Displays the amount of available logic gates used in percentage value.
Wires usage	0.0...100.0	0.1	-	Displays the amount of logic wires used in percentage value.

7 Commands menu

Figure. 7 - 66. Commands menu on the main toolbar.



7.1 Time settings

Selecting time zone

Time synchronization with certain communication protocols require that the time zone of the device is defined. You can select the time zone for the device: click *Commands* in the tooldbar and then select "Set time zone" from the drop-down menu (see the figure below).

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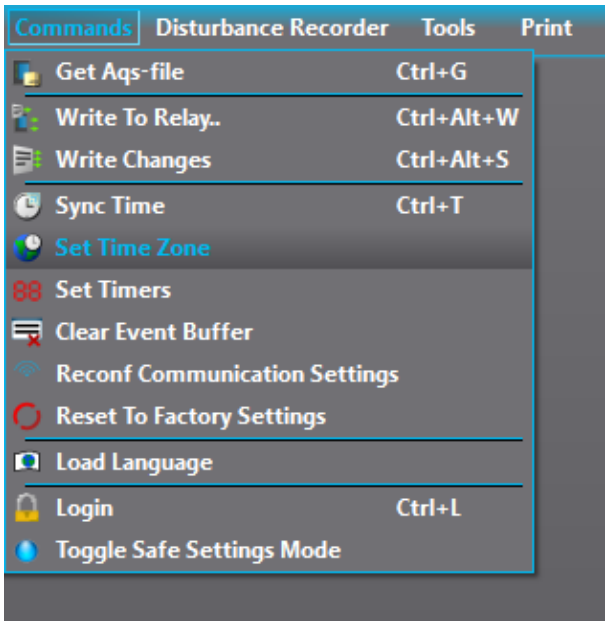
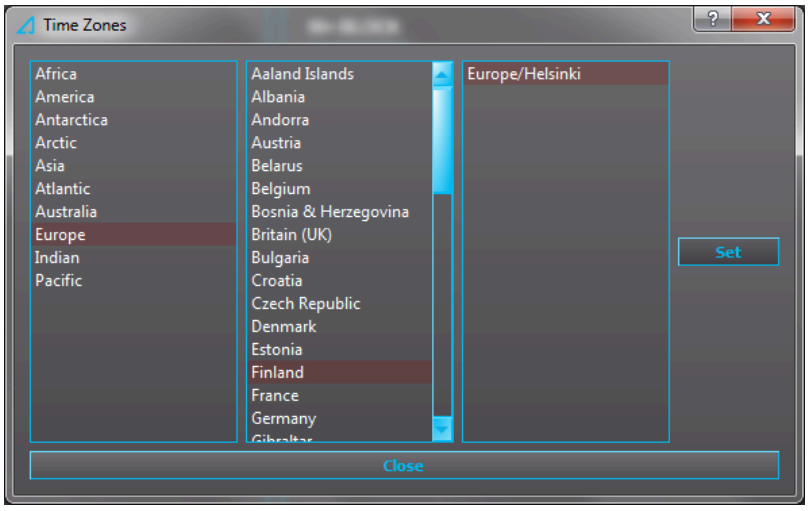
Figure. 7.1 - 67. Selecting "Set time zone".



The desired time zone can be selected from the following dialog (see the figure below).

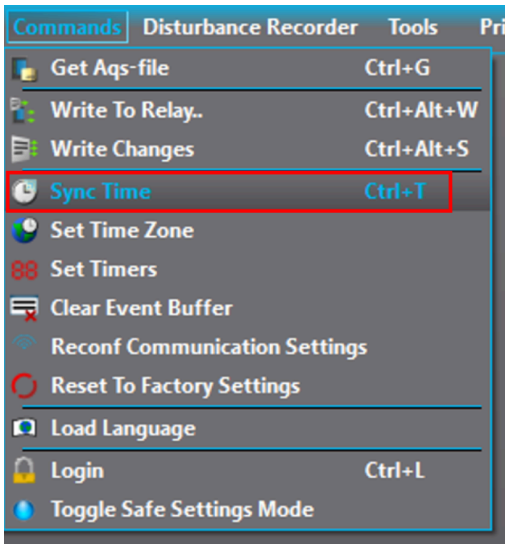
Figure. 7.1 - 68. Time zone selection.



Synchronizing time

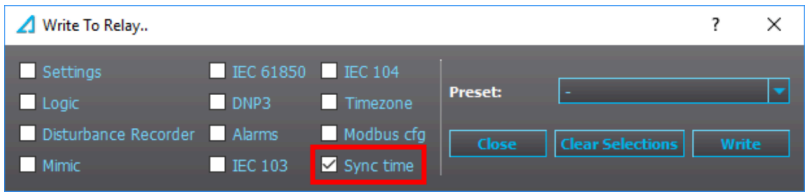
If there is no time synchronization source, you can synchronize the device time with the PC time: click *Commands* in the tooldbar, and then select "Sync time" from the drop-down menu (see the figure below).

Figure. 7.1 - 69. Synchronizing time with your PC time.



Alternatively, you can choose to synchronize the device and PC times when you upload configurations to the device by checking the box titled "Sync time" (see the figure below).

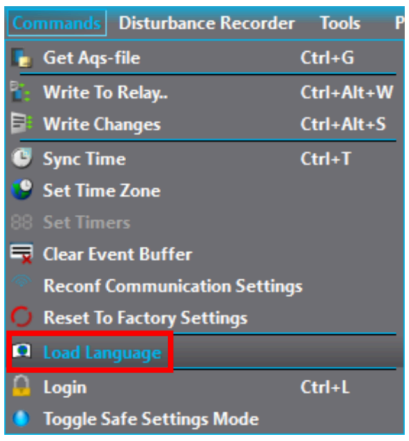
Figure. 7.1 - 70. Synchronizing device and PC times upon configuration uploading.



7.2 Uploading language files

At the moment, AQ 200 series devices have five officially included languages: English, Finnish, French, Russian and Spanish. However, a customized language file can be uploaded to the device. First, click *Commands* on the toolbar and select "Load language" from the drop-down menu (see the figure below). This opens a file dialog which allows you to upload the desired language file to the device.

Figure. 7.2 - 71. Uploading a language file.



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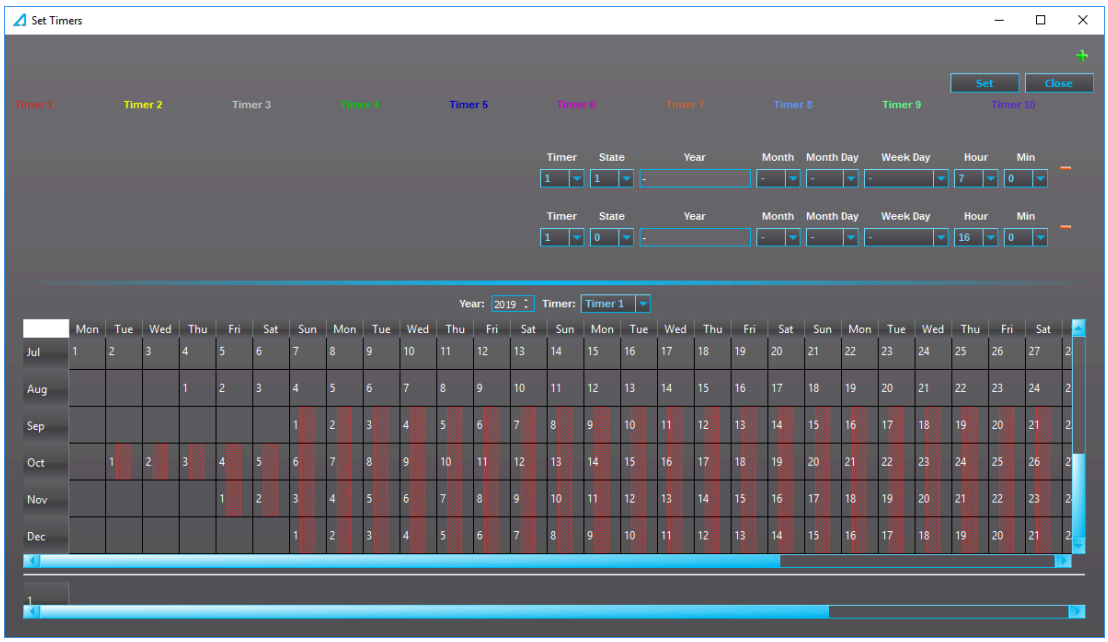
7.3 Set timers

You can set timer signals to help control setting groups and other logic components which activate and deactivate at certain intervals. First, click *Commands* in the toolbar and then select "Set timers" from the drop-down menu. When you click the green plus icon (+) at the top right of the window, you add a new timer configuration line. You can then select one of the displayed timers, and set its state to switch to 1 or 0 at a specific time.

The calendar view below the timer configuration line shows when a specific timer is on. Each timer has its own color code; the code is displayed at the top of the window above the timer configuration line. As can be seen in the example below, the state of the selected timer is 1 (as in, the timer is on) when a day's box is red. The red circle marks the current day (in this example, the date is November 13th). You can click on a day to see a more detailed division of the day below the calendar at the bottom of the window. Once the timers have been configured, you can send the configurations to the device by clicking the "Set" button on the top right of the window. This requires an active connection to the device.



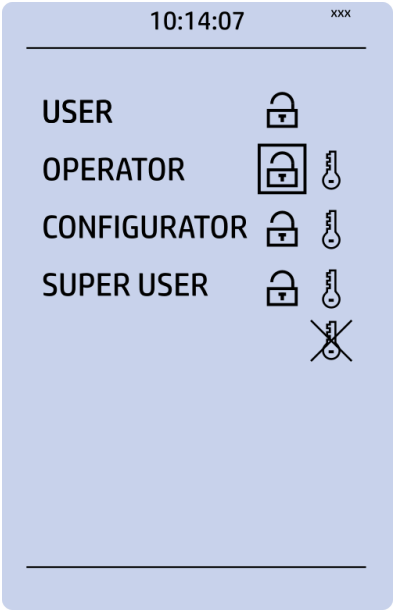
7.4 User levels and their passwords

There are four (4) user levels:

- Super user = has full accesss, including configurations.
- Configurator = has access to all settings.
- Operator = has access to limited settings and control.
- User = can only view.

Each user level is represented by a specific lock icon in the HMI (see the figure below).

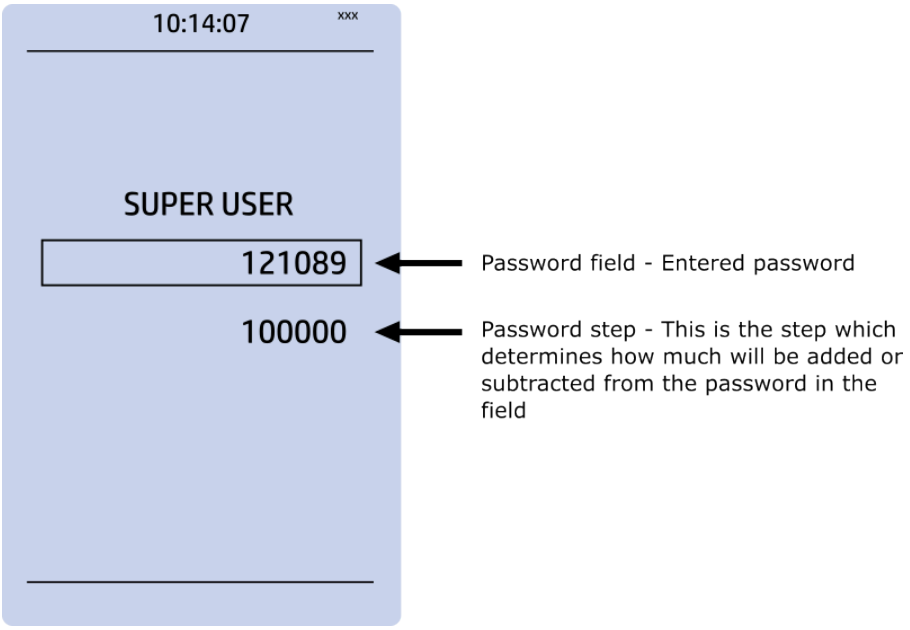
Figure. 7.4 - 72. User level icons.



Setting up user levels in your local HMI

The factory default is that all user levels are unlocked in the device. You can activate and lock various user levels: push the **Lock** button in the device's HMI, choose the key icon for the user level, and then set the desired passwords for the different user levels (see the image below).

NOTICE!
Passwords can only be set at the local HMI.



The key icon next to the user level allows you to set a new password for that user level. Any user level with a password can be locked by pressing the **Enter** key while the lock is selected. If you need to change the password, select the key icon again and give the new password. If you want to disable the password requirement for a specific user level, set the password to "0".

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Please note that in AQ 250 series devices the unlocking and locking of a user level generates a time-stamped event to the event log.

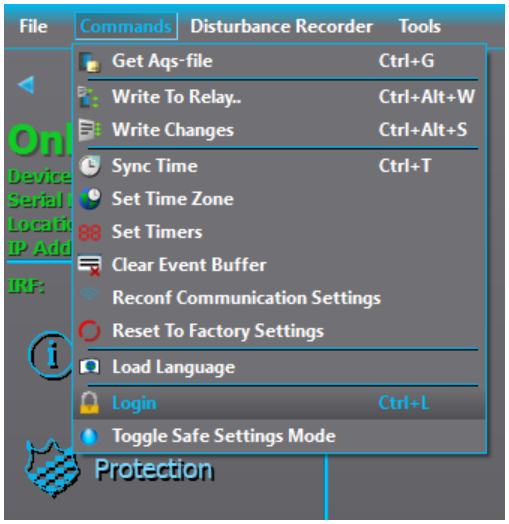
NOTICE!
A user level with a password automatically locks itself after half an hour (30 minutes) of inactivity.

NOTICE!
Changing the password requires that the user level in question is unlocked.

Accessing user levels in AQtivate

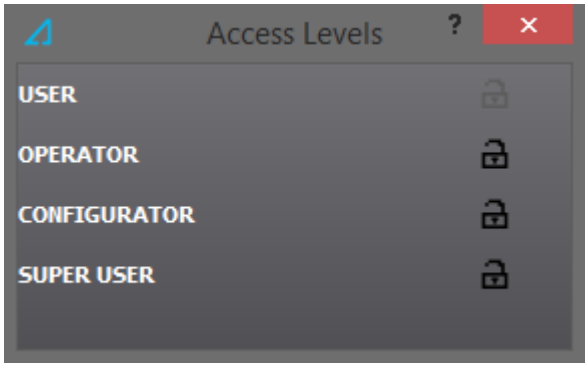
After you have activated the passwords, AQtivate requires your login information. Click *Commands* on the toolbar and select "Login" from the drop-down menu (see the figure below).

Figure. 7.4 - 73. Selecting login.



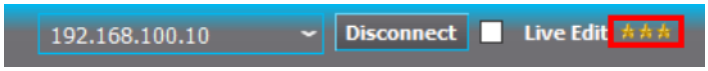
This makes The *Access levels* pop-up window appear (see the figure below). Each level requires its own password to open it. When a user level is opened, an event is recorded to the device's event history.

Figure. 7.4 - 74. Access level window.



At the top of the AQtivate window, next to the Live Edit mode box, there are a number of yellow stars (see the figure below). They indicate the active user level. Three yellow starts represent the Super user level, two yellow stars represent the Configurator level, and one yellow star represents the Operator level. If all stars are grey, the active level is User.

Figure. 7.4 - 75. Stars indicating user levels.



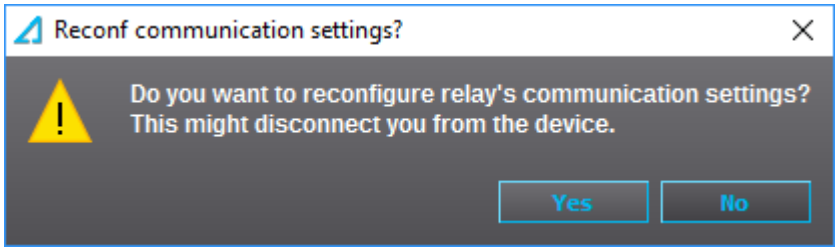
7.5 Clearing Event buffer

You can clear the event history by clicking *Commands* on the toolbar and selecting "Clear Event buffer". This clears the event history and places an "Event buffer clear" marker into the event history.

7.6 Reconfiguring communication settings

When you upload new communication IP settings to the device, a prompt appears asking whether these settings will be adopted to use immediately (see the figure below).

Figure. 7.6 - 76. Communication settings adoption window.



If "Yes" is selected, the new settings are adopted right away. If "No" is selected, the new IP settings will be adopted only after you have brought up the same window through AQtivate (*Commands → Reconf communication settings)* and clicked "Yes". If unit is rebooted before reconfiguration is done, unit will revert back to original IP address.

7.7 Safe Settings mode

You can toggle the Safe Settings mode: connect to a device, click *Commands* on the AQtivate main toolbar, and select "Toggle Safe Settings mode" from the drop-down menu (see the figure below).

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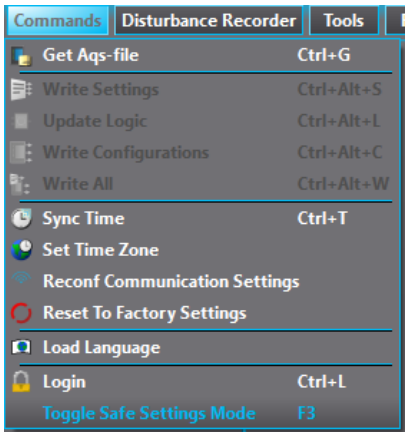
Figure. 7.7 - 77. Toggling the Safe Settings mode.

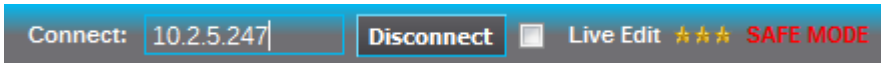


When in this mode, you can perform tests without causing the device to actually control any of the output contacts. Events are still triggered normally.

Turning the Safe Settings mode on causes the device to give a backup .aqs file. This backup has the current device settings. If the new settings fail the test and you need the old setting back, you can use this backup .aqs file to retrieve them. The file also includes the event history dialog. This dialog can be used to see whether or not the test was successful.

When the Safe Settings mode is activated, a red "SAFE MODE" label appears on the main toolbar (see the figure below).

Figure. 7.7 - 78. Indicating the Safe Settings mode on the main toolbar.

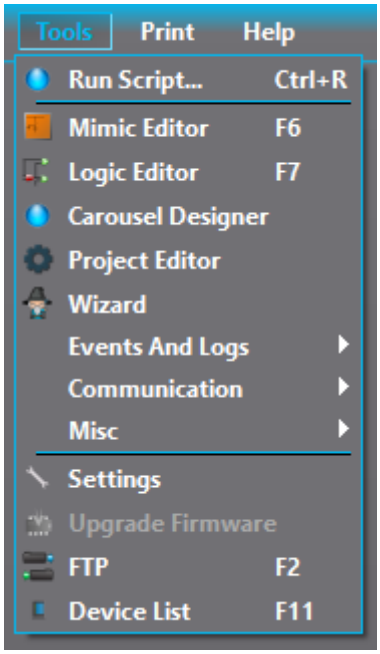


When this mode is active, the HMI display of the device displays a skull at the top of the display and of the IRF output contact; the device's ERROR LED is activated.

You can disable the Safe Settings mode by clicking *Commands → Toggle Safe Settings mode* again.

8 Tools menu

Figure. 8 - 79. Tools menu on the main toolbar.



8.1 Running scripts

Occasionally Arcteq scripts need to be run to the devices. For example, you may need to run a script when you have changed the hardware configurations after installing a new card. You can do this by clicking *Tools* on the AQtivate main toolbar and selecting "Run script" from the drop-down menu.

Disabling the firewall is recommended when running a script because the firewall may cause the script to fail. All scripts are provided by Arcteq personnel.

8.2 Mimic editor (AQ 210 series)

The Mimic editor is used to create a visualization of the protected system for the HMI. In this chapter we are going to take a look at the simple tools AQtivate has for making a mimic display for AQ 210 series units.

Figure. 8.2 - 80.

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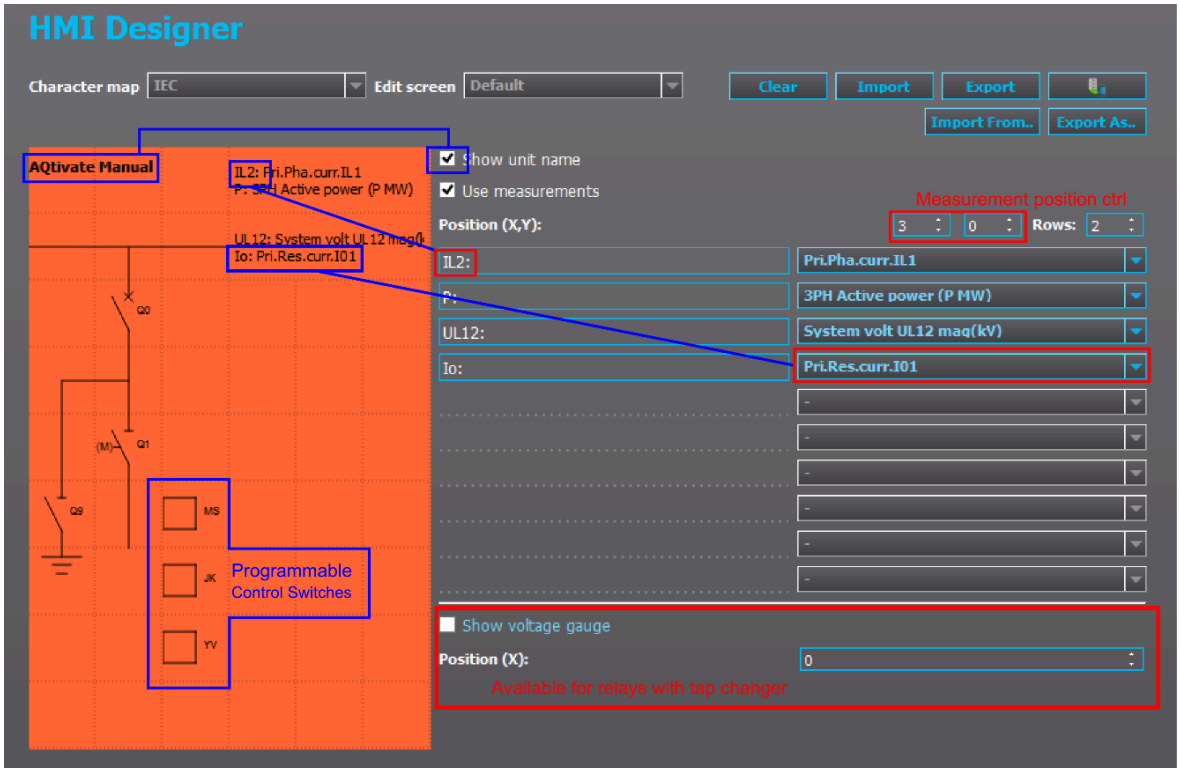


The mimic display is a 9x6 grid which can be edited individually. The selectable items in the Mimic editors' library include:

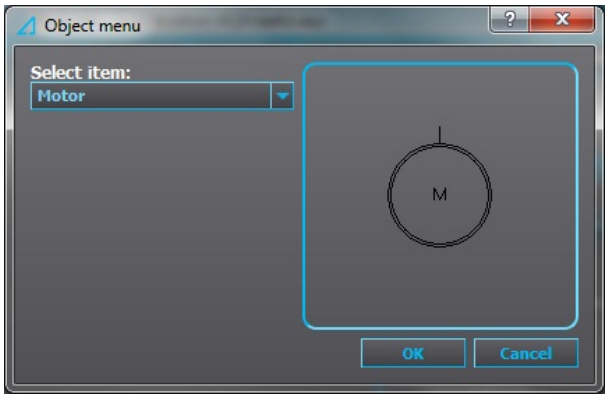
- Lines and icons for drawing purposes.
- Objects and indicators to visualize the state of breakers and disconnectors (configured in the *Objects* tab of the *Control* menu).
- Programmable control switches which can control logic, setting groups, etc.

The grid can be cleared by clicking the "Clear" button.

Adding symbols and objects

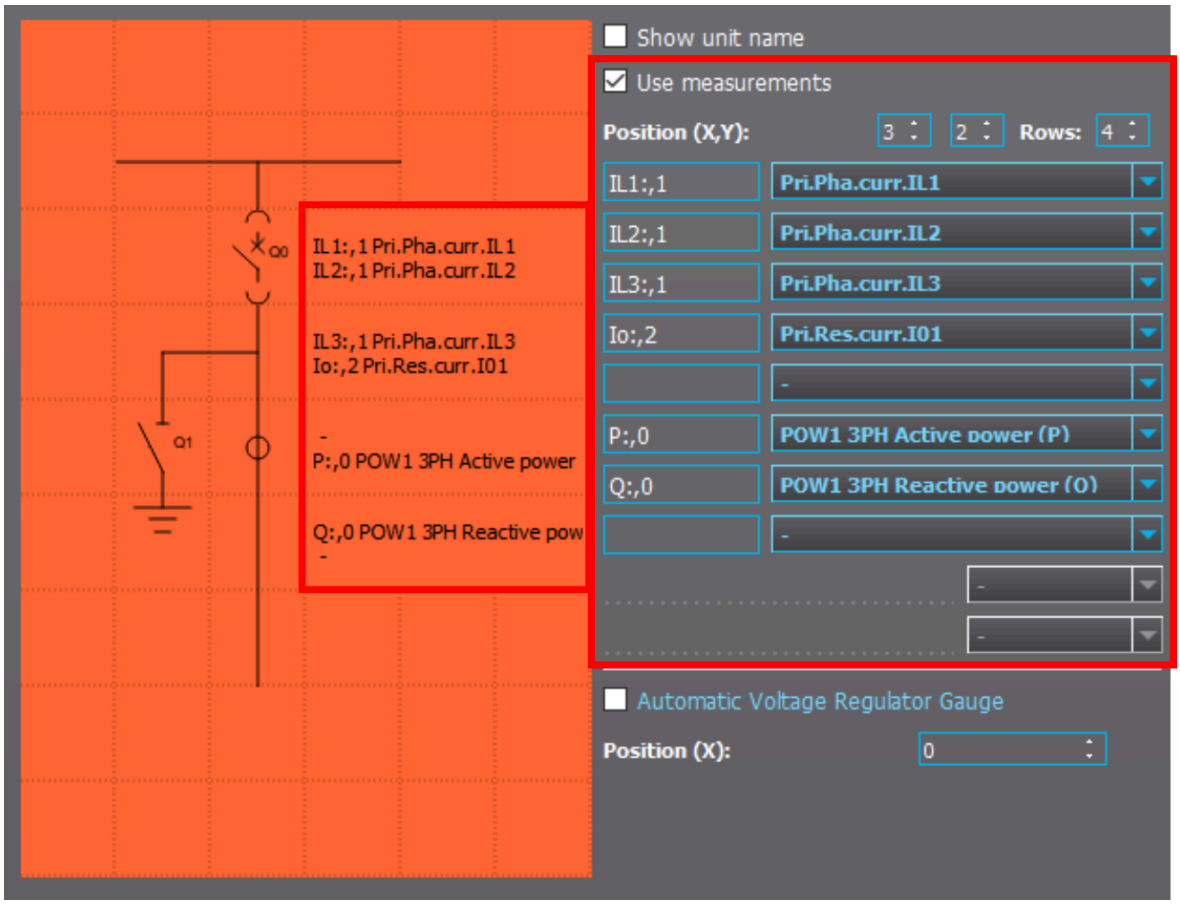
Click on one of the boxes in the grid and an *Object menu* appears. Select the item you want to use from the "Select item" drop-down menu. In the figure below, the symbol within the frame on the right shows what the item looks like.

Figure. 8.2 - 81. Example of object selection in the mimic.



Adding measurements

Figure. 8.2 - 82. Adding measurements to the mimic.



You can add measurements into the mimic by using the drop-down menus on the right side of the HMI designer (see the figure above). The HMI display can use up to ten (10) different measurements. The text boxes are used to describe what the measurements represent. If you put a comma after the text, you can define the precision of the measurement by customizing how many decimals places are used for the value. For example, "I01:,2" gives the primary residual current with the accuracy of two decimal places.

You can change which measurement is given in which row by selecting the measurement from the drop-down boxes to the right of the "Position (X,Y)" text. Changing the number of rows also changes how many measurements can be shown in the mimic. However, each row can only fit two measurements.

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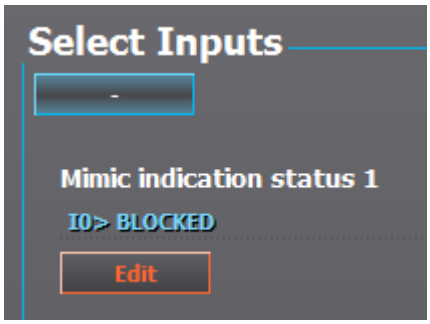
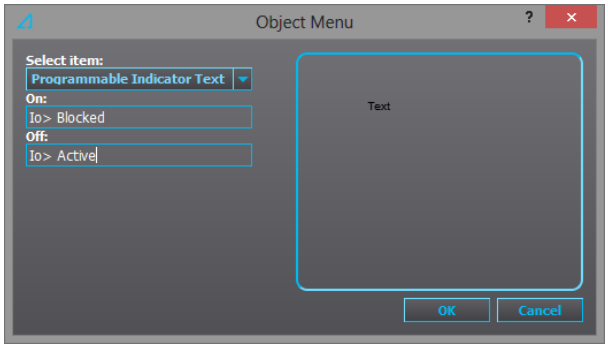
Adding programmable mimic indicators

Figure. 8.2 - 83. Example of assigning a signal to a mimic indication.



Programmable mimic indicators can display texts which indicate the status of the network. In the figure above, for example, the I0> BLOCKED signal has been assigned to Mimic indication status 1 (through *Control → Device I/O → Programmable mimic indication*). Then, you can choose a box from the Mimic editor grid and select "Programmable indicator text" from the library. Before clicking "OK" type in the texts you want displayed on the screen when the signal is on and when it is off.

Figure. 8.2 - 84. Example of assigning an indicator text to a signal.



Loading the mimic to device

Figure. 8.2 - 85. Loading your mimic into your device.

If you have an active connection to a device, click the "Send to relay" button (highlighted in the figure above) to send the mimic into the device.

Exporting the mimic

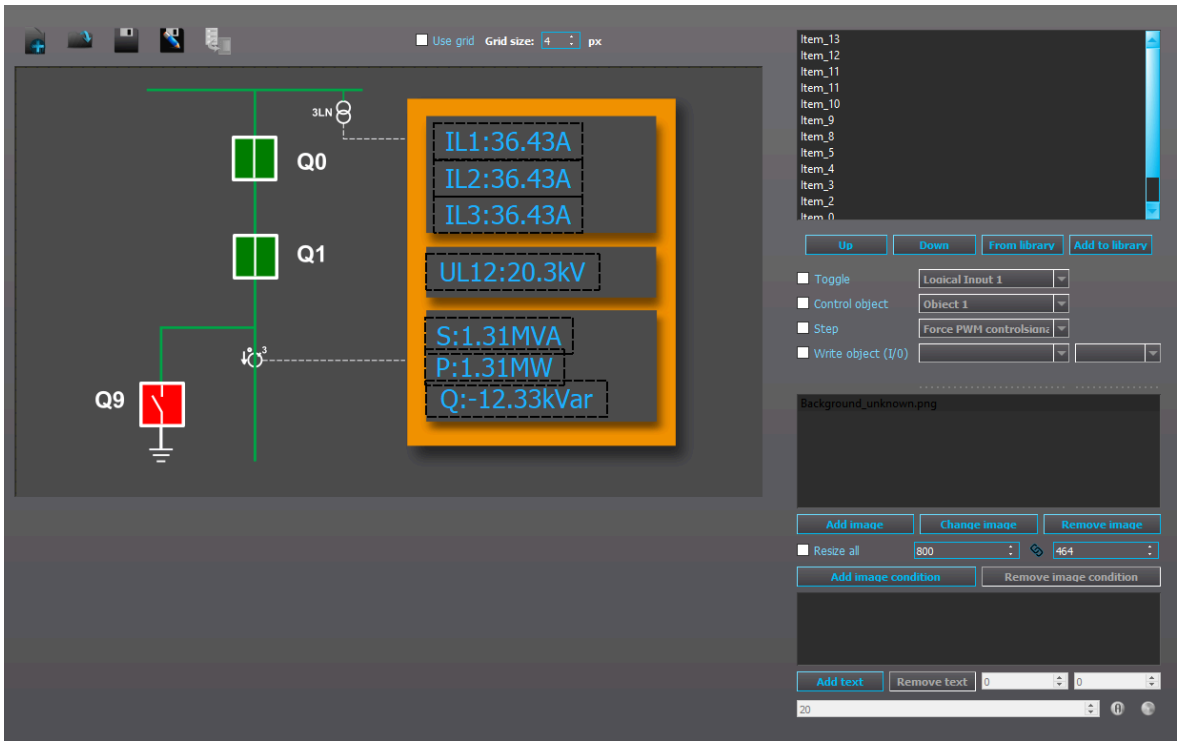
After you are finished creating the mimic, clicking the "Export" button makes it a part of the .aqs configuration file you are working on. Please note that the export command is executed automatically after certain functions, while it is not executed automatically after other functions (such as editing the measurements text field).

Saving the mimic as a separate file

The mimic can be saved as a separate file by clicking the "Export As.." button. You can import a mimic from these separate files by pressing the "Import from.." button. This is a useful tool especially when there are several devices with similar custom mimics. You can also use the Export and Import buttons to copy the same mimic to other .aqs files.

8.3 Mimic editor (AQ 250 series)

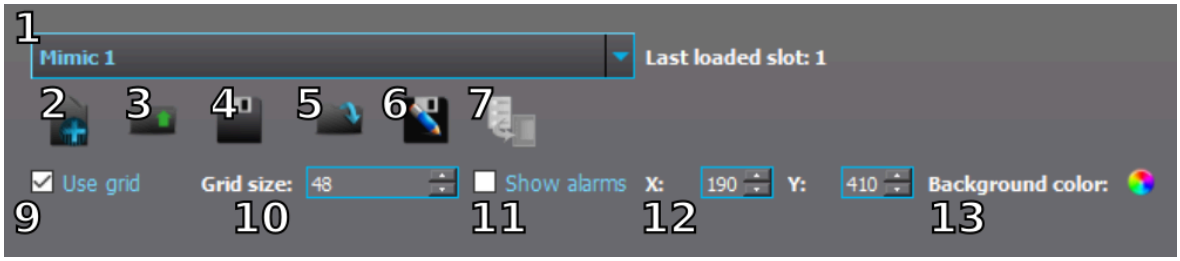
Figure. 8.3 - 86. Mimic editor of AQ 250 series devices.



The Mimic editor is used to create a visualization of the protected system for the HMI. In this chapter we are going to take a look at the tools AQtivate has for making a mimic display for AQ- 50 series units. AQ 250 series devices can store up to five (5) mimics.

The figure below presents the functions available to you in the Mimic editor's main toolbar, and the table below the figure explains the function of each icon in detail.

Figure. 8.3 - 87. Mimic's main toolbar.



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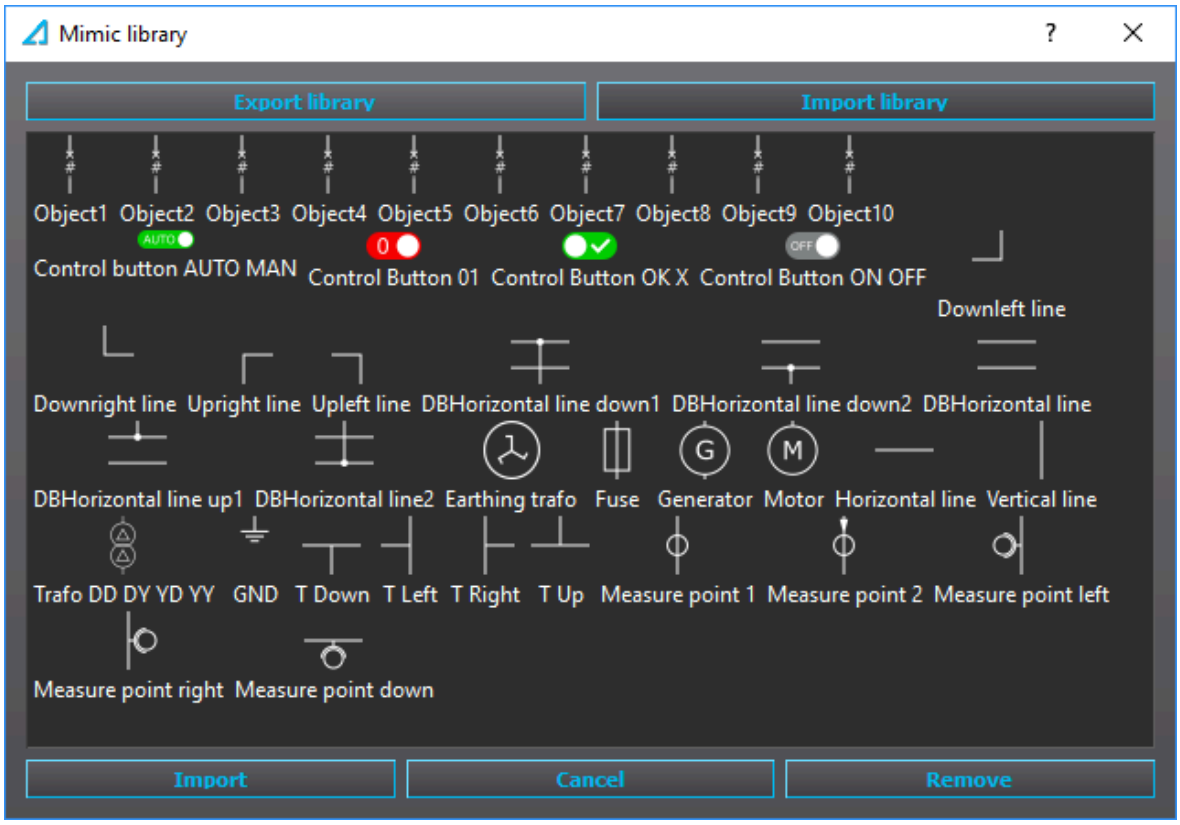
(#) Button	Description
1. Mimic drop-down menu	Chooses which of the five available mimics is being worked on.
2. New	Empties the mimic sheet.
3. Reload	Reloads a previously saved version from the mimic slot chosen with the drop-down menu (#1).
4. Save	Saves the mimic to the currently open .aqs file and to the mimic slot chosen from the drop-down menu (#1).
5. Open	Opens a mimic file.
6. Save as…	Saves the mimic file as a separate file.
7. Send to relay	Sends the currently open mimic to the device if there is a connection to the device.
8. Last loaded slot	Indicates the slot to which the mimic has been loaded.
9. Use grid	If the grid is in use, items in the mimic editor move by the number of pixels defined in "Grid size" (#10).
10. Grid size	Defines the number of pixels that items move each step when "Use grid" (#9) is enabled.
11. Show alarms	Allows the alarm box to display the latest recorded alarm. Events that are recorded to the alarm box can be defined at *Tools* → *Events and Logs* → "Set alarm events".
12. Alarm location	Moves the alarm box in the X and Y axes.
13. Background color	Opens a window for selecting the mimic's background color.

Adding and removing items

Figure. 8.3 - 88. Window listing items in the mimic library.



You can add items to the mimic by right-clicking somewhere on the mimic sheet and selecting "Add item" from the menu that appears. By clicking the "From library" button on the right, you get a pop-up window with the various item types that are already in the library (see the figure above). Select an item and then press the "Import" button. You can resize the items and move them on the mimic grid. You can also add a selected item to a library with the item name as its title with the "Add to library" button. An item that has been added to a library can then be used again by choosing it from the list by clicking "From library".

You can also remove items from the mimic: right-click on an item on the mimic and select "Remove item" from the menu that appears next to the cursor. Alternatively, you can select the to-be-deleted item from the list at the top-right window, right-click it and select "Delete" from the menu.

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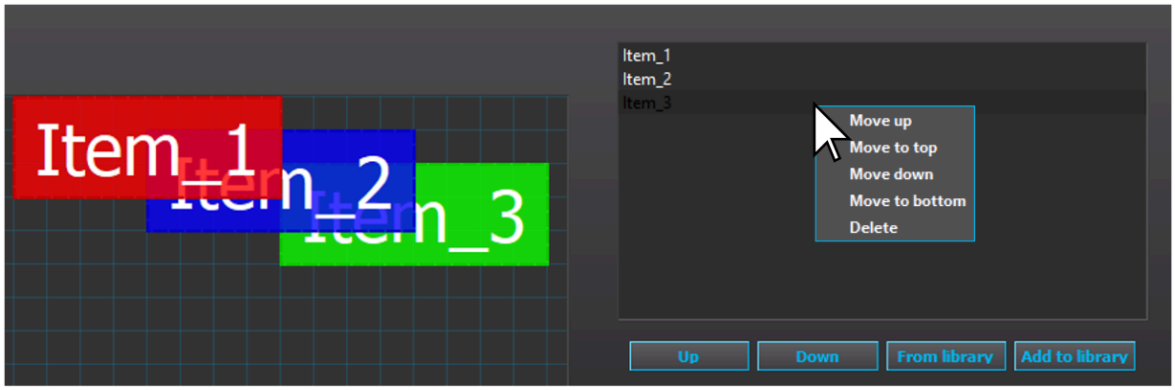
Item management

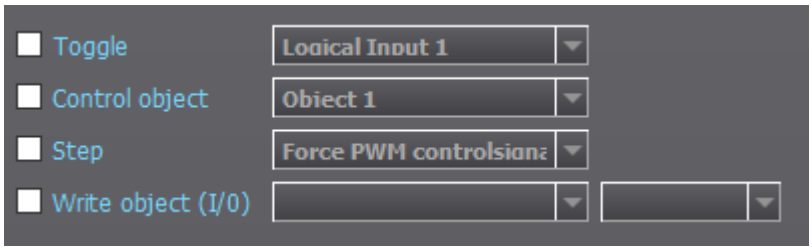
Figure. 8.3 - 89. Positioning of items in front/back of other items.



You can move an item to the front and back one step at a time with the "Up" and "Down" buttons. The item at the top of the list is in the front and the item in the bottom of the list is the furthest back. You can also rename the item by double-clicking it on the list. Right-clicking an item brings up more options for moving and deleting it.

Function control item

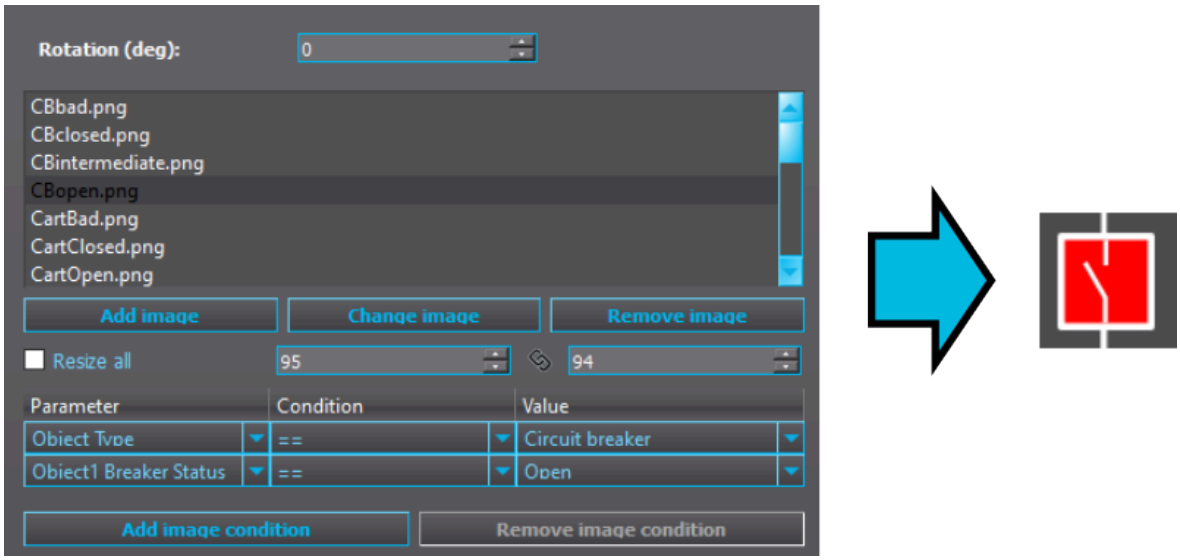
Figure. 8.3 - 90. Function controls.



You can select between four (4) function controls; only one can be selected at any one time. "Toggle" allows you to control logical inputs ON (1) and OFF (0) with the selected item. "Control object" lists the available objects that can be controlled with the item. "Step" controls the functions related to Generator commander. "Write object (I/O)" controls objects such as the voltage regulator with up and down commands.

Item images and visibility conditions

Figure. 8.3 - 91. Example of visibility conditions.



An item can contain one or more images. Each image can then be assigned with one or more visibility conditions with "Add image condition". If no visibility condition is assigned, the image is always displayed. If two images are visible in the same item at the same time, the image that is at the top of the list is displayed. If multiple visibility conditions are applied, all conditions must be met for the image to be displayed. The figure above shows an example of an item's visibility condition: the image "CBopen.png" is visible if the parameter "Object type" is set to "Circuit breaker" and its status (as in the parameter "Object2 Break") is "Open".

