



# EEZ Studio User manual

Low-code embedded GUI development tool  
T&M automation and management

Ver. M13 DRAFT – 03/2023  
www.envox.eu  
github.com/eez-open



# Table of Contents

1. Legal information.....	5
1.1. Definitions.....	5
1.2. Disclaimers.....	5
1.3. Miscellaneous.....	6
1.4. Contact information.....	6
1.5. Revision history.....	6
2. The EEZ Studio overview.....	7
2.1. Introduction.....	7
2.2. Main sections.....	7
2.3. Known issues and issue reporting.....	7
2.4. Donations.....	7
3. Installation.....	9
3.1. System requirements.....	9
3.2. Linux.....	9
3.3. Mac.....	9
3.4. Windows.....	9
3.5. Nix package manager.....	10
3.6. Build and run from source (all operating systems).....	10
3.6.1. Linux only.....	10
3.6.2. Raspbian only.....	10
3.6.3. All platforms.....	10
3.6.4. On Raspbian:.....	10
3.6.5. Nix.....	10
3.7. USB TMC.....	10
3.7.1. Windows.....	11
3.7.2. Linux.....	11
3.8. FAQ.....	11
4. Key features.....	13
4.1. General.....	13
4.2. EEZ Studio Project.....	13
4.3. EEZ Studio Instrument.....	13
5. Menu options and Settings.....	15
5.1. Home page.....	15
5.2. Menu options.....	15
5.2.1. File.....	15
5.2.2. Edit.....	16
5.2.3. View.....	16
5.2.4. Help.....	17
6. Home page instrument sections.....	19
6.1. History.....	19
6.2. Shortcuts and Groups.....	19
6.3. Notebooks.....	20
6.4. Items purge and restore.....	24
6.5. Instrument Extension (IEXT) Manager.....	25
6.6. Add instrument.....	26
6.7. Establishing a connection with the instrument.....	28

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Discord server: <https://discord.gg/dhYMnCB>

E-mail: [support@envoy.eu](mailto:support@envoy.eu)

Website: [www.envoy.eu](http://www.envoy.eu)

### 1.5. Revision history

Date	Version	Changes
2023-03-31	1.0	Initial release

## 2. The EEZ Studio overview

### 2.1. Introduction

EEZ Studio was initially developed as a companion application for the in-house developed [H24005](#) programmable power supply and [BB3](#) T&M chassis to address two important tasks: a) remote programming and management and b) simplifying the development of a feature rich embedded GUI for a color touch-screen display.

The development was inspired by the idea of offering an open source alternative to some existing commercial solutions that are used for the mentioned tasks, all in order to overcome the limitations of their closed code, outdated and complex UI or sometimes awkward UX and licensing, which in our case was not in accordance with the open source of the mentioned devices that we have developed.

### 2.2. Main sections

EEZ Studio consists of two main sections, which are described separately in the manual:

- **Project** – creating, editing, debugging and building the code for the embedded GUI project for the selected target platform. Generated code can be directly imported into the IDE/toolchain used to build the firmware and accelerate the development process. It enables the rapid development of high quality embedded GUI and also comes with support for the open-source LVGL graphics library. The drag-and-drop editor makes it easy to utilize the many features such as widgets, animations, and styles to create a GUI reducing the coding effort. Additionally flowchart-like *EEZ flow* programming feature will further save development time and complexity.
- **Instrument** – allows access to one or more T&M instruments using several communication interfaces through which it is possible to manage and collect measurement data and screenshots using SCPI commands and queries. Collected data can be analyzed, searched, annotated and exported to other applications. Automation of test and measurement tasks using JavaScript and *EEZ flow* programming allows it to be used in different scenarios from basic development, calibration, troubleshooting and quality control using multiple devices from different manufacturers that can be in different locations connected to LANs.

In the introductory chapters of the two main sections that follow, all important features will be listed and described in detail.

### 2.3. Known issues and issue reporting

EEZ Studio is continuously developing and improving. A list of known issues can be found on [GitHub](#) where you are also invited to leave your suggestions for improvements and new functionality.

When reporting bugs using the GitHub tracking system, please first check if the issue you want to report has already been reported by someone else. When opening a new ticket, the following information can simplify and speed up the resolution:

- Descriptive/detail name of the issue (avoid general descriptions)
- Installed operating system version
- Installed EEZ Studio version
- Steps to reproduce the problem you are reporting

### 2.4. Donations

As an open source project, EEZ Studio has been largely developed thanks to donations primarily from [NLnet foundation](#) as well as a number of smaller individual donors. If you want to contribute to further development with your donation, you can use [Liberapay](#).



## 3. Installation

### 3.1. System requirements

EEZ Studio is a 64-bit application. Therefore the minimum requirement for installation is a personal computer with a 64-bit operating system installed which has enough RAM and disk space for smooth operation.

Installation packages for supported operating systems for all versions of EEZ Studio are available for download at <https://github.com/eez-open/studio>

It is the official download page and we recommend that you get the latest version for the first installation. You will be able to check for future updates by using the option provided for that, as described below. If EEZ Studio becomes available on the websites of our partners, this information will be published on the Envov official website.

### 3.2. Linux

Depending on your linux distribution, choose one of the listed packages (.deb, .rpm) and start the installation using the associated installer.

In addition, there is a self-executing .AppImage version that, after downloading, needs to enable the Allow executing file as program option under file Permissions (Fig. 1) before starting it.

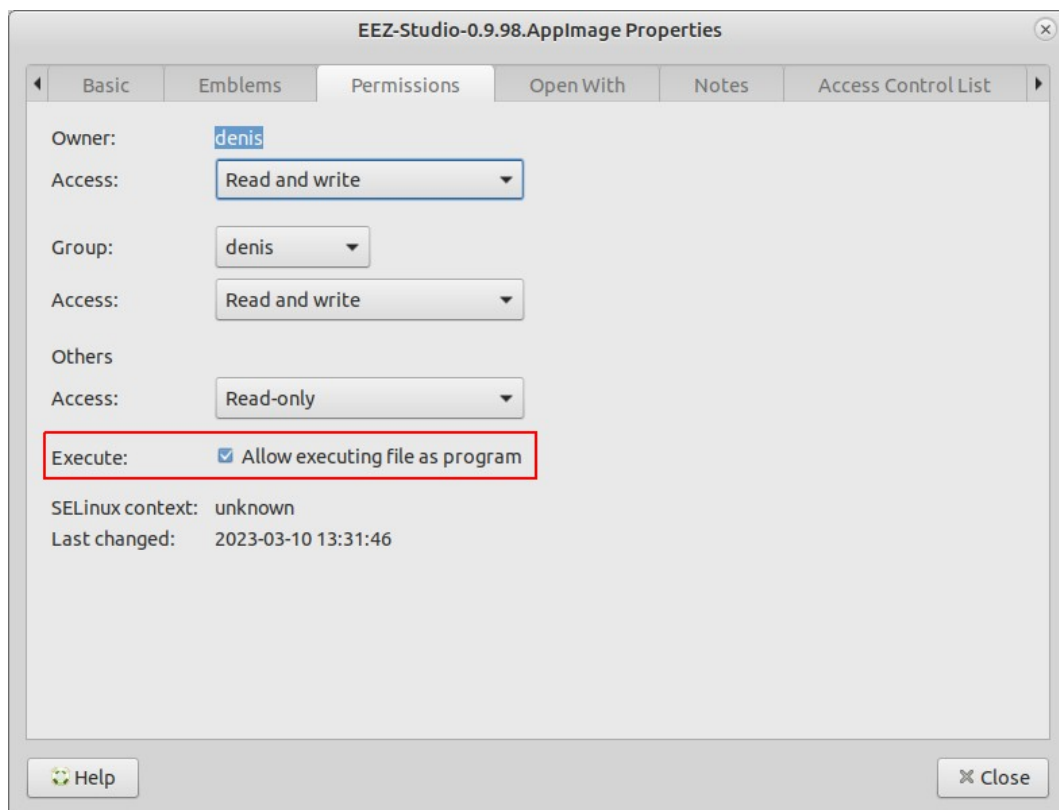


Fig. 1: .AppImage file permission

If you encounter a problem running the .AppImage version on your Linux distribution, try running it using the `--no-sandbox` option: `./EEZ-Studio-[version].AppImage --no-sandbox`

### 3.3. Mac

Download `eezstudio-mac.zip`, unpack and move `eezstudio.app` to Applications.

### 3.4. Windows

Download and start `EEZ_Studio_setup.exe`.

### 3.5. Nix package manager

The Nix [flake](#) provides a derivation for EEZ Studio or an overlay that provides that derivation. It can be used to install the project using [Nix package manager](#).

### 3.6. Build and run from source (all operating systems)

In addition to using ready-made installation packages, it is possible to build and run EEZ Studio directly from the source code located in the GitHub repository. Below is the procedure to be followed:

- Install *Node.JS 14.x* or newer
- Install *node-gyp*, more information at <https://github.com/nodejs/node-gyp#installation>

#### 3.6.1. Linux only

```
sudo apt-get install build-essential libudev-dev
```

#### 3.6.2. Raspbian only

Install *Node.js 16* and *npm* on Raspberry Pi: <https://lindevs.com/install-node-js-and-npm-on-raspberry-pi/>

```
sudo apt-get install build-essential libudev-dev libopenjp2-tools ruby-full
sudo gem install fpm
```

#### 3.6.3. All platforms

In the folder where you want to build the project, it will be necessary to clone the GitHub project repository, and start project building as follows:

```
git clone https://github.com/eez-open/studio
cd studio
npm install
npm run build
```

Start with:

```
npm start
```

Create distribution packages (except [Raspbian](#)):

```
npm run dist
```

#### 3.6.4. On Raspbian:

```
npm run dist-raspbian
```

#### 3.6.5. Nix

To build:

```
nix build 'github:eez-open/studio'
```

To start:

```
nix run 'github:eez-open/studio'
```

### 3.7. USB TMC

The USB TMC driver must be installed if you want to access the T&M instrument using the USB-TMC interface from EEZ Studio *Instrument* section.



### 3.7.1. Windows

Download and start [Zadig](#). Select your device, select libusb-win32 and press “Replace Driver” button:

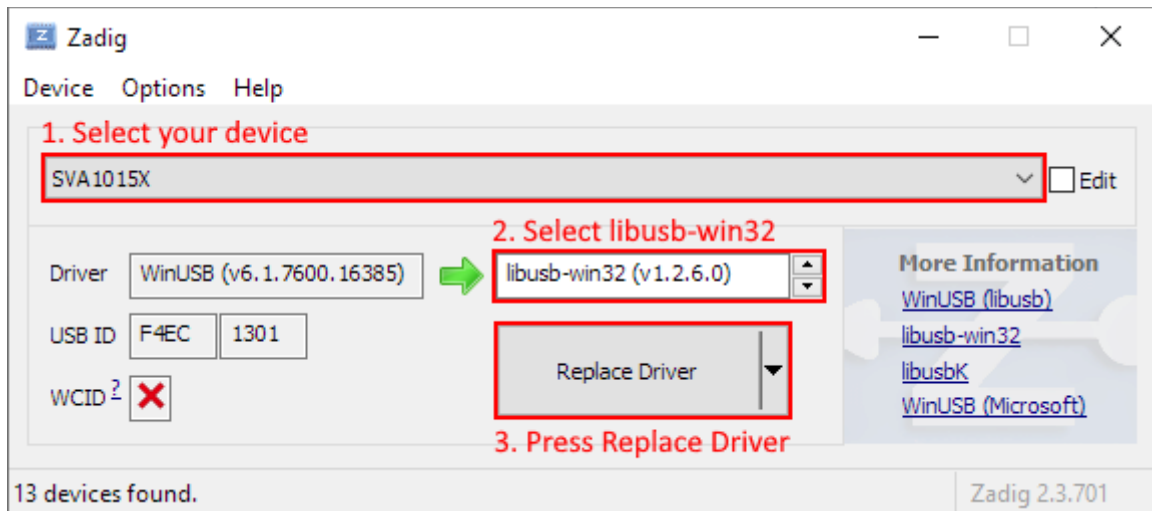


Fig. 2: Zadig driver settings

### 3.7.2. Linux

You will probably need to add your Linux account to the `usbترم` group before you can access the instrument using EEZ Studio. Connect your instrument with a USB cable and turn it on. Wait until booting is complete. Now check the instrument group name by entering the following command:

```
ls -l /dev/usbترم*
```