Available visibility condition signals are:

- Digital inputs
- Logical outputs
- Logical inputs
- GOOSE inputs
- Programmable control switch statuses
- Various object and indicator object statuses
- Modbus gateway signals

The "Change image" button allows you to change the image while retaining the image conditions of the image being replaced. Please note that the new image is applied with the original resolution. You can resize it (and other images) by changing the resolution number located next to the "Resize all" button; if that button is active, you resize all the images in the item at the same time.

Rotation (deg) rotates the images in the item. Changing this setting rotates every image in the item.

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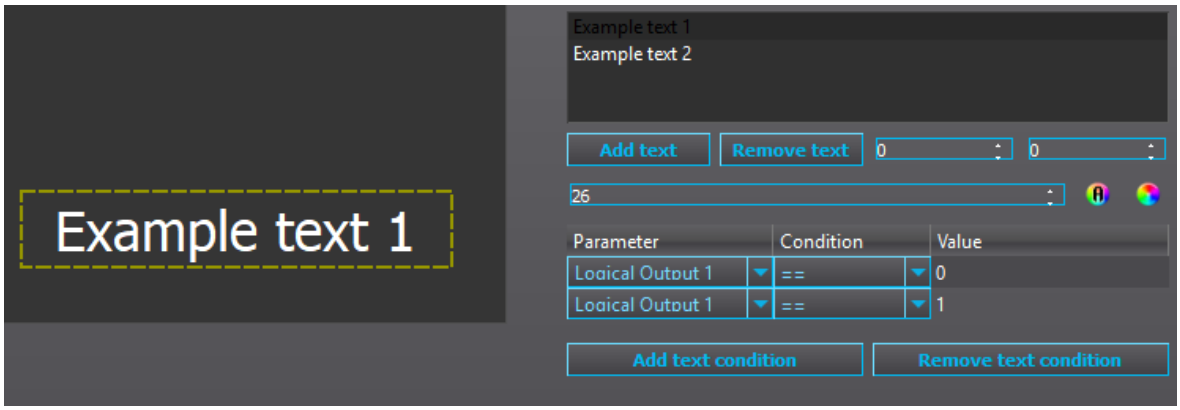
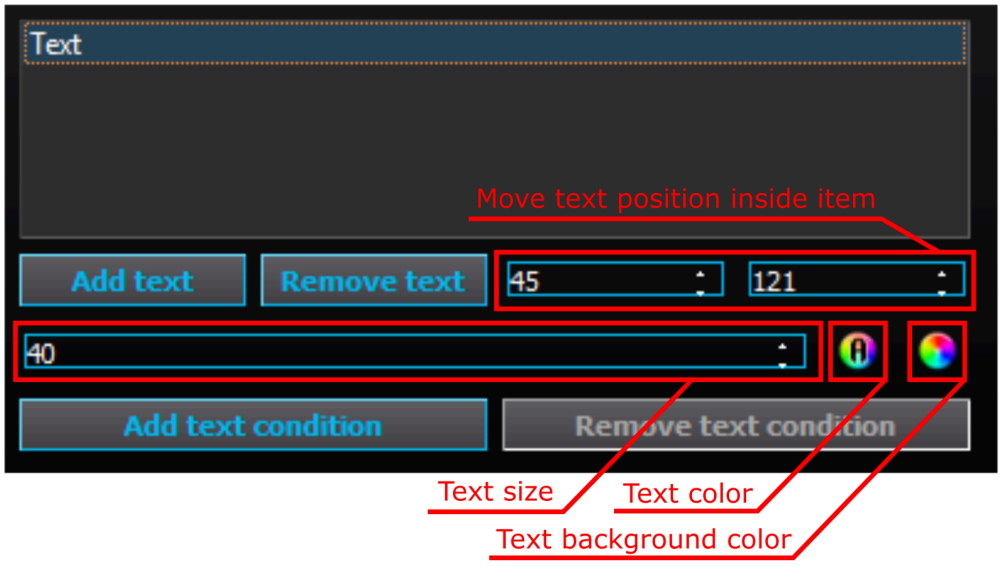
Figure. 8.3 - 92. Applying a visibility condition to an item text.



An item can contain one or more texts. Each text can then be assigned with one or more visibility conditions. If no visibility condition is assigned, the text is always displayed. If two texts are visible in the same item at the same time, the texts are displayed on top of each other unless the texts within the item have been moved by changing their text position numbers. If multiple visibility conditions are applied, all conditions must be met for the text to be displayed.

Figure. 8.3 - 93. Editing item texts, their appearance, and their positions.



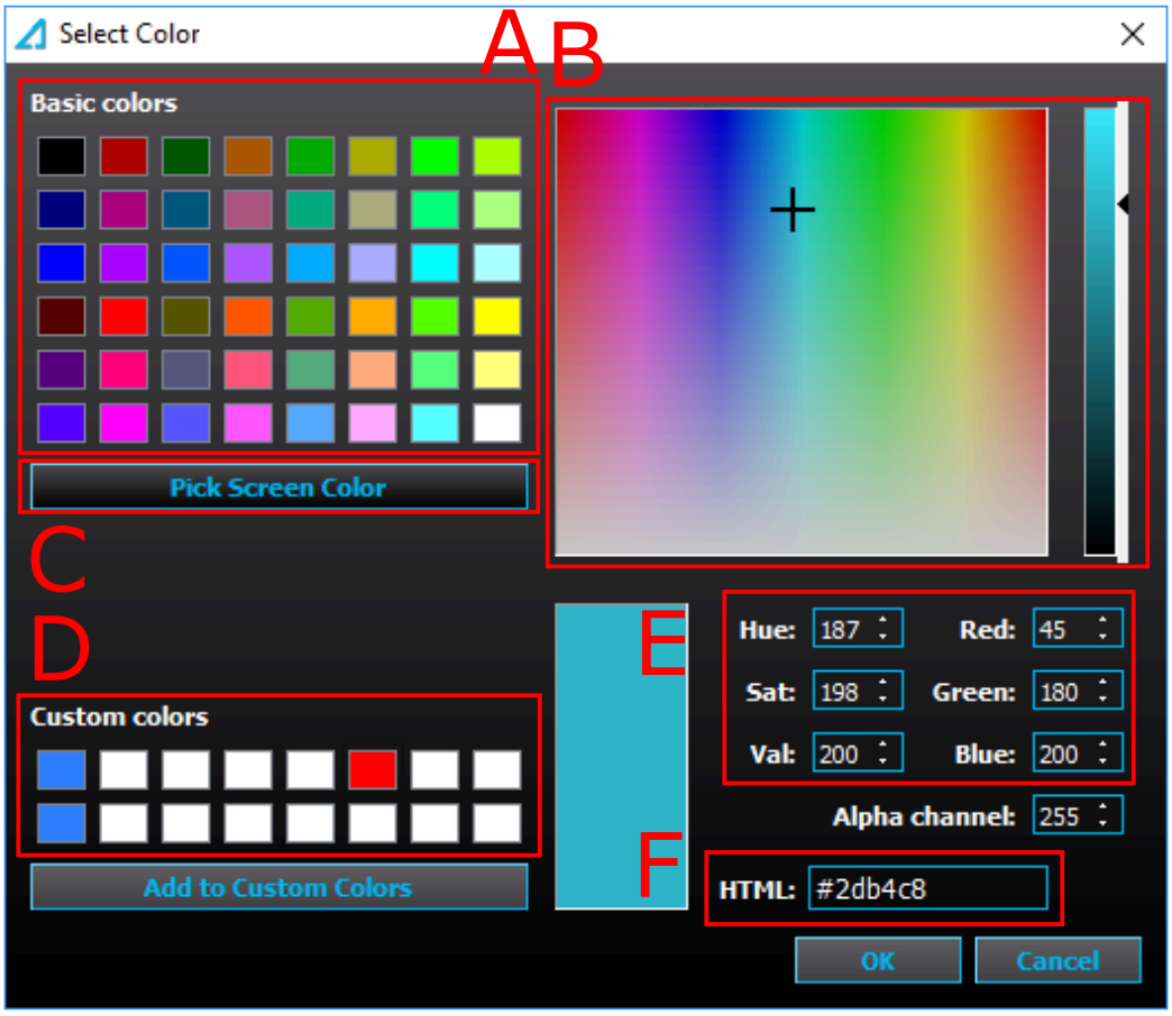
The figure above presents the various text settings available in the Mimic editor. The default font size for texts added to items is 12 pt; however, you can resize the font with the number box. You can also move the text's position inside the item with the two number boxes (the left one moves the texts horizontally, the right one vertically). Additionally, you can add and remove text conditions with their respective buttons. You can also change the color of the text (the multicolored circle with A) and the color of the text's background (the multicolored circle).

There are a total of six ways to pick a color for text or its background (see the figure below):

A) From the collection of basic colors.
B) From the color gradient grid and brightness slider.
C) Move the cursor to any point on the screen and click to use that specific color.
D) From the collection of saved custom colors.
E) Edit the red, green and blue integers as well as the hue, saturarion and brightness individually.
F) Enter the color's HTML code.

In addition to these settings, the "Alpha channel" number box sets the transparency of the text or of the text background (0 = fully transparent, 255 = fully visible).

Figure. 8.3 - 94. Six ways to set a color.



The same item can have both images and texts. For example, you can have the component's abbreviation (e.g. "Q0") next to the image as in the figure below.

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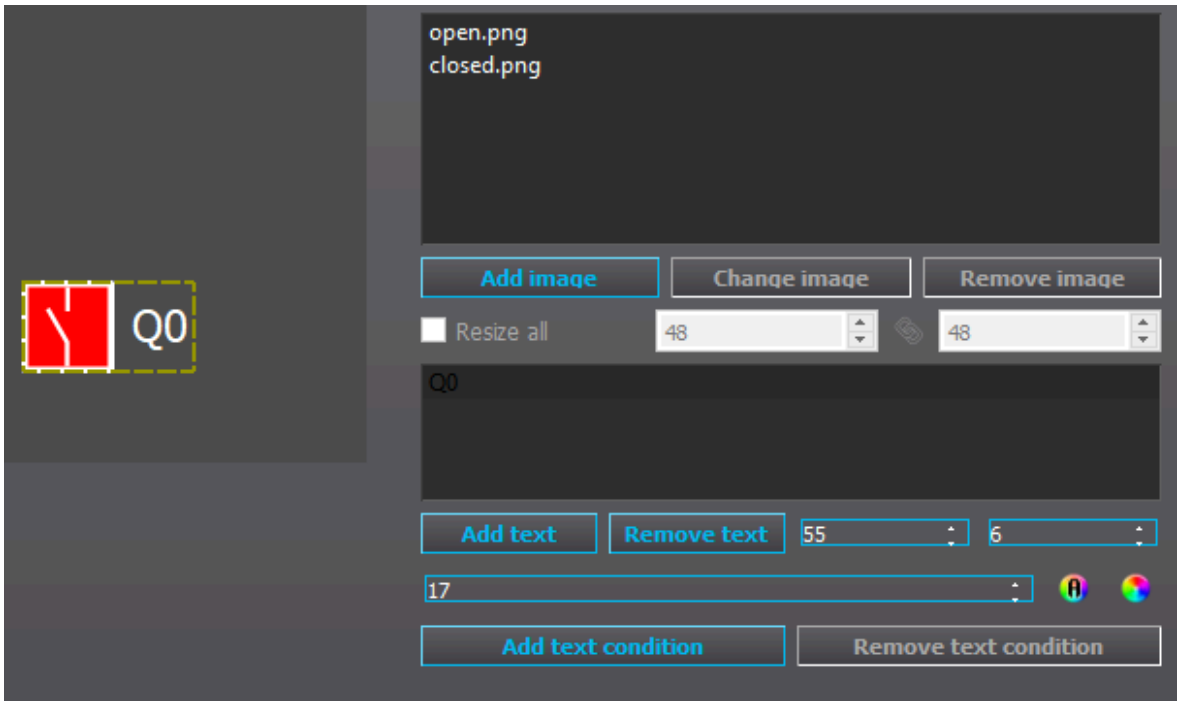
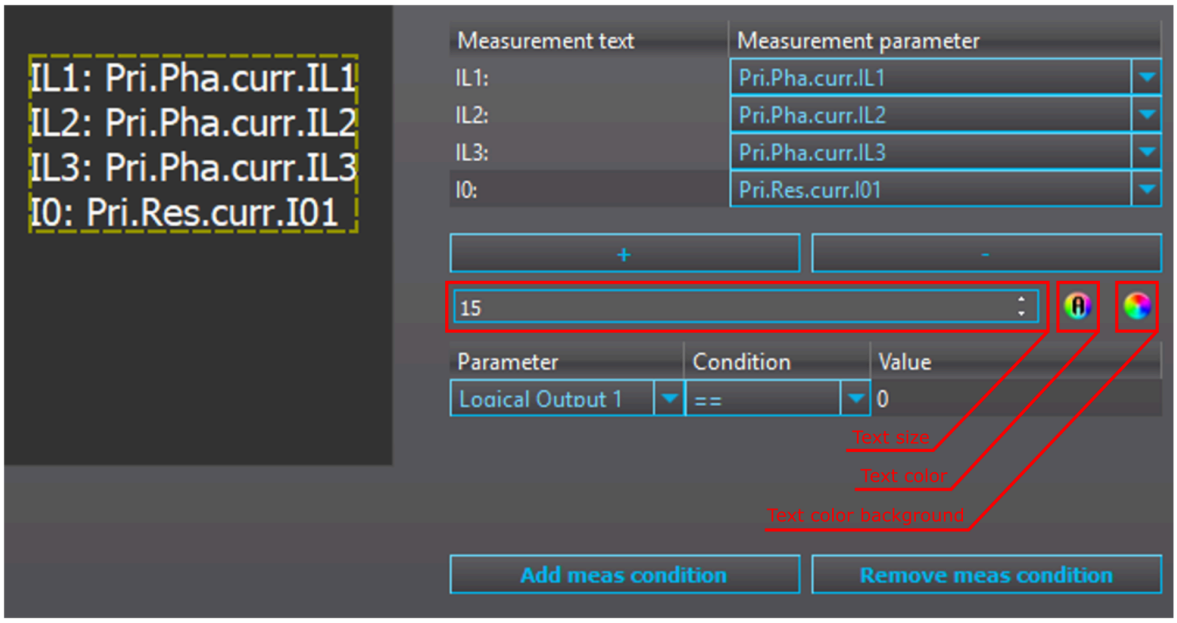
IM00037

Figure. 8.3 - 95. Example of an item with both image and text assigned to it.



Adding measurements to the mimic view

Figure. 8.3 - 96. Adding measurements and editing their text and appearance.



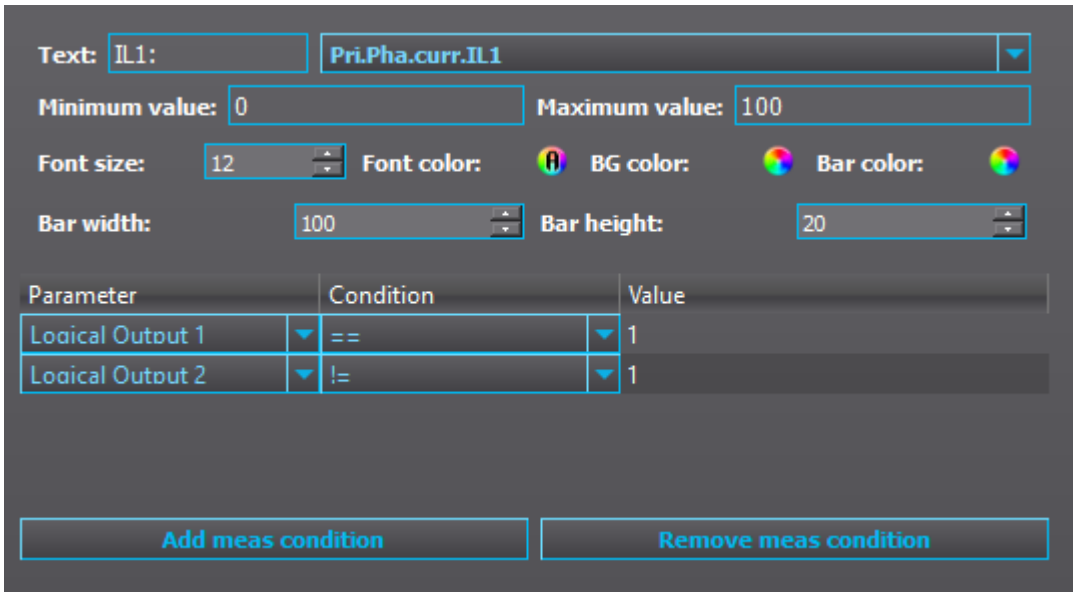
The plus (+) button adds a new row to the measurement item. You can add a prefix to any measurement row by right-clicking its slot below "Measurement text". From the "Measurement parameter" drop-down menus you can define which measurement is shown in the mimic. You can change the number of decimal digits displayed by adding a comma and the desired number of decimals (e.g. "IL1,1" to get only one decimal). Additionally, you can change the font size, the text color, and the text's background color in the same way as in text settings. *Measurement text* is a user defined prefix for the measurement.

The measurement can be assigned with one or more visibility conditions. If no visibility condition is assigned, the measurement is always displayed. If multiple visibility conditions are applied, all conditions must be met for the measurement to be displayed.

Adding a measurement bar to the mimic view

You can add measurements bars by right-clicking the mimic sheet and selecting "Add measurement bar" from the menu that appears. The following setting selection (see the figure below) appears on the right side of the Mimic editor window.

Figure. 8.3 - 97. Setting selection for a measurement bar.



Setting	Description
Text	Defines the prefix shown before the measurement value.
Minimum value	Defines the lowest value the bar can display. If the measured value is lower than what is set here, the bar appears empty. NOTICE! Please note that this setting does not affect how wide the bar appears in the mimic view! Use the "Bar width" setting to change the width.
Maximum value	Defines the highest value the bar can display. If the measured value is higher than what is set here, the bar displays the highest value set. NOTICE! Please note that this setting does not affect how wide the bar appears in the mimic view! Use the "Bar width" setting to change the width.
Font size	Defines the font size of a user-defined prefix text and measurement value text.
Font color	Changes the color of a user-defined prefix text and measurement value text. Uses the same tools as the items in text (described previously).
BG color	Changes the color of text behind a prefix text and measurement value text. Uses the same tools as the items in text (described previously).

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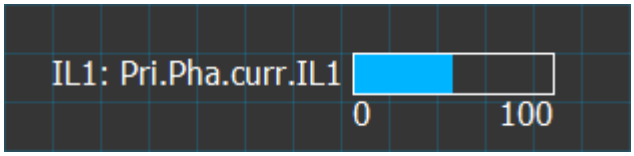
Setting	Description
Bar color	Changes the color of the measurement bar. Uses the same tools as the items in text (described previously).
Bar width	Changes the width of the bar. This setting is in pixels.
Bar height	Changes the height of the bar. This setting is in pixels.

The figure below shows the resulting measurement bar, when you use the settings shown in the previous figure above the table.

Figure. 8.3 - 98. Example of a measurement bar.



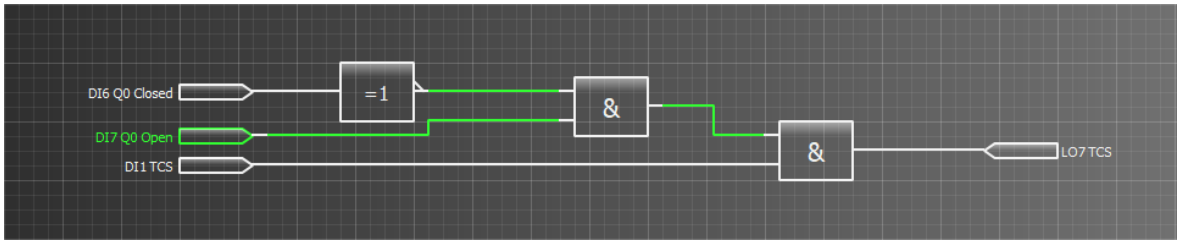
8.4 Logic editor

8.4.1 Logic editor (AQ 210 series)

The logic editor has the tools that are most commonly needed in logic programming.

The figure below presents an example where the NOT and AND gates are ON (the wires are green), and the DI7 Q0 Open input is ON (the text is green). If the Live Edit mode is activated, you can observe the status of each signal in real time.

Figure. 8.4.1 - 99. Example with NOT and AND gates.



NOTICE!
The logic is updated every 5 ms in the device. Fast events might be not be seen in the Live Edit mode. To guarantee that the event activation and de-activation analysis is reliable, it is recommended to use event recording and disturbance recordings instead.

NOTICE!
Please note that logic must be designed from left to right. The logic gate operation that must be done first must be furthest to the left on the canvas. If the order is important, make sure one is not placed right below another.

NOTICE!
While very large and complex logics can be made with the logic editor, the number of logic gates and wires that can be placed is limited. The maximum number of gates is 768, and for wires the maximum is 256. The number of wires currently used is displayed as a percentage value at *Monitoring* → "Device diagnostics" in the parameters "Gates usage" and "Wires usage". These parameters will update only after the logic has been uploaded to the device.

Logic editor command buttons

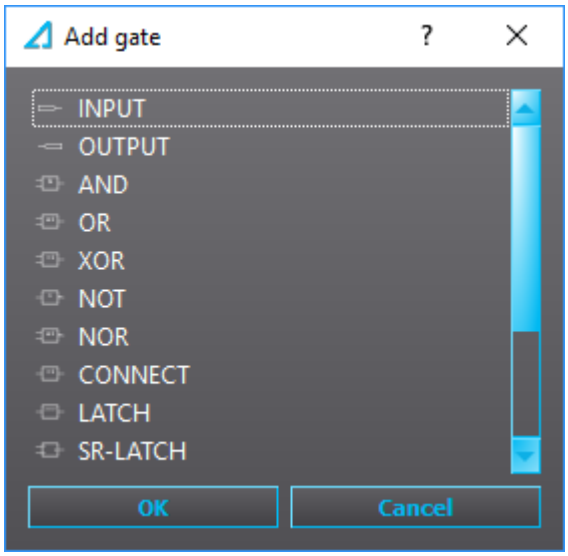
Figure. 8.4.1 - 100. Logic editor's main toolbar.

Logic editor has the following commands on its main toolbar:

- Save
  Saves the logic to the .aqs file that is currently open.
- Reload
  Loads back the logic that is in use in the .aqs file that is currently open.
- Clear
  Clears the logic sheet.
- Export
  Saves the logic as an .aql file that can then be opened in another .aqs file. It also functions as backup save of the logic.
- Load
  Opens any .aql logic file.
- Export script
  Saves only the script of the logic. Mostly used by Arcteq personnel for troubleshooting purposes.

Adding and removing logic gates, inputs and outputs

Figure. 8.4.1 - 101. Adding logic gates.



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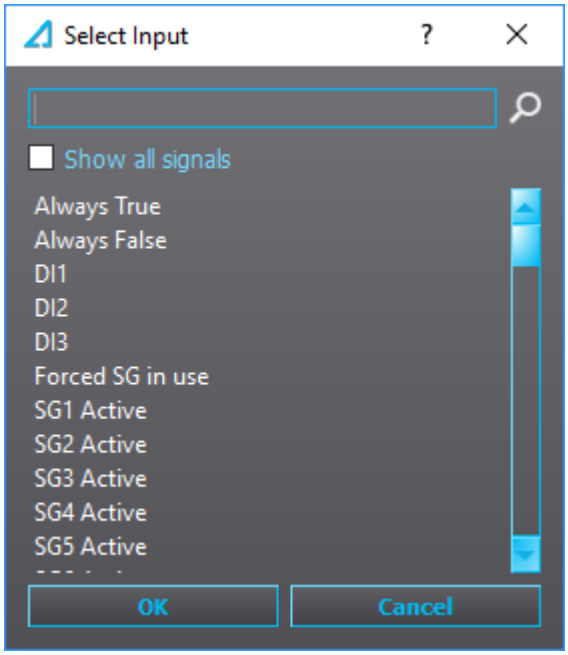
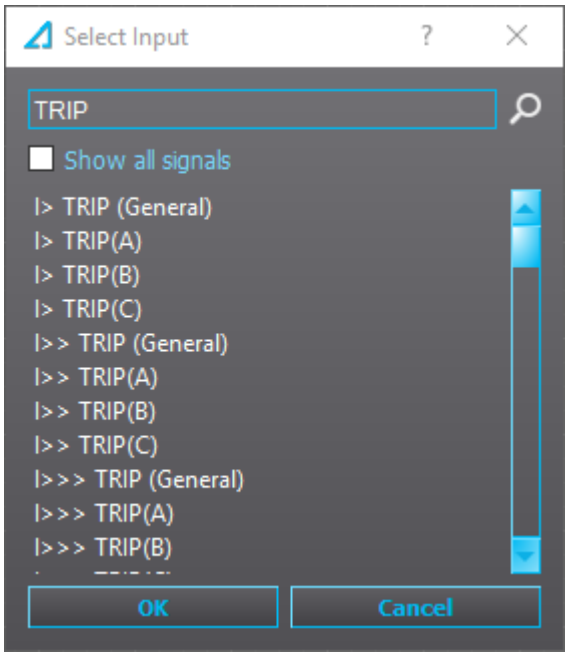
You can add a logic gate to the table by double-clicking on the table, selecting the wanted logic gate from the pop-up window (see the figure above), and then clicking the "OK" button. To choose the specific signal for your input and output gates, double-click the I/O symbol on the table and select the wanted signal from the pop-up window (see the figure below).

Figure. 8.4.1 - 102. Selecting a specific signal for a gate.



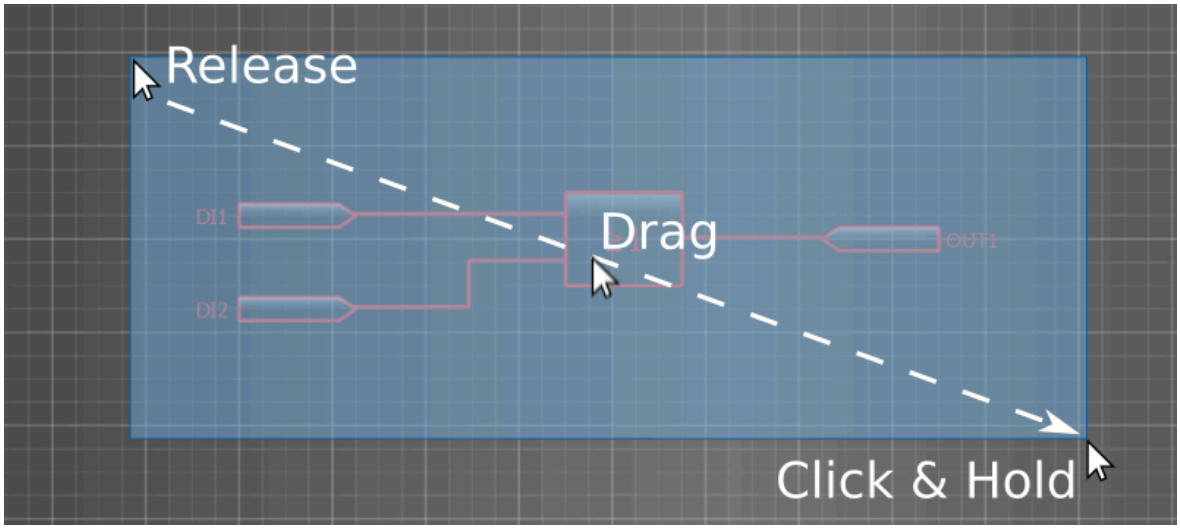
You can filter the signal with the search box. For example, typing "trip" to the search box lists all signals that contain the word 'trip'. The editor does not differentiate between upper and lower case, so "trip", "Trip" and "TRIP" all result in the same signal list (see the figure below).

Figure. 8.4.1 - 103. Searching signals.



If you want to remove a gate or a wire, you can click it (making it red) and then press **Delete**. If there are multiple items on the logic sheet you want to delete simultaneously, paint the area with your mouse (making all components within that area red) and then press **Delete** (see the image below). Painted logic can also be moved around and copied (**Ctrl** + **C**) and pasted (**Ctrl** + **V**).

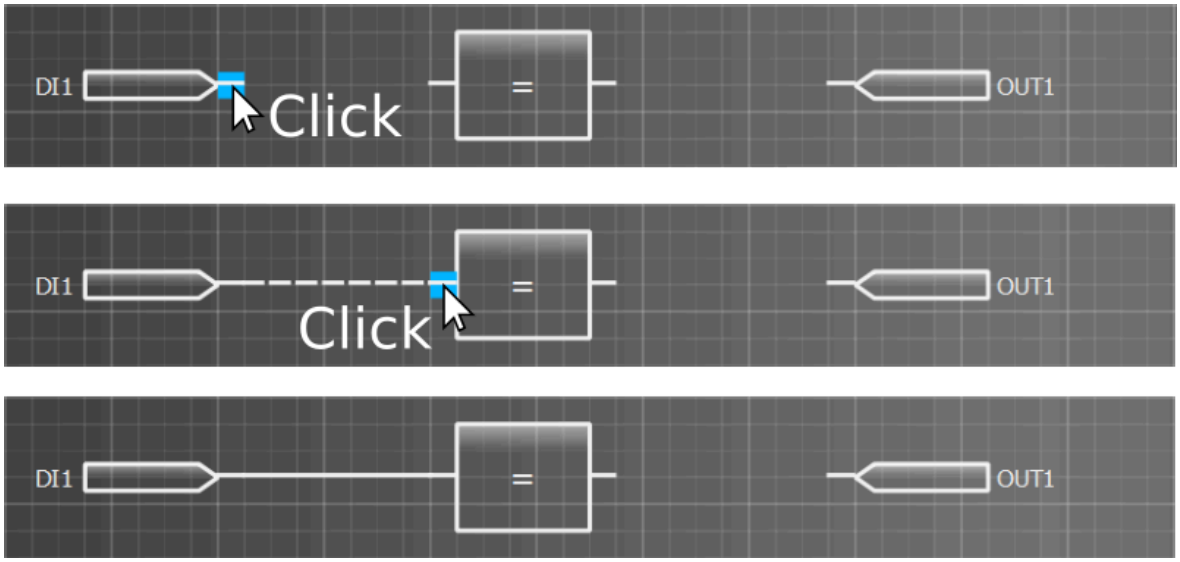
Figure. 8.4.1 - 104. Painting an area in the logic editor.



Drawing lines

When you hover the mouse over an input or output pin, an blue box appears. Click the box, move the mouse to the destination and click on the box that appears (see the figure below).

Figure. 8.4.1 - 105. Drawing lines in the logic editor.



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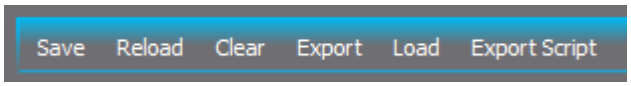
8.4.2 Logic editor (AQ 250 series)

Figure. 8.4.2 - 106. Main toolbar of the logic editor.

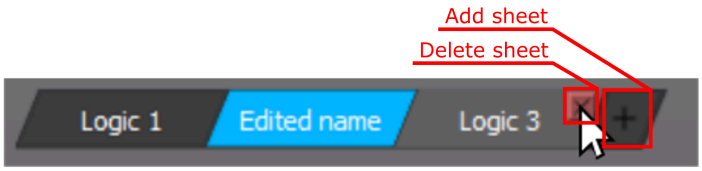


The logic editor has the tools that are most common for logic programming. The logic editor has the following commands on its main toolbar:

- Save
  Saves the logic to the .aqs file that is currently open.
- Reload
  Loads back the logic that is in use in the .aqs file that is currently open.
- Clear
  Clears the logic sheet.
- Export
  Saves the logic as an .aql file that can then be opened in another .aqs file. It also functions as backup save of the logic.
- Load
  Opens any .aql logic file.
- Export script
  Saves only the script of the logic. Mostly used by Arcteq personnel for troubleshooting purposes.

AQ 250 series logics can be divided into multiple logic sheets. To add a new sheet, click on the "Plus" button or press Ctrl+T. These logic sheets can be renamed by double-clicking on the name. You can remove a logic sheet by clicking on the red "X" button in the top right corner of the sheet name box; note that the red "X" only appears when the cursor is on top of it (see the figure below).

Figure. 8.4.2 - 107. Adding a new logic sheet.



You can move the logic view with the directional keys (up, down, left, right). Alternatively, you can move vertically with the mouse scroll wheel, and horizontally by holding the Alt key while scrolling the mouse wheel. You can also zoom in and out by holding the Ctrl key while scrolling the mouse wheel.

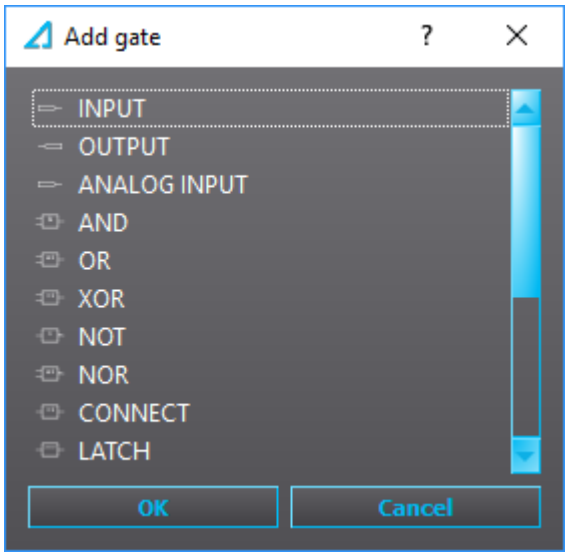
NOTICE!
The logic is updated every 5 ms in the device. Fast events might be not be seen in the Live Edit mode. To guarantee that the event activation and de-activation analysis is reliable, it is recommended to use event recording and disturbance recordings instead.

NOTICE!
The logic must be designed from left to right. The logic gate operation that must be done first must be furthest to the left on the canvas. If the order is important, make sure one is not placed right below another.

NOTICE!
While very large and complex logics can be made with the logic editor, the number of logic gates and wires that can be used is limited. The maximum number of gates is 768, and for wires the maximum is 256. The number of wires currently used is displayed as a percentage value at *Monitoring* → "Device diagnostics" in the parameters "Gates usage" and "Wires usage". These parameters will update only after the logic has been loaded to the device.

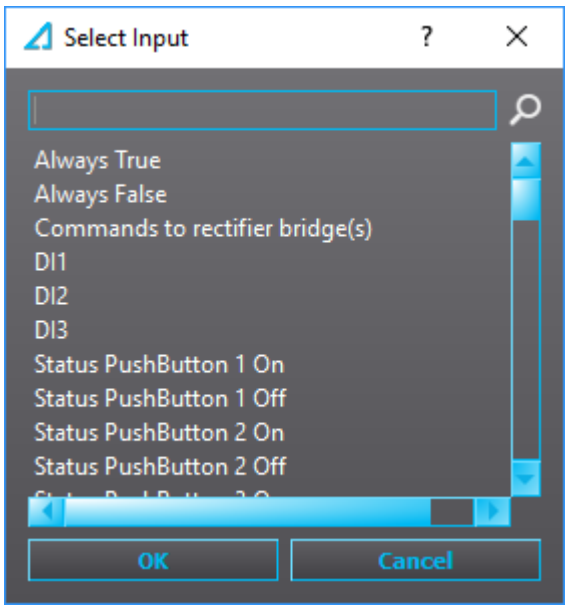
Adding inputs, outputs and logic gates

Figure. 8.4.2 - 108. Adding logic gates.



You can add a gate to the logic by double-clicking on the table, selecting the wanted gate from the pop-up window (see the figure above), and then clicking the "OK" button. To select the input or output signal, double-click an input or output on the logic sheet. Another pop-up window appears (see the figure below) and you can choose the signal from the list.

Figure. 8.4.2 - 109. Selecting a specific signal for a gate.



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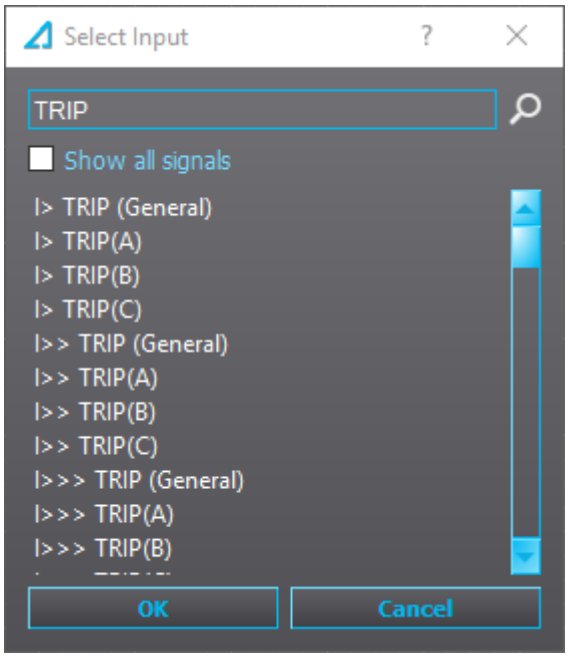
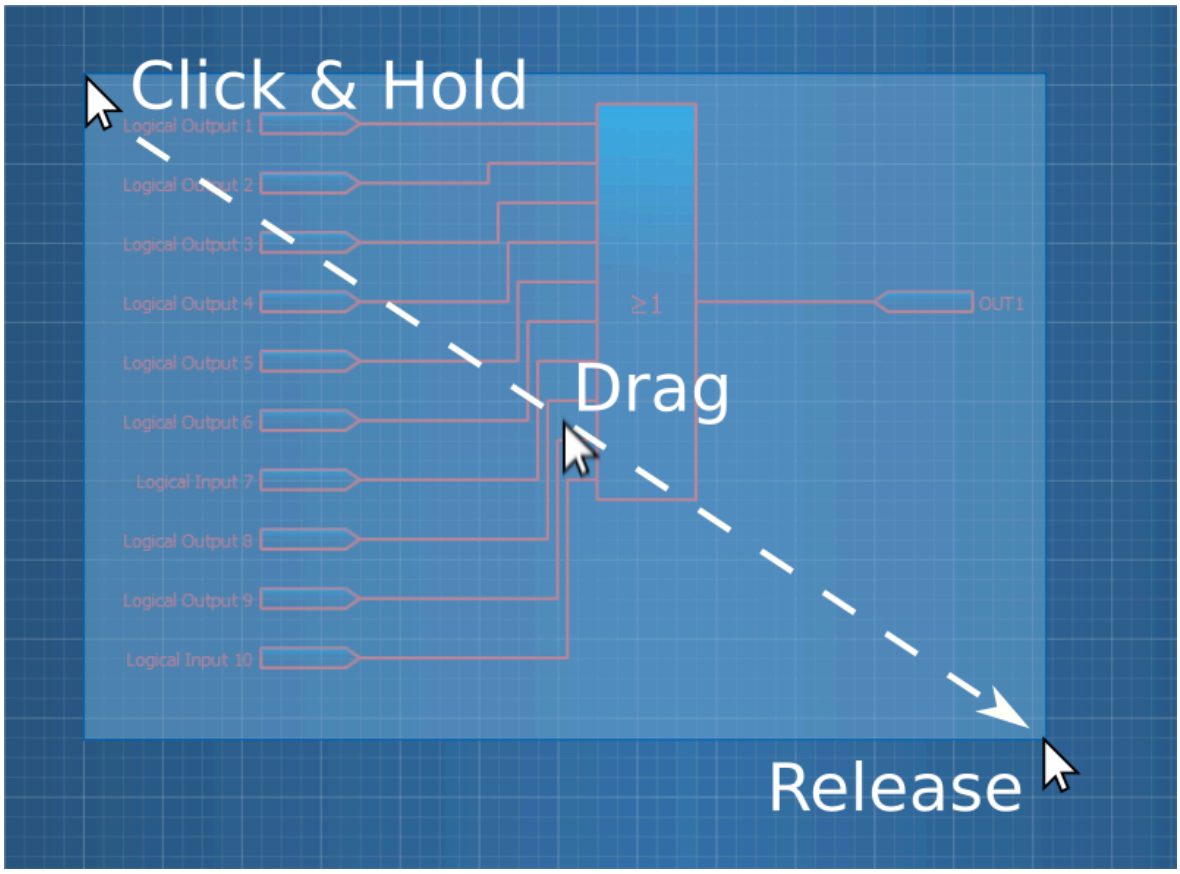
You can filter the signal with the search box. For example, typing "trip" to the search box lists all signals that contain the word 'trip'. The editor does not differentiate between upper and lower case, so both "trip" and "TRIP" result in the same signal list (see the figure below).

Figure. 8.4.2 - 110. Searching signals.



Multiple items in the logic sheet can be chosen to be edited simultaneously by painting the area with the mouse (see the figure below). When multiple items have been painted, you can move the selected items, delete them (with the **Delete** key), or copy and paste them (with **Ctrl+C** and **Ctrl+V**, respectively).

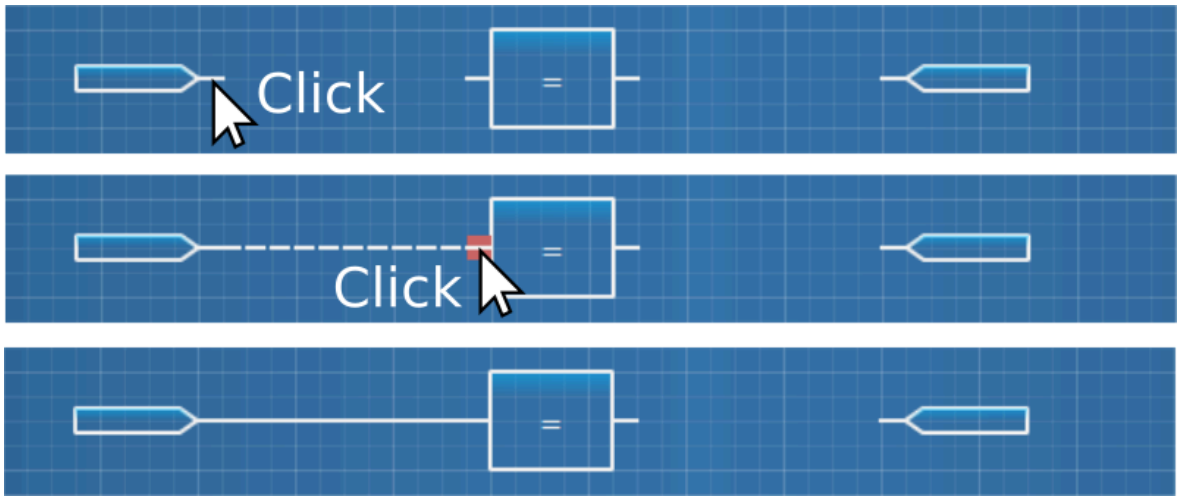
Figure. 8.4.2 - 111. Painting an area in the logic editor.



Drawing lines

When you hover the mouse over an input or output pin, an red box appears. Click the box, move the mouse to the destination and click on the box that appears (see the sequence in the figure below).

Figure. 8.4.2 - 112. Connecting signals in the logic editor.



You can also connect signals to multiple destinations by repeating the previous steps (see the figure below).