In case it is `root`, enter the command:

```
sudo groupadd usbترم
```

Now, add your account (<username>) to the group:

```
sudo usermod -a -G usbترم <username>
```

A reboot is required. After that, the `gid` of `/dev/usbترم0` should be set to `usbترم` and you are ready to use your instrument via USB-TMC interface.

## 3.8. FAQ

Q: Where is the database file by default?

A: Depending on the operating system, it can be:

- Linux: `~/.config/eezstudio/storage.db`
- Mac: `~/Library/Application\ Support/eezstudio/storage.db`
- Windows: `%appdata%\eezstudio\storage.db`

The default created database as well as its location can be changed later through the options in the *Settings* section of EEZ Studio.

Q: Where are the IEXTs (Instrument EXTensions) used to access T&M instruments stored?

A: Depending on the operating system, it can be:

- Linux: `~/.config/eezstudio/extensions`
- Mac: `~/Library/Application\ Support/eezstudio/extensions`
- Windows: `%appdata%\eezstudio\extensions`

## 4. Key features

### 4.1. General

- Modern and attractive UI/UX developed in [Electron](#)
- Light / Dark theme
- Multi-tab support for faster navigation
- Cross-platform run-time (Linux, Windows, MacOS)
- Modular design based on plug-ins that can be added/removed depends of scope of the work
- Source/Version control integration ([GitHub](#) and [gitea.io](#))
- Open source project

### 4.2. EEZ Studio Project

- Modular visual development environment for designing TFT display screen decorations and defining user interaction (embedded GUI)
- [LVGL](#) (Light and Versatile Graphivs Library) support
- Generate C++ code for embedded GUI functionality that can be directly included in [STM32CubeIDE](#) for BB3 and other STM32 target platforms or [Arduino IDE](#) for H24005 and other Arduino compatible target platforms
- *Instrument definition file* (IDF) builder with context sensitive SCPI commands help (based on Keysight's [Offline Command Expert command set](#) XML structure) suitable for EEZ Studio *Instrument* and [Keysight Command Expert](#)
- SCPI command help generator based on bookmarked HTML generated directly from .odt file using [EEZ WebPublish](#) extension for OpenOffice/LibreOffice.
- Project templates (using giteo.io repositories) and comparison of projects
- Drag&drop editor for creating instrument's desktop dashboard (for remote control and management)
- Flowchart based low-code programming for desktop dashboard

### 4.3. EEZ Studio Instrument

- Dynamic environment where multiple instruments can be configured and easily accessed
- Session oriented interaction with each SCPI instrument
- Serial (via USB), Ethernet and VISA (via free [R&S@VISA](#)) T&M instrument interfaces support
- Direct import of EEZ Studio generated IDFs and Keysight's Offline Command Expert command sets
- IEXT (Instrument EXTension) catalog with growing number of supported instruments (Rigol, Siglent, Keysight, etc.)
- History of all activities with search/content filtering
- Quick navigation via calendar ("heatmap") or sessions list view
- Shortcuts (hotkeys and buttons) that can be user defined or come predefined from imported IDF. The shortcut can contain single or sequence of SCPI commands or Javascript code.
- Javascript code for task automation (e.g. logfile, or programming list upload/download, etc.) can be also assigned to the shortcut
- SCPI commands context sensitive help with search
- File upload (instrument to PC) with image preview (e.g. screenshots)
- File download (PC to instrument) automation for transferring instrument profiles
- Simple arbitrary waveform editor (envelope and table mode)
- Displaying measurement data as graphs
- FFT analysis, harmonics and simple math functions (Period, Frequency, Min, Max, Peak-to-Peak, Average)
- Export graphs as .CSV file

## 5. Menu options and Settings

### 5.1. Home page

When EEZ Studio is started for the first time, the *Home* tab is displayed, in which the *Projects* and *Instruments* sections can be seen simultaneously (Fig. 3).

The Project section will be described in detail in chapters xx to xx, and the Instrument section in chapters xx to xx.

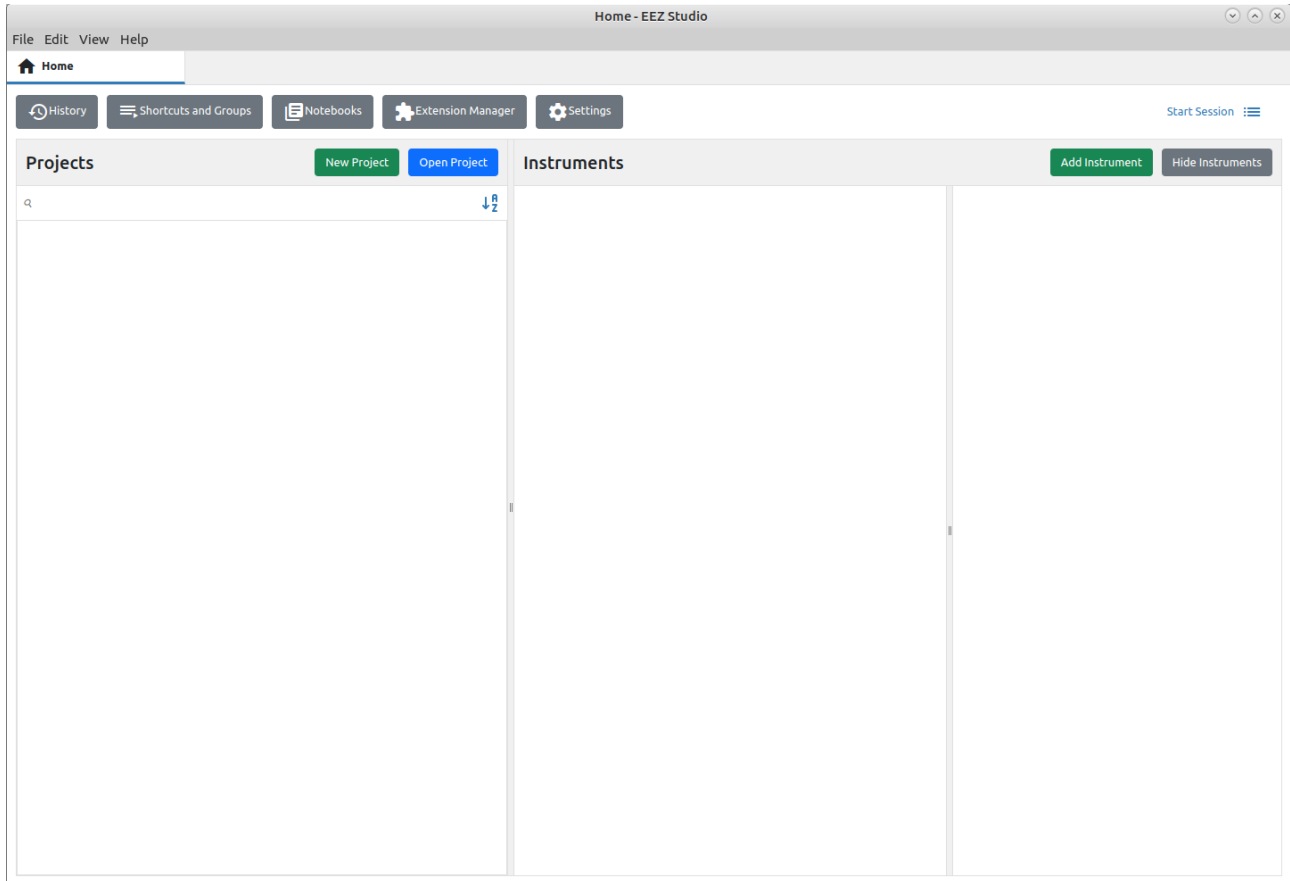


Fig. 3: Home page

### 5.2. Menu options

All menu options available from both sections of EEZ Studio are listed below.

#### 5.2.1. File

Option	Shortcut	Description
<i>New project...</i>	Ctrl + N	Creates a new project.
<i>Add instrument...</i>	Alt + Ctrl + N	Adds an instrument to the EEZ Studio workbench that can be controlled.
<i>New Window</i>	Ctrl + Shift + N	Opens a new copy of the window.
<i>Open...</i>	Ctrl + O	Opens an existing project.
<i>Open Recent</i>		List of recently opened projects.
<i>Import Instrument Definition...</i>		Import IEXT (Instrument EXTension) file.
<i>Save</i>	Ctrl + S	Saving project files.
<i>Exit</i>		EEZ Studio shutdown.

### 5.2.2. Edit

Option	Shortcut	Description
<i>Undo</i>	Ctrl + Z	Undo previous action.
<i>Redo</i>	Ctrl + Y	Redo previous action.
<i>Cut</i>	Ctrl + X	Move content to Clipboard.
<i>Copy</i>	Ctrl + C	Copy content to Clipboard.
<i>Paste</i>	Ctrl + V	Paste content from Clipboard.
<i>Delete</i>	Del	Delete selected content.
<i>Select All</i>	Ctrl + A	Select all content.

### 5.2.3. View

Option	Shortcut	Description
<i>Home</i>		Return to the <i>Home</i> tab.
<i>History</i>		Opening the Instrument's <i>History</i> tab.
<i>Shortcuts and Groups</i>		Opening the Instrument's <i>Shortcuts and Groups</i> tab.
<i>Notebooks</i>		Opening the Instrument's <i>Notewbooks</i> tab.
<i>Extension Manager</i>		Opening the Instrument's <i>Extension Manager</i> tab.
<i>Settings</i>		Opening the <i>Settings</i> tab (Fig. 4).
<i>Toggle Full Screen</i>	F11	View EEZ Studio in full screen (select F11 again to restore).
<i>Toggle Developer Tools</i>	Ctrl + Shift + I	Opening the developer tools in the right part of the window.
<i>Switch to Dark Theme</i>	Ctrl + Shift + T	Toggle between Light and Dark theme.
<i>Zoom In</i>	Ctrl + +	Zoom in (enlargement) of all screen elements. On some Linux distributions you will need to use Ctrl + Shift + + as a shortcut.
<i>Zoom Out</i>	Ctrl + -	Zoom out (reduction) of all screen elements.
<i>Reset Zoom</i>	Ctrl + 0	Returning the zoom to the default level.
<i>Reload</i>		Reload all content.