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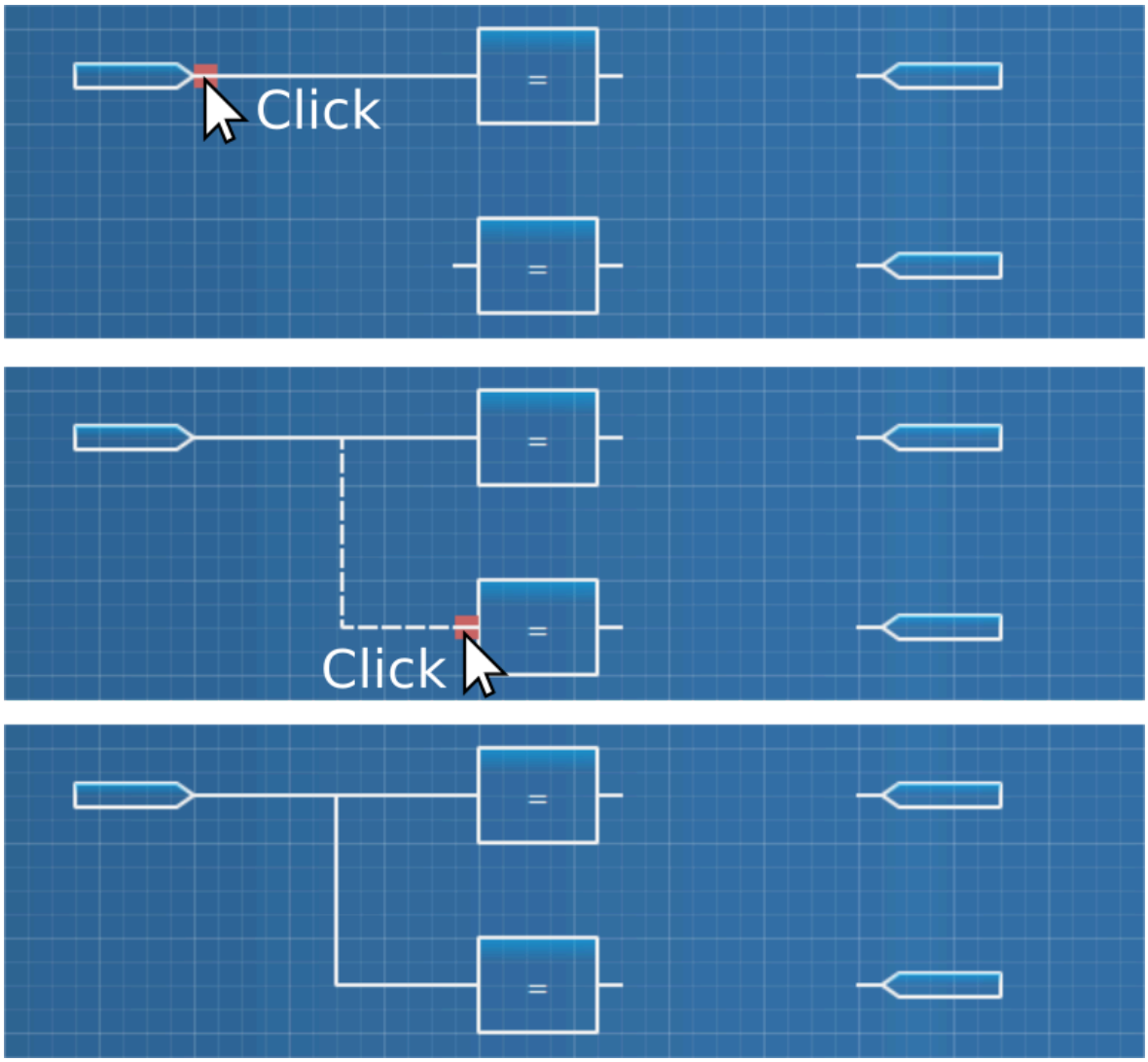
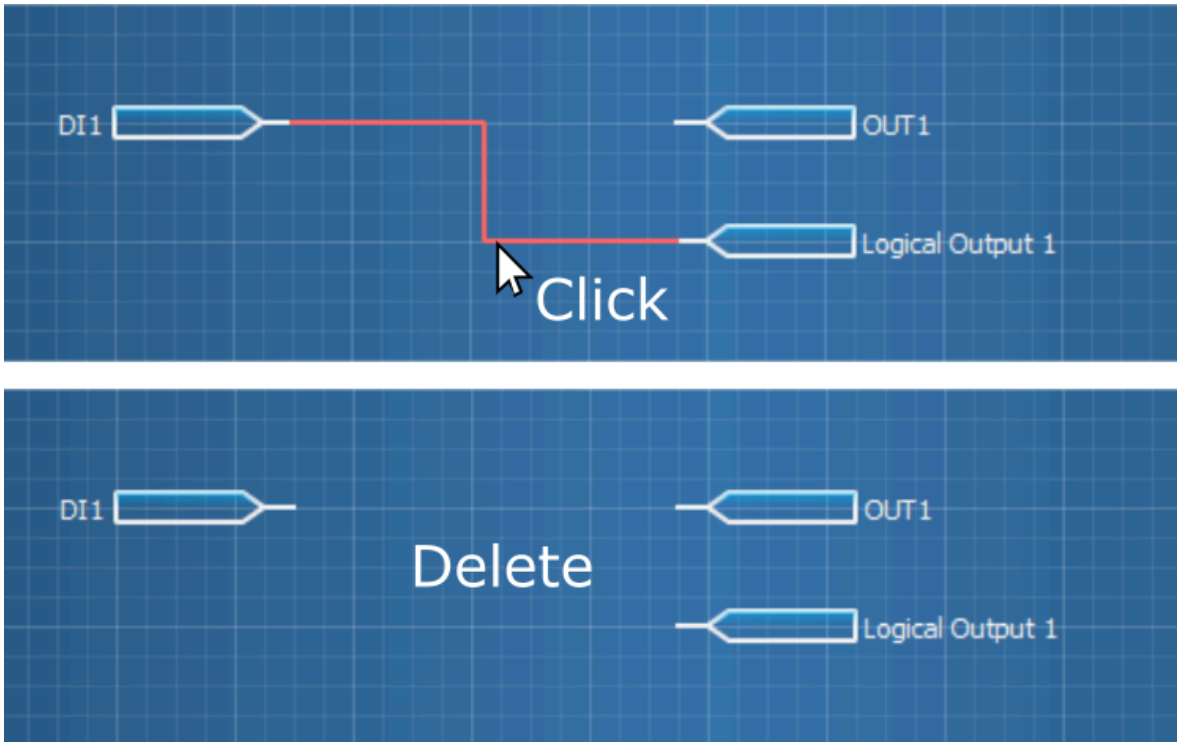
Figure. 8.4.2 - 113. Connecting signals to multiple destinations.



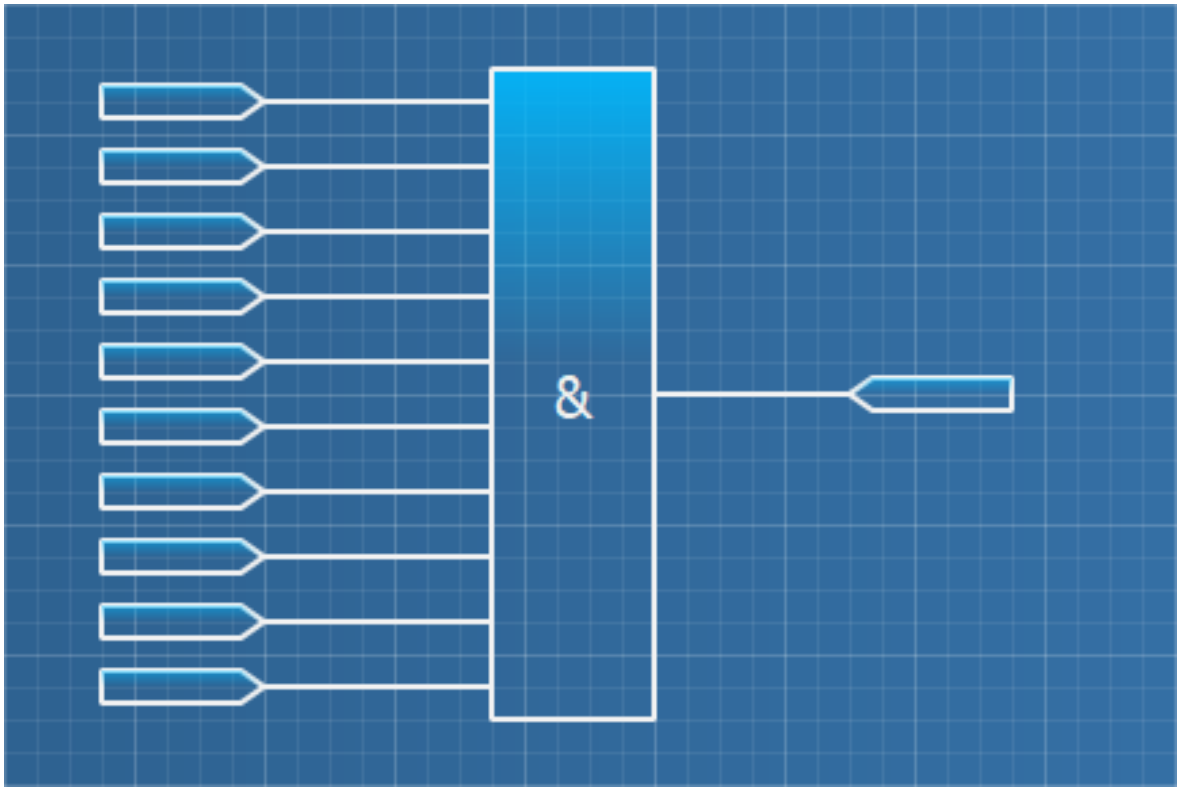
You can remove connections by clicking on the line and pressing the **Delete** key (see the figure below). If you want to exit the wiring mode before connecting two pins, press **Esc**.

Figure. 8.4.2 - 114. Removing a connection.



Some logic gates (such as AND and OR gates) can take more than two inputs. This can be done by dragging a line close to the gate's inputs which makes more inputs appear (see the figure below). You can add up to ten inputs to a single gate.

Figure. 8.4.2 - 115. Example of an AND gate with ten inputs.



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8.4.3 Logic gates

Both AQ 210 series devices and AQ 250 series devices have almost the same logic gates. The available logic gates for each device type are listed in the table below.

Table. 8.4.3 - 3. Availability of logic gates in AQ 210 and AQ 250 devices.

Gate name	AQ 210 series	AQ 250 series
INPUT	Yes	Yes
OUTPUT	Yes	Yes
CONNECT	Yes	Yes
NOT	Yes	Yes
AND	Yes	Yes
OR	Yes	Yes
XOR	Yes	Yes
NOR	Yes	Yes
SR latch	Yes	Yes
RS latch	–	Yes
D FLIP-FLOP	Yes	Yes
COUNTER	Yes	Yes
DELAY	Yes	Yes
EDGE	Yes	Yes
LATCH	Yes	Yes
ANALOG INPUT	–	Yes
ANALOG COMPARATOR	–	Yes

Input gate

Figure. 8.4.3 - 116. INPUT gate.

Input gates are used for bringing user-selected binary signals into the logic sheet. An input can be connected to multiple logic gates. It is possible to set multiple inputs with the same binary signal.

Output gate

Figure. 8.4.3 - 117. OUTPUT gate.

Output gates are used for controlling digital outputs (output relays), high-speed outputs, logical outputs, LEDs, and the Local/Remote switch. Outputs can also be used for resetting latched signals ("Reset latches") and to silence alarm buzzers in alarm annunciator devices (such as AQ-S254A).

CAUTION!
Because a logic sheet configured in the logic editor is the last part in a logic cycle, any output controlled here will dominate all other control signals elsewhere. When you have a direct connection to an output contact in the logic editor, all other connections to the same output contact will be ignored elsewhere (e.g. the matrix). If controlling the same output contact by multiple signals is desired, you can connect a logical output to an output gate and then connect the logical output in the matrix to an output contact.

CONNECT gate

Figure. 8.4.3 - 118. CONNECT gate.

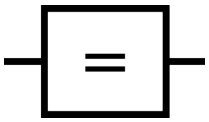
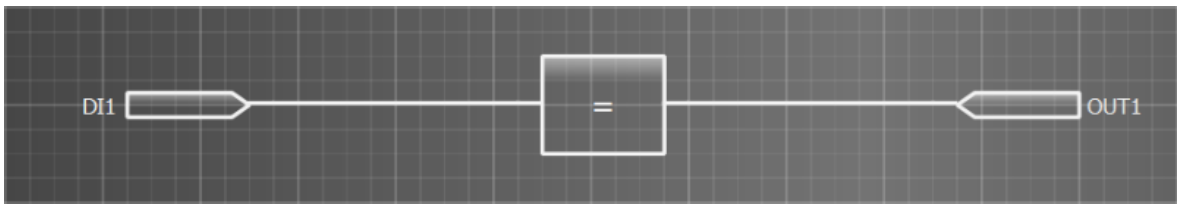
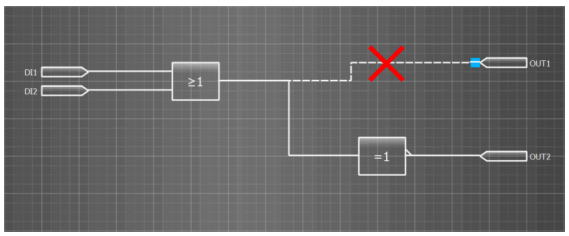


Figure. 8.4.3 - 119. Using the CONNECT gate to connect an input to an output.



The CONNECT gate has two applications. The first, and the simplest, application is using the gate to connect a signal directly from an input to an output (as seen in the figure above). The CONNECT gate is also used if an output of a logic gate needs to be connected to two outputs when configuring an AQ 210 series device. This is because AQ 210 series units do not support the connecting of the same signal to two outputs without a gate between them, and AQtivate does not let you make that kind of connections (see the figure below).

Figure. 8.4.3 - 120. Faulty way to connect a signal to two outputs in AQ 210 series devices.



The figure below shows the correct way to connect two outputs to a logic gate.

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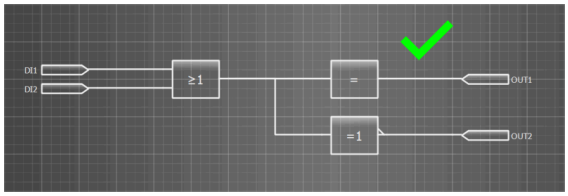
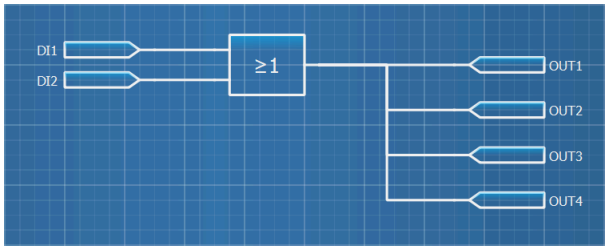
Figure. 8.4.3 - 121. Correct way to connect a signal to two outputs in AQ 210 series devices.



Note that the above-mentioned restriction only applies to AQ 210 units; AQ 250 series units don't require a CONNECT gate when connecting to multiple outputs (see the figure below).

Figure. 8.4.3 - 122. Connecting a signal to two outputs in AQ 250 series devices.



However, you can always connect a single signal to a single output without a CONNECT gate (see the figure below) in AQ 210 series devices!

Figure. 8.4.3 - 123. Connecting a signal to one output in AQ 210 series devices.

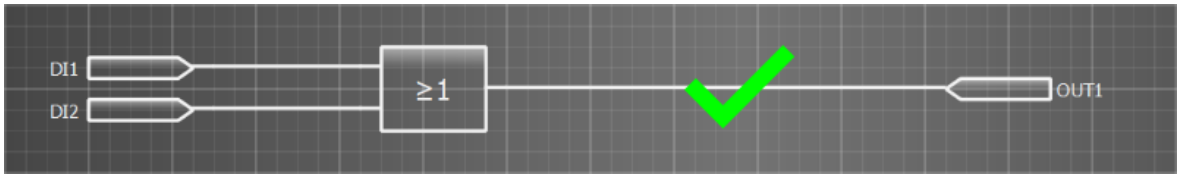
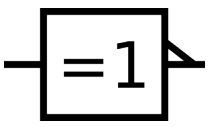


Figure. 8.4.3 - 124. The truth table of the CONNECT gate.

Input	Output
0	0
1	1

NOT gate

Figure. 8.4.3 - 125. NOT gate.



The NOT gate is a basic logic gate which inverts the input status.

Figure. 8.4.3 - 126. The truth table of the NOT gate.

Input	Output
0	1
1	0

AND gate

Figure. 8.4.3 - 127. AND gate.

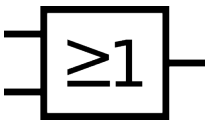
The AND gate is a basic logic gate which activates its output when all inputs are active.

Figure. 8.4.3 - 128. The truth table of the AND gate.

Input 1	Input 2	Output
0	0	0
0	1	0
1	0	0
1	1	1

OR gate

Figure. 8.4.3 - 129. OR gate.



The OR gate is a basic logic gate which activates its output when at least one of the inputs is active.

Figure. 8.4.3 - 130. The truth table of the OR gate.

Input 1	Input 2	Output
0	0	0
0	1	1
1	0	1
1	1	1

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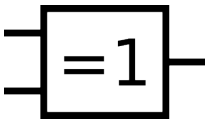
XOR gate

Figure. 8.4.3 - 131. XOR gate.



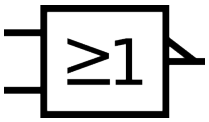
The XOR gate is a basic logic gate which activates its output when only one of the inputs is active.

Figure. 8.4.3 - 132. The truth table of the XOR gate.

Input 1	Input 2	Output
0	0	0
0	1	1
1	0	1
1	1	0

NOR gate

Figure. 8.4.3 - 133. NOR gate.



The NOR gate is a basic logic gate which activates its output when none of the inputs is active.

Figure. 8.4.3 - 134. The truth table of the NOR gate.

Input 1	Input 2	Output
0	0	1
0	1	0
1	0	0
1	1	0

SR LATCH gate

Figure. 8.4.3 - 135. SR LATCH gate.

The SR LATCH gate sets the output value to 1, when the S value is 1. The output value remains at 1 (even if the S value goes back to 0) until the R value is set to 1. If both S and R input are 1, the output value is set to 1.

Figure. 8.4.3 - 136. The truth table of the SR LATCH gate.

S	R	Output
0	0	Previous
0	1	0
1	0	1
1	1	1

RS LATCH gate

Figure. 8.4.3 - 137. RS LATCH gate.

The RS latch gate sets the output value to 1, when the S value is 1. The output value remains at 1 (even if the S value goes back to 0) until the R value is set to 1. If both S and R input are 1, the output value is set to 0.

Figure. 8.4.3 - 138. The truth table of the RS LATCH gate.

S	R	Output
0	0	Previous
0	1	0
1	0	1
1	1	0

D FLIP-FLOP gate

Figure. 8.4.3 - 139. D FLIP-FLOP gate.

The D FLIP-FLOP gate captures the D input value every time the clock input ">" rises and then forwards the D input value to the output (Q).

Figure. 8.4.3 - 140. The truth table of the D FLIP-FLOP gate.

>	D	Output
Rising	0	0
Rising	1	1
Non-rising	0	Previous

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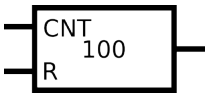
COUNTER gate

Figure. 8.4.3 - 141. COUNTER gate.



The COUNTER gate adds 1 to the counter value every time the value of the CNT signal goes to 1. When the counter value is equal to or higher than the trigger value, the output is set to 1. The R signal resets the counter to 0.

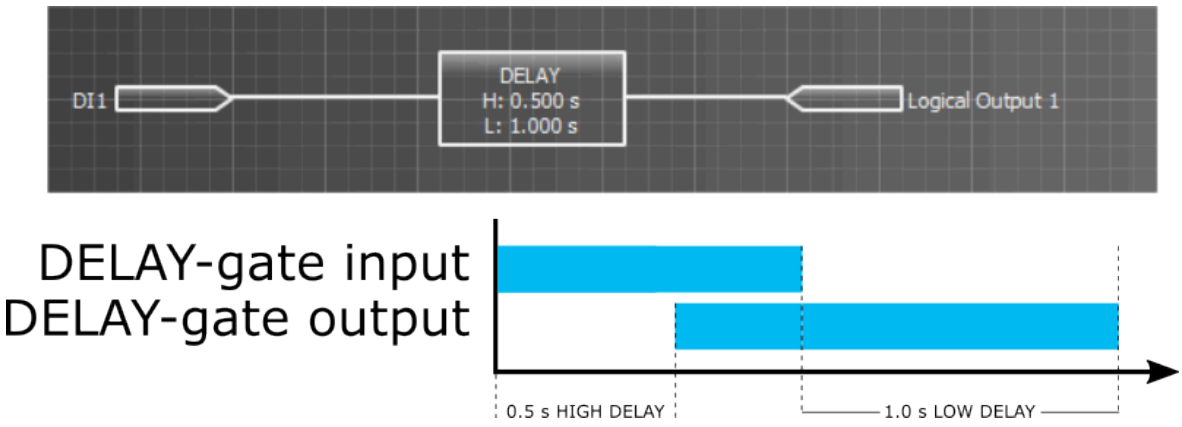
DELAY gate

Figure. 8.4.3 - 142. DELAY gate.

The DeELAY gate is able to delay the high or low value of the output signal. When you double-click on the gate, you can set the high (H) and low (L) values (in milliseconds). After you have made the wanted changes, click "Set" and upload the settings to the device. There can be up to sixteen (16) DELAY gates in use at any one time.

The figure below displays an example where the DELAY gate has been used to delay the signal from the input for 0.5 seconds before its sent to the output. When the input signal drops, the output signal is held for one second.

Figure. 8.4.3 - 143. Example of using the DELAY gate.



EDGE gate

Figure. 8.4.3 - 144. EDGE gate.

The EDGE gate produces a 5-ms pulse when the D input receives a rising or a falling signal, depending on the R/F input's logic. If the R/F input is active, the output generates a pulse from a rising input signal. If the R/F input is not active, the output generates a pulse from a falling edge.

Figure. 8.4.3 - 145. Example of using the EDGE gate.

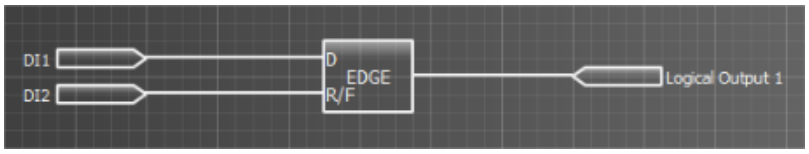
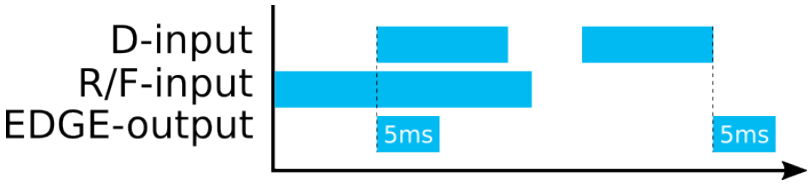
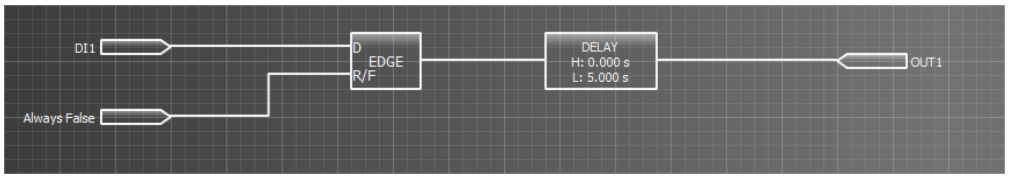


Figure. 8.4.3 - 146. Example of the activation and de-activation of the EDGE gate.



If you need a pulse longer than 5 ms, you can extend the pulse with the DELAY gate. In the figure below the DELAY gate has 0 s of high delay and 5 s of low delay, resulting in a five-second pulse.

Figure. 8.4.3 - 147. Example of using a DELAY gate to extend the EDGE pulse.



If the gate is only going to be used in the rising or falling edge mode, the easiest method to define that mode is to connect an "Always true" or an "Always false" signal to the R/F input.

Figure. 8.4.3 - 148. The truth table of the EDGE gate.

R/F	D	Output
0	0	0
0	1	0
0	0 > 1	0
0	1 > 0	5 ms pulse
1	0	0
1	1	0
1	0 > 1	0
1	1 > 0	5 ms pulse

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LATCH gate

Figure. 8.4.3 - 149. LATCH gate.

When a LATCH gate receives a rising signal, its output remains active until the signal is cleared (see the figure below). You can clear the signal by pushing the Back button on the device's front panel.

Figure. 8.4.3 - 150. Using the LATCH gate.

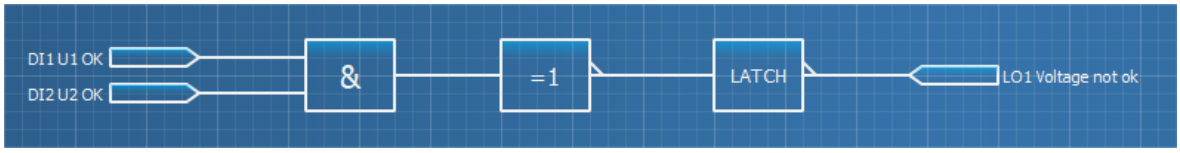
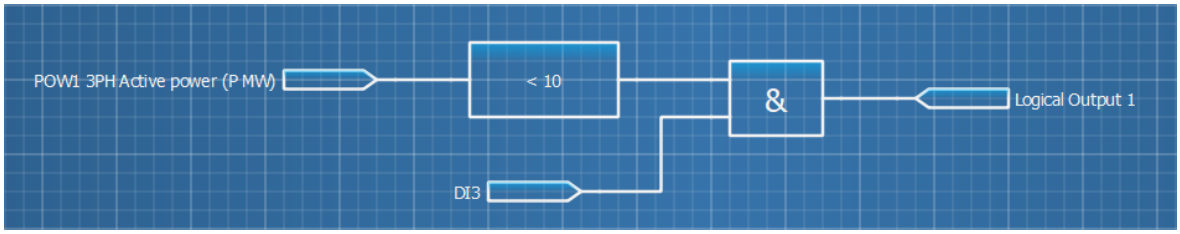


Figure. 8.4.3 - 151. The truth table of the LATCH gate.

S	Back-button	Output
0	0	Previous
0	1	0
1	0	1
1	1	1

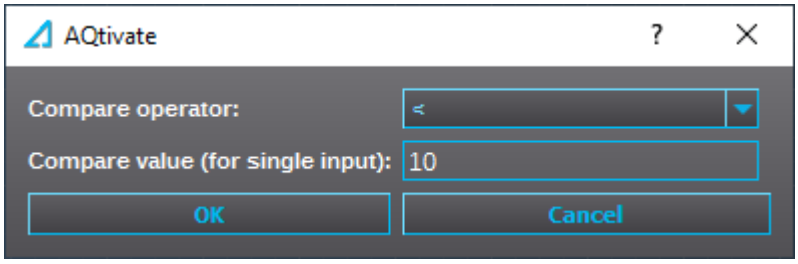
Analog input and analog comparator

Figure. 8.4.3 - 152. Logic example with an analog input and a comparator.



The analog comparator can be used to activate or disable the gate's output based on the measurement selected to the analog input. When adding an analog comparator to your logic, double-click on the gate to open a pop-up window (see the figure below), where you can select the operator mode and the comparator value. In the example above, the analog input "3PH active power (P MW)" is connected to the analog comparator gate, where the value has been set to "10" and the operator mode is "<". This means that the analog comparator output gate is active whenever the three-phase active power is under 10 MW.

Figure. 8.4.3 - 153. Analog comparator settings.



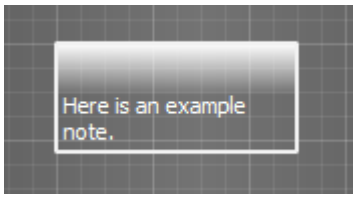
The analog comparator gate has six different operator modes, described in the table below:

Table. 8.4.3 - 4. Operator modes of the analog comparator gate.

Operator	Description
==	Equal to
!==	Not equal to
<	Less than
>	Greater than
<=	Less than or equal to
>=	Greater than or equal to

Notes

Figure. 8.4.3 - 154. Example of a note added to logic.



Notes can be used for describing logic programs to make them easier to understand. Notes can be added by double-clicking the editor table and selecting "Note" from the pop-up window menu. You can start writing on the note by clicking the note's bottom row. You can also edit the note later by clicking the existing text.

8.5 Carousel Designer (AQ 210 series)

The number and content of the menus shown on the HMI display can be edited in the Carousel Designer editor when an .aqs file is open.

Pressing the green "Plus" button adds a new view. You can select the type of the view from the drop-down menu. Once the design is finished, you can export the design into the .aqs file that is currently open by pressing the "Export" button. To save the changes, click *File → Save* in AQtivate. You can send the changes to a device by writing the Mimic to the device at *Commands → Write to relay*. If you have an previously saved carousel menu, the "Import" button imports it to the currently open .aqs file.

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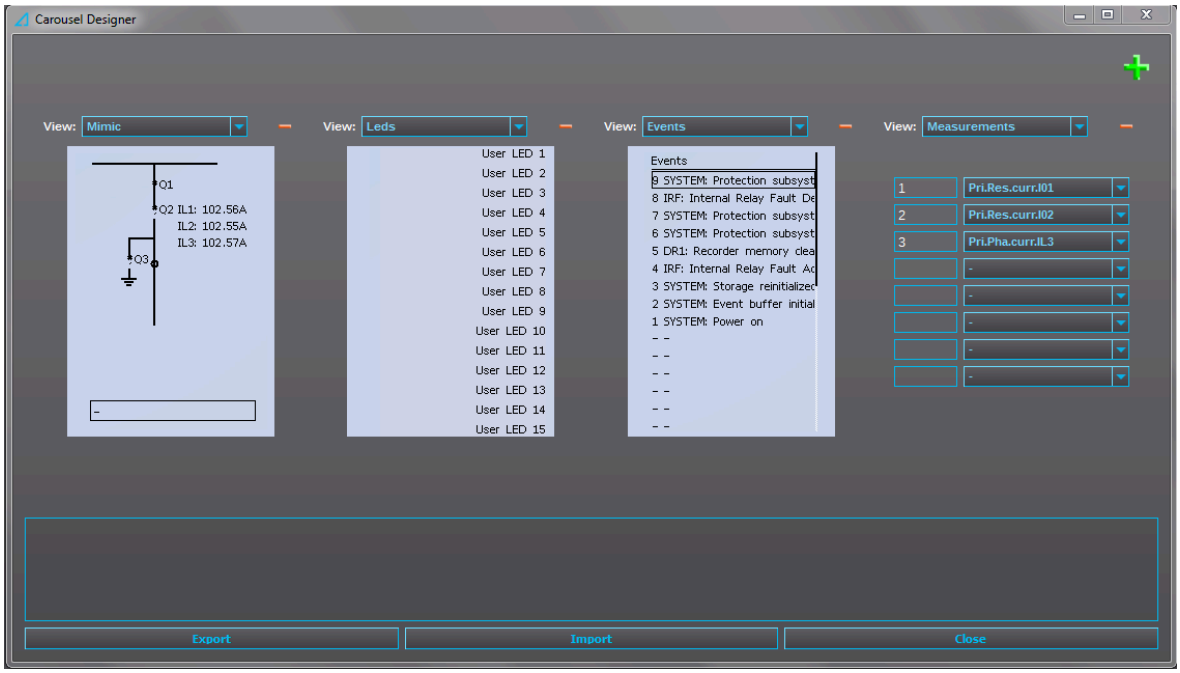
The figure below shows an example of the Carousel Designer editor. This carousel has four views: the mimic, the LED designations, a list of the events recorded by the device, and a list of three selected measurements.

Figure. 8.5 - 155. Example of a carousel design.



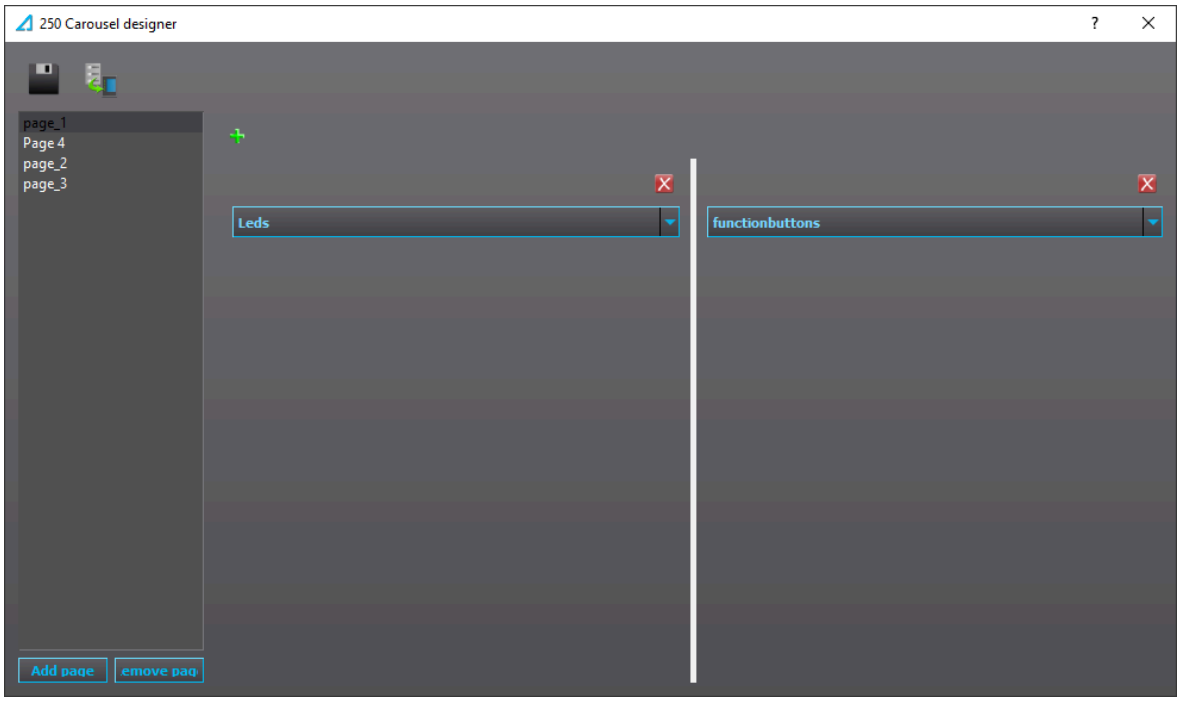
The following table lists all the types of carousel views available to you in the Designer:

Table. 8.5 - 5. Types of carousel views available in AQ 250 series devices.

View name	Description
Mimic	Displays the unit's mimic. The mimic view image can be edited at *Tools → Mimic editor*.
LEDs	Displays the user-defined descriptions of the LEDs.
Events	Lists all of the events recorded by the unit.
Measurements	Displays measurements up to eight (8) lines. You can edit which measurements are shown at *Tools → Carousel Designer*.
Favorites	Shows the setting menus favorited by the user.
Clock	Displays the unit's time and date. The time and the date can also be set here.
Fault register	Displays the fault values recorded by the VREC function. NOTICE! Please note that this type is not available in all AQ 210 series devices!
Alarms	Displays the activated alarms. NOTICE! Please note that this type is only available in AQ-S214!

8.6 Carousel Designer (AQ 250 series)

Figure. 8.6 - 156. Carousel Designer in AQ 250 series devices.



The number and content of the menus shown on the HMI display can be edited in Carousel Designer editor when an .aqs file is open.

Pressing the green "Plus" button adds a new view (see the figure above). You can select the type of the view from the drop-down menu. If there is more than one view on a page, the size of the view box can be changed with the thick white bar between the views. You can add and remove pages with the "Add page" and "Remove page" buttons. The order of the pages is determined by their position in the list on the left of the Carousel Designer window. Once the carousel design is done, you can export the design into the .aqs file that is currently open by pressing the "Save" button (the floppy disk icon). You can send the changes to the device by pressing the "Send to relay" icon next to the "Save" button, or by the writing a mimic to the device at *Commands → Write to relay*.

The following table lists all the types of carousel views available to you in the Designer:

Table. 8.6 - 6. Types of carousel views available in AQ 250 series devices.

Name	Description
Mimic (1-5)	Displays the unit's mimic. The mimic view image can be edited at *Tools → Mimic editor 250*. Up to five (5) mimics are supported.
Alarms	Displays the alarm view. **NOTICE!** Available only in AQ-S254! Please see the AQ-S254 instruction manual for more details.
LEDs	Displays the user-defined descriptions of the LEDs.

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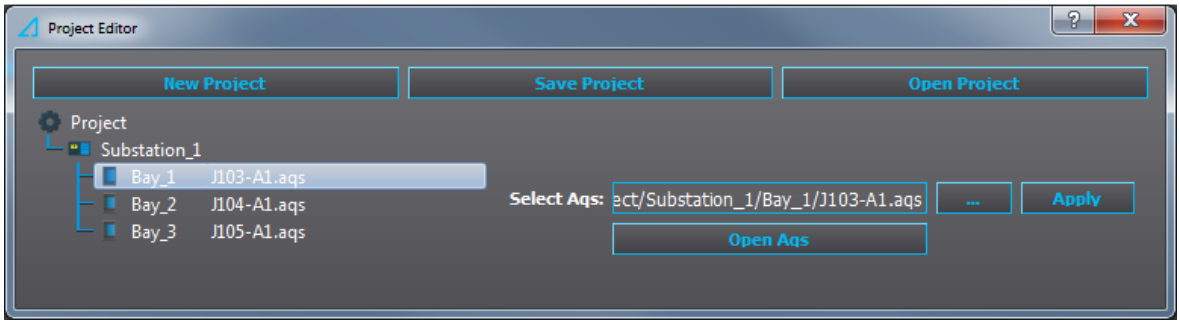
Name	Description
Timesettings	Displays the unit's time and date. You can also set these here if it is impossible to use external time synchronization and you cannot connect to the device with the AQtivate software.
Events	Displays the name, the time, and the date of all the events recorded into the device's event history.
Measurements	Displays up to fifteen (15) user-defined measurements.
Function buttons	Displays the user-defined descriptions of the twelve (12) function buttons.

NOTICE!
If there is more than one view on a page to interact with, select the needed view with the left and right arrow buttons.

8.7 Project editor

The Project editor is an optional project management tool. You can create a new project by clicking the "New project" button, and then creating a node called "Project". You can change the node's name by double-clicking it. Right-clicking a node will open a context menu. Selecting "Add substation" from this menu adds a substation to the node. You can add bays to a substation by right-clicking a substation node and selecting "Add bay" from the context menu. Clicking on a bay node enables the menu on the right side of the node tree view. In this menu you can assign a setting file to the selected bay. The "..." button opens a file dialog where you can select an .aqs file, and clicking the "Apply" button assigns this selected .aqs file to the selected bay. Once a setting file has been assigned, it can be opened by clicking the "Open .aqs" button. You can save a project by clicking the "Save project" button. A saved project can be opened by clicking the "Open project"button.

Figure. 8.7 - 157. Project editor.



8.8 Wizards

8.8.1 Transformer Wizard

The Transformer Wizard tool uses a selection of transformer-related information and other settings (such as CT specifications and wiring) as the basis for building suitable setting parameters to the device.

A complete Wizard manual (titled "Transformer Wizard – Instruction booklet") is available for downloading at the Arcteq website (arcteq.fi/documents-and-software/ → "AQ 200 series" → "Resources").

8.8.2 Generator Wizard

The Generator Wizard tool uses a selection of generator-related information and other settings (such as application and CT data) as the basis for building suitable setting parameters to the device.

A complete Wizard manual (titled "Generator Wizard – Instruction booklet") is available for downloading at the Arcteq website (arcteq.fi/documents-and-software/ → "AQ 200 series" → "Resources").

8.8.3 Motor Wizard

The Motor Wizard tool uses a selection of motor-related information and other settings (such as name plate values and system configuration) as the basis for building suitable setting parameters to the device.

A complete Wizard manual (titled "Motor Wizard – Instruction booklet") is available for downloading on the Arcteq website (arcteq.fi/documents-and-software → "AQ 200 series" → "Resources").

8.9 Events and logs

8.9.1 Event history

The "Event history" window displays the time-stamped events. Up to 15,000 events can be stored at once. When 15,000 events have been recorded, the event history will begin to remove the oldest events to make room for new events. These can be, for example, pick-ups, trips, or blocks. You can find more information about event masks in the selected function's "Events" tab. Event masks determine what is recorded into the event history, and they are configured in each function's individual settings in the *Protection*, *Control* and *Monitoring* menus. The event history can be exported as a separate text file (.txt) by clicking the "Save" button (the floppy disk icon).

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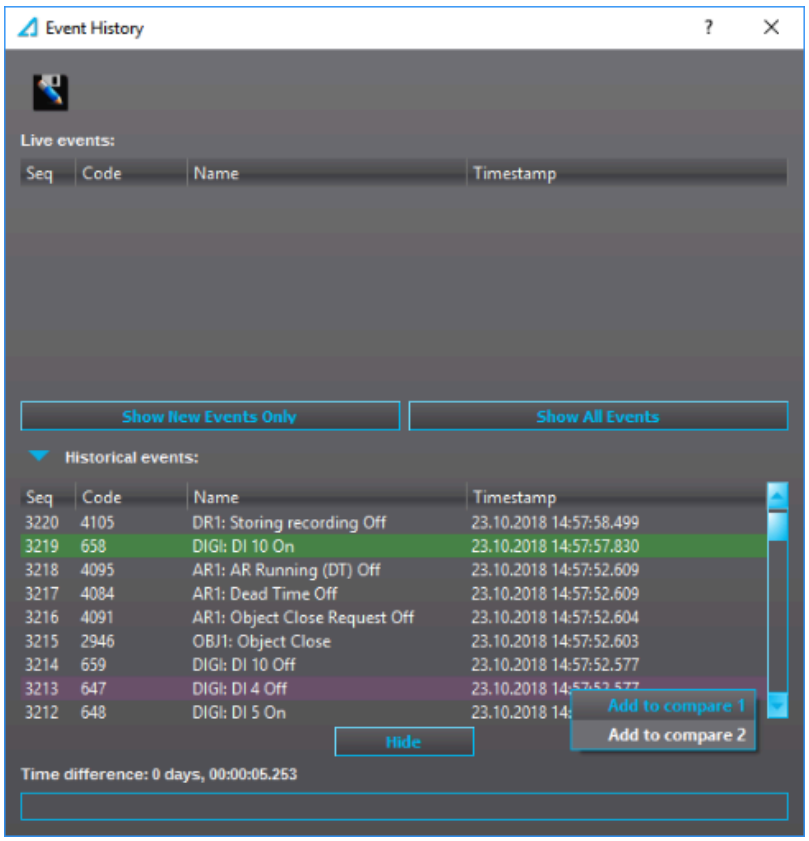
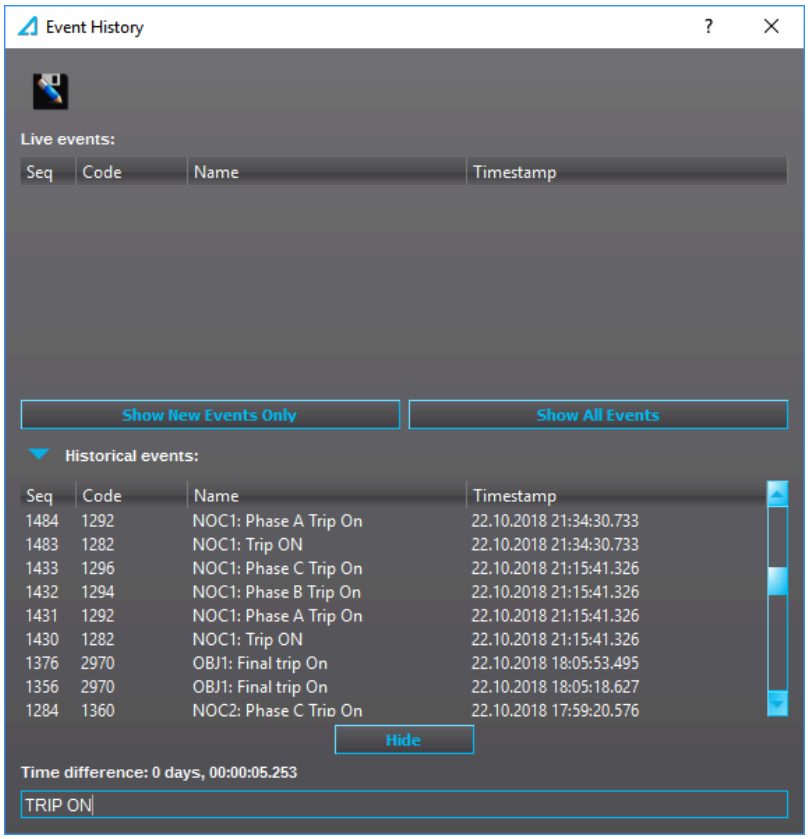
Figure. 8.9.1 - 158. Event history window.



When you click the "Show new events only" button, AQtivate shows only those events that happen from that point on. Clicking the "Show all events" button switches back to the view that shows all events. If you want to see the time difference between two events, right-click on an event and select "Add to compare [x]" from the context menu.

Event lists can also be filtered to show specific events. This filtering is done by writing in the text box at the bottom of the window. For example. as in the figure below, "TRIP ON" has been written in the text box so that only events that contain the text "TRIP ON" are displayed. Please note that the tool does not differentiate between lower and upper case: writing "trip on", "Trip on" or "tRiP oN" all bring up the same events in the example.

Figure. 8.9.1 - 159. Filtering events.



8.9.2 Configuration change log

The configuration change log can be used to observe parameter changes made to the device. The configuration change log records the parameter, the new value, and the time when the change occurred.

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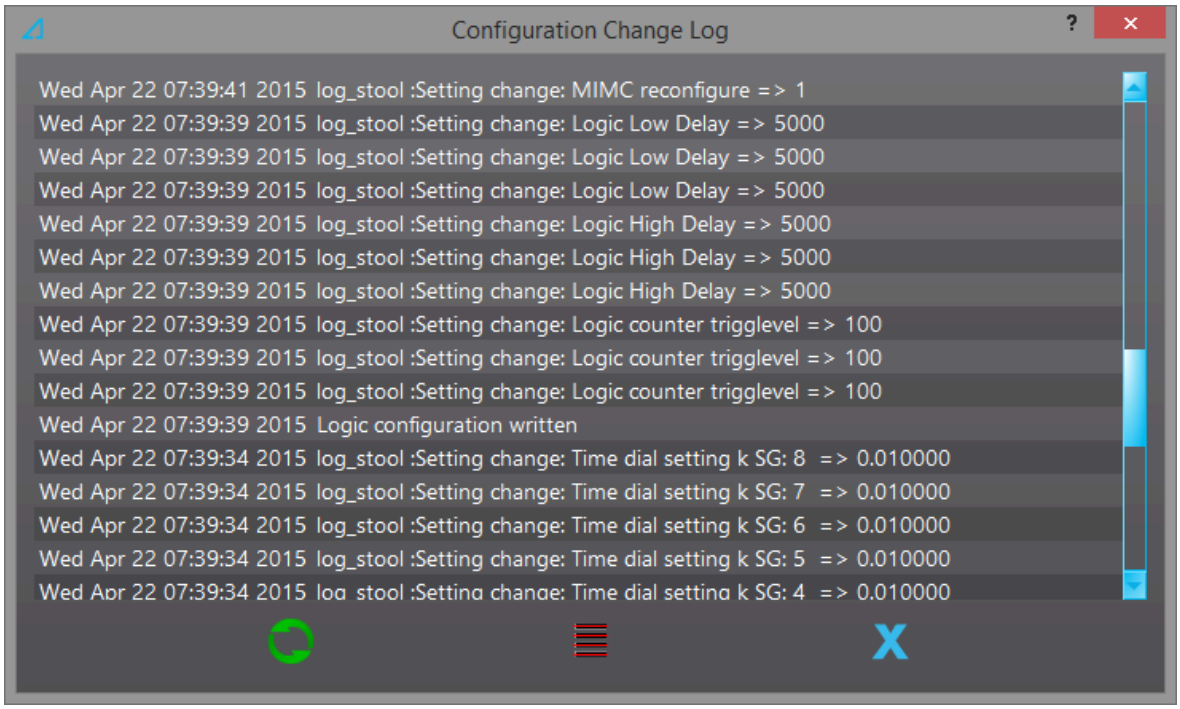
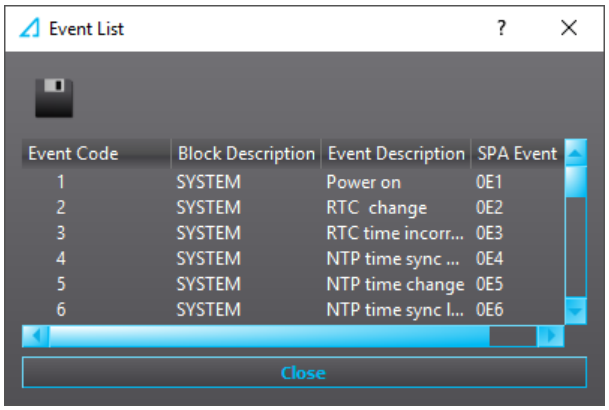
Figure. 8.9.2 - 160. Configuration change log.