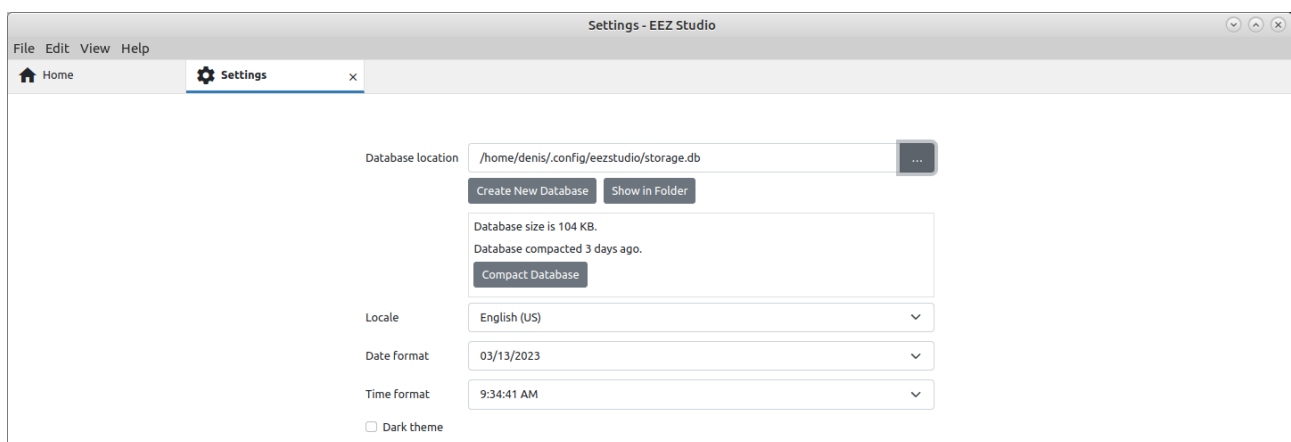


Fig. 4: Settings tab

#### Database location

A database is used to store the data collected in communication with the instruments. An empty base is created at first launch and its location can be seen here. You can also change the location here to one of the existing databases (backup, imported from another EEZ Studio, etc.).

*Changing the parameters of the database requires a restart of EEZ Studio. The Restart button will be displayed in the lower right corner.*

### Create New Database

Creating a new database with the name and location you specified.

### Show in Folder

View the folder where the database is located.

### Locale

Defines the date and time formats for the selected country.

*Changing the Locale requires a restart of EEZ Studio. The Restart button will be displayed in the lower right corner.*

### Date format

Display format of all date values.

### Time format

Display format of all time values.

### Dark theme

Toggle between Light and Dark theme (same as shortcut Ctrl + Shift + T).

## 5.2.4. Help

Option	Shortcut	Description
About		Opens the EEZ Studio version information (Fig. 5).

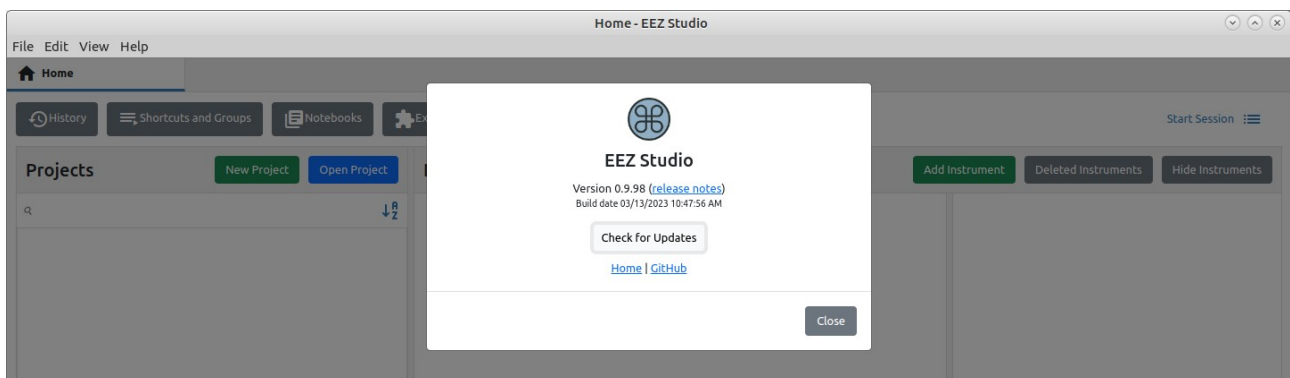


Fig. 5: About page

### Check for Updates

This function requires an internet connection in order for EEZ Studio to connect to the GitHub repository and check for a newer version than the one installed. This function does not take into account versions that have a pre-release status, but only released versions.

### Home

Opens the home page of the Envov official site (requires internet browser installed).

### Github

Opens Envov's GitHub home page (requires internet browser installed).

*EEZ Studio  
Instrument*

## 6. Home page instrument sections

The top of the home page contains general options for working with instruments (Fig. 6). Instrument specific *History*, *Shortcuts and Groups* and *Notebooks* options can also be accessed through the *Instruments action bar* for the currently selected instrument as described below.

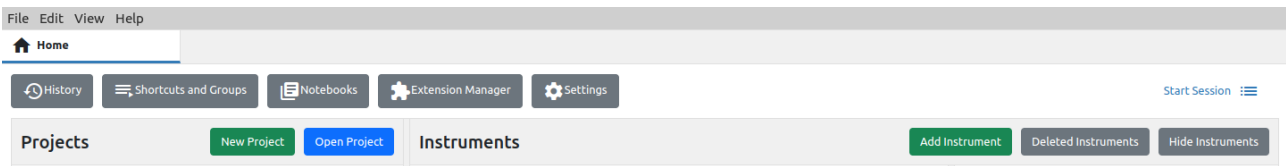


Fig. 6: Home page instrument options

### 6.1. History

*History* displays communication via the *Terminal* option for all instruments in one place. In this way, it will be easier to search all activities as well as to add notes, files and graphs in the same way as in the *Terminal* of the currently selected instrument, as will be described below.

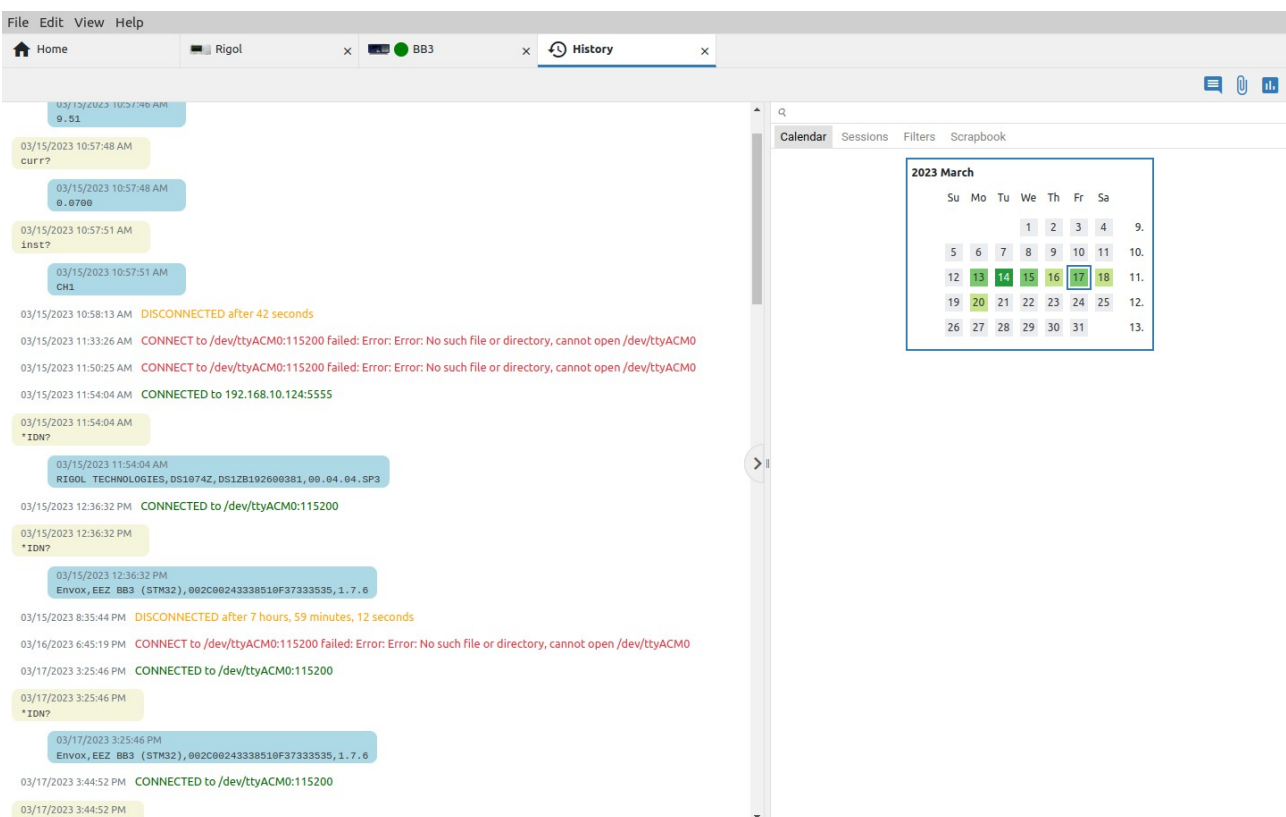


Fig. 7: Instruments History view

### 6.2. Shortcuts and Groups

Just like with *History*, *Shortcuts and Groups* is not a system feature, but only displays the available shortcuts and their groups in one place for easier searching, editing, deleting and adding new shortcuts and their groups.

Therefore, all operations with shortcuts on this page are possible as via the *Shortcuts* page of the currently selected instrument, which will be described below.



File Edit View Help

Home Rigol BB3 Shortcuts and Groups

Show IEXT shortcuts Add Shortcut Show Groups

Name	Group / Extension	Keybinding	Action	Confirmation	Toolbar	Toolbar position
Abort	EEZ BB3 STM32 EEZ BB3 Simulator EEZ H24005 r3B4	F9	SCPI		✓	9
Clear protections	EEZ BB3 STM32 EEZ BB3 Simulator	F10	SCPI	✓	✓	10
Clear protections	EEZ H24005 r3B4	F10	SCPI	✓	✓	10
Coupling	EEZ BB3 STM32 EEZ BB3 Simulator	F5	JavaScript		✓	5
Dlog abort	EEZ BB3 STM32 EEZ BB3 Simulator EEZ H24005 r3B4	—	SCPI		✓	15
Dlog start	EEZ BB3 STM32 EEZ BB3 Simulator	—	JavaScript		✓	13
Dlog start	EEZ H24005 r3B4	—	JavaScript		✓	13
Dlog upload	EEZ BB3 STM32 EEZ BB3 Simulator	—	JavaScript		✓	14
Dlog upload	EEZ H24005 r3B4	—	JavaScript		✓	14
Init	EEZ BB3 STM32 EEZ BB3 Simulator EEZ H24005 r3B4	F8	SCPI		✓	8
Outputs OFF	EEZ BB3 STM32 EEZ BB3 Simulator	F1	SCPI		✓	1
Outputs OFF	EEZ H24005 r3B4	F1	SCPI		✓	1
Outputs ON	EEZ BB3 STM32 EEZ BB3 Simulator	F2	SCPI		✓	2
Outputs ON	EEZ H24005 r3B4	F2	SCPI		✓	2

Fig. 8: Instruments Shortcuts and Groups view

### 6.3. Notebooks

The *Notebooks* feature enables data collected from one or more sources (instruments) to be stored and presented in one place. Data stored in this way can be searched as if they belonged to a single source. Notebooks can also be appended, exported and imported, which facilitates the exchange of collected data.

The screenshot displays the 'Notebooks' interface in EEZ Studio. On the left, a sidebar shows a list of notebooks, including 'bb3 notebook test' and 'test notebook'. The main area displays the content of a selected notebook, showing a timeline of data entries with timestamps and source information. A large screenshot of a Rigol instrument's control interface is embedded within the notebook content. On the right, a calendar for March 2023 is visible. Red numbered callouts (1-7) highlight specific UI features: 1 points to the notebook list, 2 to the 'Add' button, 3 to the 'Edit' button, 4 to the 'Delete' button, 5 to the 'Calendar' button, 6 to the 'Filters' button, and 7 to the 'Scrapbook' button.