8.9.3 Event list

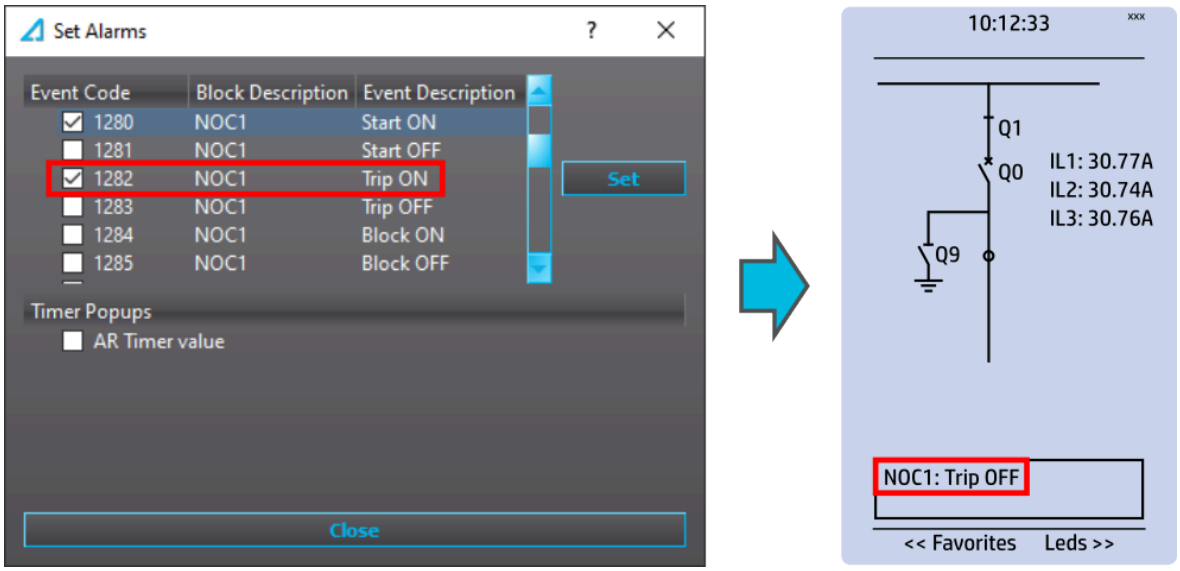
You can access a list of all possible events by opening the "Event list" from the *Tools* menu. Each event has an event code and a SPA event channel. This list can also be saved as a text file by clicking the "Save" button (the floppy disk icon).

Figure. 8.9.3 - 161. Full list of all possible events.



8.9.4 Set alarm events

Figure. 8.9.4 - 162. Setting an alarm event.



Alarm events can be set by using this dialog. You can select which events cause alarms in the device by checking their respective boxes in the "Set alarms" window and then pressing the "Set" button (see the figure above, on the left). When one of the alarm events occurs, it is shown in the device's mimic view (see the figure above, on the right). The newest alarm is always displayed, and it can be cleared with the HMI's Back button. Up to five (5) alarm events can be stored at any one time; when all five slots are full, the oldest alarm is deleted to make way for new alarms.

NOTICE!
The mimic view must be enabled in the Carousel designer for alarm event setting to work!

NOTICE!
If the auto-recloser is in use, checking the "AR Timer" box enables a timer that displays the remaining dead time or reset time!

NOTICE!
The event that is to be recorded has to be activated also in the event mask of the function in question!

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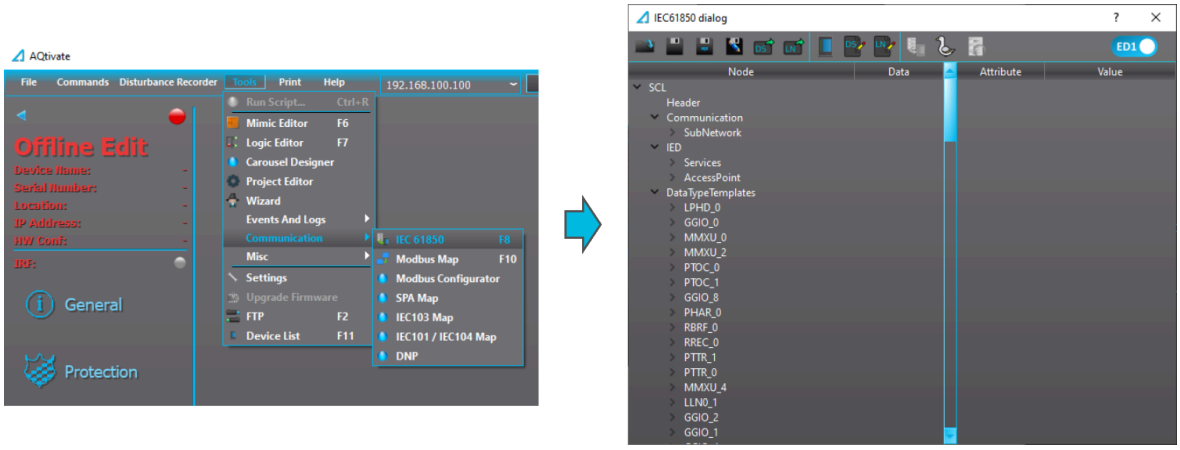
8.10 Communication

8.10.1 IEC 61850

Figure. 8.10.1 - 163. Main view of the IEC 61850 editor.

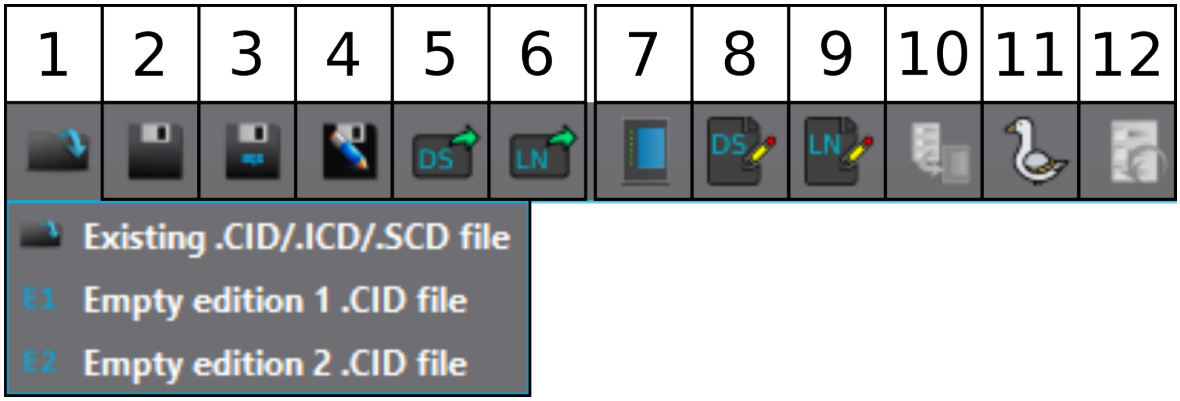


The user can enable the IEC 61850 protocol in device models that support this protocol at *Communication → Protocols → IEC61850*. All AQ 210 series devices support Edition 1 of the IEC 61850 communication protocol. All AQ 250 series units support both Edition 1 and Edition 2 of the IEC 61850 protocol. The following services are supported by IEC 61850 in Arcteq devices:

- Up to six (6) data sets (pre-defined data sets can be edited with the IEC 61850 tool in AQtivate),
- Report Control Blocks (both buffered and unbuffered reporting),
- Control ('Direct operate with normal security', 'Select before operate with normal security, 'Direct with enhanced security' and 'Select before operate with enhanced sequrity' control sequences),
- Disturbance recording file transfer,
- GOOSE,
- Time synchronization.

IEC 61850 main toolbar

Figure. 8.10.1 - 164. Main toolbar.



The following buttons are available in the main toolbar of the IEC 61850 tool (see also the figure above):

1. Open .CID/.ICD file
   a) Open an existing .CID/.ICD/.SCD file from the PC's hard drive.
   b) Open empty Edition 1 .CID file.
   c) Open empty Edition 2 .CID file.
2. Save .CID/.ICD file
   If a .CID file was opened from the PC's hard drive, this button saves all changes to that .CID or .ICD file.
3. Save to .aqs
   Saves the .CID or .ICD file into the .aqs currently open (remember to save the .aqs file as well [*File → Save*] to keep the changes!).
4. Save .CID/.ICD as...
   Saves the .CID or .ICD file on the PC's hard drive as a separate .CID or .ICD file.
5. Export data set info
   Exports the data set information into a .txt file which can then be viewed in table format with tools such as Excel.
6. Export logical node info
   Exports the info of logical nodes currently activated into a .txt file which can then be viewed in table format with tools such as Excel.
7. Configurations
   Opens the main configurations pop-up window.
8. Edit data sets
   Opens the data set editing window.
9. Edit logical nodes
   Opens the logical node editing window. Used for enabling and disabling logical nodes.
10. Send to relay
    Sends the .CID/.ICD configurations to the device (requires a connection to the device).
11. Import GOOSE settings
    Imports GOOSE signals of another device from a .CID/.ICD file and connects them to the GOOSE inputs in this device.
12. Get default .CID/.ICD file from the device
    Retrieves the default .CID/.ICD file from the device (requires a connection to the device).

Configurations

Figure. 8.10.1 - 165. Opening the "Configurations" window.

The main configurations dialog window is opened by pressing the seventh button ("Configurations") in the main toolbar (see the figure above). The most important parameters here are the "IED name" and the "IP" settings.

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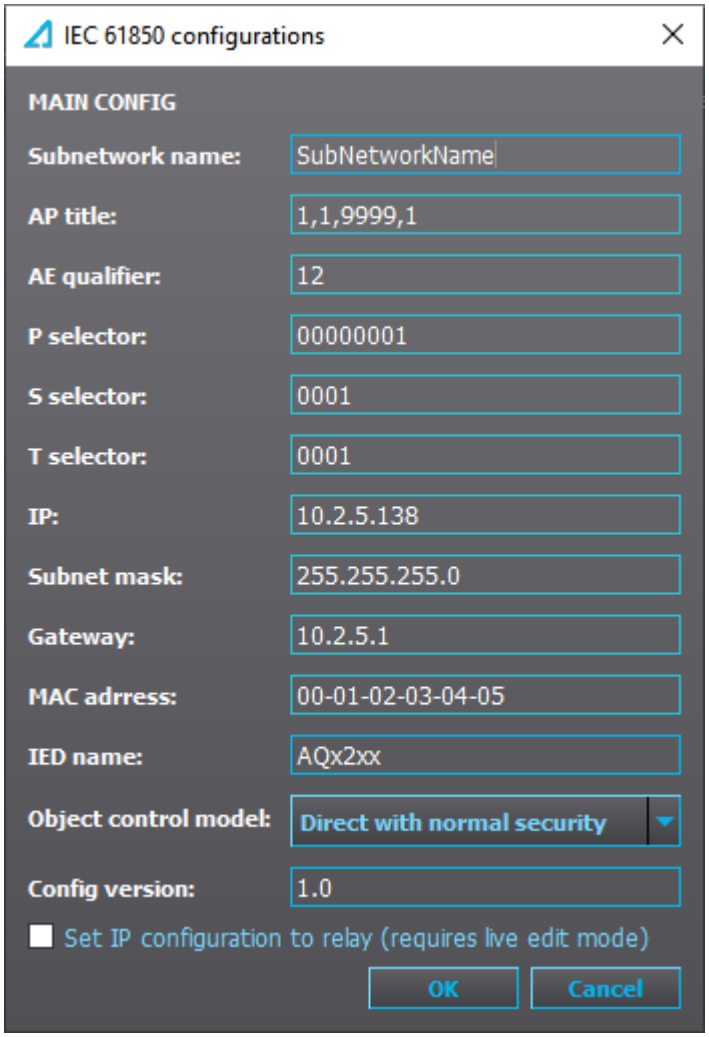
Figure. 8.10.1 - 166. "Configurations" window.

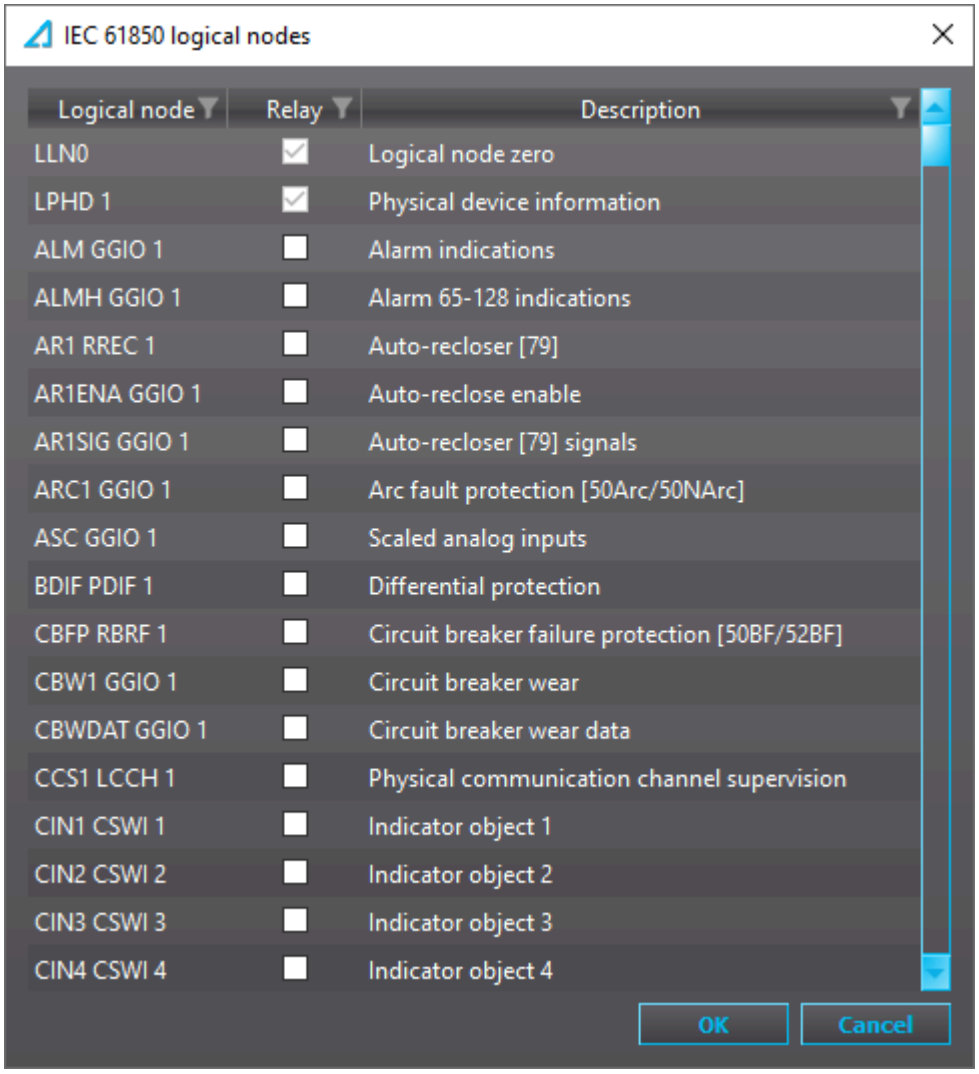


Edit logical nodes

Figure. 8.10.1 - 167. Opening the "Edit logical nodes" window.

You can open the logical node editor by pressing the ninth button on the main toolbar (see the figure above). The logical node editor is used for selecting which logical nodes are available in the data set editor. If a logical node is selected in the "Edit logical nodes" tool, it is possible to add that logical node to a data set in the "Data set editor".

Figure. 8.10.1 - 168. "Edit logical nodes" window.



Logical node list can be filtered by right clicking any of the funnel symbols (see the figure below).

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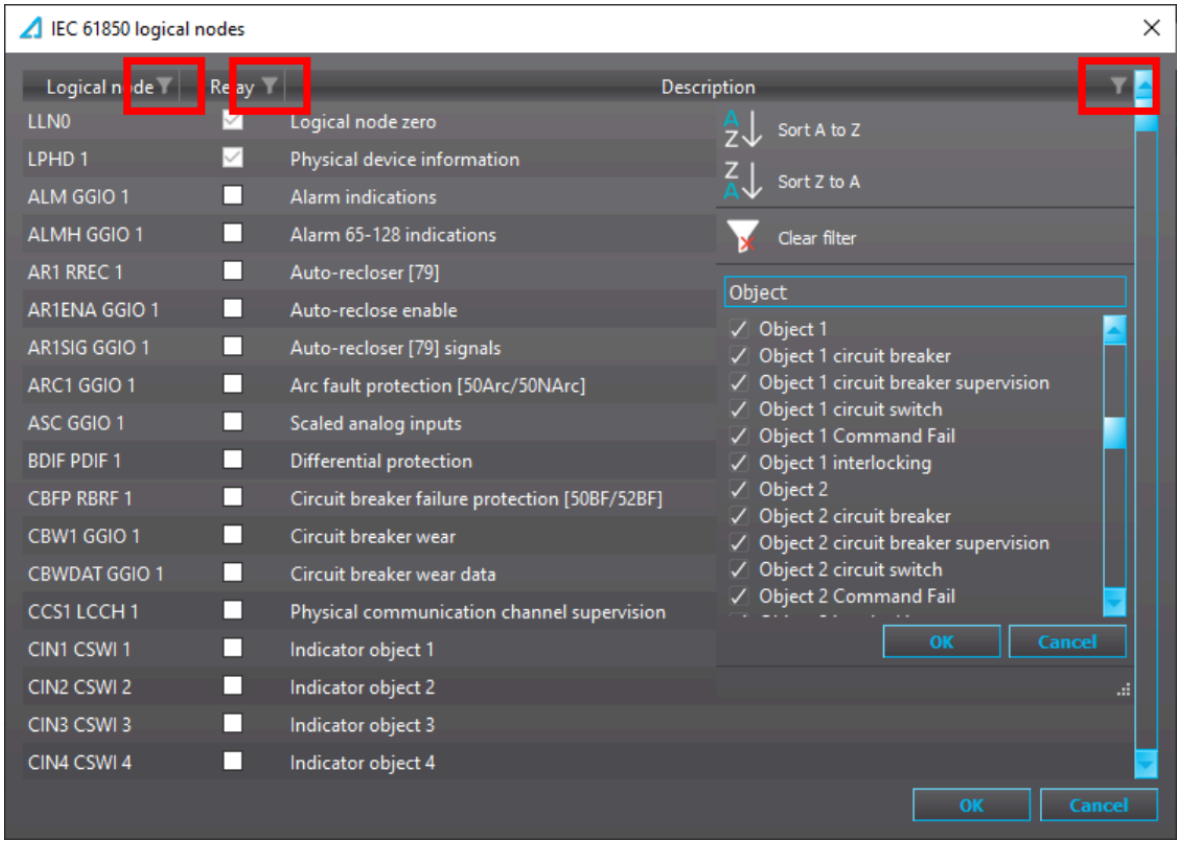
Figure. 8.10.1 - 169. Filtering logical nodes.

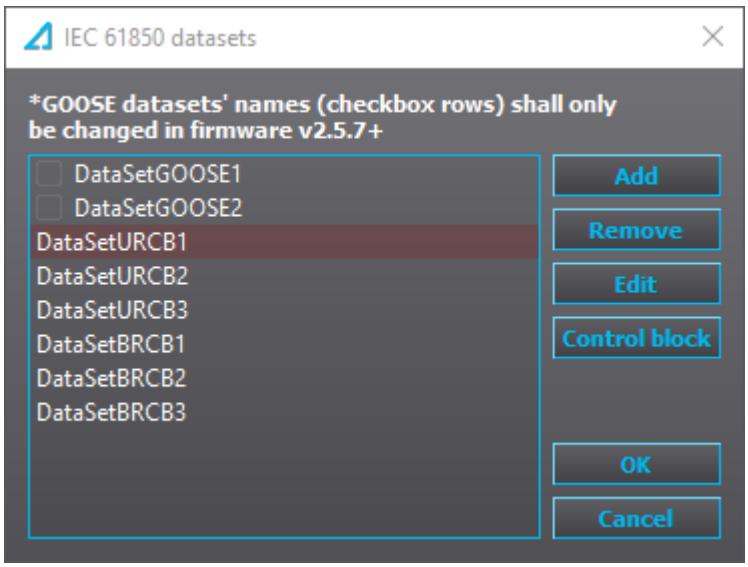


Data sets

Figure. 8.10.1 - 170. Opening the "Data set editing" window.

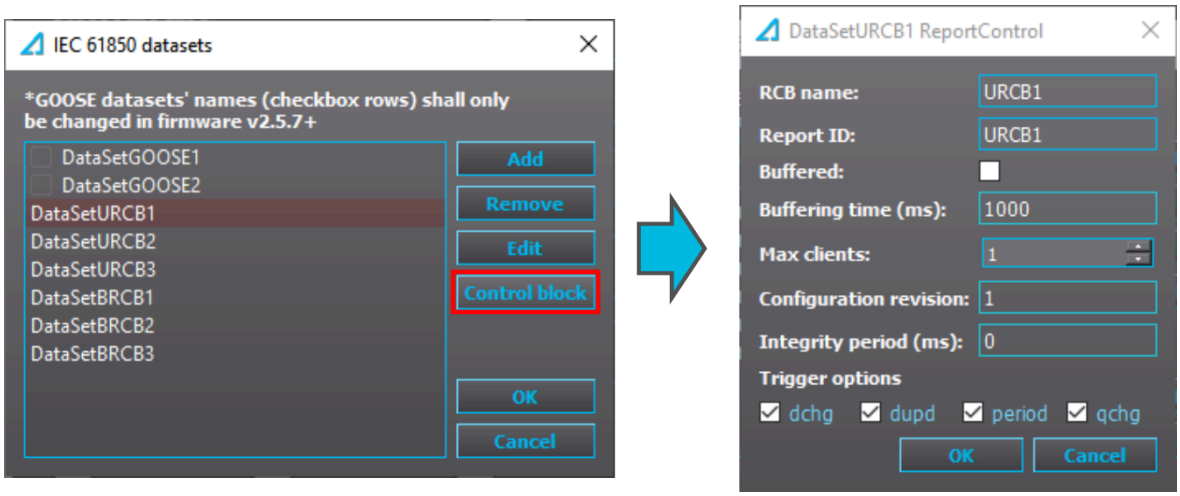
The data set editing window is opened by pressing the eighth button on the main toolbar (see the figure above).

Figure. 8.10.1 - 171. "Data set editing" window.



Data sets can be added and removed by using the "Add" and "Remove" buttons, respectively. GOOSE data sets can't be removed but they can be enabled and disabled with the checkbox. If both of the GOOSE publisher data sets are un-checked, the GOOSE publisher service is disabled (see the figure below, image on the left). Up to six (6) data sets can be used. When a data set has been added, its report control block (RCB) settings can be set with the "Control block" button. This opens a new pop-up window (see the figure below, image on the right).

Figure. 8.10.1 - 172. Report control block settings.



In ReportControl settings you can set the name of the RCB and the Report ID, whether or not the data set is buffered, the buffering time (if the data set is buffered), the maximum number of clients that can connect to the data set at any one time, the configuration revision, as well as the integrity period. The integrity period can be used to force the data set to refresh the data set even when there has not been any changes.

The table below lists all the RCB settings and their functions.

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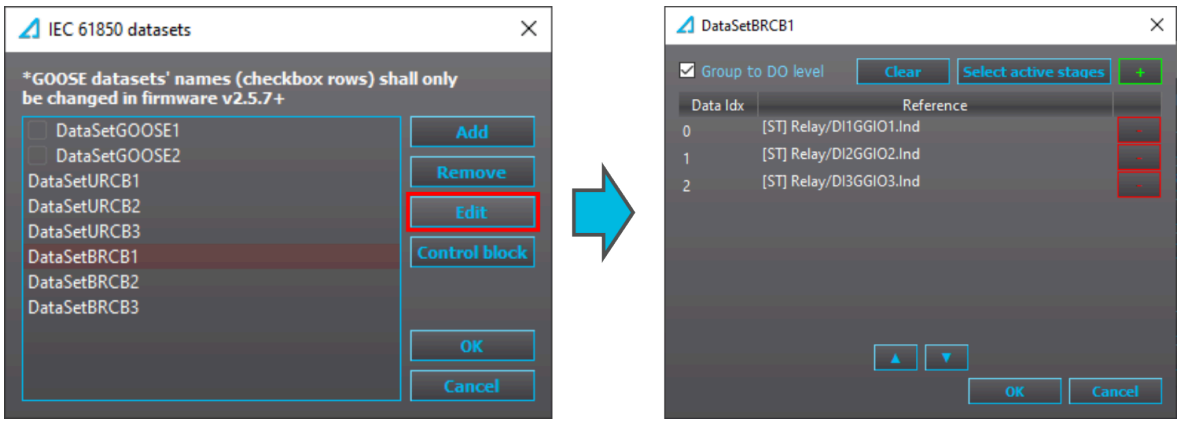
Table. 8.10.1 - 7. RCB settings.

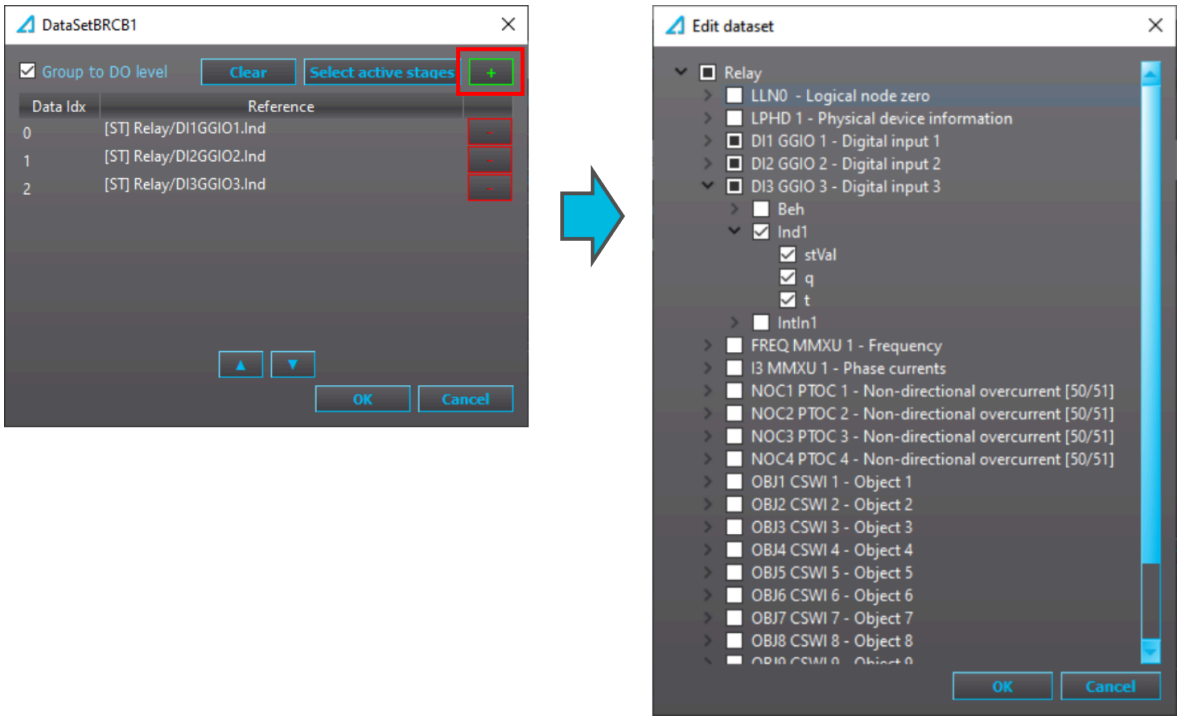
Name	Description
RCB name	Defines the Report Control Block's name. **NOTICE!** Please note that each Report Control Block has an RCB reference! The reference is built from the RCB name like this: LogicalDeviceName/ LogicalNodeName.RCBName.
Report ID	Identifies the Report Control Block. If this parameter is not set, the RCB reference will be used. The report ID ("RptId") will be sent with each report to identify the RCB responsible for the report.
Buffered	Defines whether the reporting is buffered or not. If the reporting is buffered, the reports are buffered by the device if the connection to a client(s) is lost. Reports are then sent after the client has connected again.
Buffering time (ms)	Defines how long the reports are buffered for if the data set has been set as "Buffered".
Max clients	Defines how many clients are allowed to connect to the data set.
Configuration revision	Defines the configuration revision.
Integrity period (ms)	Can be used to force the data set to refresh even when there has not been any changes.
Trigger options	Determines the default trigger options and they can be configured for the RCBs. These can, however, be changed by the client prior to enabling reporting.
dchg	Defines the trigger report on a data change event.
dupd	Defines the trigger report on a data update.
period	Defines the trigger report periodically (please refer to the "Integrity period (ms)" parameter in this table).
qchg	Defines the trigger report on a quality change event.

Figure. 8.10.1 - 173. "Data set editing" window.



All data sets can be edited (see the figure above). The data set editing dialog is opened by selecting the data set you want to edit and then clicking the "Edit" button. The editing dialog shows all the entries of the data set that are currently configured. An entry can be removed from the data set by clicking the red "-" button located at the end of the entry's row.

Figure. 8.10.1 - 174. Data selection on the data attribute level.



New entries can be added and old ones edited by clicking the green "+" button at the top right of the window (see the figure above). "Edit dataset" window lists all logical nodes that have been activated in "Edit logical nodes" window. For URCB and BRCB data sets it is recommended that the data is selected on the doName (**d**ata **o**bject) level. This way all available information (such as status, quality, and time) is always sent in the report.

Data can also be selected on daName (**d**ata **a**ttribute) level, which selects each individual piece of data. This approach may be preferred over GOOSE data sets. The nature of GOOSE communication is such that same frame is repeatedly sent. The interval between frames increases until the interval is 2 seconds, which is the keep-alive rate. If a data value in the GOOSE data set changes, the interval is reduced again. Time stamp information is not relevant in this kind of communication. In GOOSE data sets we recommend that only value and quality attributes are added.

NOTICE!
Up to 65 signals can be added to each data set!

Settings

The general setting parameters for the IEC 61850 protocol are visible both in AQtivate and in the local HMI (*Communication → Protocols → IEC61850*). The settings are described in the table below.

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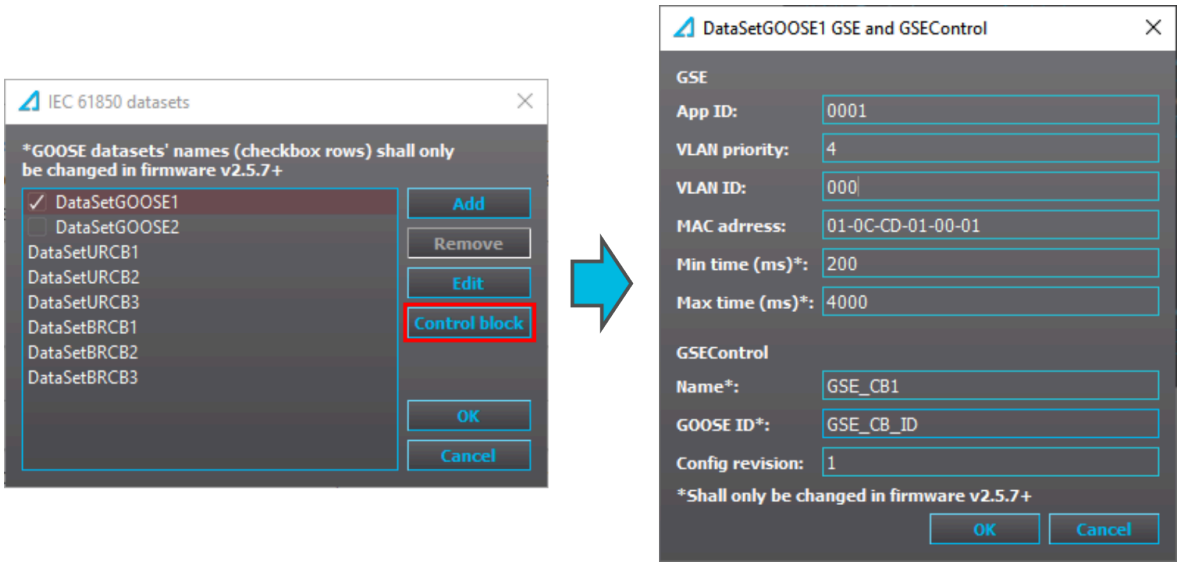
Table. 8.10.1 - 8. General settings.

Name	Range	Step	Default	Description
Enable IEC 61850	0: Disabled 1: Enabled	-	0: Disabled	Enables and disables the IEC 61850 communication protocol.
Reconfigure IEC 61850	0: - 1: Reconfigure	-	0: -	Reconfigures IEC 61850 settings.
IP port	0…65,535	1	102	Defines the IP port used by the IEC 61850 protocol. The standard (and default) port is 102.
IEC61850 edition	0: Ed1 0: Ed2	-	-	Displays the IEC 61850 edition used by the device. The edition can be chosen by loading a new .CID file at *Tools → Communication → IEC 61850* with the *Open* button.
Control Authority switch	0: Remote Control 1: Station Level Control	-	0: Remote Control	The device can be set to allow object control via IEC 61850 only from clients that are of category "Station-level control". This would mean that other remote control clients would not be allowed to control. In Remote Control mode all IEC 61850 clients of both remote and station-level control are allowed to control objects.
Ethernet port	0: All 1: COM A 2: Double ethernet card	-	0: All	Determines which ports use IEC 61850.
Configure GOOSE Subscriber from CID file allowed	0: Disabled 1: Allowed	-	0: Disabled	In edition 2 of IEC 61850 the configuration of the GOOSE subscriber is a part of the .CID file. This setting determines if it is possible to import published GOOSE settings from another device with a .CID file and set them as GOOSE inputs at *Tools → Communication → IEC 61850 → GOOSE subscriptions*.
General deadband	0.1…10.0 %	0.1 %	2 %	Determines the general data reporting deadband settings.
Active energy deadband	0.1…1000.0 kWh	0.1 kWh	2 kWh	Determines the data reporting deadband settings for this measurement.
Reactive energy deadband	0.1…1000.0 kVar	0.1 kVar	2 kVar	Determines the data reporting deadband settings for this measurement.
Active power deadband	0.1…1000.0 kW	0.1 kW	2 kW	Determines the data reporting deadband settings for this measurement.
Reactive power deadband	0.1…1000.0 kVar	0.1 kVar	2 kVar	Determines the data reporting deadband settings for this measurement.
Apparent power deadband	0.1…1000.0 kVA	0.1 kVA	2 kVA	Determines the data reporting deadband settings for this measurement.
Power factor deadband	0.01…0.99	0.01	0.05	Determines the data reporting deadband settings for this measurement.
Frequency deadband	0.01…1.00 Hz	0.01 Hz	0.1 Hz	Determines the data reporting deadband settings for this measurement.

Name	Range	Step	Default	Description
Current deadband	0.01…50.00 A	0.01 A	5 A	Determines the data reporting deadband settings for this measurement.
Residual current deadband	0.01…50.00 A	0.01 A	0.2 A	Determines the data reporting deadband settings for this measurement.
Voltage deadband	0.01…5000.00 V	0.01 V	200 V	Determines the data reporting deadband settings for this measurement.
Residual voltage deadband	0.01…5000.00 V	0.01 V	200 V	Determines the data reporting deadband settings for this measurement.
Angle measurement deadband	0.1…5.0 deg	0.1 deg	1 deg	Determines the data reporting deadband settings for this measurement.
Integration time	0…10 000 ms	1 ms	0 ms	Determines the integration time of the protocol. If this parameter is set to "0 ms", no integration time is used.
GOOSE Ethernet port	0: All 1: COM A 2: Double ethernet card	-	0: All	Determines which ports can use GOOSE communication.

For more information on the IEC 61850 communication protocol support, please refer to the conformance statement documents (MICS, PICS, PIXIT, & TICS) for both AQ 210 series and AQ 250 series on Arcteq's website (www.arcteq.fi/documents-and-software/→ *AQ 200 series* → *Resources*).

GOOSE publisher



There are two (2) GOOSE data sets available. By default they are both off. To activate them click on their respective checkbox (see the figure above, image on the left).

In Control block settings you can set the specific GOOSE publisher settings. The right side of the figure above shows the GOOSE control block parameters, and they are used to configure the GOOSE publisher.

The following lists all these parameters and their functions:

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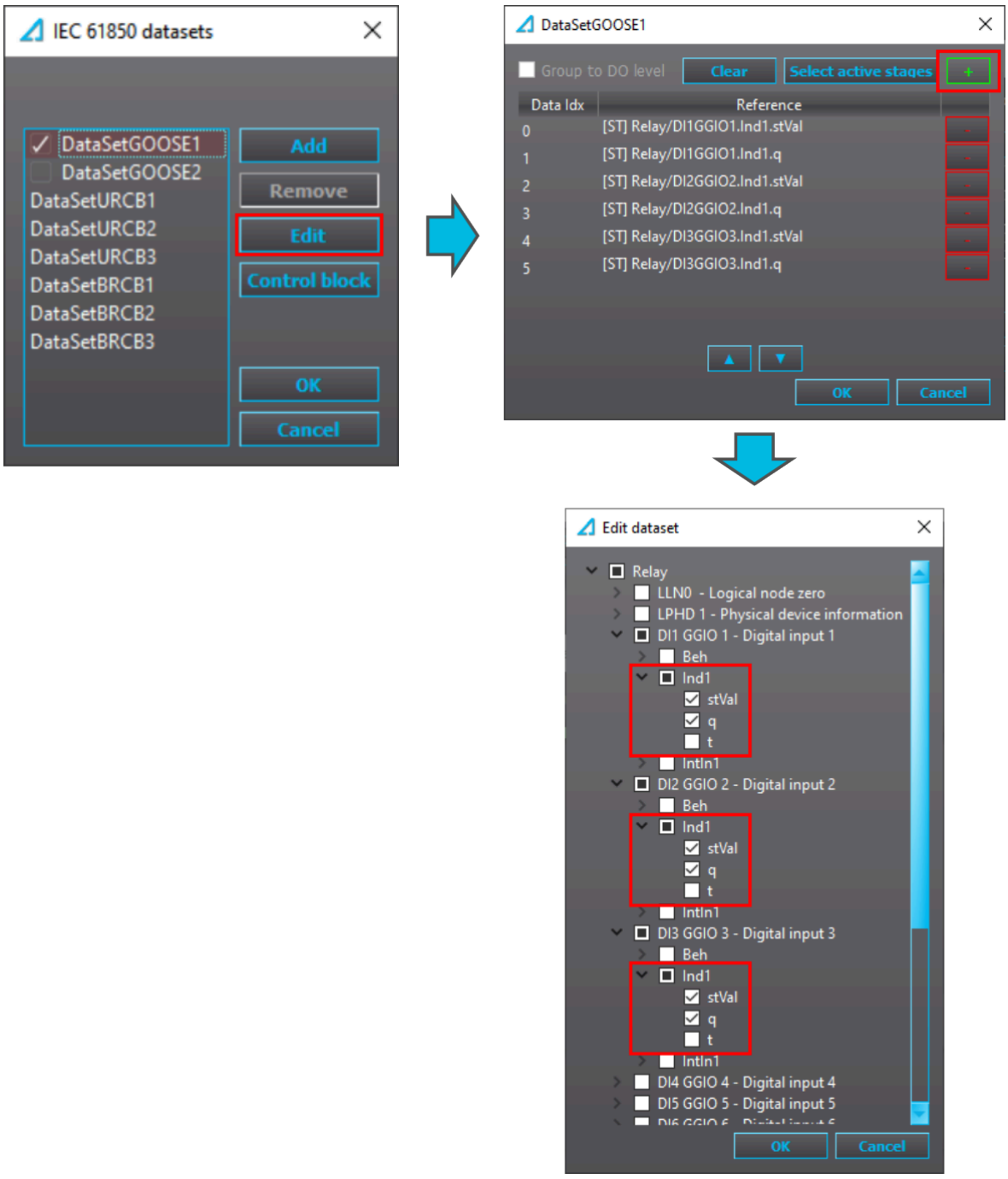
- App ID
  Stands for "Application Identification". This hexadecimal parameter defines the ID of the published GOOSE data from this unit. The App ID must be unique in the network, as it is used in the subscriber to identify the incoming GOOSE data frame.
- VLAN Priority and VLAN ID
  Together these parameters are used to build sub-networks in the system utilizing intelligent switches.
- MAC address
  Defines the multicast address to which the GOOSE publisher is sending its frames.
- Min time (ms) and Max time (ms)
  Defines the minimum and maximum times in milliseconds for the GOOSE publisher.
- Name and GOOSE ID
  Define the name and the unique ID for the GSE control.
- Config revision
  Stands for "Configuration revision", and can be considered to be the version number of the GOOSE dataset.

Figure. 8.10.1 - 175. Example of GOOSE publisher signal setup.



The example above is a typical setup for a GOOSE subscriber data set. GOOSE data set 1 is enabled with a checkbox. The status ("stVal") and quality ("q") of the three first digital inputs are added to the data set. Each signal then has a data index starting from zero and counting up.

NOTICE!
Both GOOSE data sets can hold up to sixteen (16) signals each!

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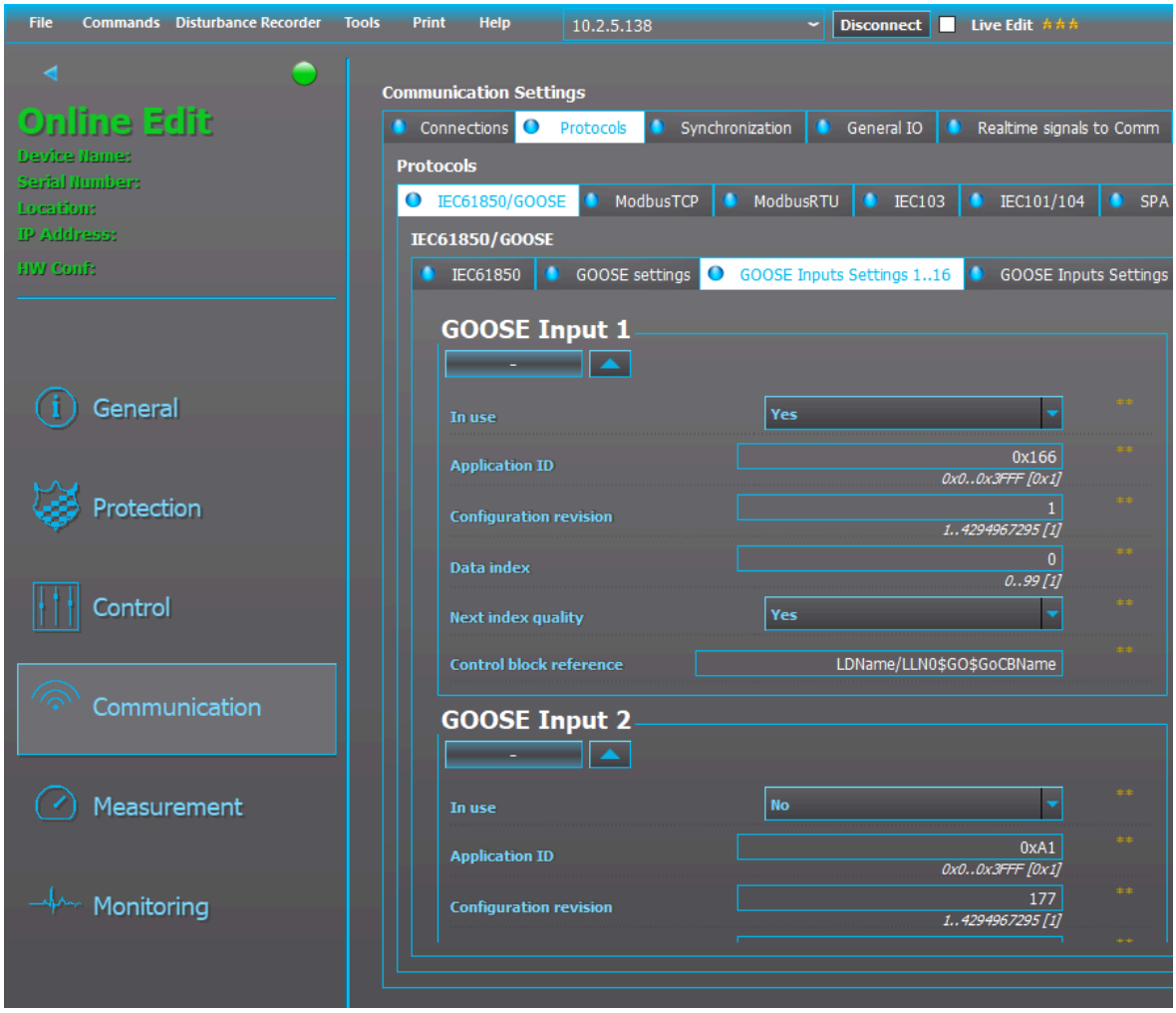
GOOSE subscribing

A GOOSE subscriber is enabled with the "GOOSE subscriber enable" parameter, which can be found under the *Communication → Protocols → IEC61850/GOOSE → GOOSE settings* view. There are 64 independent GOOSE inputs available in the device. For each of the inputs there are five (5) settings: "In use", "Application ID", "Configuration Revision", "Data index", "Next index quality", and "Control block reference". These settings are used to pair an input with a single data point in the published frames in the system.