Fig. 9: Instrument Notebooks view

## # Option

## Description

## 1 Add / Import notebook

Create a new blank notebook or import a notebook file. When creating a new notebook, you will need to enter a name. To import data into a notebook, use the Notebook option in the instrument's *Terminal*, as shown in Fig. 11: (1) go to the *Terminal* tab in the *Action bar*, (2) select one or more items and (3) export them to a notebook file, a new notebook or an already created notebook.

In the case of exporting to a file, it will be necessary to choose a destination on the local storage, and in the case of exporting to a new notebook, the name of the notebook should be entered.

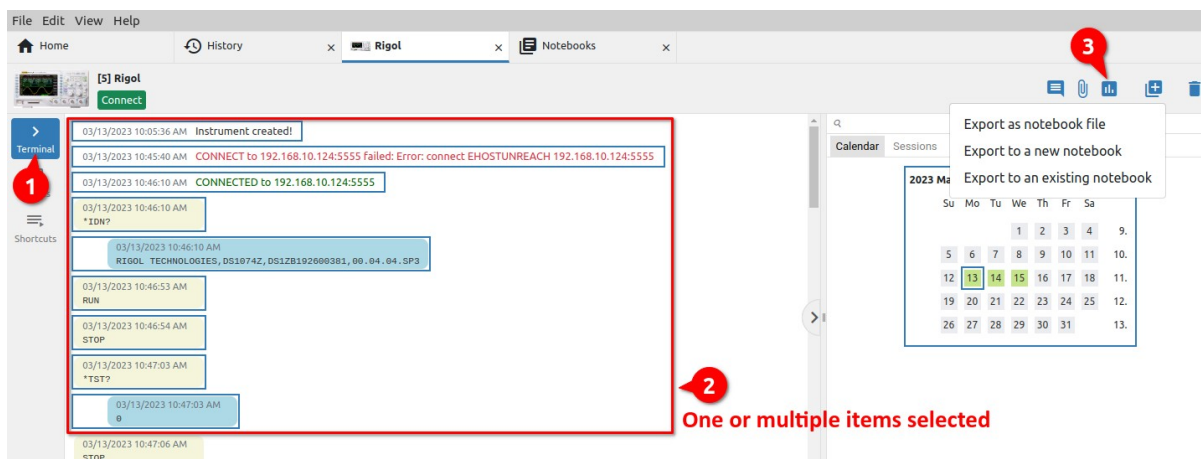


Fig. 10: Adding items to the notebook

## 2 Remove notebook

Remove the notebook from the list.

## 3 Change notebook name

Change notebook name.

## 4 Show deleted notebooks

Notebooks that have been removed from the list are not immediately deleted from the database. This option enables the display of all notebooks (Fig. 11) that have been removed from the list and offers the possibility to restore (return to the list) or permanently delete the notebook.

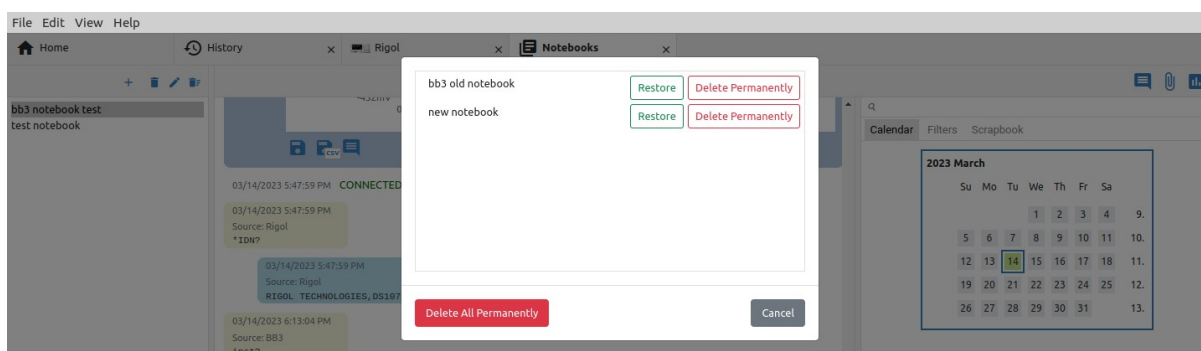


Fig. 11: Deleted notebooks

## 5 Add note

Adding a note to the notebook (Fig. 12). The number of notes is not limited and the last added note will appear at the bottom of the notebook (Fig. 13).