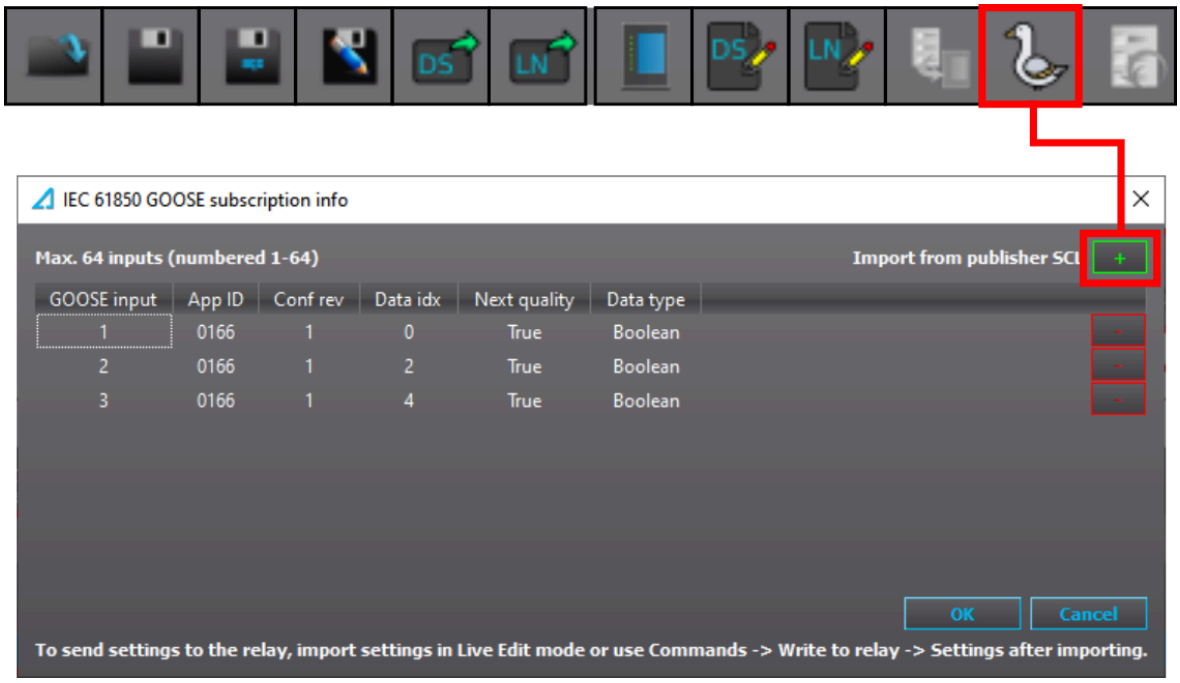
Figure. 8.10.1 - 176. Example of the GOOSE subscriber settings.



In the figure above GOOSE Input 1 has been configured to receive the DI1 input value that was configured in the previous chapter's configuration. "Next index quality" has been enabled which means that the device will assume the next DataIdx (0+1 = 1) to be of the same quality as the GOOSE signal.

In the figure above the GOOSE input was configured manually, but they can be also configured by importing a GOOSE publisher's .CID file and assigning signals to the GOOSE inputs. This can be done in the "GOOSE settings" tab in the IEC 61850 editor (see the figure below). If the Live Edit mode is activated, the settings are loaded into the device automatically. If the Live Edit mode is not active, the parameters take effect when the parameters are loaded into the device with the *Write to relay* command.

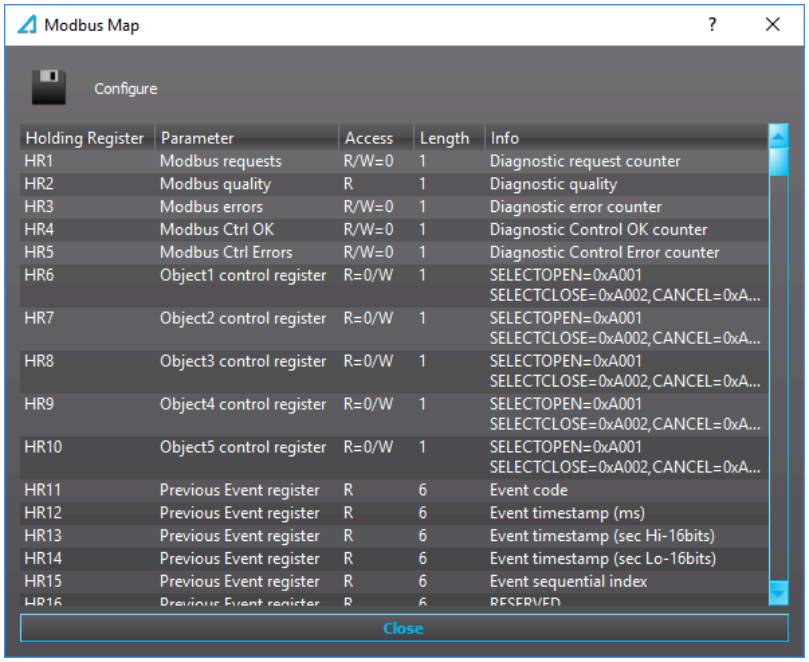
Figure. 8.10.1 - 177. Importing a GOOSE publisher's .CID file.



8.10.2 Modbus map

You can access Modbus-related information by opening the "Modbus map" dialog (see the figure below) from *Tools* → *Communication*. The Modbus map can be saved as a text file (.txt) by clicking the "Save" button (the floppy disk icon).

Figure. 8.10.2 - 178. "Modbus map" window.



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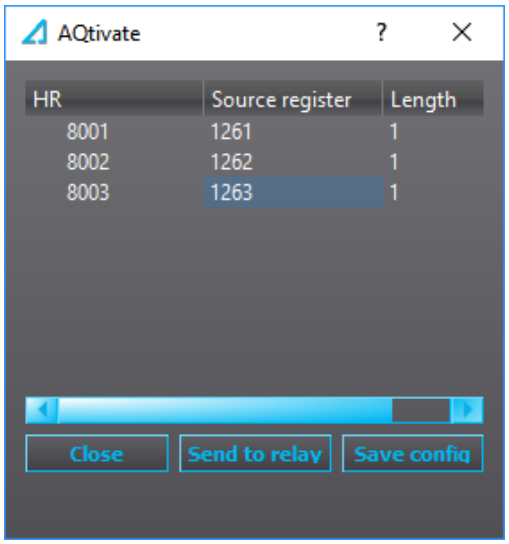
All signal holding registers in the default map are fixed, which means that they cannot be edited by the user. If you need custom holding registers, you can use the Modbus configurator to change the used Modbus map. The Modbus configurator can be found at *Tools → Communication → Modbus configurator* (see the figure below). The fixed holding registers can be also reassigned to user-defined holding registers with the "Configure" button in the Modbus map window. This brings up a smaller pop-up window, where you can add a new row by right-clicking and choosing "Add". You can then choose the holding register you want to use in the new holding register. The holding registers that users can edit start their numbering from 8001.

Figure. 8.10.2 - 179. Custom holding registers.



8.10.3 Modbus configurator

This tool is used to make changes to the register map when communicating using a Modbus protocol.

Available buttons

Button	Description
	Load old configuration
	Preview
	Export to .txt
	Save to .aqs
	Send to .aqs

Button	Description
	Sort by HR
	Delete HR(s)
	Undo
	Redo

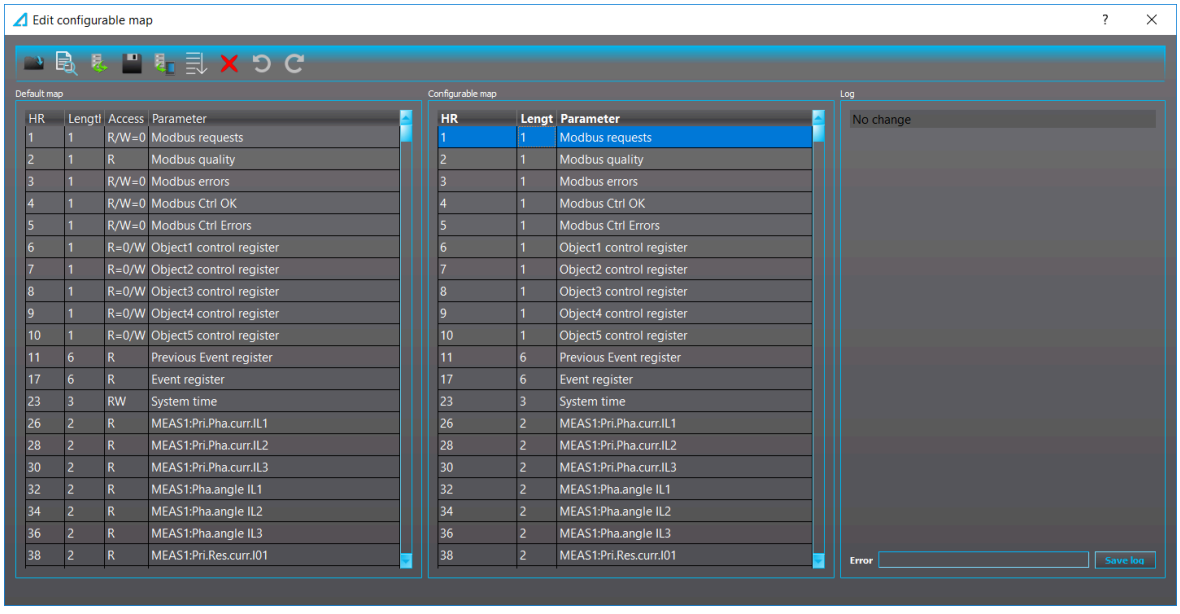
Terms

Term	Description
Holding register (HR)	An object type in Modbus, has Read-Write access, 16 bits in size.
Default map	The static Modbus map that has been used by the device.
Configurable map	The new Modbus map that can be altered.

Usage

The default map is unconfigurable while the configurable map is there for the user to change. If no configuration has been made, it will be a copy of the default map.

Figure. 8.10.3 - 180. Editing the configurable map, based on the default map.



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Limitations

The configurable map is set to only hold 10,000 rows at maximum. In each row, the sum of the values in columns "HR" and "Length" cannot exceed 65,535.

When one of the limitations is reached, the user is notified and they should undo the latest action.

Loading an old configuration

If there are configurations made by the old configuration dialog, there is a button to import it in the toolbar. The old configurations are typically imported once when the new configuration dialog is first used.

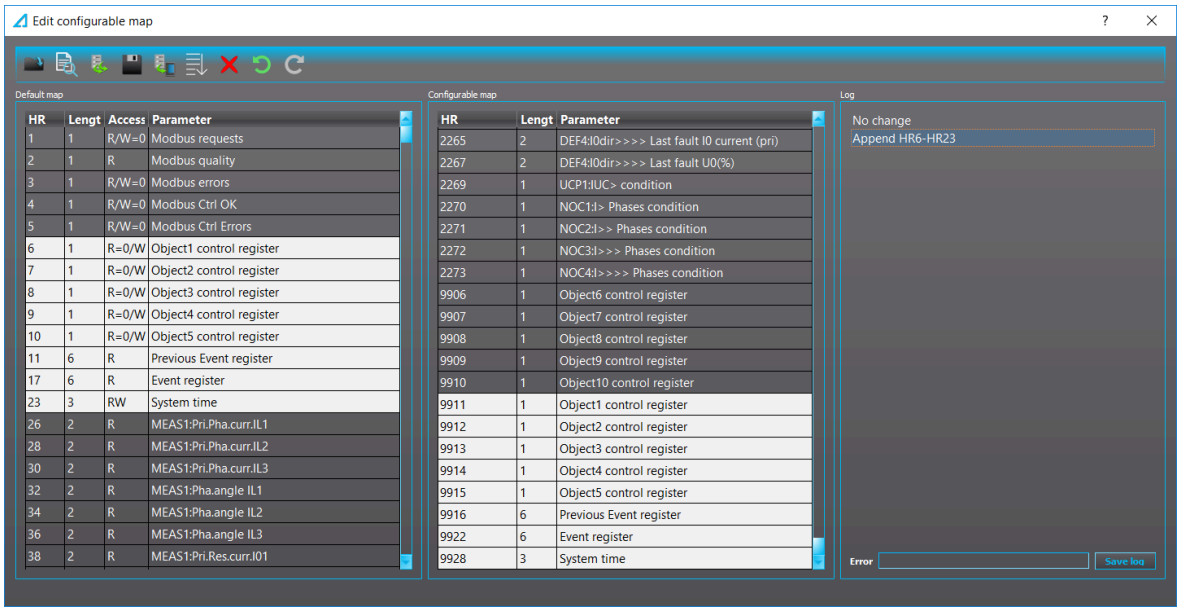
If there are configurations made by the new configuration dialog, the configurations are be loaded automatically. The loading steps are shown in the log section.

Adding data

New data can be copied from the default map to the configurable map following these steps:

1. Select the row(s) you want to copy from the default map.
2. Drag the row(s) on top of the configurable map.
3. Drop the data onto the configurable map.
4. The new data is appended to the configurable map.

Figure. 8.10.3 - 181. Copying rows from the default map to the configurable map.

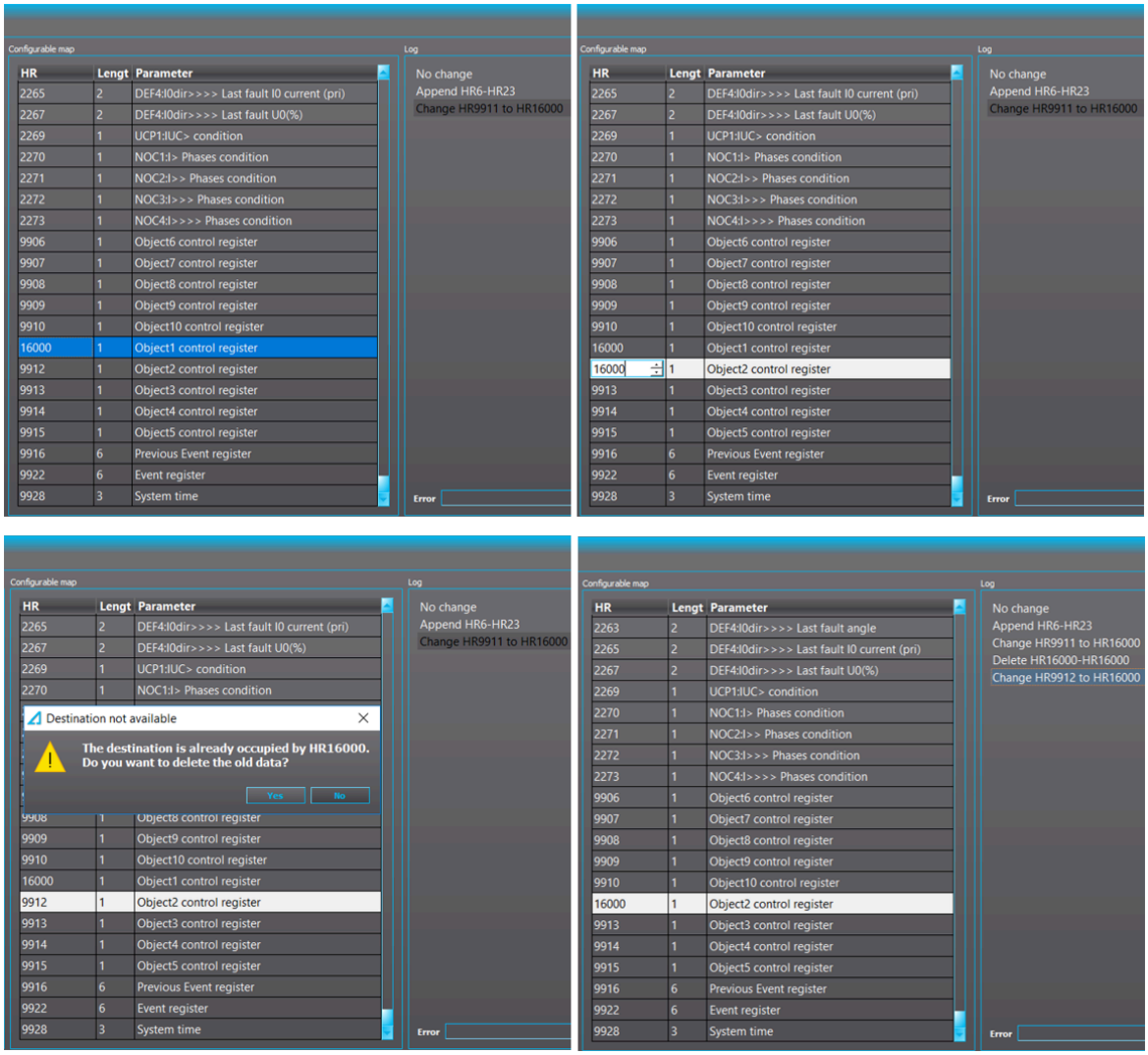


Changing a holding register

The HR can be changed by double-clicking the HR column of the wanted parameter. You can use the arrow buttons or the keyboard arrow keys to select an HR. Before the HR is changed, if there is other data at that destination, the user is notified of the conflict and given two choices:

- Delete the current data at the destination ("Yes").
- Cancel the change ("No").

Figure. 8.10.3 - 182. Changing an HR in the Modbus configutator.



Filling a holding register

This function can be used to change all HRs of multiple consecutive parameters starting from the selected HR.

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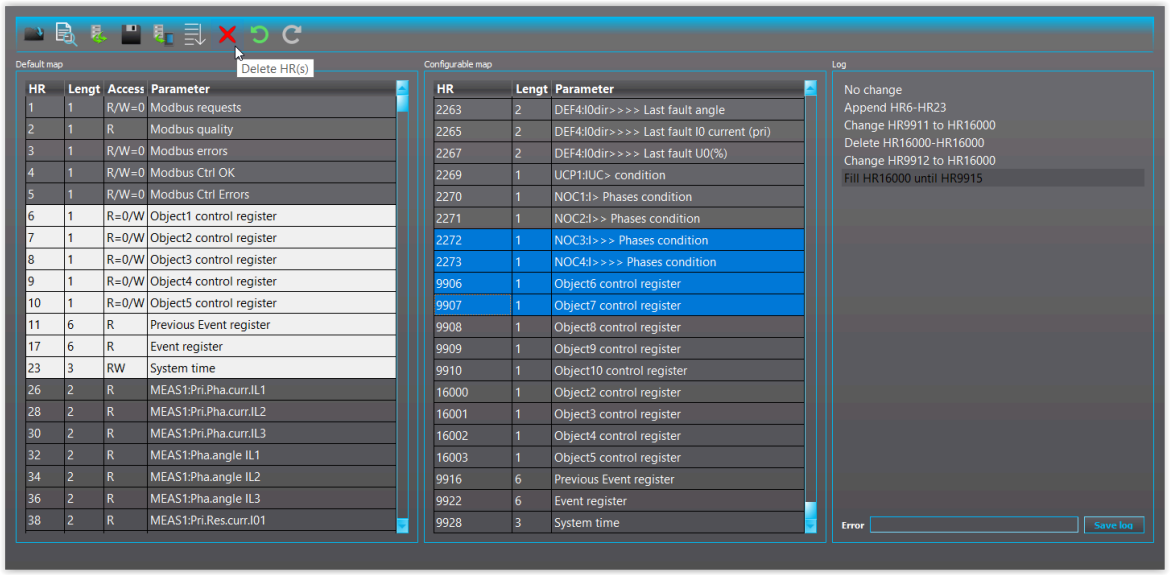
Figure. 8.10.3 - 183. Filling an HR in the Modbus configutator.



To fill a holding register you must first select a row. The cursor becomes a cross cursor when moved near the bottom line of the selection area. While on the cursor, click and drag the mouse to where you want to fill to. While dragging, a tooltip text is shown containing the resulting HR after the fill. The fill is executed after you release the mouse. Filling can be done in both directions, up and down.

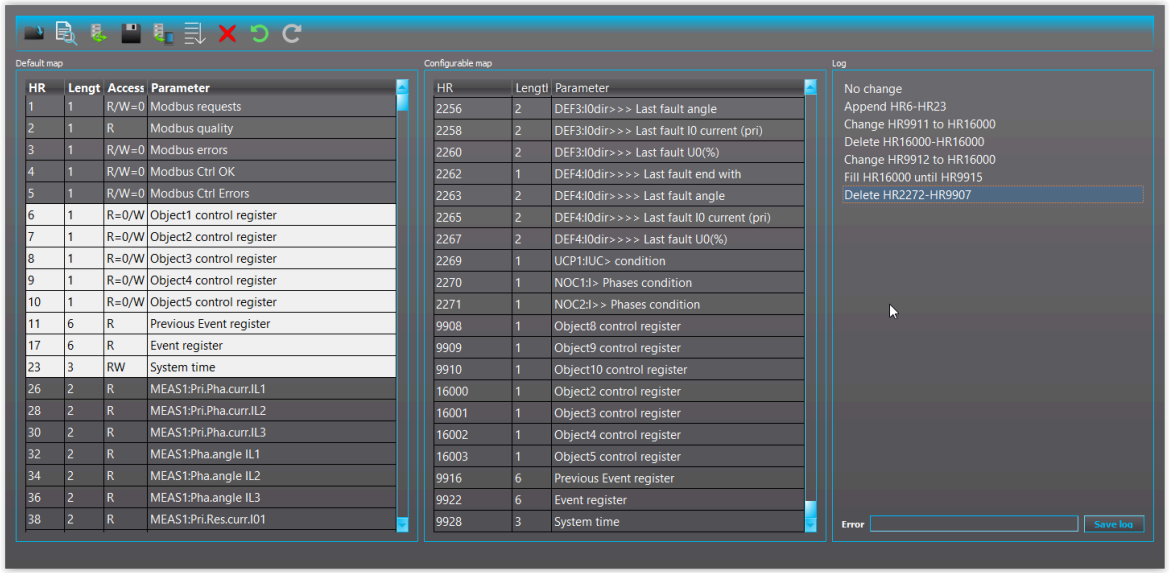
Similar to when changing an HR value, if the destination of the fill is already occupied, the user is notified of the conflict and prompted to choose between deleting the occupied data or cancelling the fill.

Deleting a holding register

HR(s) can simply be deleted by selecting the range to delete and clicking the "Delete" icon (the red X; see the figure below) on the toolbar or by pressing the **Delete** key on the keyboard.

NOTICE!
Please note that the deletion applies only to rows! If the row order is HR5-HR10-HR7, deleting HR5-HR10 will not delete HR7.

Figure. 8.10.3 - 184. Deleting an HR in the Modbus configurator.

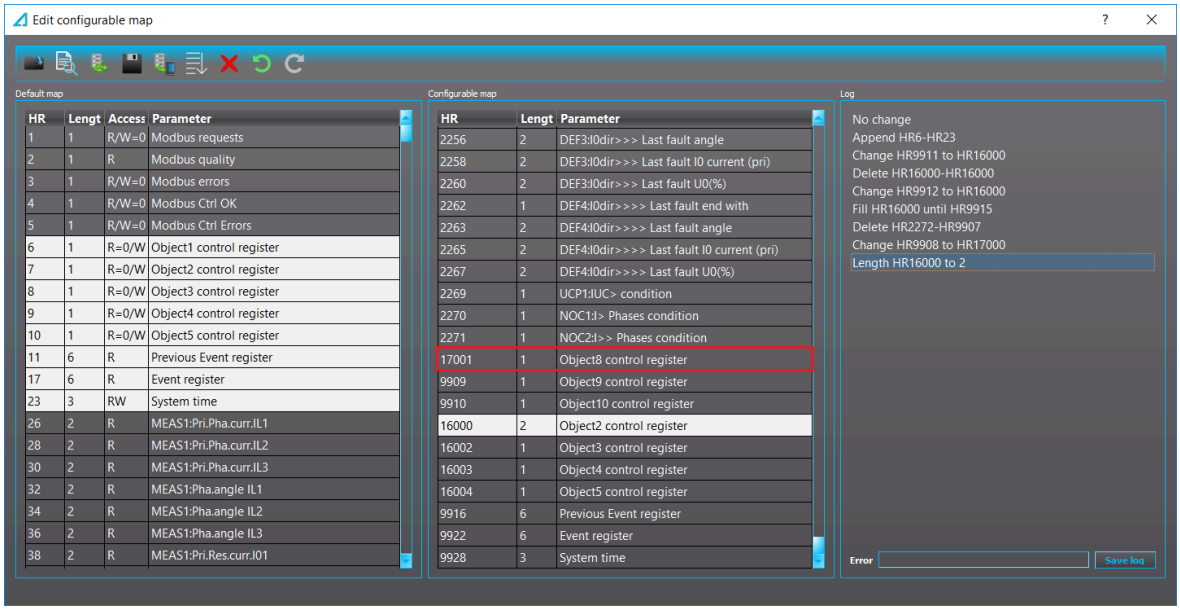


Changing the length of the data

The length of the data can be changed from "1" to "2" and vice versa. This can be done by double-clicking the row that needed to be changed in the configurable map. All the rows with HR greater than the selected row will have their HRs changed accordingly.

If two changes are made consecutively to a row (1 to 2 and back to 1), no log entry is created.

Figure. 8.10.3 - 185. Changing the data length in the Modbus configurator.



Sorting by holding registers

The configurable map can be sorted by HRs using the "Sort by HR" icon on the toolbar (see the figure below). If the map is already sorted, no log entry is created.

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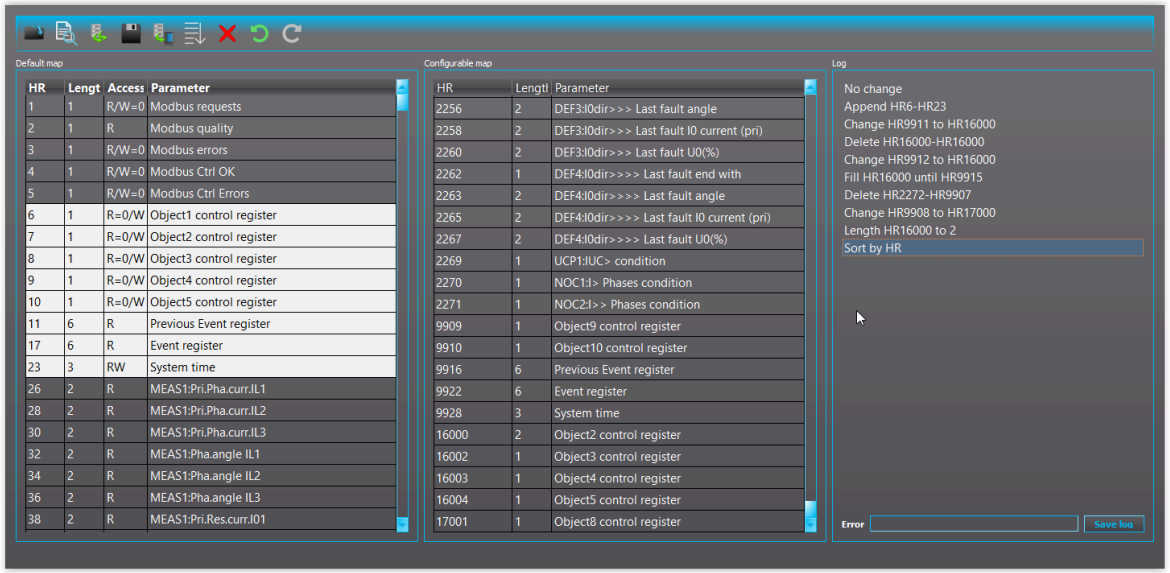
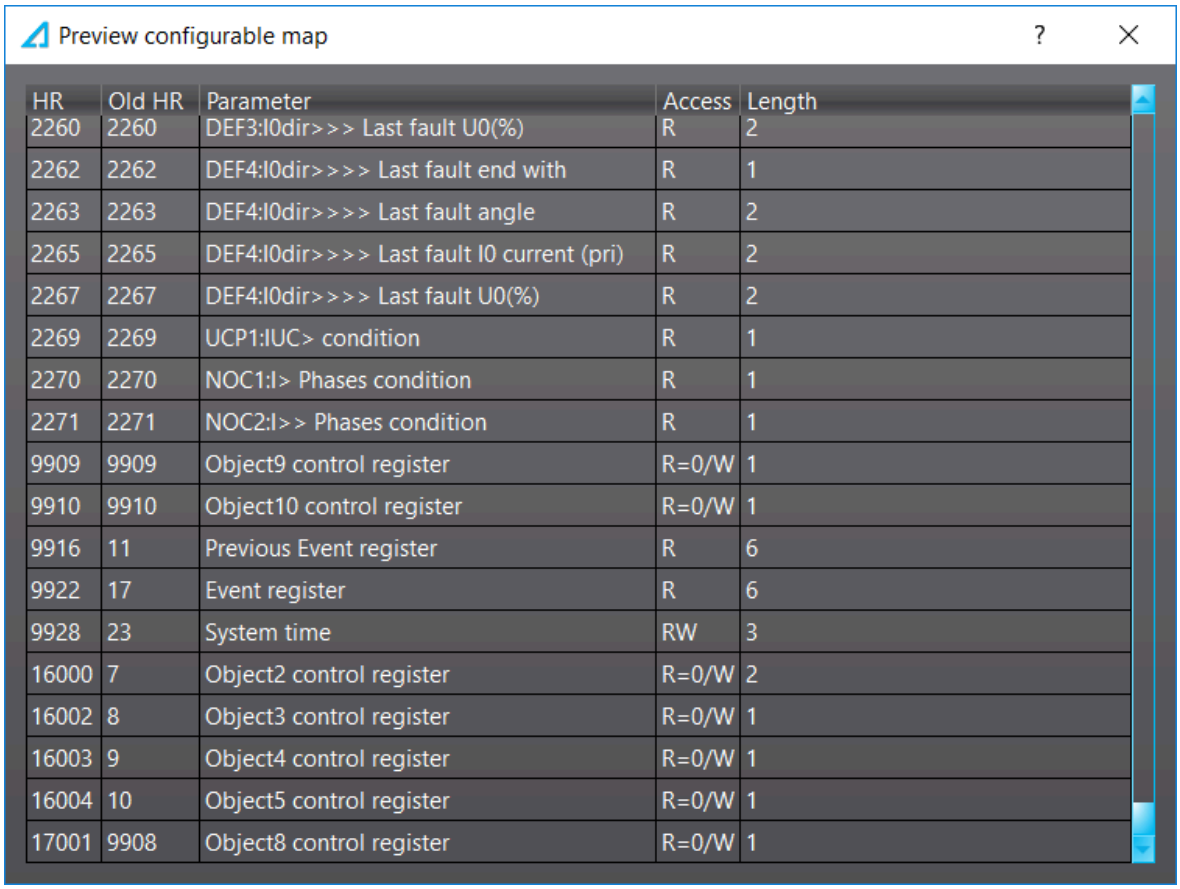
Figure. 8.10.3 - 186. Sorting by HRs in the Modbus configurator.



Previewing the map

A preview of the map can be seen by clicking the "Preview" icon on the toolbar (see the figure below).

Figure. 8.10.3 - 187. Previewing the configurable map.



Exporting the preview map as a text file

The preview map can be exported as a text file using the "Export" icon on the toolbar (see the figure below).

Figure. 8.10.3 - 188. Example of a preview map exported as a text file.

```
HR  Old HR  Parameter   Access  Length

// many lines omitted

2262    2262    DEF4:I0dir>>>> Last fault end with  R   1
2263    2263    DEF4:I0dir>>>> Last fault angle R   2
2265    2265    DEF4:I0dir>>>> Last fault I0 current (pri)  R   2
2267    2267    DEF4:I0dir>>>> Last fault U0(%) R   2
2269    2269    UCP1:IUC> condition R   1
2270    2270    NOC1:I> Phases condition    R   1
2271    2271    NOC2:I>> Phases condition   R   1
9909    9909    Object9 control register    R=0/W   1
9910    9910    Object10 control register   R=0/W   1
9916    11  Previous Event register R   6
9922    17  Event register  R   6
9928    23  System time RW  3
16000   7   Object2 control register    R=0/W   2
16002   8   Object3 control register    R=0/W   1
16003   9   Object4 control register    R=0/W   1
16004   10  Object5 control register    R=0/W   1
17001   9908    Object8 control register    R=0/W   1
```

Undo/Redo

Changes made to the configuration map are displayed in the log section and can be undone and redone.

The Undo action can be executed in any of the following ways listed below:

- Using the key combination Ctrl + Z.
- Clicking on the line in the log section.
- Clicking the "Undo" icon on the toolbar.

The Redo action can be executed in any of the following ways listed below:

- Using the key combination Ctrl + Y.
- Clicking on the line in the log section.
- Clicking the Redo icon on the toolbar.

Save and write to the device

The configuration is saved to the .aqs file after you click the "Save" icon on the toolbar.

You can send the configuration to the device by clicking the "Send to relay" icon on the toolbar.

The configuration can also be sent from the AQtivate menu bar: choose *Commands → Write To Relay*, check the "Modbus cfg" box in the pop-up window's list and then click the "Write" button.

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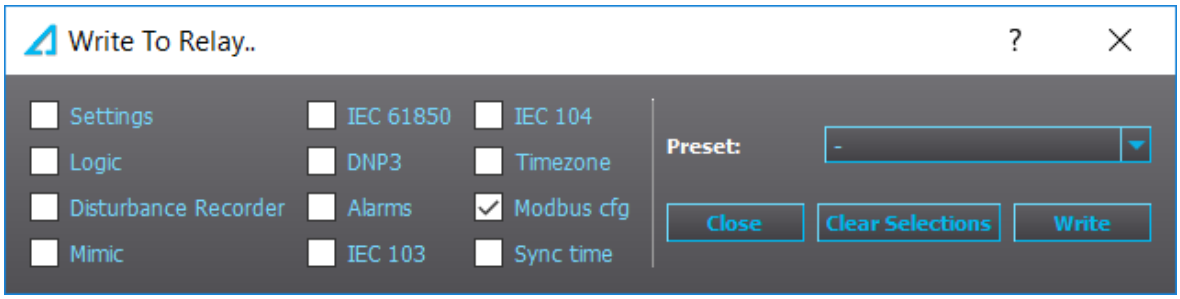


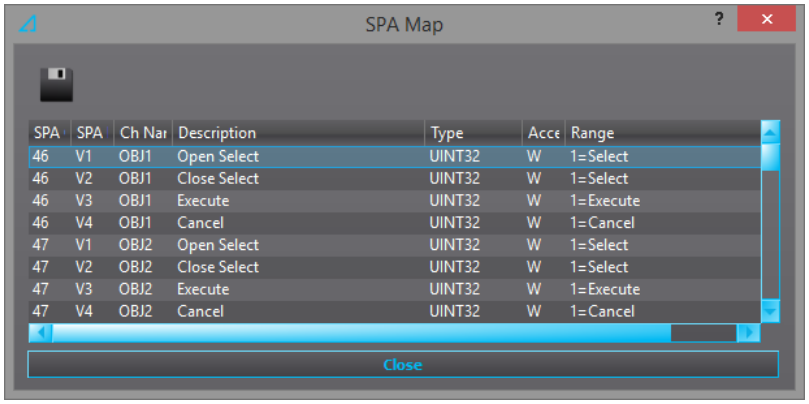
If no configuration file exists (e.g. the user may have forgotten to save it), there can be errors sending it to the device.

After sending the configuration file, Modbus must be turned off and on again for the changes to apply.

8.10.4 SPA map

You can access SPA-related information by opening the "SPA map" dialog from the *Tools* menu. The SPA map can be saved as a text file with the "Save" button (the floppy disk icon).

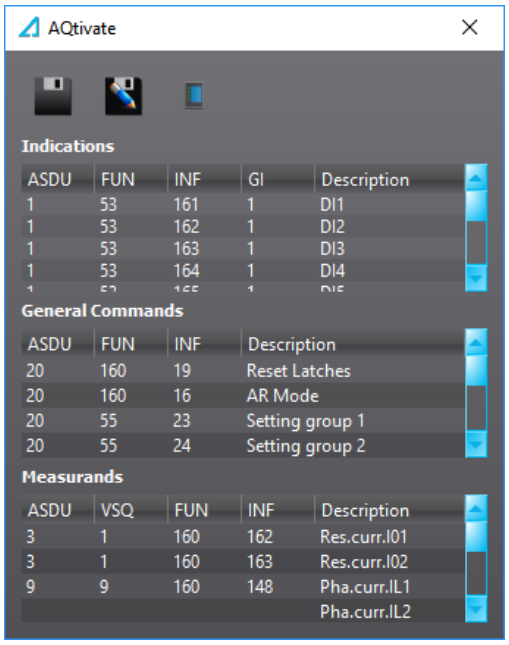
Figure. 8.10.4 - 189. "SPA map" window.



All SPA events can be found in *Tools* → *Events and registers* → *Event list*.

8.10.5 IEC 103

Figure. 8.10.5 - 190. IEC 103 map editor.



The IEC 103 map editor lists the addresses of the various signals. The user can set the General interrogation (GI) to 0 or 1.

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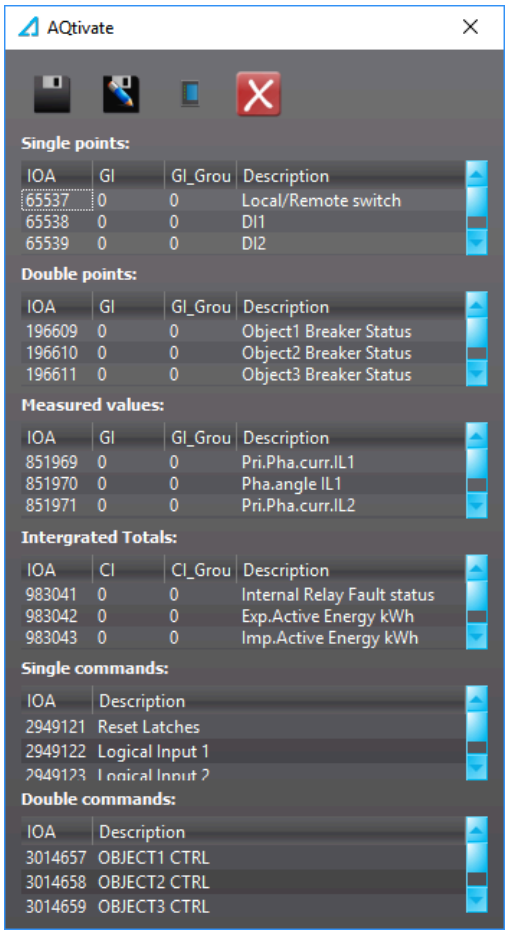
8.10.6 IEC 101/104

Figure. 8.10.6 - 191. 101/104 tool.



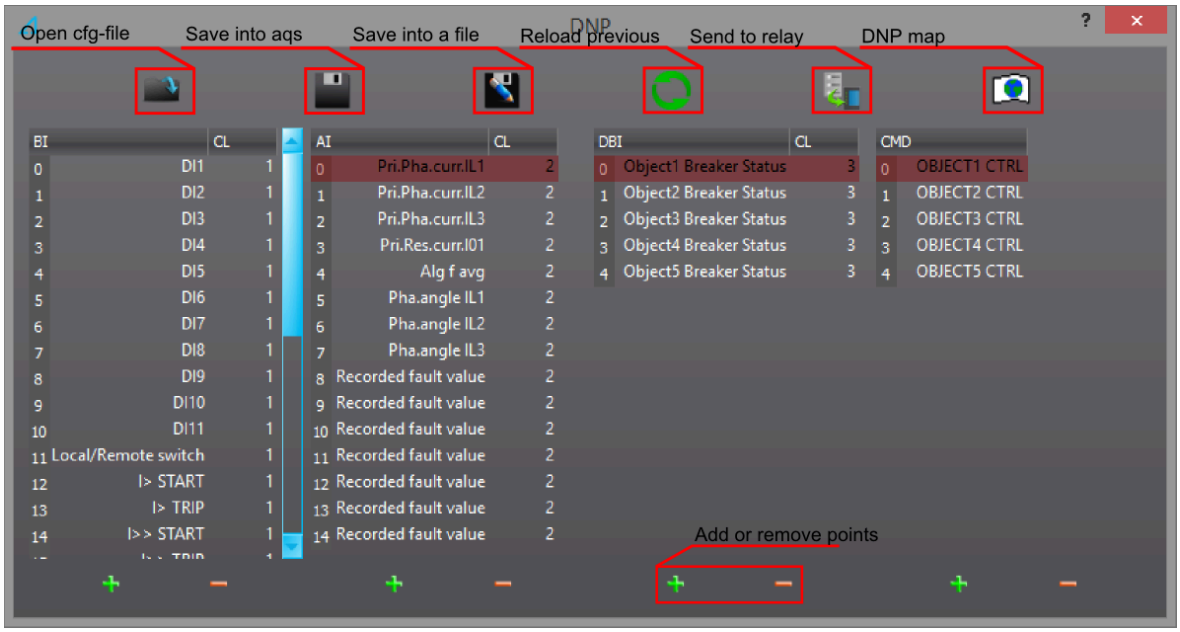
The IEC 101/104 tool displays all signals available with the communication protocols. The user can define both the General interrogation (GI) and the GI groups for the signals.

8.10.7 DNP

You can access DNP-related information and settings by opening the "DNP" dialog from the *Tools* menu.

When the DNP map is ready, it can be saved as a text file by clicking the "DNP map" button (the earth flag icon) and then the "Save" button (the floppy disk icon). See the figure below for further explanations of the DNP map's various icons.

Figure. 8.10.7 - 192. "DNP map" window and its various icons explained.



8.10.8 Modbus Gateway

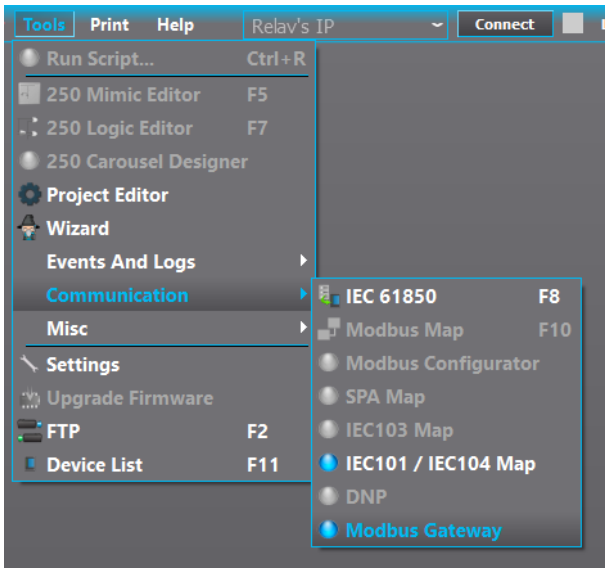
Modbus Gateway is a feature supported by all AQ 250 series devices. It serves as a gateway, polllng data from Modbus RTU slaves and Modbus TCP servers as well as making data of those available to IEC 61850.

For simplicity, this chapter abbreviates Modbus RTU slaves and Modbus TCP servers as "RTU slaves" and "TCP slaves", respectively. The data acquired from the slaves is called "virtual inputs".

Configure Modbus Gateway

The configuration dialog for the gateway can be opened from AQtivate's main toolbar under *Tools → Communication*.

Figure. 8.10.8 - 193. Opening Modbus Gateway.



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An empty configuration is shown in the figure below.

Figure. 8.10.8 - 194. Example of an empty configuration.

The following table explains the icons on the gateway's toolbar.

Table. 8.10.8 - 9. Modbus gateway's toolbar.

Button	Description
	Open an existing configuration file (.csv).
	Save the currently open file.
	Save the configuration to the current .aqs file. NOTICE! This button is enabled only when an AQS file is open in AQtivate!
	Save the configuration as a .csv file.
	Send the configuration to the device.

Configuring the slave

A slave can be added by pressing the green plus sign ("+") at the bottom of the slave list and can be deleted using the red minus sign ("-") next to the slave's name. The maximum number of slaves is sixteen (16).

Figure. 8.10.8 - 195. Configurations for an RTU slave and a TCP slave.

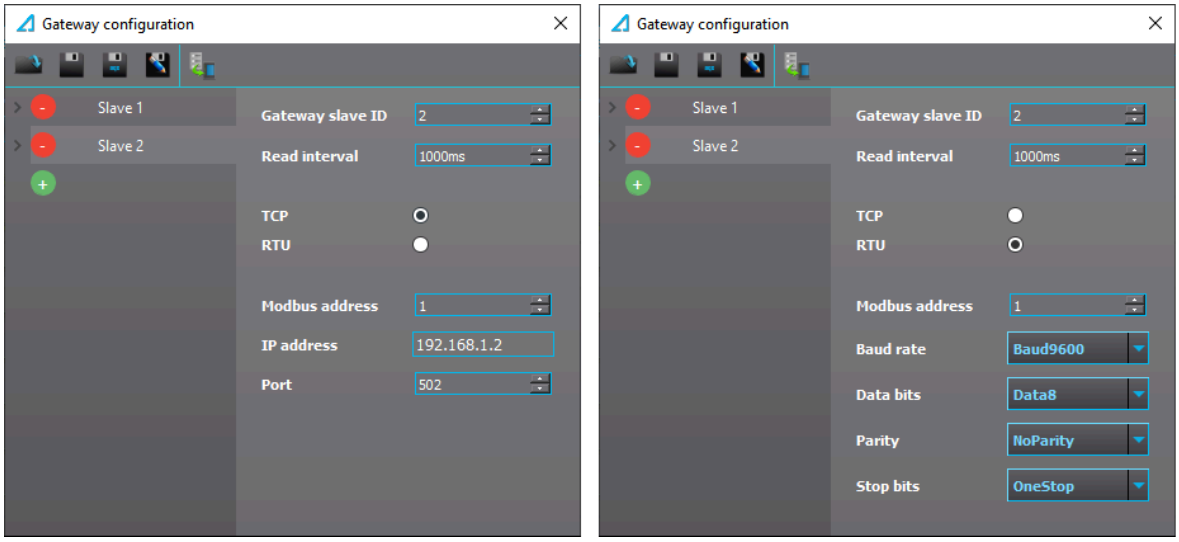

Table. 8.10.8 - 10. Common parameters.

Parameter	Range	Default	Description
Slave type	TCP RTU	RTU	Defines which slave type is used for the configuration.
Gateway slave ID	1...32	1	Defines the unique ID number for the slave in the gateway.
Modbus address	1...247	1	Defines the Modbus slave address.
Read interval	100 ms...60 000 ms	1 000 ms	Defines the polling interval.

Table. 8.10.8 - 11. RTU parameters.

Parameter	Range	Default	Description
Baud rate	Baud1200 Baud2400 Baud4800 Baud9600 Baud19200 Baud38400 Baud57600 Baud115200	Baud9600	Defines the baud rate for the RTU.
Data bits	Data8 Data7	Data8	Defines the data bits for the RTU.
Parity	NoParity EvenParity OddParity	NoParity	Defines the parity bit(s) for the RTU.
Stop bits	OneStop TwoStop	OneStop	Defines the stop bit(s) for the RTU.

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Table. 8.10.8 - 12. TCP parameters.

Parameter	Range	Default	Description
IP address	0.0.0.0 ... 255.255.255.255	192.168.1.2	Defines the IP address of the slave in the TCP.
Port	0 ... 65535	502	Defines the TCP port of the slave.

Configuring virtual inputs (general)

The data acquired from the slaves are called virtual inputs, which can be categorized into the following six (6) types:

Table. 8.10.8 - 13. Five virtual input types.

Virtual input type	Underlying data type	Value range	Max. number of inputs
Virtual counter	32-bit unsigned integer	0 … 4,294,967,295	128
Virtual integer	32-bit signed integer	–2,147,483,648 ... 2,147,483,647	128
Virtual measurement	32-bit floating point value	-3.4×10^{38} ... 3.4×10^{38}	128
Virtual measurement (converted)	Scaled floating point value	-3.4×10^{38} ... 3.4×10^{38}	128
Virtual single bit	One (1) bit	0 … 1	128
Virtual double bit	Two (2) bits	0 … 3	32

You can add a virtual input to a slave by clicking the arrow next to the slave unit and then pressing the green plus sign ("+") at the bottom of the virtual input list. It can be deleted using the red minus sign ("-") next to the input's name. While the default type of the inputs is counters, you can change the type from the "Imported value type" parameter.

All virtual inputs share the following configurations presented in the table below:

Table. 8.10.8 - 14. Shared configurations.

Configuration parameter name	Value range	Default	Description
Input/holding registers	Input registers Holding registers	Holding registers	Defines which Modbus register type is to be read.
Start data address	1 … 65 535	1	Defines the first Modbus register to be read.
Imported value type	Counter Integer Measurement Measurement (converted) Single bit Double bit	Counter	Defines the type of the virtual input.

Configuration parameter name	Value range	Default	Description
Imported value number	1 … the maximum number of the selected virtual input type	(type) 1	Defines the unique input ID for the current type in the gateway. See the maximum number of inputs for each type in the previous table ("Five virtual input types").
Description	Max. 31 characters	–	A text field that allows you to add a description of the input. NOTICE! This parameter is optional!

Configuring the virtual input types "Counter" and "Integer"

The configurations for the virtual counter and the virtual integer input types are shown in the figures below.

Figure. 8.10.8 - 196. Configuring a virtual counter input.

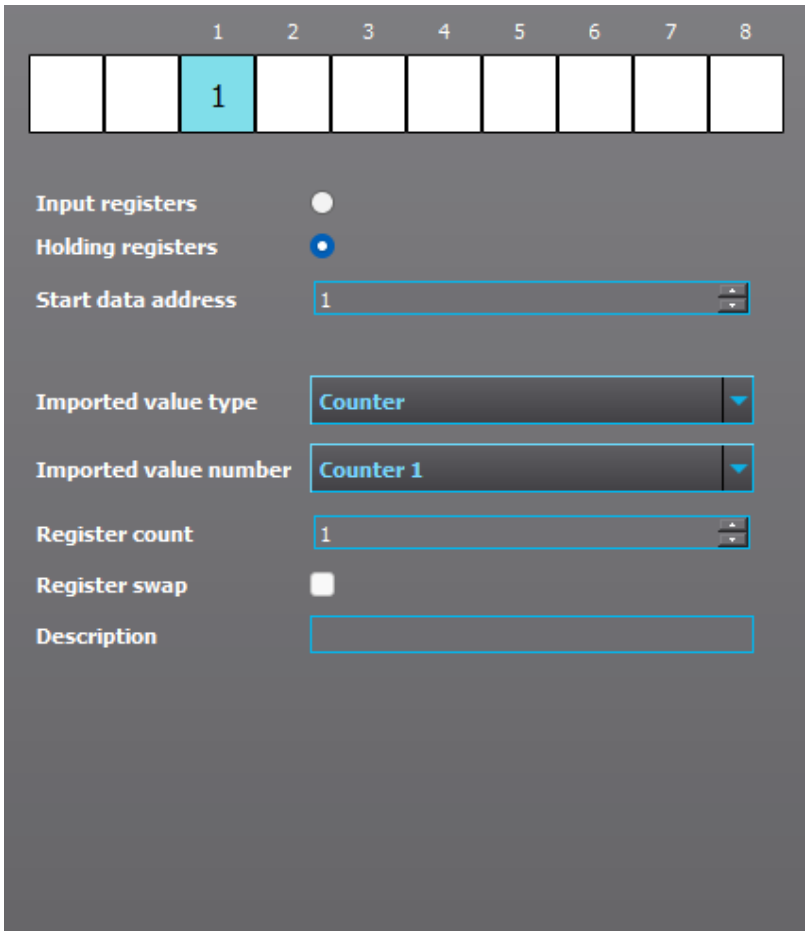

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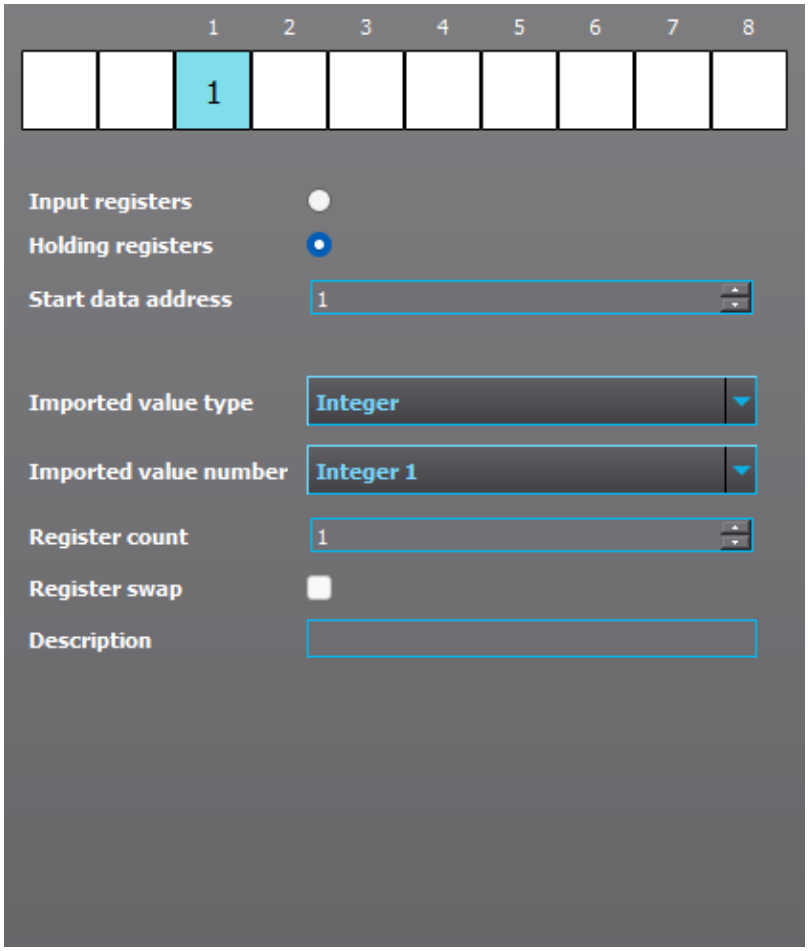
Figure. 8.10.8 - 197. Configuring a virtual integer input.



In addition to the common configuration parameters, the virtual counter and the virtual integer input types have the following configuration parameters:

Table. 8.10.8 - 15. Additional configuration parameters for the virtual counter and integer input types.

Configuration parameter name	Value range	Default	Description
Register count	1 … 2	1	Defines whether one (1) or two (2) registers will be read.
Register swap	(checkbox is empty) (checkbox is ticked)	(checkbox is empty)	Defines whether the register order is swapped or not.

NOTICE!

Please note that the *Register swap* parameter configuration is only taken into account when the option "2" has been selected for the *Register count* parameter!

- When the register swap is disabled (and the checkbox is empty), the first register is the high register.
- When the register swap is enabled (and the checkbox has been ticked), the first register is the low register.

Configuring the virtual input types "Measurement" and "Measurement (converted)"

Modbus Gateway supports two (2) ways of storing floating point values, as presented in the following tables.

Table. 8.10.8 - 16. 32-bit floating point value stored in two consecutive 16-bit registers (no word swap).

Floating point value	2.875
Hexadecimal value	0x4038 0000
1st Modbus register	0x4038
2nd Modbus register	0x0000

Table. 8.10.8 - 17. Scaled floating point value stored in 1 ... 4 consecutive register(s) as integers (no word swap, 2 registers).

Floating point value	2.875
Scaling factor	1000
Scaled value	2875
Hexadecimal value	0x0000 0B3B
1st Modbus register	0x0000
2nd Modbus register	0x0B3B

If the value is stored using the 32-bit floating point value, the input type should be configured to “Measurement”. Otherwise, the input type should be configured to “Measurement (converted)”. The configurations for both of these inputs are shown in the figures below.

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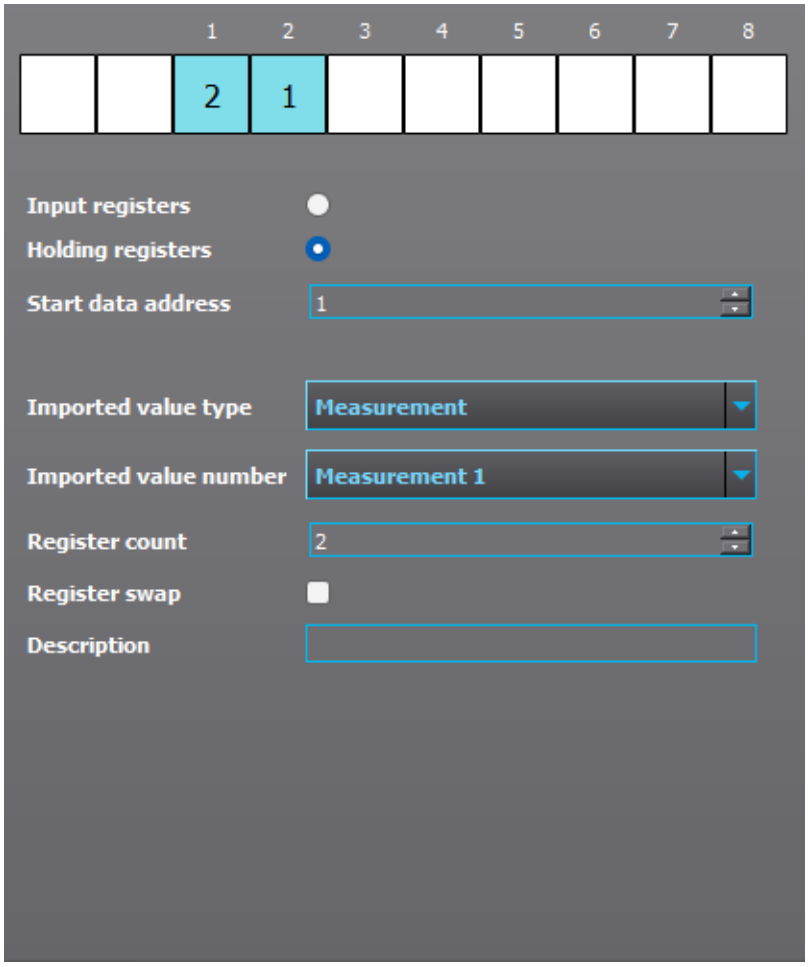
Figure. 8.10.8 - 198. Configuring a virtual measurement input.



In addition to the common configuration parameters, the virtual measurement input type has the following configuration parameters:

Table. 8.10.8 - 18. Additional configuration parameters for the virtual measurement input type.

Configuration parameter name	Value range	Default	Description
Register count	–	2	Defines that two (2) registers will be read.
Register swap	(checkbox is empty) (checkbox is ticked)	(checkbox is empty)	Defines whether the register order is swapped or not.

NOTICE!
Please note that the *Register swap* parameter configuration is only taken into account when the option "2" has been selected for the *Register count* parameter!

- When the register swap is disabled (and the checkbox is empty), the first register is the high register.
- When the register swap is enabled (and the checkbox has been ticked), the first register is the low register.

The following two (2) tables present examples where the first register is the high register (because the register swap is disabled) and where it is the low register (because the swap in enabled).

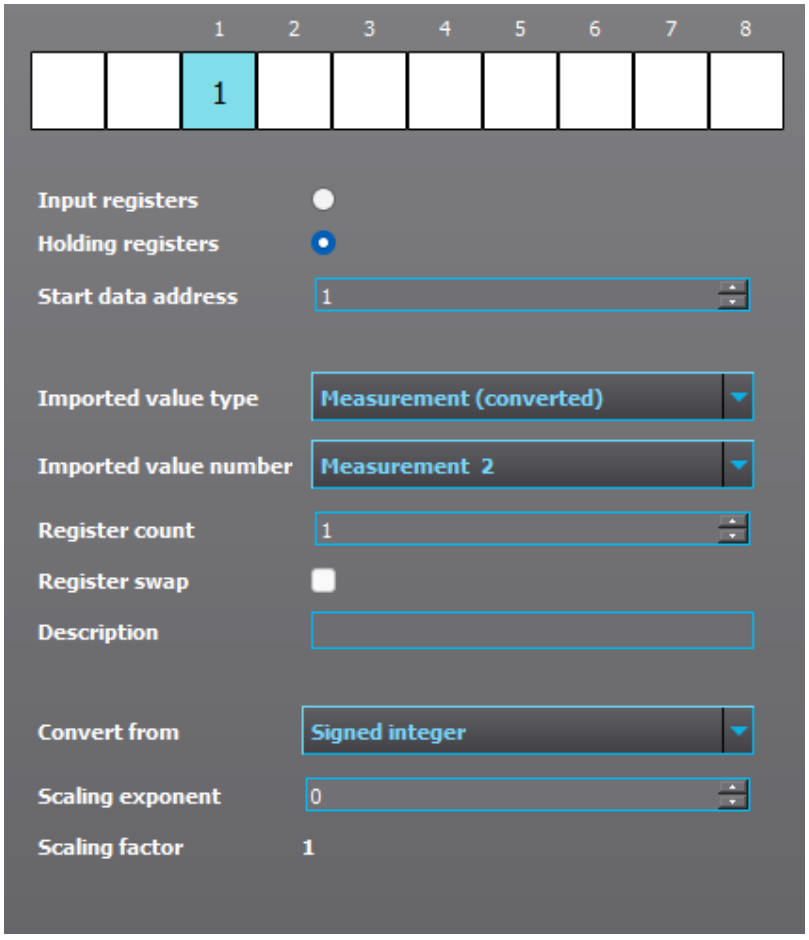
Table. 8.10.8 - 19. Example where the register swap is disabled and the first register is therefore the high register.

Floating point value	2.875
Hexadecimal value	0x4038 0000
1st Modbus register	0x4038
2nd Modbus register	0x0000

Table. 8.10.8 - 20. Example where the register swap is enabled and the first register is therefore the low register.

Floating point value	2.875
Hexadecimal value	0x4038 0000
1st Modbus register	0x0000
2nd Modbus register	0x4038

Figure. 8.10.8 - 199. Configuring a virtual measurement (converted) input.



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In addition to the common configuration parameters, the virtual measurement (converted) input type has the following configuration parameters:

Table. 8.10.8 - 21. Additional configuration parameters for the virtual measurement (converted) input type.

Configuration parameter name	Value range	Default	Description
Register count	1 … 4	2	Defines that two (2) registers will be read.
Register swap	(checkbox is empty) (checkbox is ticked)	(checkbox is empty)	Defines whether the register order is swapped or not.
Convert from	Signed integer Unsigned integer	Signed integer	Defines whether the Modbus register is treated as signed or unsigned before converting it to float.
Scaling exponent	–3 … 3	0	Defines the value of the exponent in the scaling factor calculation in the following parameter.
Scaling factor	–1 000 … 1 000	–	Presents the calculated scaling factor based on the selected exponent in the previous parameter: scaling factor = $10^{\text{scaling exponent}}$

NOTICE!
Please note that the *Register swap* parameter configuration is only taken into account when the selected option for the *Register count* parameter is greater than 2 ("3" or "4")!

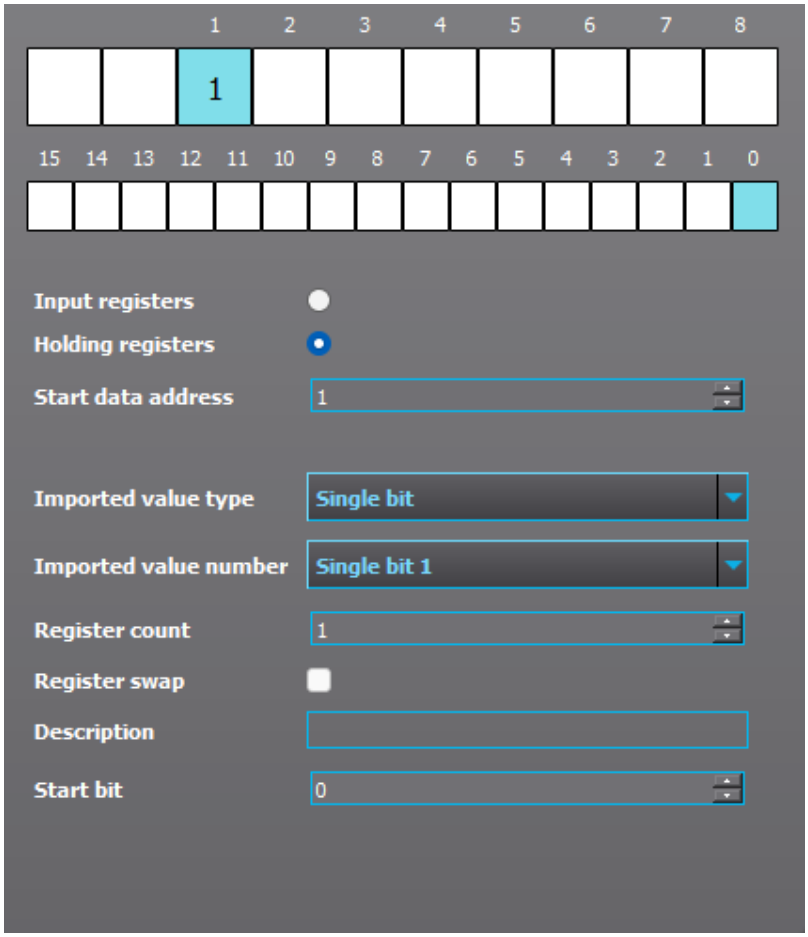
Table. 8.10.8 - 22. Examples for different register counts.

Register count 2 (for example, 111 – 112)	
Not swap order (high to low)	111 – 112
Swap order (high to low)	112 – 111
Register count 3 (for example, 111 – 113)	
Not swap order (high to low)	111 – 112 – 113
Swap order (high to low)	113 – 112 – 111
Register count 4 (for example, 111 – 114)	
Not swap order (high to low)	111 – 112 – 113 – 114
Swap order (high to low)	112 – 111 – 114 – 113

Configuring the virtual input types "Single bit" and "Double bit"

The configurations for the virtual single bit and the virtual double bit input types are shown in the figures below.

Figure. 8.10.8 - 200. Configuring a virtual single bit input.



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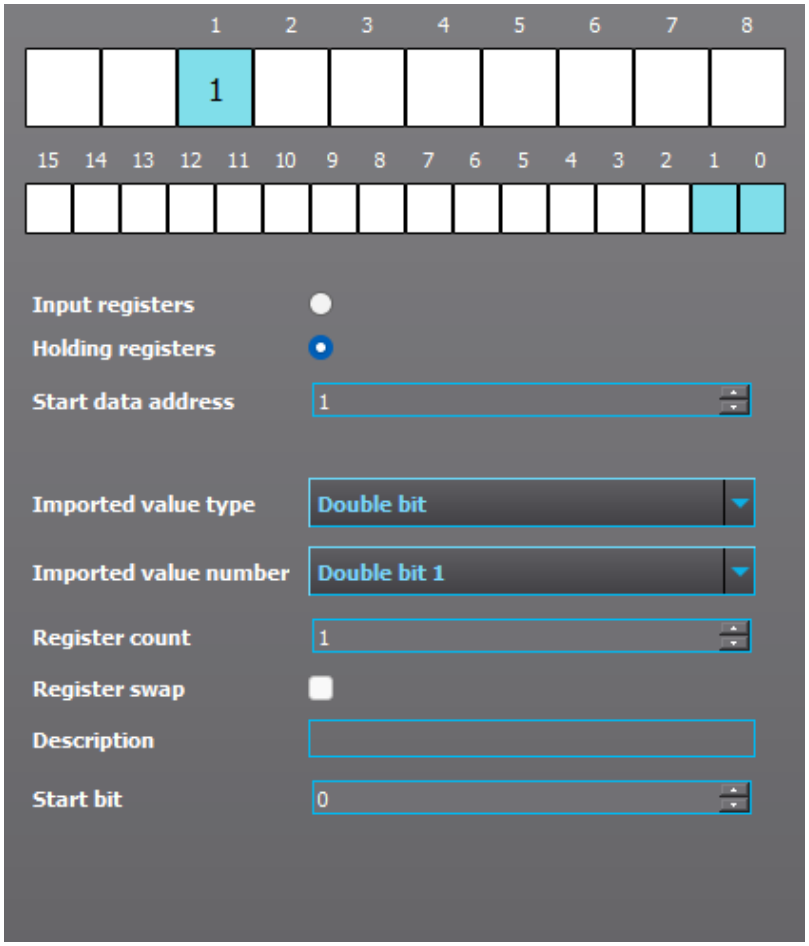
IM00037

Figure. 8.10.8 - 201. Configuring a virtual double bit input.



In addition to the common configuration parameters, the virtual single bit and double bit input types have the following configuration parameters:

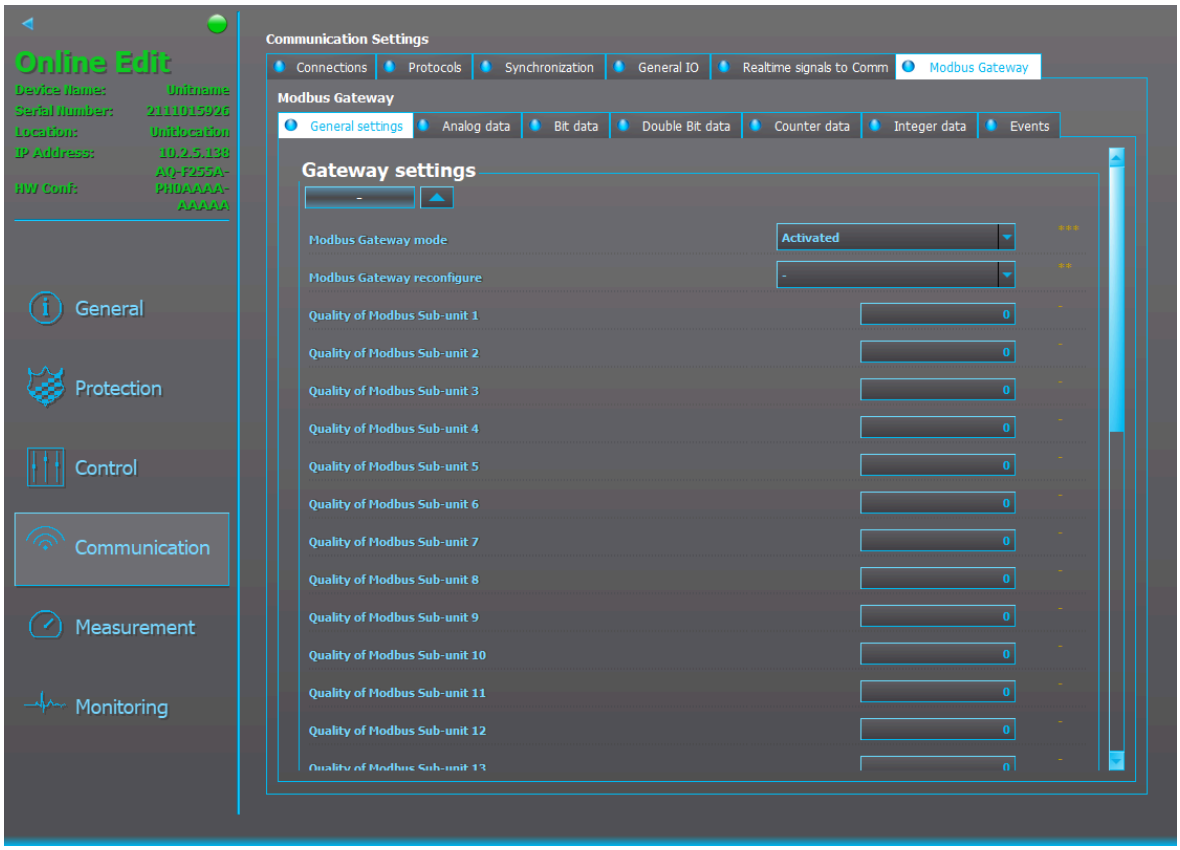
Table. 8.10.8 - 23. Additional configuration parameters for the single bit and double bit input types.

Configuration parameter name	Value range	Default	Description
Register count	1 … 4	2	Defines that two (2) registers will be read.
Register swap	(checkbox is empty) (checkbox is ticked)	(checkbox is empty)	Defines whether the register order is swapped or not.
Start bit	0 … 15 **(Single bit only!)** 0 … 14 **(Double bit only!)**	0 **(both)**	Defines the first bit in the register to be taken into account.

Running Modbus Gateway

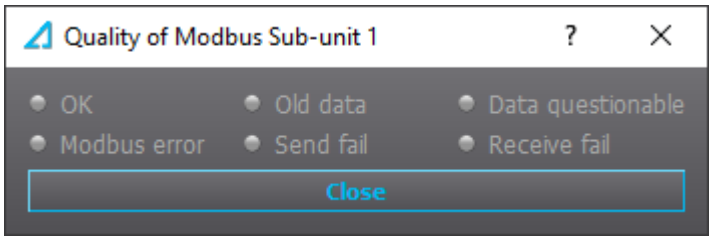
After saving the configuration file and sending it to the device, the gateway can be enabled at *Communication → Modbus Gateway → General settings*.

Figure. 8.10.8 - 202. Enabling the configured gateway.



In the "General settings" tab you can also see the quality of the slaves. Please note that this requires that you are in the Live Edit mode (see the Live Editchapter for details on how to enable this mode). The acquired data can be seen in the corresponding tab divided according to the virtual input types.

Figure. 8.10.8 - 203. Checking the quality of Modbus sub-units.



Getting data from the IEC 61850 protocol

In the IEC 61850 communication protocol the acquired data is stored in six (6) logical nodes that correspond to the six (6) virtual input types.

Table. 8.10.8 - 24. Logical node data categorized according to the virtual input types.

Virtual input type	Logical node prefix	Logical node class	Logical node instance
Virtual counter	GWCNT	GGIO	1
Virtual integer	GWINT	GGIO	1

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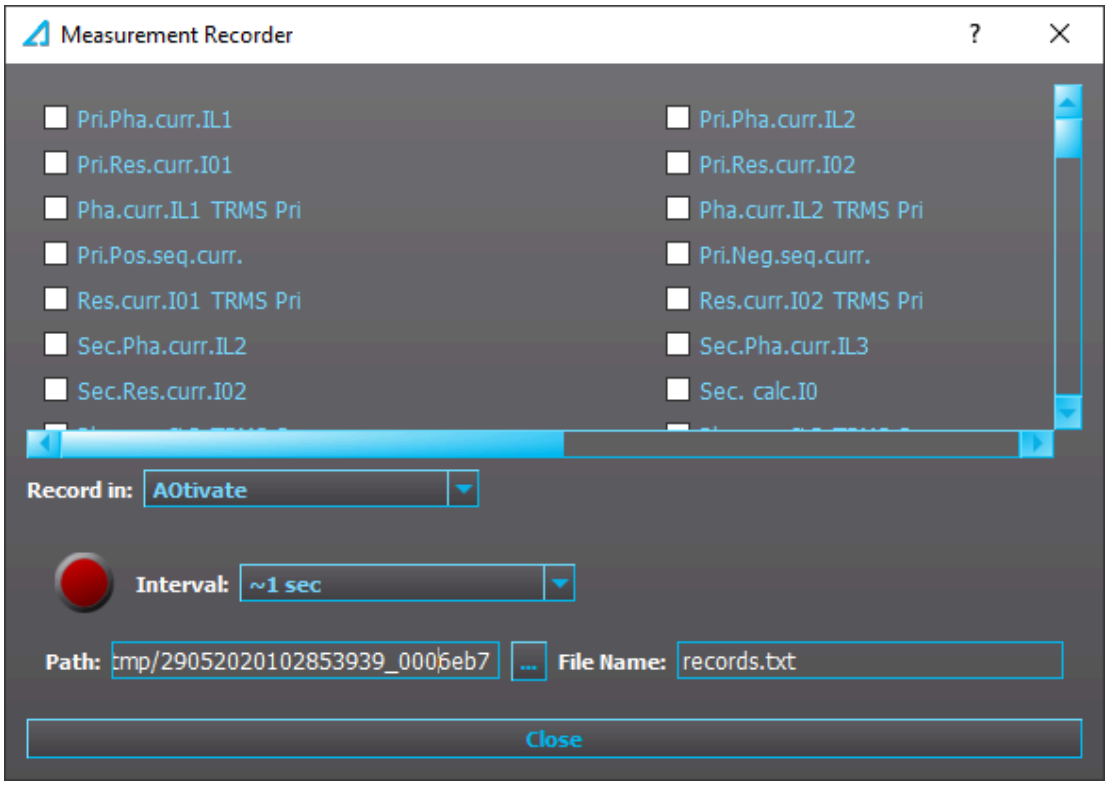
Virtual input type	Logical node prefix	Logical node class	Logical node instance
Virtual measurement	GWMEAS	GGIO	1
Virtual measurement (converted)	GWMEASC	GGIO	1
Virtual single bit	GWBIT	GGIO	1
Virtual double bit	GWDBIT	GGIO	1

8.11 Miscellaneous tools

NOTICE!
This chapter describes various miscellaneous tools that are not used often. These tools are usually designed for a very specific purpose.

8.11.1 Measurement recorder

Figure. 8.11.1 - 204. Measurement recorder window.



Specific measurements can be recorded as a text file by using the *Measurement recorder* tool. In the "Measurement recorder" dialog window, you can select the measurements you want to be recorded by checking their respective check boxes.

NOTICE!
Please note that activating the measurement recorder requires that there is a connection to a device and that the Live Edit mode is enabled (see the Live Edit chapter for more information)

The recording interval can be changed from the drop-down menu of the "Interval" box (next to the big red circle; if Live Edit mode is not on, the circle is gray).

With the "Record in" selection (located right below the check boxes) you can choose whether the measurements are recorded in AQtivate or in the device itself. If you select "Relay", you only need to set the recording interval (from which AQtivate estimates the maximum recording time) and then start recording by pressing the red "Record" button.

You can change the record file location by editing the "Path" field. You can also change the file name in the "File name" field.

Recording starts when you hit the red "Record" button. You can stop the recording by hitting the blue "Stop" button.

CAUTION!
Closing the "Measurement recorder" dialog window does not stop the recording!

8.11.2 Clear matrix

The *Clear matrix* tool does what the name suggests: it clears the matrix portion of a logic file.

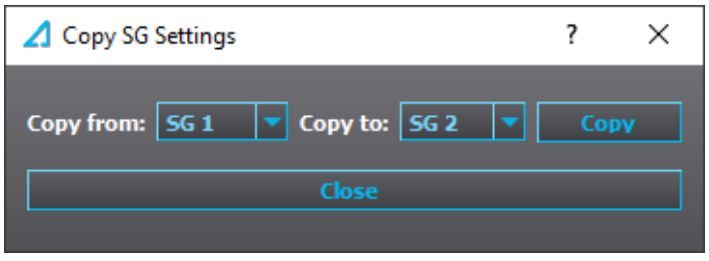
NOTICE!
Please note that this process affects the connections made to the device I/O matrix (*Control → Device I/O → Device I/O matrix*). After clearing the matrix you must load the logic at the main toolbar (*Commands → Write to relay*) for the changes to take effect.

8.11.3 Copy SG settings

You can copy the setting group (SG) settings from one setting group to another with the *Copy SG settings* tool. This is useful if the settings are very similar between two or more setting groups you are using.

As you can see in the figure below of the tool's dialog window, you only need to select which SG you are copying from and then select which SG you want to copy them to.

Figure. 8.11.3 - 205. Dialog window for the *Copy SG Settings* tool.



8.11.4 Aqs generator

With the *Aqs generator* tool you can generate .aqs files without having a device to download configuration files from. You only need a firmware package to generate a configuration file. When generating a file you have to choose the firmware package, the destination for the file (includes the name for the .aqs package), and the exact device type. See the figure below for an example of generating an .aqs file for an AQ-G215 device.

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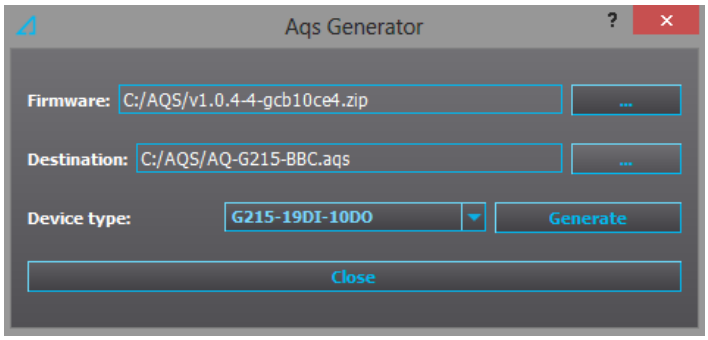
Figure. 8.11.4 - 206. Example of generating an .aqs file.

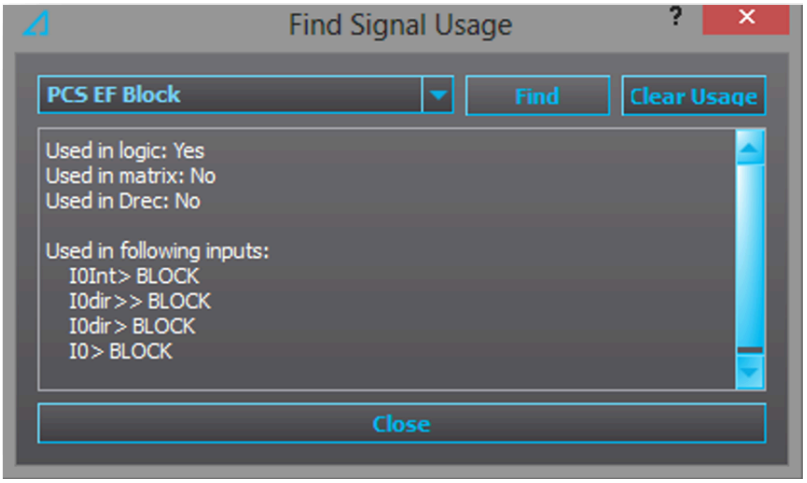


The generated file can be used for studying and other similar purposes. It is otherwise similar to a file downloaded from a device, except it does not have a serial number nor does it display its hardware and software configurations in the *General* menu. You can upload the generated configuration to any device with the same hardware configuration. Please note that AQtivate may warn about missing mimics, logic and disturbance recorder if these are not in the configuration!

NOTICE!
When selecting the device type, you can only choose a hardware configuration with digital inputs ("DI") , digital outputs ("DO"), and/or an arc protection card. Other types of option cards are not supported by the Aqs generator!

8.11.5 Find signal usage

Figure. 8.11.5 - 207. Example of finding signal connections.



With the help of the ***Find signal usage*** tool you can see where a signal has been connected to in the configuration.

In the example figure above, the programmable control switch "PCS EF Block" has been chosen. When the "Find" button is clicked, AQtivate displays a list of places where the chosen signal has been used. In this case this PCS button can block four earth fault functions: "I0int> BLOCK", "I0dir>> BLOCK", "I0dir> BLOCK", and "I0> BLOCK". Additionally, AQtivate displays whether or not the signal has been used in logic ("Used in logic:"), matrix ("Used in matrix:"), and the disturbance recorder ("Used in Drec:").

Pressing the "Clear usage" button erases all of the listed connections. Please note that the new logic must be written into the device to use any changes made to the listed connections!

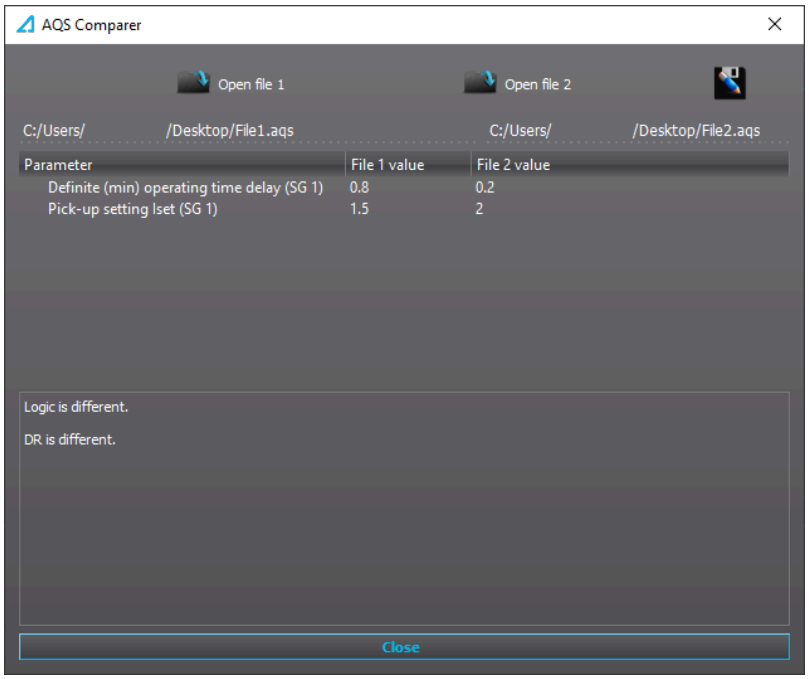
CAUTION!
When you clear a signal that has been used in a logic, you are advised to check that the logic is still intact!

8.11.6 Compare files

You can compare .aqs files with the *Compare files* tool.

At the top of the tool's dialog window, select one .aqs file with the "Open file 1" button and another with the "Open file 2" button. AQtivate will then check the two files for differences. The basic value differences are shown in the top half of the list, while the latter half shows if there are any differences in the logic, mimic or disturbance recorder files.

Figure. 8.11.6 - 208. Comparing .aqs files.



8.11.7 Rear panel

The *Rear panel* tool opens a dialog window that shows the content of the device's back panel. The exact image depends on the .aqs file that you have open when you open the tool's dialog window.

The figure below presents an example of what the tool's dialog window would show for an .aqs file made for an AQ-x215 device. It has three additional option cards (2 × DI8 + 1 × DO5) as well as the default cards CPU, voltage measurement, and current measurement.

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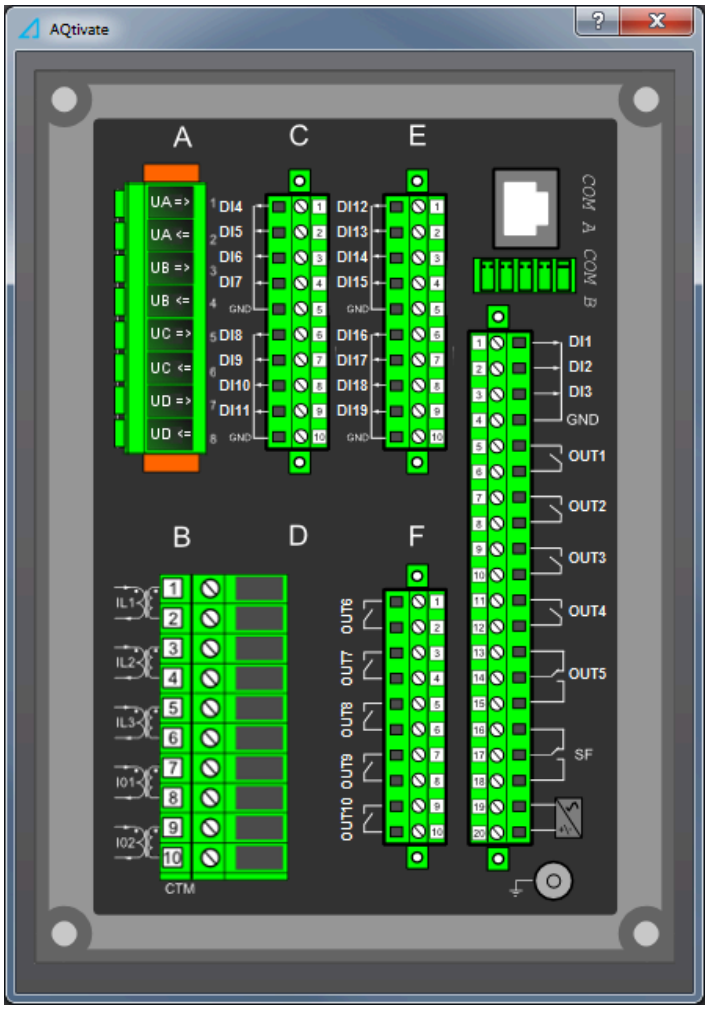
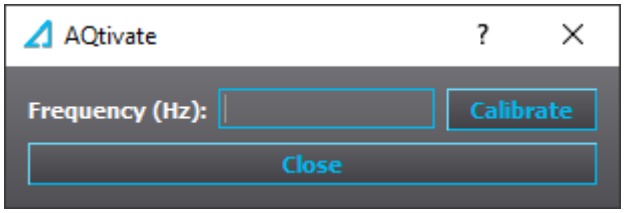
Figure. 8.11.7 - 209. Example of the *Rear panel* tool for an AQ-x215 device.



8.11.8 Calibrations

Figure. 8.11.8 - 210. Dialog window for the *Calibrations* tool.



The *Calibrations* tool is used to calibrate the accuracy of the frequency measurement manually. All AQ 200 devices are always delivered with the frequency measurements calibrated.

WARNING!
Please note that all AQ 200 devices are always delivered with the frequency measurements calibrated! Any calibration of the frequency measurement should only be done by a qualified person who has been instructed how to do this!

8.11.9 GC-30 configurator

The *GC-30 configurator* tool is used in Generator and Motor Commander applications to read values from and to write values to the excitation unit, GC-30.

While all values listed in the tool's dialog window can be read, only eight (8) of them can also be written to the unit (see the table below).

Table. 8.11.9 - 25. Values in the GC-30 Configurator tool.

Value name	Can be read	Can be written
Calibrated MA input in mA	X	
Calibrated V input	X	
Calibrated DC C	X	
Calibrated DC V	X	
Calibrated 24 V	X	
Calibrated device temperature in Celsius	X	
Calibrated SKIIP temperature in Celsius	X	
PMW rate	X	X
DCC_ADD scaling component	X	X
DCV_ADD scaling component	X	X
DCV_DIV scaling component	X	X
GOOSE application ID	X	X
GOOSE conf rev	X	X
GOOSE publ. VLAN_PRIO	X	X
GOOSE publ. VLAN_ID	X	X
Mac hi	X	
Mac lo	X	
Firmware hash	X	

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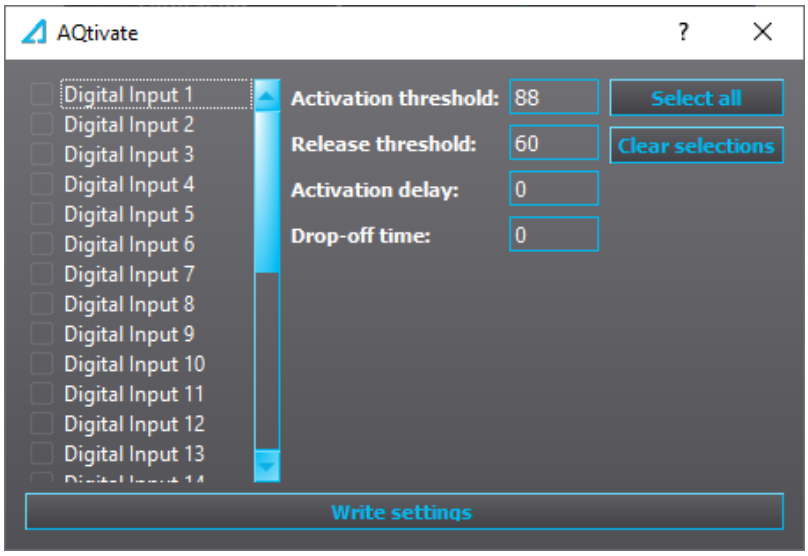
Figure. 8.11.9 - 211. Dialog window for the *GC-30 configurator* tool.

8.11.10 DI configurator

With the *DI configurator* tool you can adjust the input activation, as well as release thresholds and delay times for activation and release. You can adjust multiple or all inputs at once, which lets you avoid typing the same setting to each input individually.

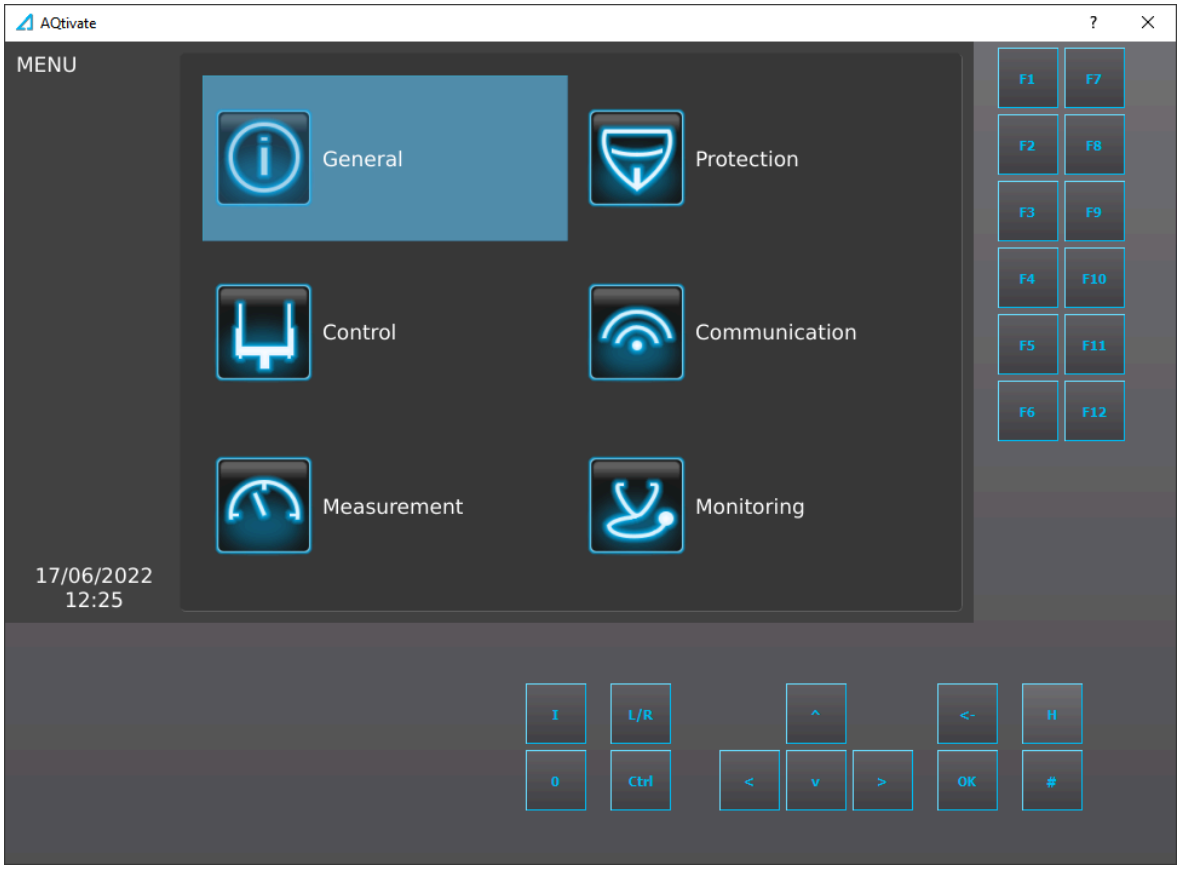
Figure. 8.11.10 - 212. Dialog window for the *DI configurator* tool.



8.11.11 HMI view

When connected to an AQ 250 series device, you can use the ***HMI view*** tool to navigate the device interface. All the physical push buttons on the device can be controlled from this view.

Figure. 8.11.11 - 213. HMI view.



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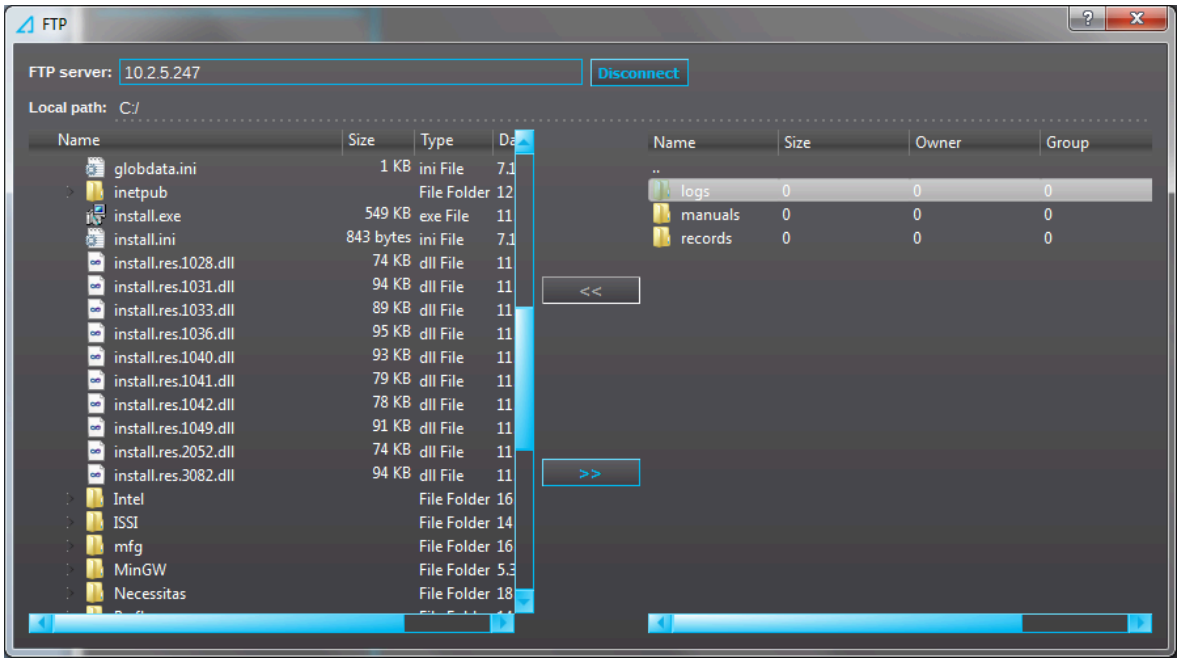
8.12 FTP

You can open the FTP client from the *Tools* menu (*Tools* → "FTP") located in AQtivate's main toolbar. You can also open this dialog window by pressing the shortcut key F2.

The dialog window contains two views. The one on the left lists the local directories, while the one on the right lists server directories. You can connect to the device's FTP server by typing in the device's IP address in the "FTP server" field and then clicking the "Connect" button (see the figure below).

Figure. 8.12 - 214. Dialog window for the *FTP* tool.



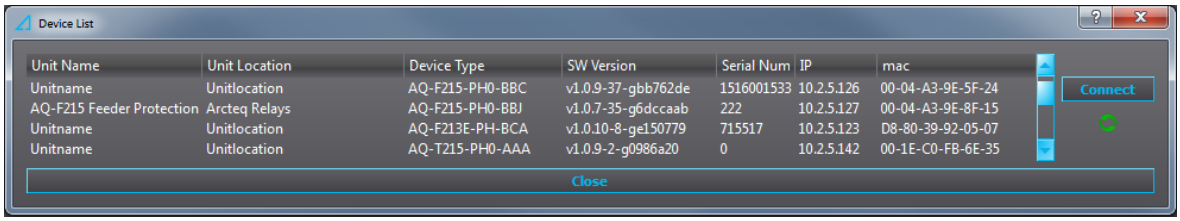
You can upload files to the server by selecting a file from one of the local directories and then pressing the ">>" button. To download a file, select a file from one of the server directories and then press the "<<" button. The file is then downloaded to the current selected local directory, which can be seen in the "Local path" field.

8.13 Device list

You can open the ***Device list*** tool from the *Tools* menu (*Tools* → "Device List") located in AQtivate's main toolbar. You can also open this dialog window by pressing the shortcut key F11.

The tool's dialog window lists all the available devices connected to the same network as your computer. You can connect to the selected device by double-clicking it on the list, or by selecting the device from the list and then clicking the "Connect" button. If new devices were connected to the network while viewing the device list, press the "Refresh" button (the green arrows icon) to make the new devices appear on the list.

Figure. 8.13 - 215. Dialog window for the *Device list* tool.



NOTICE!
Some switches and firewalls may prevent AQtivate from getting this list.

NOTICE!
Establishing a connection closes the dialog window.

NOTICE!
The device list is not able to list the available devices, if more than one instance of AQtivate is open at the same time.

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9 Exporting and importing settings in a .txt file

You can export all parameters as well as the matrix and logic settings into a single .txt file. It can then be edited in Excel or other spreadsheet software and imported back into an .aqs file. You can do this with "Export settings" and "Import settings" that can be found under the *File* menu in AQtivate's main toolbar.

The table below presents an example snippet of an exported setting file parameters with I> (overcurrent protection) settings. The values in the "Values" column are editable!

Table. 9 - 26. Example snippet of exported I> settings.

#Id	Name	Value	Unit	Min	Max	Step	Description
24029	NOC1_DT_SET_1	1.160 000	s	0.000	1800.000	0.005	Definite (min) operating time delay
24030	NOC1_DT_SET_2	1.160 000	s	0.000	1800.000	0.005	Definite (min) operating time delay
24031	NOC1_DT_SET_3	1.160000	s	0.000	1800.000	0.005	Definite (min) operating time delay
24032	NOC1_DT_SET_4	0.040000	s	0.000	1800.000	0.005	Definite (min) operating time delay
24033	NOC1_DT_SET_5	0.040000	s	0.000	1800.000	0.005	Definite (min) operating time delay
24034	NOC1_DT_SET_6	0.040000	s	0.000	1800.000	0.005	Definite (min) operating time delay
24035	NOC1_DT_SET_7	0.040000	s	0.000	1800.000	0.005	Definite (min) operating time delay
24036	NOC1_DT_SET_8	0.040000	s	0.000	1800.000	0.005	Definite (min) operating time delay
24037	NOC1_DT_SET_P	0.040000	s	0.000	1800.000	0.005	Definite (min) operating time delay
24038	NOC1_EVENTMASKHI	0		0	4,29E+09	1	EventMaskHi
24039	NOC1_EVENTMASKLO	262095		0	4,29E+09	1	EventMaskLo
24041	NOC1_HARMBLK_1	0		0	1	1	Inrush Harmonic Blocking (Internal Only Trip)
24042	NOC1_HARMBLK_2	0		0	1	1	Inrush Harmonic Blocking (Internal Only Trip)
24043	NOC1_HARMBLK_3	0		0	1	1	Inrush Harmonic Blocking (Internal Only Trip)
24044	NOC1_HARMBLK_4	0		0	1	1	Inrush Harmonic Blocking (Internal Only Trip)
24045	NOC1_HARMBLK_5	0		0	1	1	Inrush Harmonic Blocking (Internal Only Trip)

24046	NOC1_HARMBLK_6	0		0	1	1	Inrush Harmonic Blocking (Internal Only Trip)
24047	NOC1_HARMBLK_7	0		0	1	1	Inrush Harmonic Blocking (Internal Only Trip)
24048	NOC1_HARMBLK_8	0		0	1	1	Inrush Harmonic Blocking (Internal Only Trip)

The table below presents an example snippet of an exported setting file parameters with matrix, logic, and block connections.

Table. 9 - 27. Example snippet of exported settings for matrix, logic and block connections.

#Logic		
#Output	Type	Input1
#Matrix script:		
RELE_T1	CONNECT	OBJ1_OPENSIGNAL
RELE_T2	CONNECT	OBJ1_CLOSESIGNAL
RELE_T1	CONNECT	NOC1_TRIP
RELE_T1	CONNECT	NOC2_TRIP
RELE_T9	CONNECT	CBF1_CBFPACT
RELE_T8	CONNECT	CBF1_CBFPACT
RELE_T10	CONNECT	OV1_TRIP
LED_START	CONNECT	OV1_START
LED_TRIP	LATCH	OV1_TRIP
LED_TRIP	LATCH	CBF1_CBFPACT
LED_TRIP	LATCH	NOC1_TRIP

The table below presents an example snippet of an exported setting file parameters with logic details.

Table. 9 - 28. Example snippet of exported settings for logic details.

#Logic details	
#Gate pos x	Gate pos y
0	190
0	490
50	340
100	410
100	510

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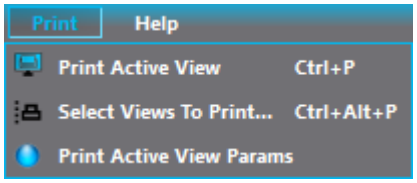
IM00037

110	660
110	730
140	40
140	130
150	210
230	350
240	710

10 Print menu

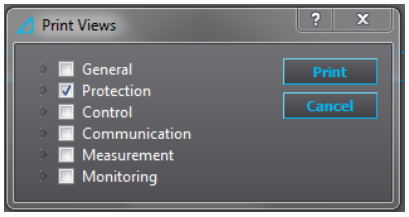
Figure. 10 - 216. Options in the Print menu.



You can print out .aqs configurations as PDF files with the *Print* menu.

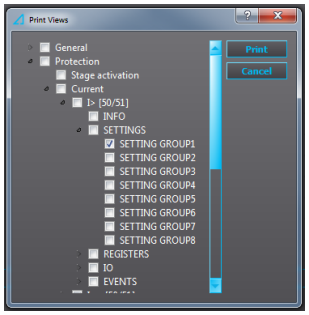
"Print active view" (or use the shortcut Ctrl + P) prints out the view that is currently open as a PDF. However, if you need more than one view of the .aqs file, you can click "Select views to print" (or use the shortcut Ctrl + Alt + P) and pick which views you want printed out. Please note that the first selection only shows the main menus. If you need to print everything under a main menu, check its box (see the figure below) and click "Print".

Figure. 10 - 217. Dialog window for the "Select views to print".



If you do not need entire menus but rather one or more specific subsections within the menus, you can expand them by clicking the gray arrow next to the check boxes. The figure below presents an example where the user wants to print only the setting view of the I> (overcurrent) function's first stage.

Figure. 10 - 218. Example print for I>.



The figure below shows what that the previous example of the I> function's first stage print looks like in its PDF form.

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Figure. 10 - 219. Example PDF print for I>.

SETTINGS: Overcurrent I>	SETTING GROUP1
Pick-up setting Iset	1 xIn
Delay type	DT
Definite operating time delay	0.26 s
Delayed Pick-up release	Yes
Release Time delay	0.06 s
Op.Time calc reset after release time	Yes
Continue time calculation during release time	No

11 Updating firmware

The process of updating the firmware begins by checking that you have the firmware file available to continue with the update. The firmware file is always labelled in a specific style and looks something like this: v1.0.1-97-g14e806f.zip.

CAUTION!
Please note that while the firmware file appears to be a .zip file, DO NOT UNZIP it before updating, as the AQtivate setting and configuration tool does this automatically when it is required!

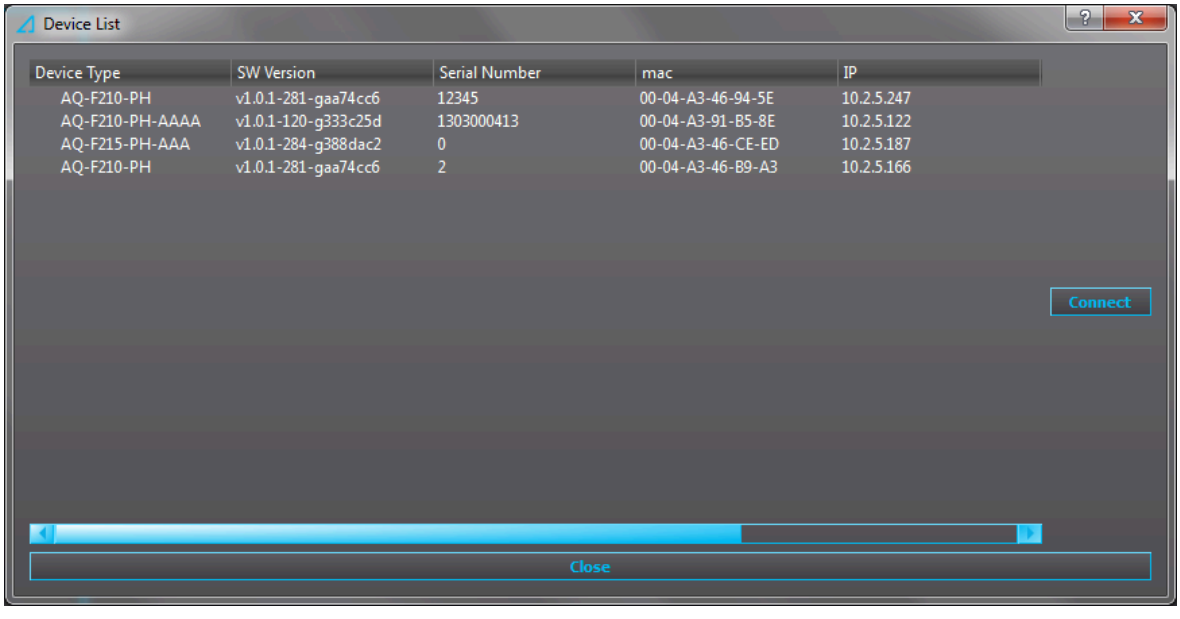
Connecting to a device

Next, connect to the device. Connect the cable between the device's back panel port and the PC. If your device is in a network, connect your PC with the corresponding IP settings to the hub.

NOTICE!
You can only use the device's back Ethernet port to update the firmware!

Open the AQtivate setting tool and search for the device from *Tools → Device List* (or use the shortcut key F11). The software shows a list with the current firmware of the devices under the column titled "SW version". If you are updating multiple devices in the network, please note that the "Device list" will display all the devices in the same list, both those that have already been updated and those that have not!

Figure. 11 - 220. AQtivate 200 listing all the devices in the network.



NOTICE!
You can only update the firmware when when you have no .aqs configuration file open! If an .aqs file is open, you can close it at *File → Close.*

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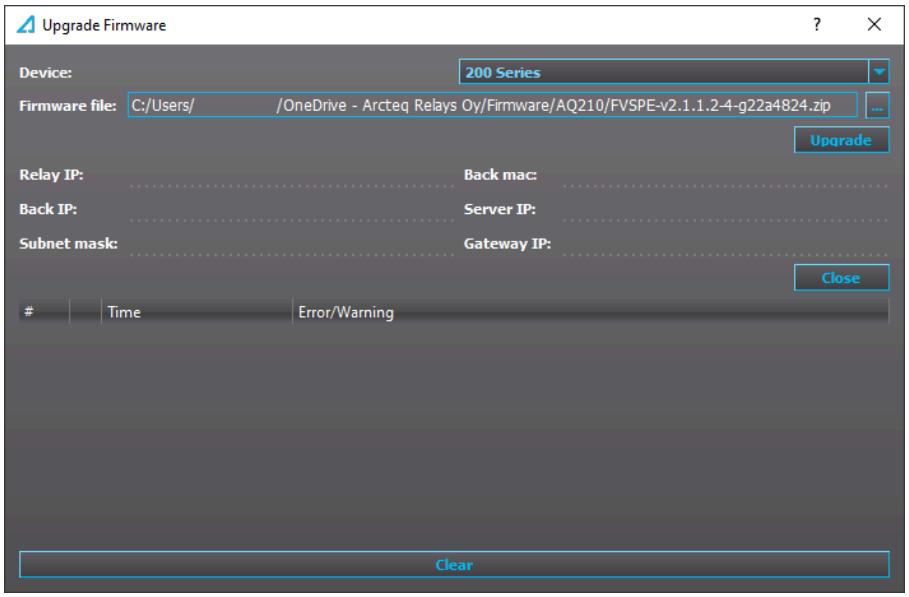
Updating the firmware

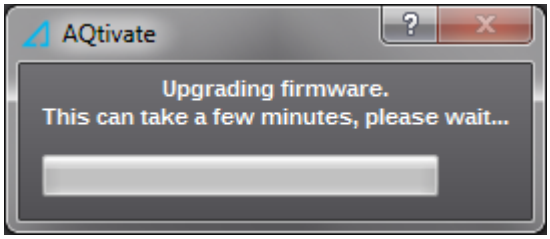
Next, select "Upgrade firmware" from the *Tools* menu. This opens an update window (see the figure below).

Figure. 11 - 221. Dialog window for firmware update.



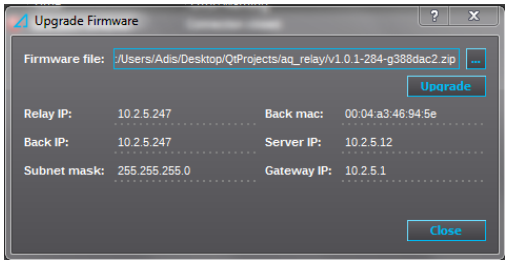
Add the new firmware package into the "Firmware file" field by locating it with the "..." button at the top right. Select the firmware .zip file and click "Open". Once you click the "Upgrade" button, AQtivate begins to update the firmware. you can follow its progress in the pop-up window's loading bar (see the figure below).

Figure. 11 - 222. Pop-up window to follow the progress of the firmware update process.



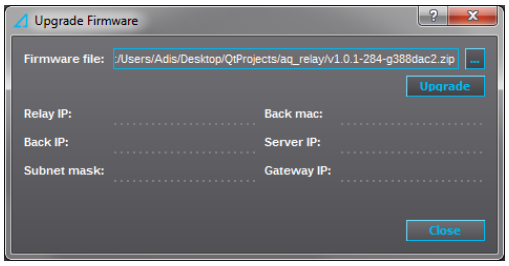
While AQtivate and the device work on the firmware update, the device will reboot several times and show a black and/or distorted display; this is normal. At some point AQtivate will also inform you that the connection was closed; this is also normal. During the firmware update the window's info tags are filled with the information from the device being updated (see the figure below).

Figure. 11 - 223. Information tags during the firmware upgrade process.



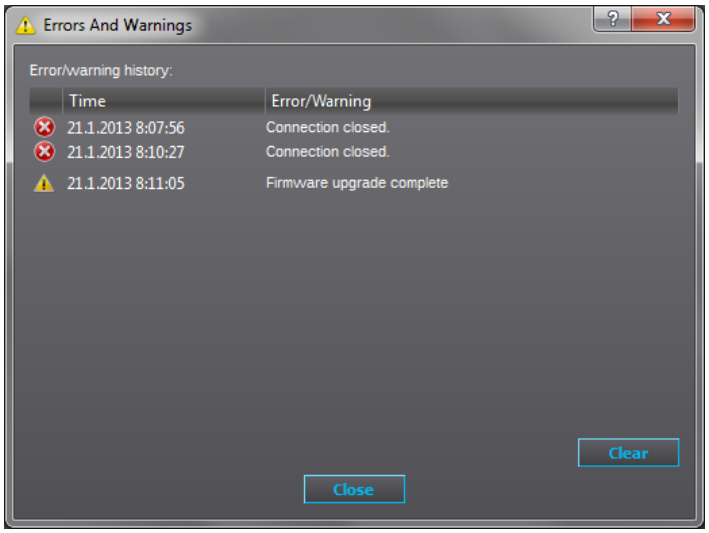
When the update process is finished, the window's tags go blank once again (see the figure below).

Figure. 11 - 224. Upgrade process finished.



The "Errors and Warnings" window shows when the firmware update is complete ("Firmware upgrade complete") (see the figure below).

Figure. 11 - 225. Errors and warnings window.



After the update is finished, the device's display should be back to looking normal.

CAUTION!
The last reboot of the device may take longer than what AQtivate estimates, so please be patient and give the device approximately one (1) minute to restart!

Troubleshooting the update process

Sometimes the firmware update does not succeed. When this happens, you get a "Firmware upgrade failed" message instead of the normal "Firmware upgrade complete" message. The most common cause for update failures is that an anti-virus or a firewall software interferes with the update process. In order to avoid this, we recommend disabling any anti-virus and firewall softwares for the duration of the update process. VPN softwares can also cause trouble with the firmware update, so we recommend disabling them as well.

11.1 Troubleshooting firmware upgrade

Under some conditions the firmware is not able to get through. Most of the time the issue is firewall or anti-virus related. The following chapters describe some methods to get through these issues.

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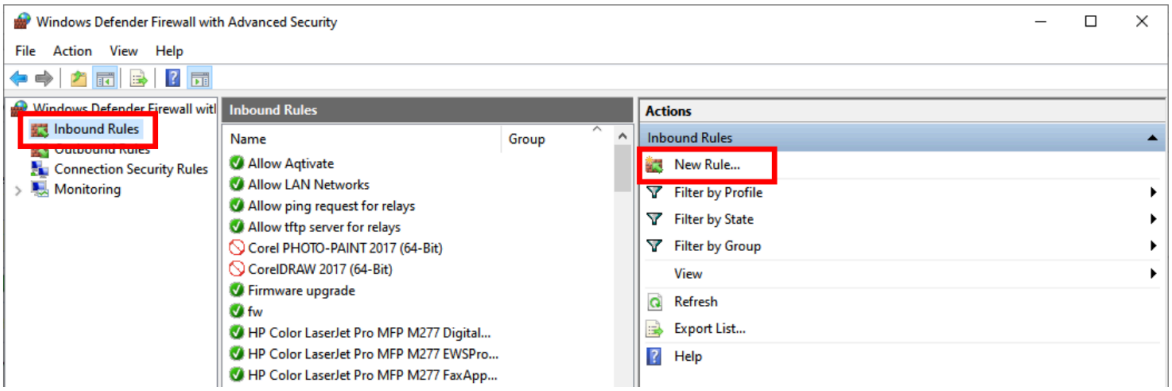
11.2 How to allow inbound ping

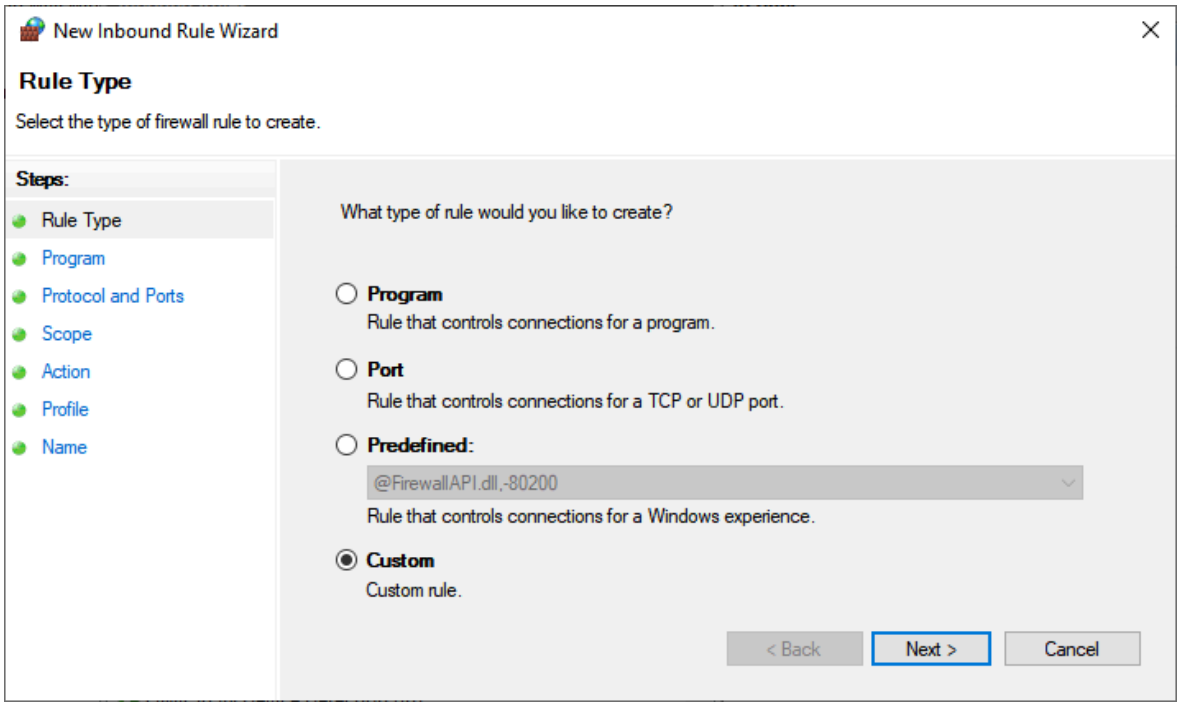
The first step is to search for the "Windows Firewall with Advanced Security" with Windows Search. Begin adding a new rule: select "New Rule..." in the "Actions" pane (see the figure below). This opens the "New Inbound Rule Wizard" dialog window.

Figure. 11.2 - 226. Adding a new rule.



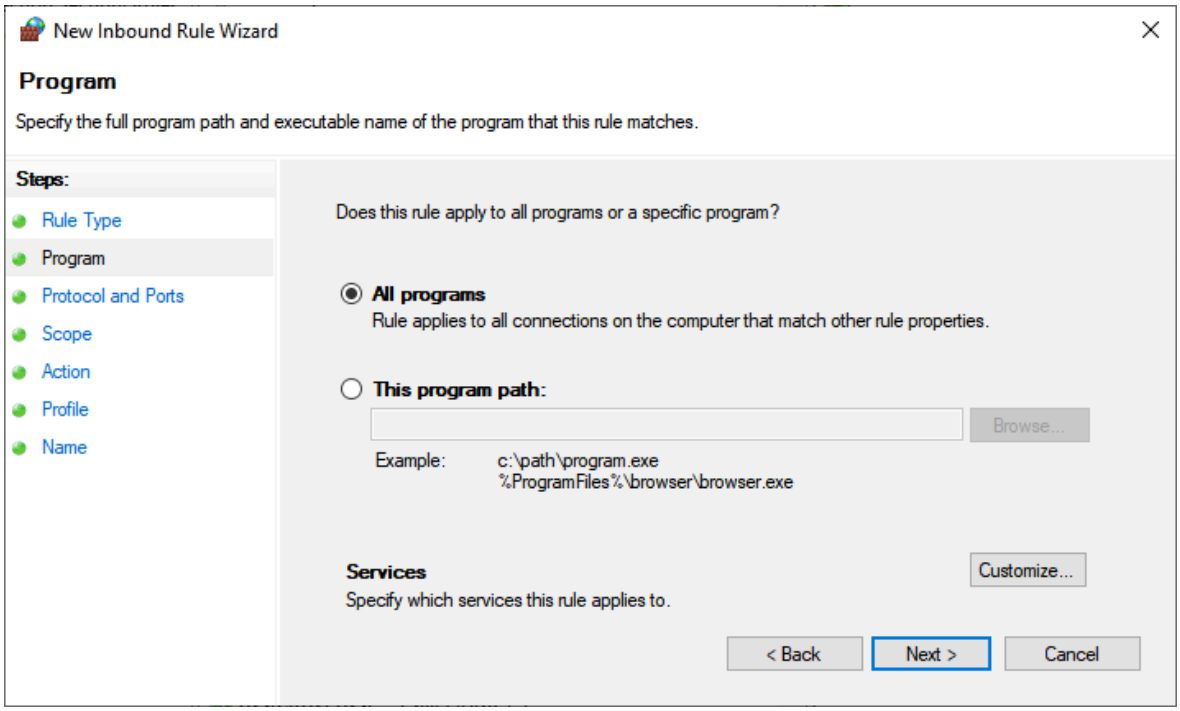
In the second step you need to define the new rule as a custom rule. Select the "Custom" option and press **Next** (see the figure below).

Figure. 11.2 - 227. Defining the new rule as a custom rule.



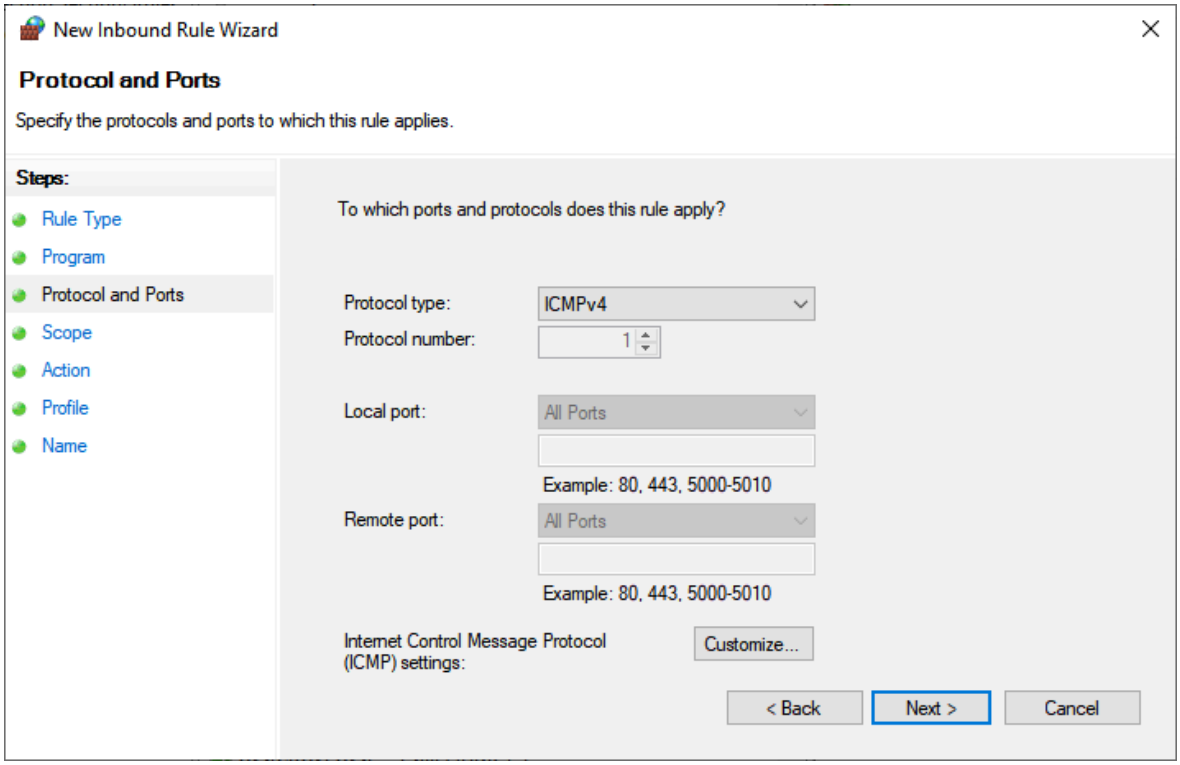
In the third step you need to make sure that your new rule applies to all connections you make with your PC as long as they match other rule properties. Select the "All programs" option and press **Next** (see the figure below).

Figure. 11.2 - 228. Applying the new rule to all connections.



The fourth step is to specify the protocols and ports to which your new rule applies. Select the "ICMPv4" option from the "Protocol type" drop-down list and then press the Customize button (see the figure below).

Figure. 11.2 - 229. Specifying the protocols and ports.



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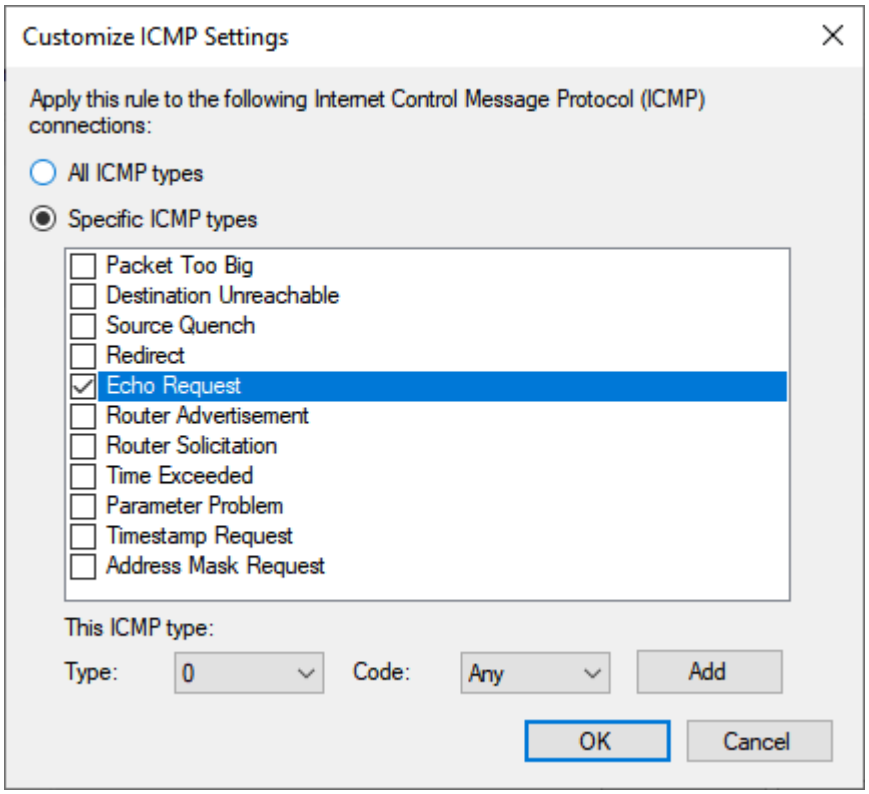
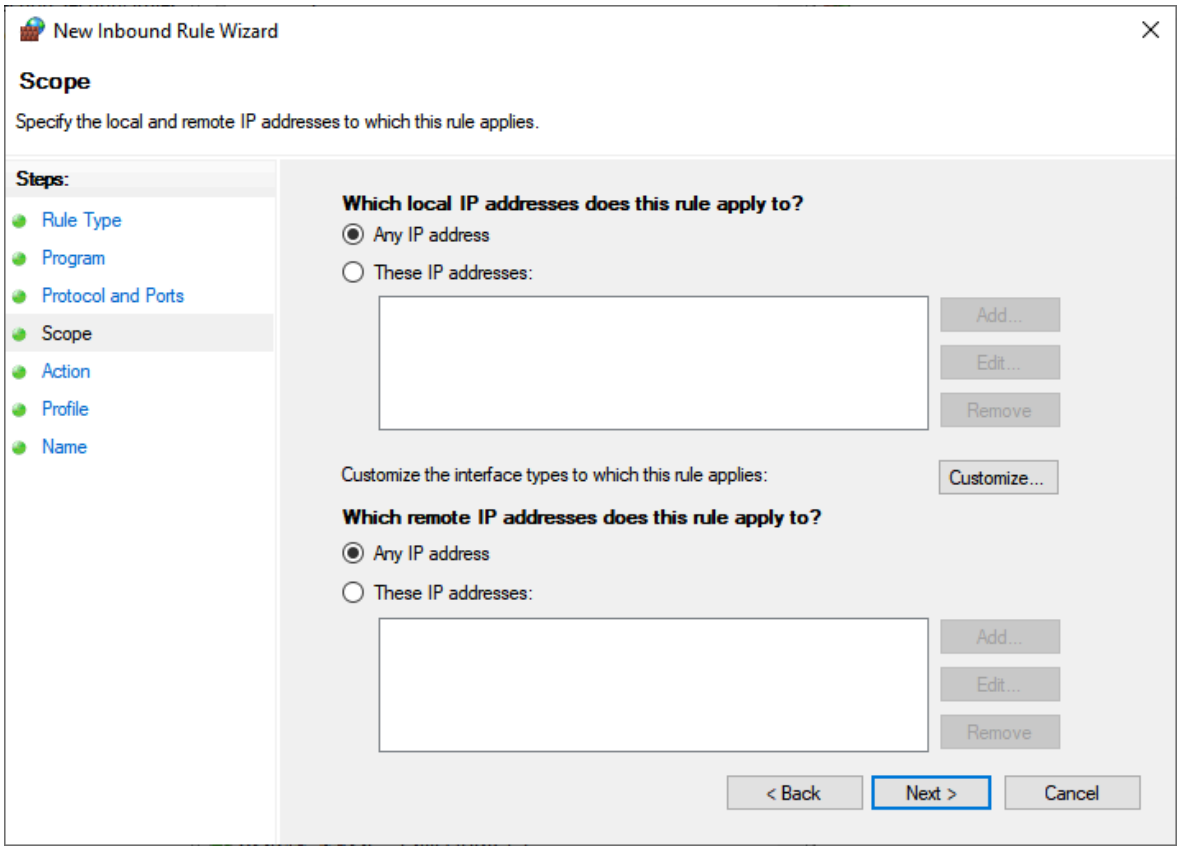
In the fifth step you face the "Customize ICMP Settings" window where you define the ICMP (Internet Control Message Protocol) types to which your new rule will apply. Select the "Specific ICMP types" option and then make sure that the "Echo Request" checkbox is ticked. Press **OK** (see the figure below), and upon returning to the "New Inbound Rule Wizard" window (see the previous figure) click **Next**.

Figure. 11.2 - 230. Customizing the rule's ICMP settings.



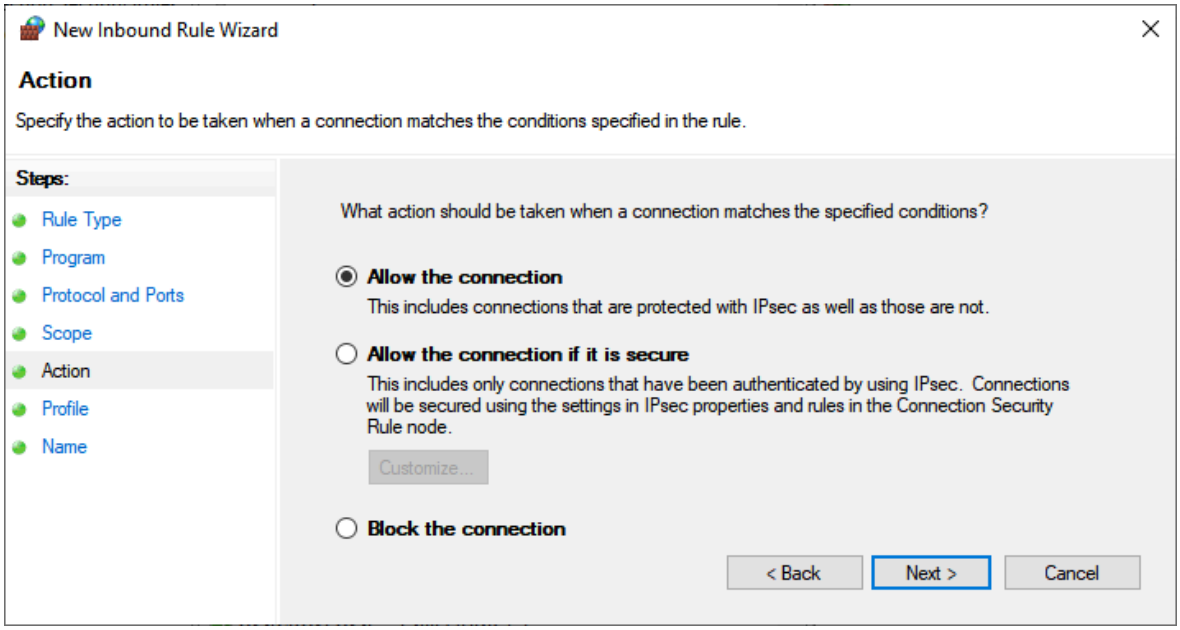
In the sixth step you need to specify the local and remote IP addresses to which the rule applies. Select either of the two options in the "Which local IP addresses does this rule Apply to?" and "Which Remote IP addresses does this rule Apply to?" sections. If you select the "These IP addresses" option, you will need to specify the IP addresses you want to allow. Once all the necessary settings are done, press the **Next** button (see the figure below).

Figure. 11.2 - 231. Specifying the IP addresses.



The seventh step in this process is to specify the action that will be taken when a connection matches the conditions you have specified for your new rule. Select the "Allow the Connection" option so that the rule includes all connections regardless of whether they are protected with IPsec or not. Finish the step by pressing Next (see the figure below).

Figure. 11.2 - 232. Specifying actions.



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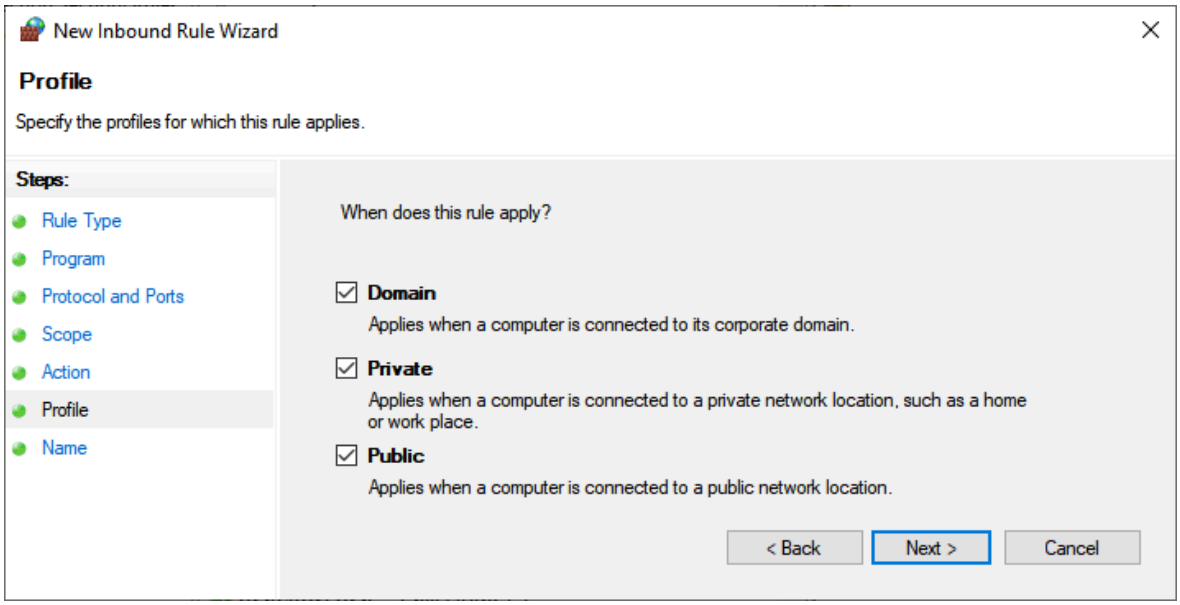
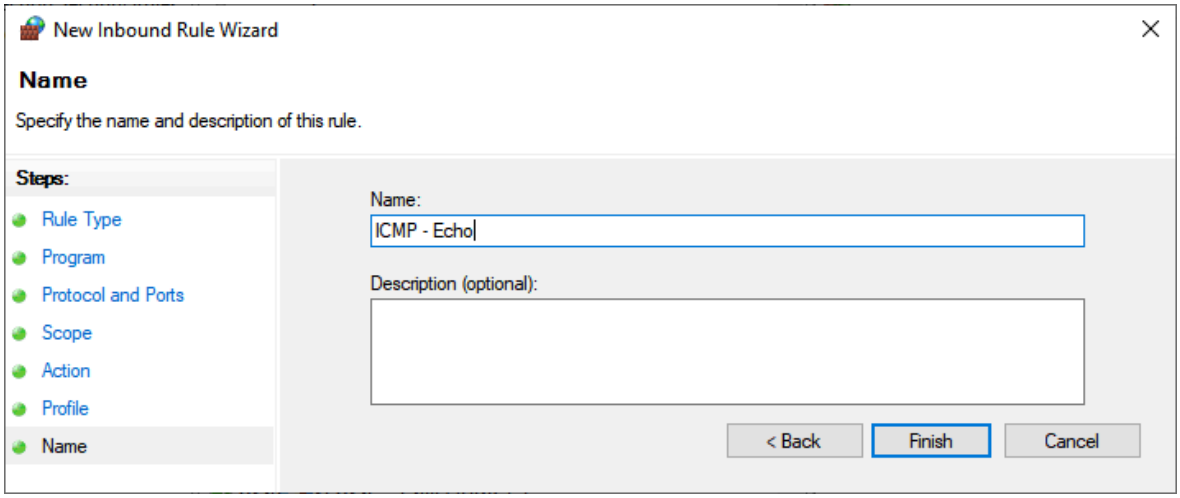
In the eighth step you need to specify the profiles for which your new rule applies to. Select one or more profile names ("Domain", "Private", and/or "Public") to which you want this rule to apply, and then press **Next** (see the figure below).

Figure. 11.2 - 233. Specifying the profiles.



Finally, you need to give your new rule a name, and also a description if you want to. Type the name of the rule in the "Name" text field. You can also optionally give it a description in the "Description (optional)" text box. When you are done, press **Finish** to complete the "New Inbound Rule Wizard" (see the figure below).

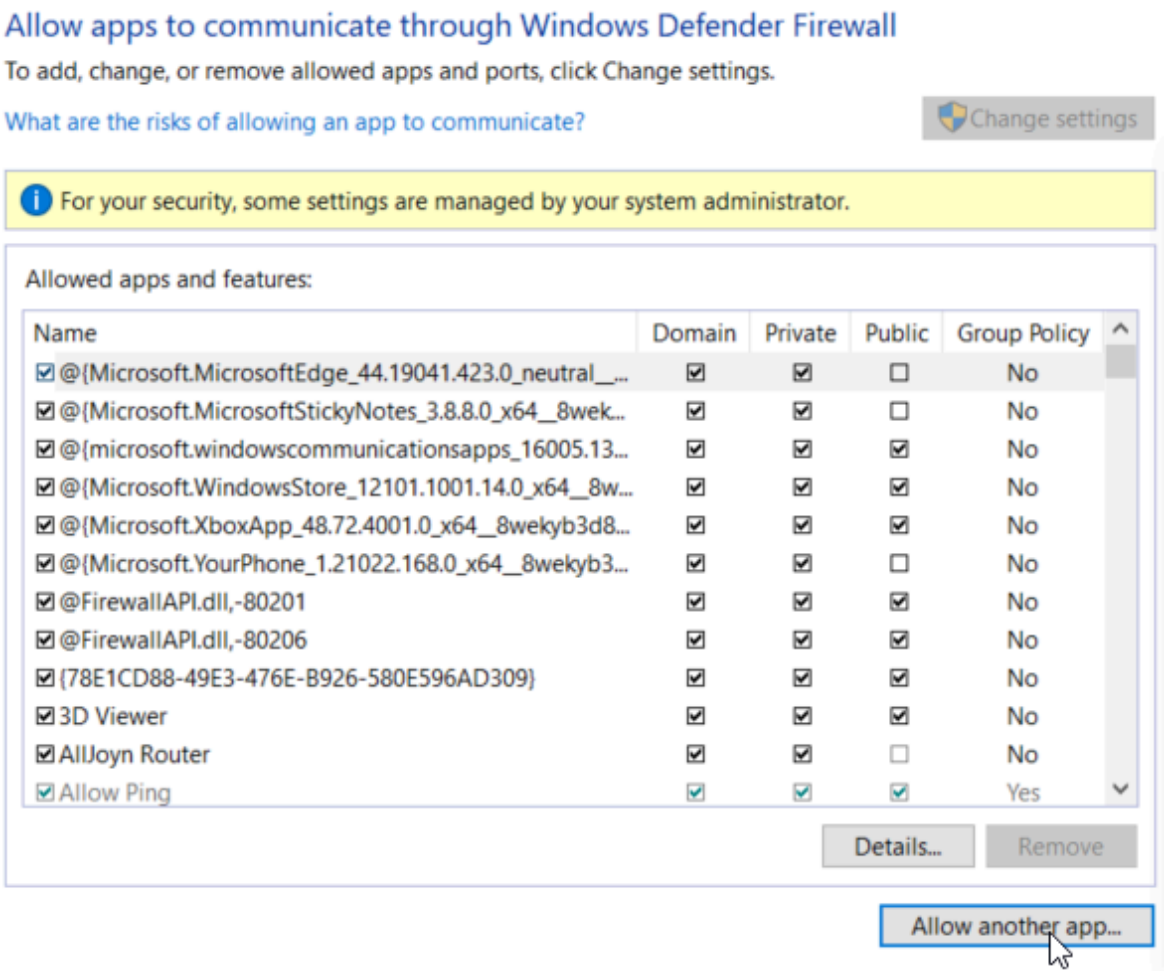
Figure. 11.2 - 234. Giving the new rule a name and a description.



11.3 Allow AQtivate through firewall

In order to allow your firewall software accept AQtivate's firmware upgrade, you need to search for "Allow and app through Windows Firewall" with Windows Search. Press the **Allow another app** button and then select "AQtivate.exe" (see the figure below). AQtivate is installed by default to C:\Program Files (x86)\Arcteq\Aqtivate\AQtivate.exe.

Figure. 11.3 - 235. Whitelisting AQtivate in your firewall software.



11.4 Add TFTP rule to firewall

You can also add a trivial file transfer protocol (TFTP) rule to your firewall software. Begin the process by search for "Windows Defender Firewall with Advanced Security" with Windows Search. Add new rule by selecting "New Rule..." in the "Actions" pane (see the figure below).

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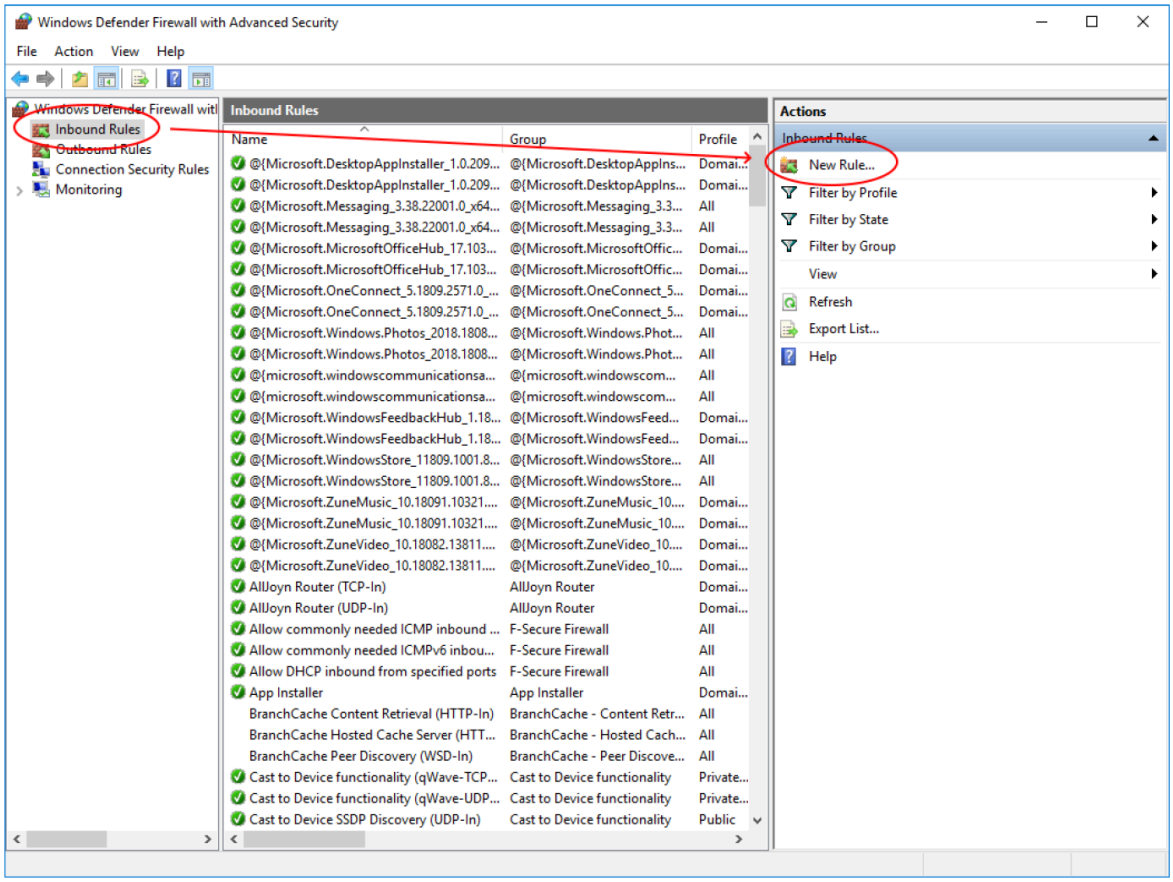
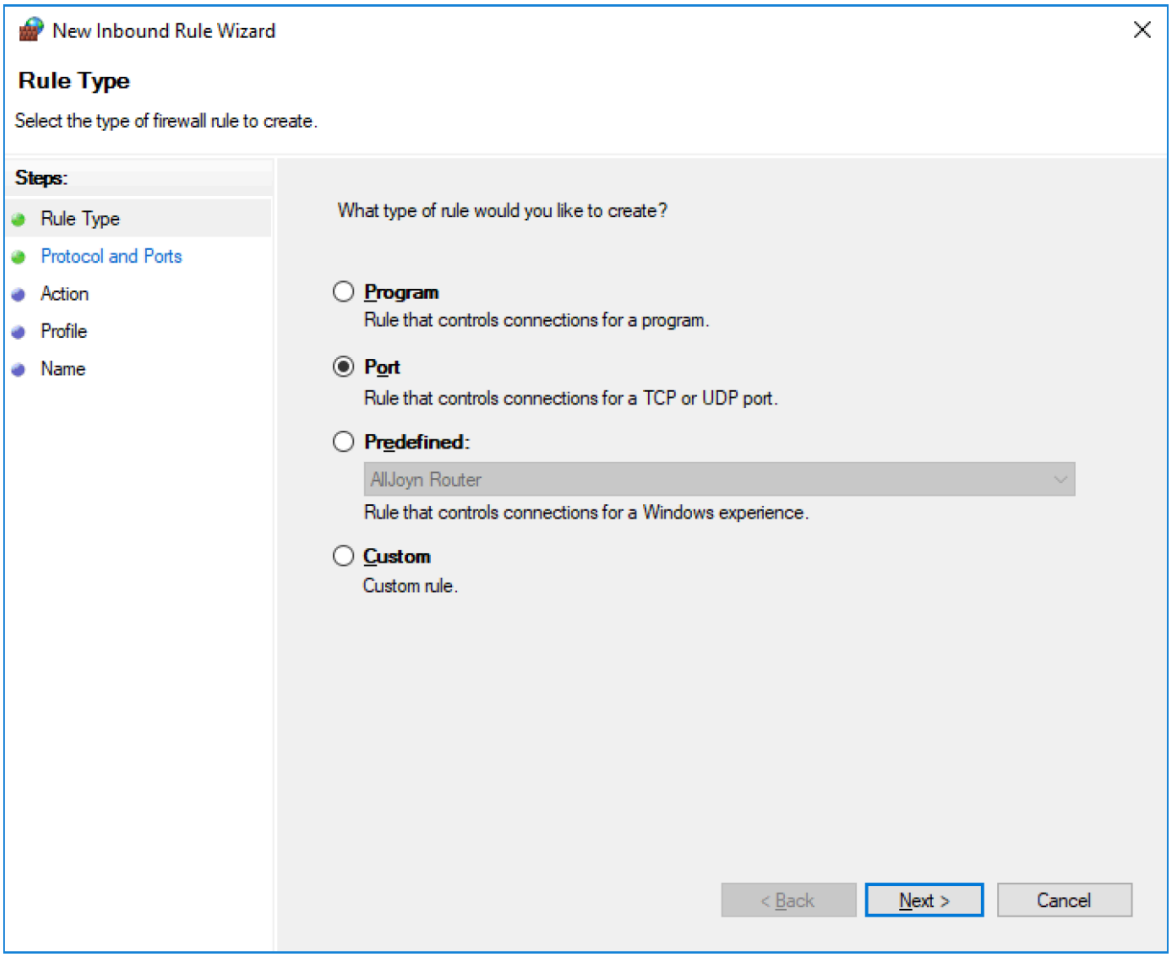
Figure. 11.4 - 236. Adding a new TFTP rule.



The second step in the process is to select the type of firewall rule you want to create. Select the "Port" option and press **Next** (see the figure below).

Figure. 11.4 - 237. Selecting the firewall rule type.



In the third step you need to specify the protocols and ports to which your new rule applies. Select the "UDP" option and set the "Specific local ports" to "69". Press **Next** (see the figure below).

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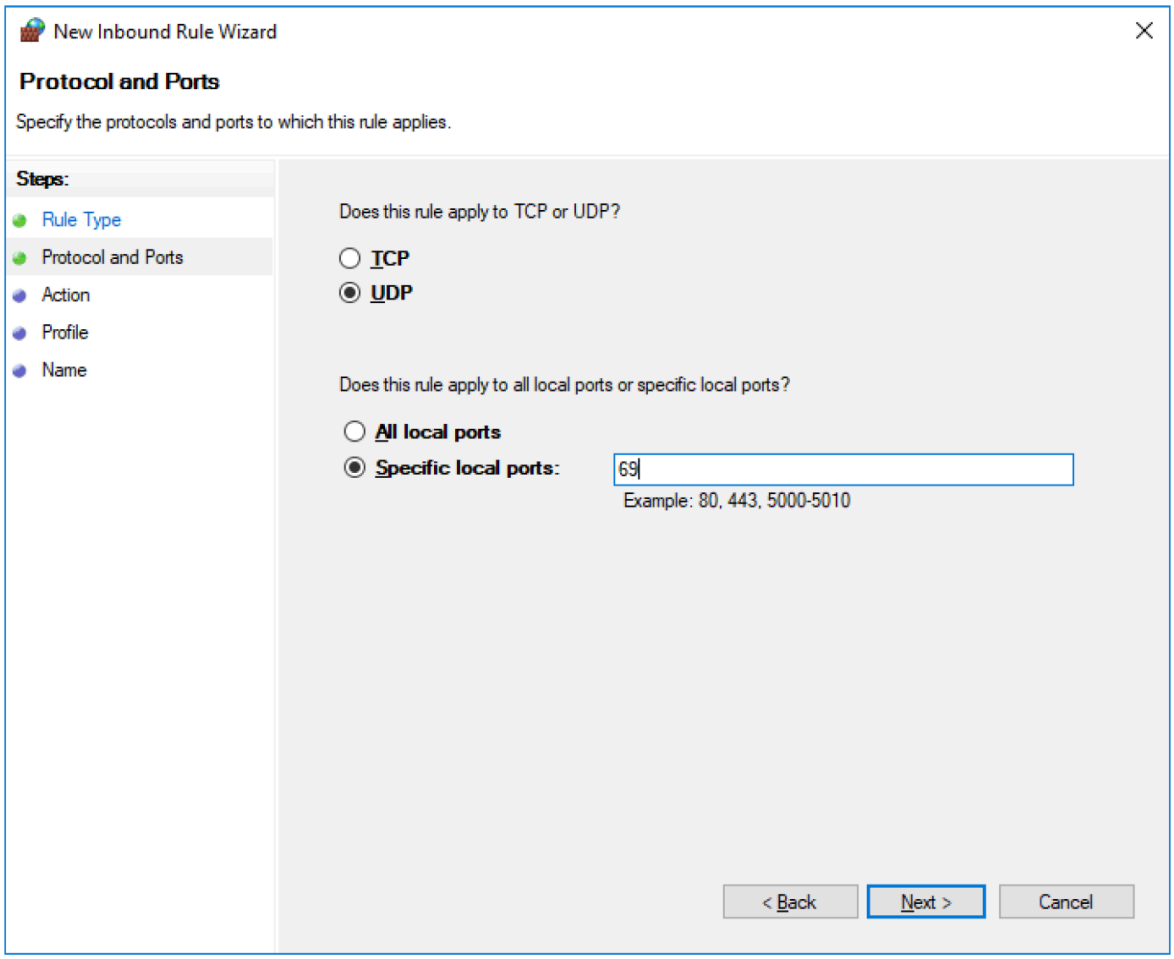
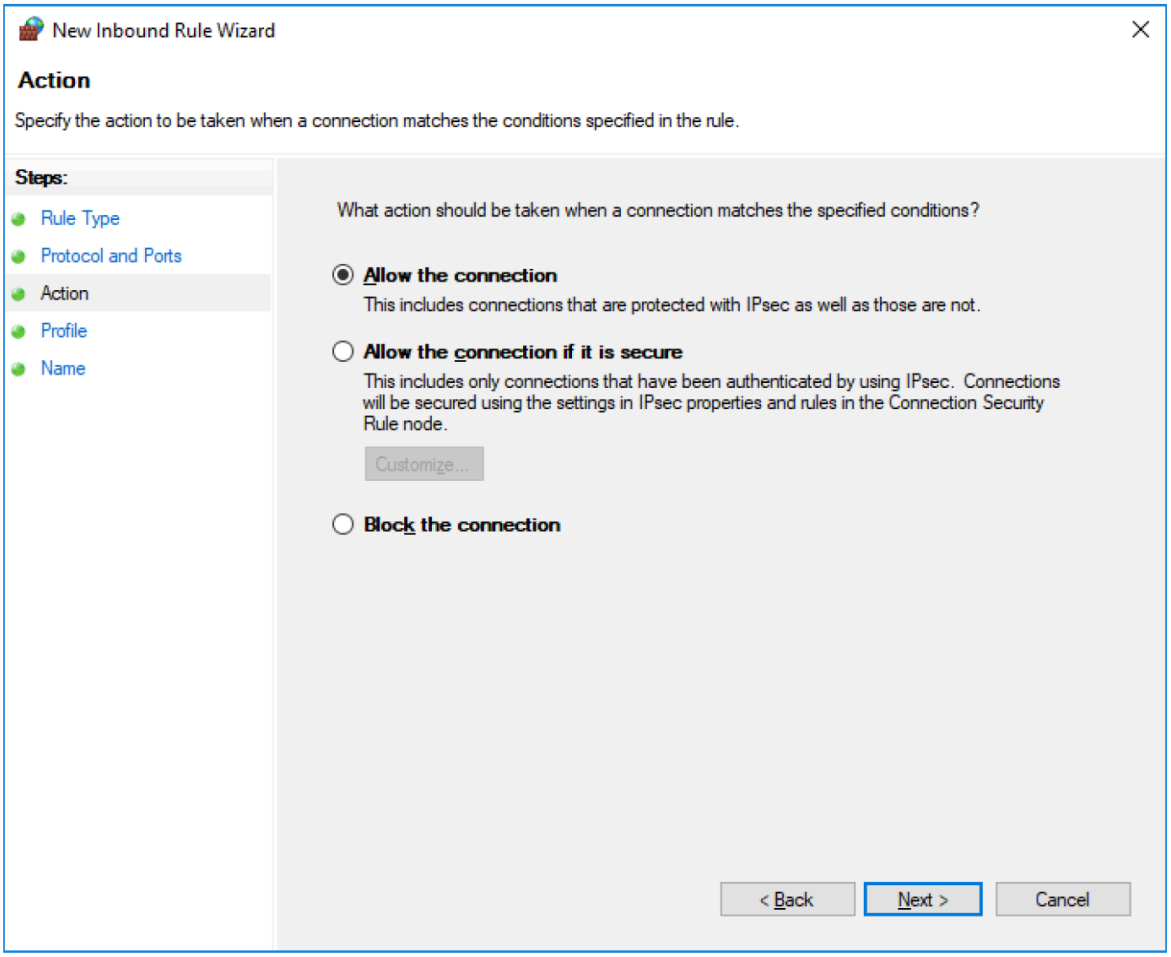
Figure. 11.4 - 238. Specifying the protocols and ports to the new TFTP rule.



In the fourth step you need to specify the action that will be taken when a connection matches the conditions you have set for your new TFTP rule. Select the "Allow the connection" option and press **Next** (see the figure below).

Figure. 11.4 - 239. Specifying actions.



The fifth step is to specify the profiles to which your new TFTP rule applies. Select the profile(s) you want your rule to apply to: "Domain", "Private" and/or "Public". Then, press **Next** (see the figure below).

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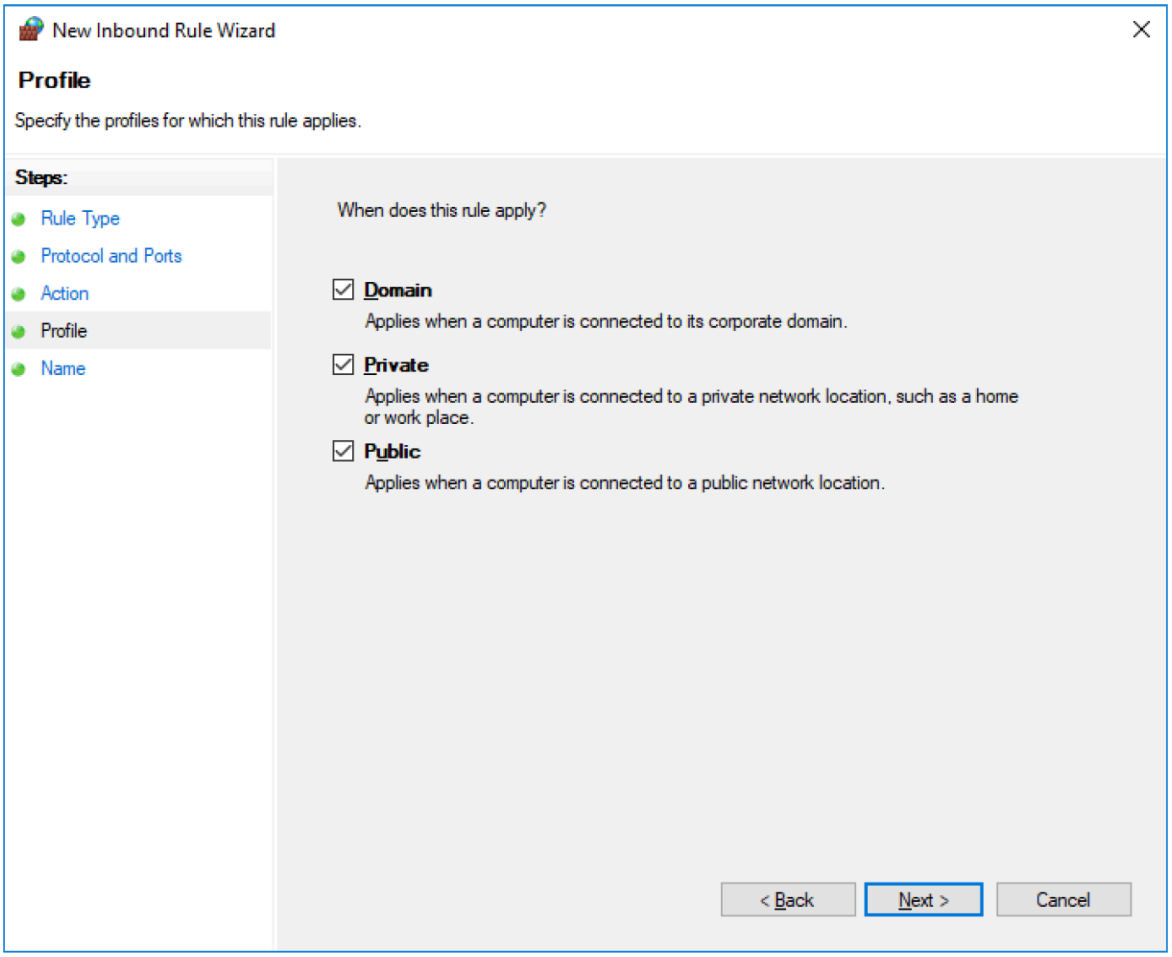
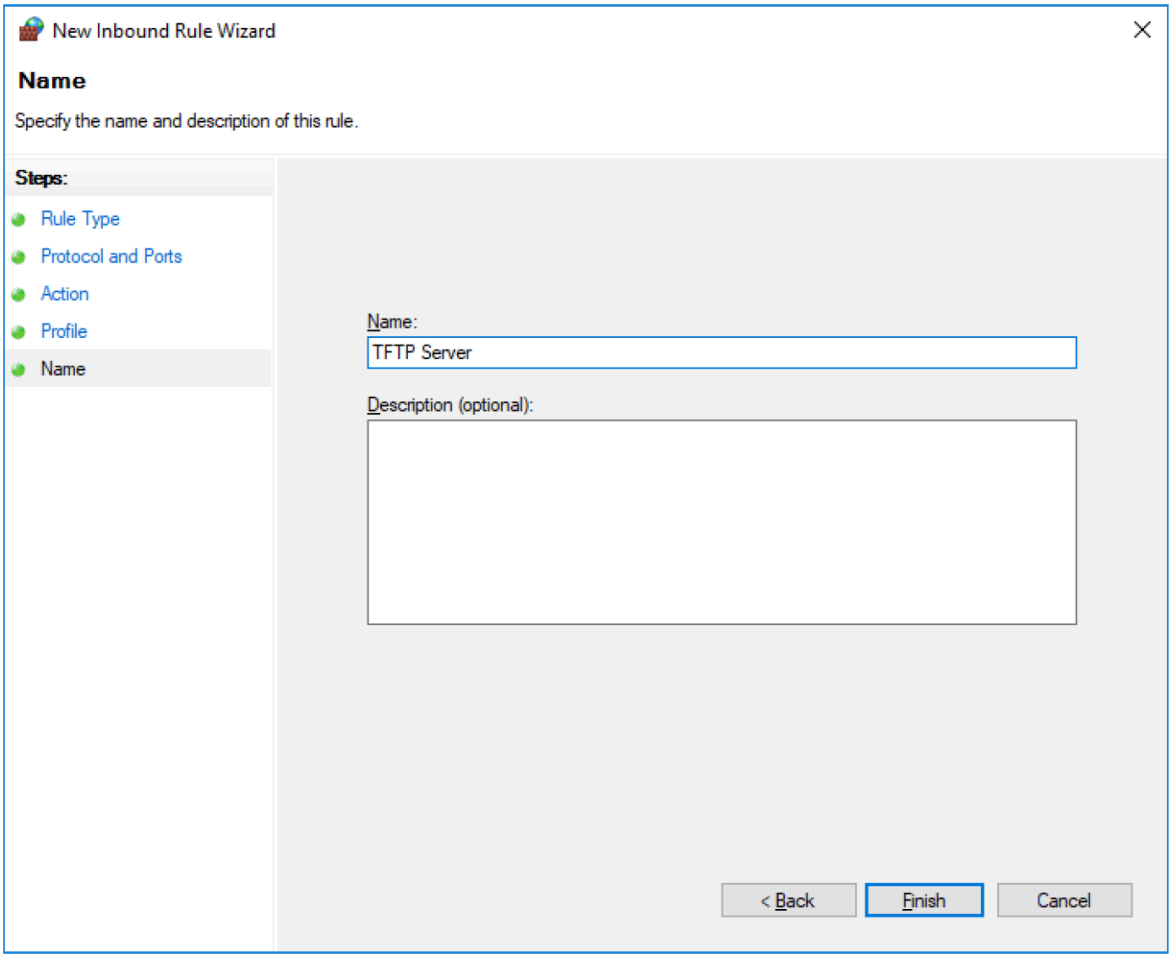
Figure. 11.4 - 240. Specifying profiles.



Finally, you need to give your new TFTP rule a name, and also a description if you want to. Type the name of the rule in the "Name" text field. You can also optionally give it a description in the "Description (optional)" text box. When you are done, press **Finish** to complete the "New Inbound Rule Wizard" (see the figure below).

Figure. 11.4 - 241. Giving the new TFTP rule a name and a description.



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12 Viewing disturbance recordings with AQviewer

Open the AQviewer software by clicking the *Disturbance recorder* menu on AQtivate's main toolbar and then select "Launch AQviewer" (or use the shortcut Ctrl + Alt + D).

You can open disturbance recordings in AQviewer by clicking the "Open" icon (the leftmost icon on the main toolbar, numbered 1 in the figure below) or by going to *File → Open*. Recordings are packed COMTRADE files. A .zip file includes *.cfg and *.dat. AQviewer can open original packed .zip files and COMTRADE files, as both *.cfg and *.dat are in the same directory.

Figure. 12 - 242. Main toolbar icons in AQviewer.

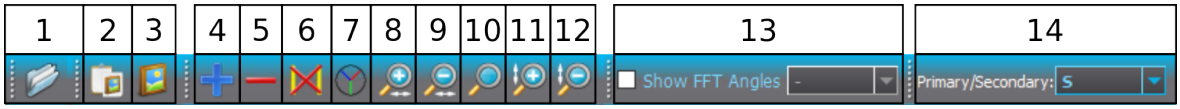

Table. 12 - 29. Main toolbar icon descriptions.

#	Name	Description
1	Open	Open a recording.
2	Copy to clipboard	Copy a screenshot to clipboard.
3	Save screenshot	Save a screenshot as a .png file.
4	Add plotter	Add a plotter (see the description later in this chapter).
5	Remove plotter	Remove added plotters.
6	Remove all cursors	Removes all added cursors (see the description later in the chapter).
7	Show vectors	Opens vector menu (see the description later in the chapter).
8	Zoom in	Zooms the plotter in horizontally.
9	Zoom out	Zooms the plotter out horizontally.
10	Zoom reset	Resets the zoom.
11	Vertical zoom in	Zooms the plotter in vertically.
12	Vertical zoom out	Zooms the plotter out vertically.
13	Show FFT Angles	Shows the FFT angles. When this tool is enabled you can choose the channel with a drop-down box.
14	Primary/ Secondary	Choose which values are shown in the plotter(s): secondary, primary, or per-unit values.

Plotters

Figure. 12 - 243. Plotters in AQviewer.

By default, the plotter is empty. You can select the measured signals from the list titled "Analog Channels" (see the figure above, top left) to move them to the plotter. In the example above the residual current I02F has been selected.

You can add another plotter by clicking on the "Add plotter" button (the blue plus icon highlighted in the top-left part of the figure above). In this example the neutral voltage U0 has been selected and moved to the right in the "Add graph" window (see the top-right part of the figure above). The plotter can be given a name in the "Graph name" text box. Confirm the plotter by pressing the **OK** button. The name of the plotter can be changed by double-clicking on the plotter name. You can also remove a plotter by clicking the red minus icon (to the right of the blue plus icon mentioned before).

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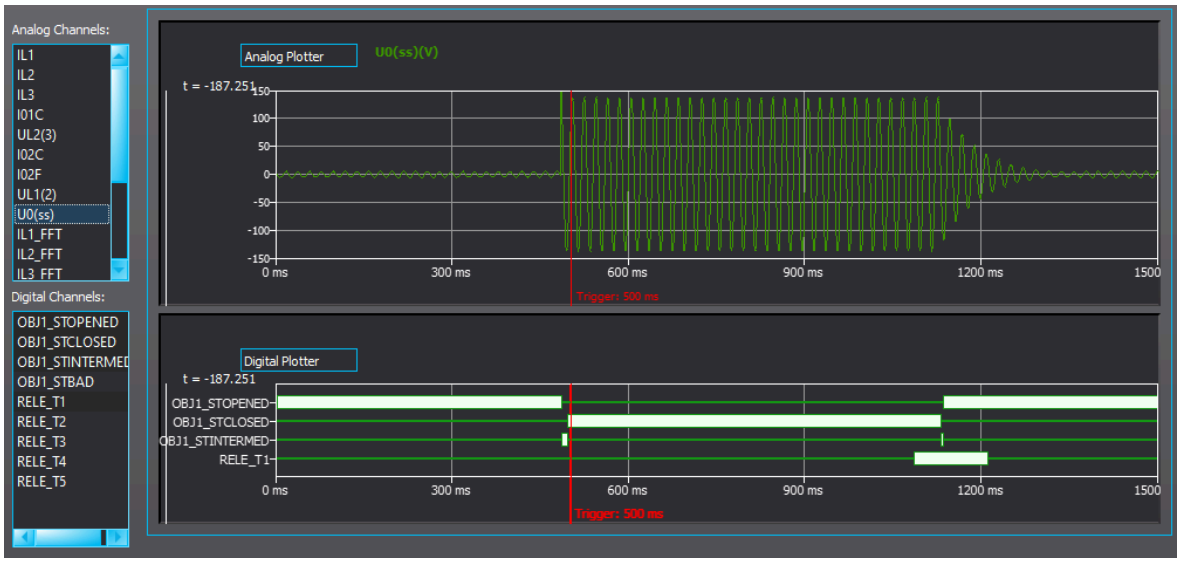
Figure. 12 - 244. Digital signal statuses in AQviewer's plotters.



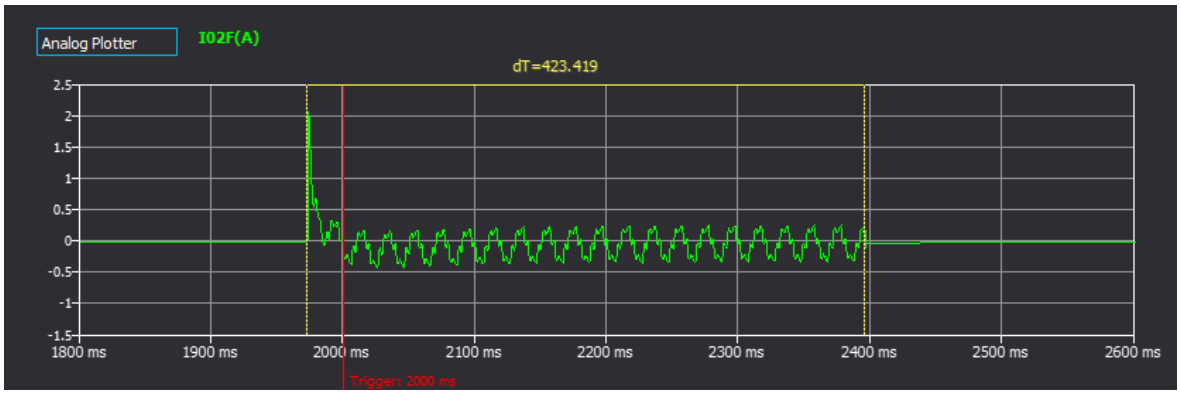
Digital signal statuses are shown at the bottom of the window (see the figure above). All signals which have activations during the recording are selected automatically when the recording is opened.
Any recorded signals can be activated or disabled from the "Digital Channels" list (the bottom-left part of the figure above).

You can zoom in and out by going on top of any plotter, holding down the left mouse button and moving the mouse to create the area you want to zoom in. You can also use the "Zoom" buttons (the magnifying glass icons). You can reset the zooming by pressing the "Zoom reset" (the magnifying glass in the middle).

NOTICE!
You can zoom the amplitude of individual plotters by holding down the **Shift** button and scrolling the mouse wheel. You can also zoom the time by holding down the **Ctrl** button and scrolling the mouse wheel.

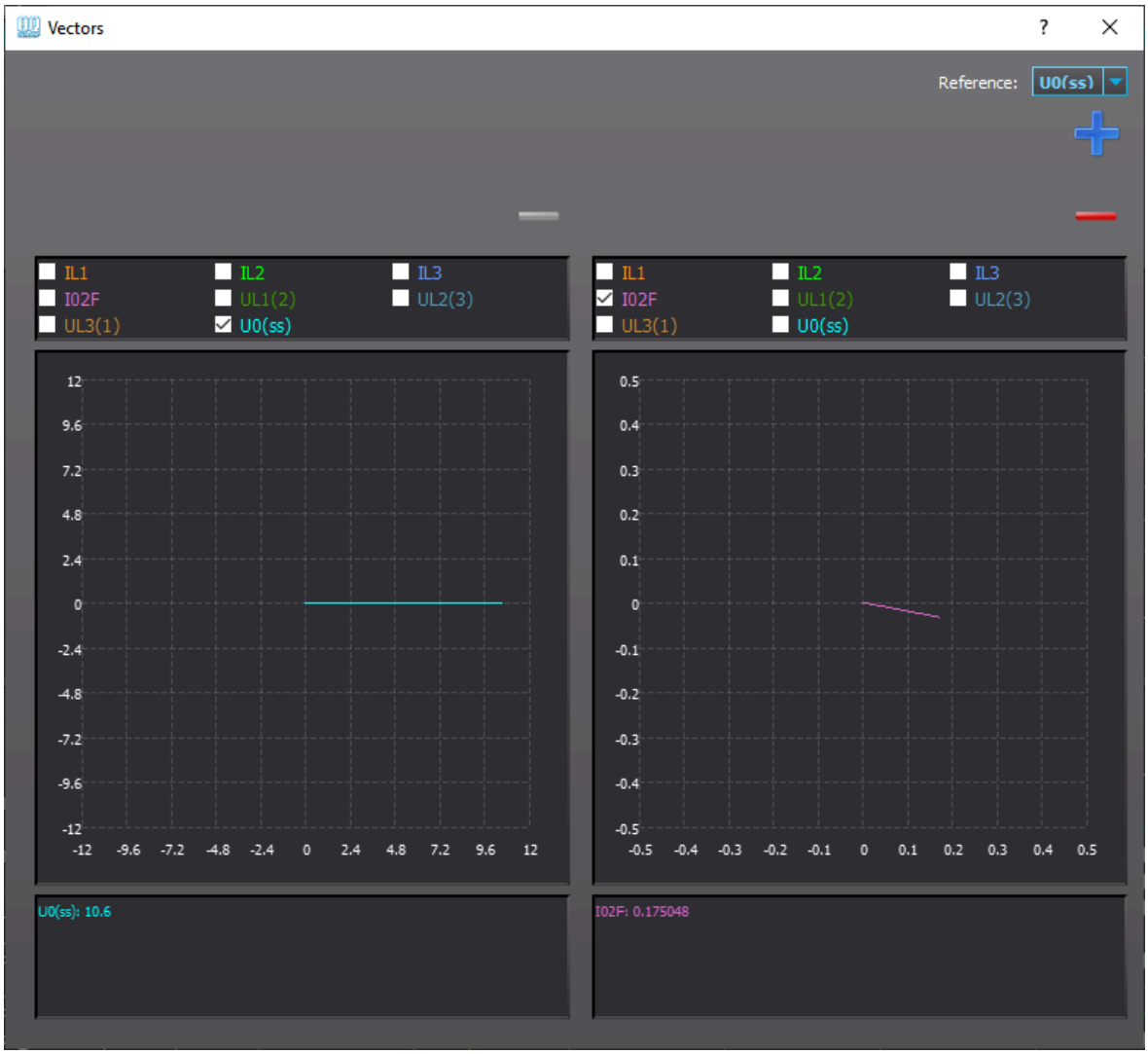
Cursors and vectors

Figure. 12 - 245. Cursors in AQviewer.



You can add cursors to plotters by double-clicking the left mouse button while on top of any plotter. If you add two (2) cursors, the software will show the time difference between the cursors. In the figure above, one cursor has been set to the beginning of a fault and another to the end of the fault. The time difference ("dT") between the two points is 423 ms. You can add up to five (5) cursors at the same time. You can remove all cursors by pressing the "Remove cursors" icon in the main toolbar.

Figure. 12 - 246. Vector is AQviewer.



If a cursor has been set to a plotter, you can check the vectors at that point in time. The "Reference" drop-down box defines which channel is set as the reference angle. Click the plus and minus icons on the main toolbar to add and remove vector diagrams.

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13 Adding an option card

When you want to add a new option card, you must also run a script to the device to update the device's hardware configuration and the menu structure. To start this process, contact Arcteq's technical support (https://support.arcteq.fi/portal/home) and list the following details in the support ticket:

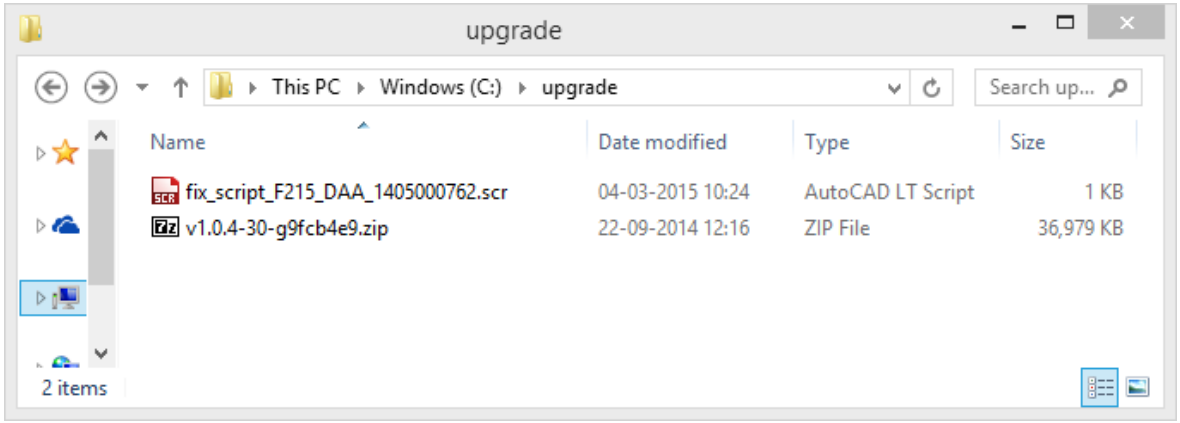
- the device's serial number ("Serial number"),
- the software version ("SW version"),
- the hardware configuration in use at the moment ("HW conf."),
- which option card is being added to the device.

You can find all this information in the device's *General* menu, either from AQtivate or from the device's HMI (see the figure below).

Figure. 13 - 247. Accessing all the relevant device information in the device HMI.

Once Arcteq's technical support has received all the necessary information, they will send you a firmware package that matches the software version as well as a script in a compressed (.zip) folder. The script and the firmware should be placed into a folder with nothingelse than these files. See the figure below for an example of this. Note how the firmware package is still compressed while the script is not!

Figure. 13 - 248. Example of an upgrade folder with only the script and the firmware files.



Next, connect to the device and run the script from *Tools → Run script*. When the script has finished running, the device restarts automatically.

NOTICE!
If the "Error" light is on, go to *Monitoring → Device diagnostics → Clear fault status → Clear*. Please note that the Live Edit mode must be activated when you do this via AQtivate!

14 Contact and reference information

Manufacturer

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