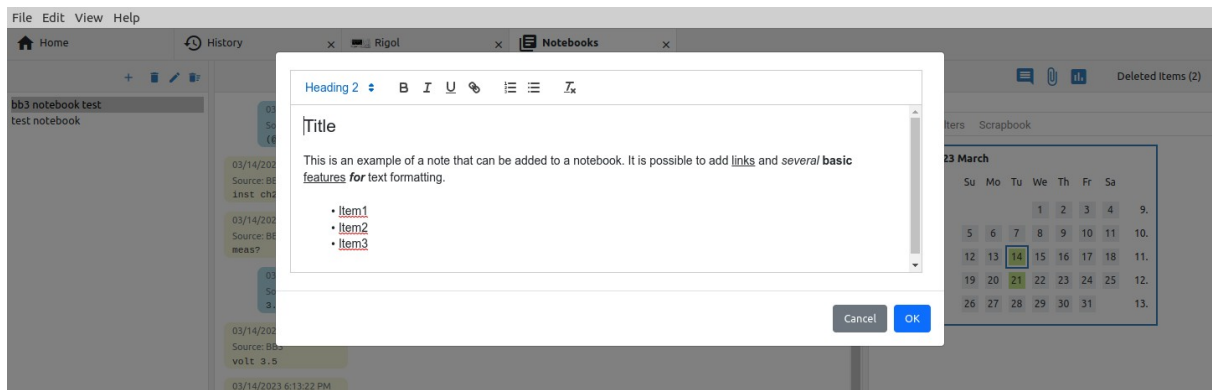


Fig. 12: Adding a new note to the notebook

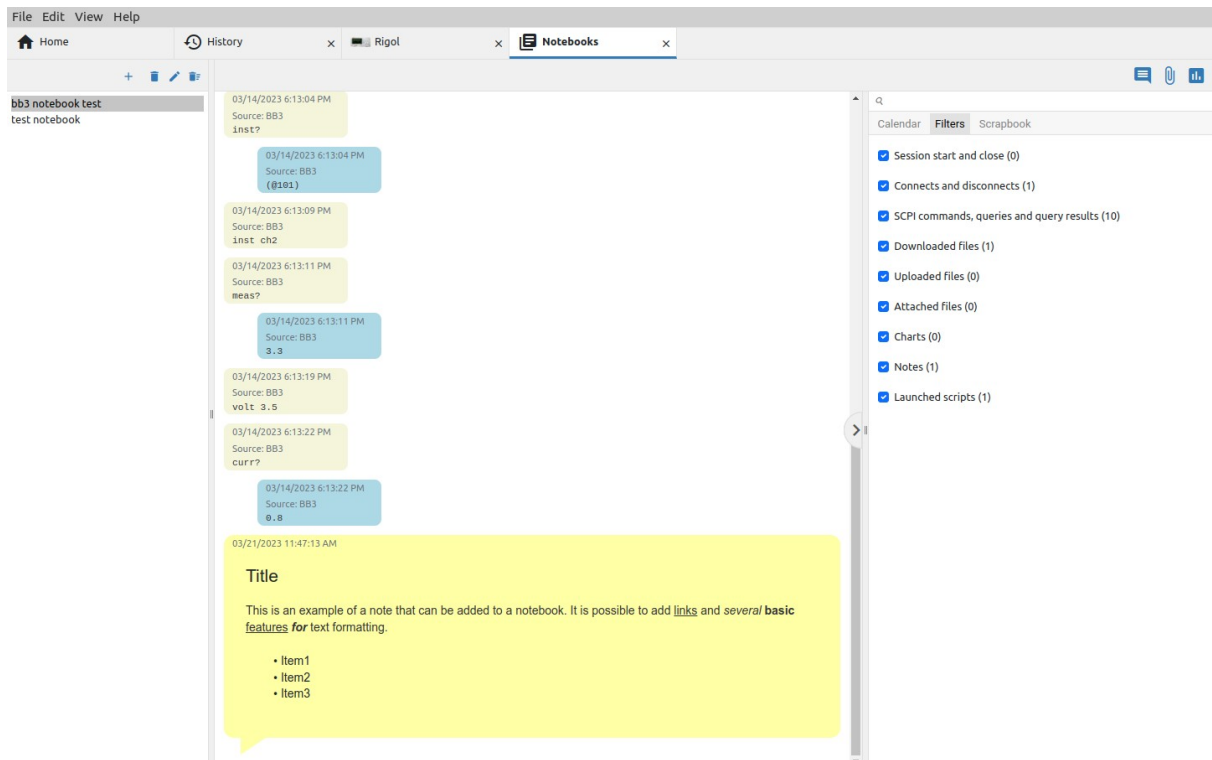


Fig. 13: Newly added note in the notebook

## 6 Attach file

Different files from local storage can be added to the notebook. In this way, all relevant data collected with the instruments can be combined together with images, recordings, datasheets into a whole that can be searched and further shared.

All imported files are marked with a paper clip icon in the upper left corner. It also displays the full path from where the file was imported as well as its size (Fig. 14).

Files whose format EEZ Studio can recognize (.jpeg, .png, etc.) also have a preview. Such files, in addition to the option to save to local storage and to add a note, will also have the option to copy to the clipboard.

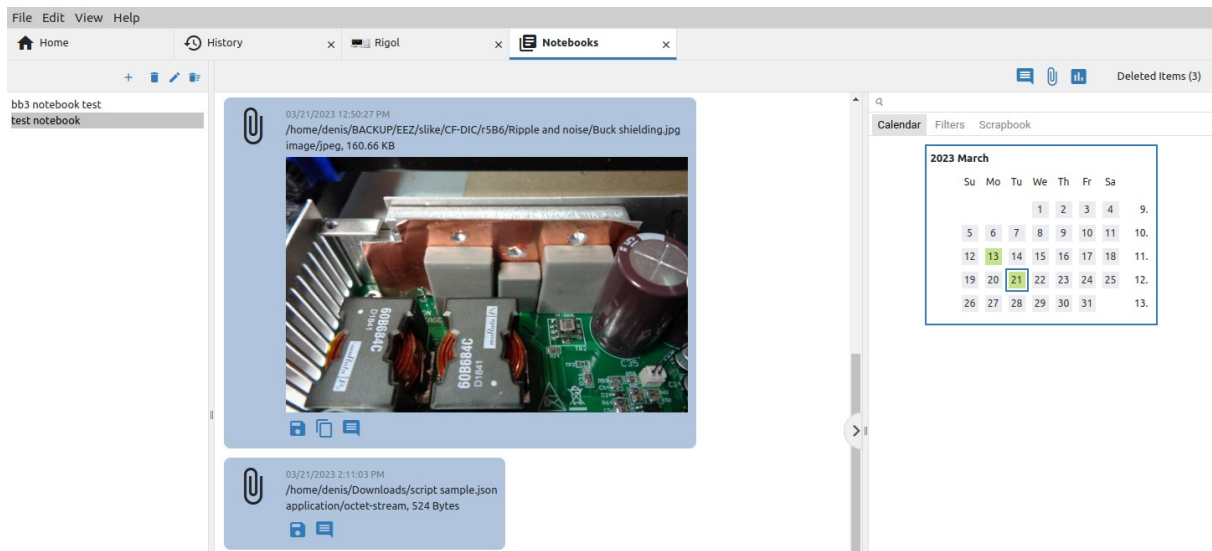


Fig. 14: Files imported into the notebook

## 7 Add chart

This option allows you to create a new graph from two or more existing ones and add it to the notebook. To create a new graph, you will need to select at least two of the found graphs in the currently selected notebook (1, 2) and add it to the notebook (3) as shown in Fig. 15.

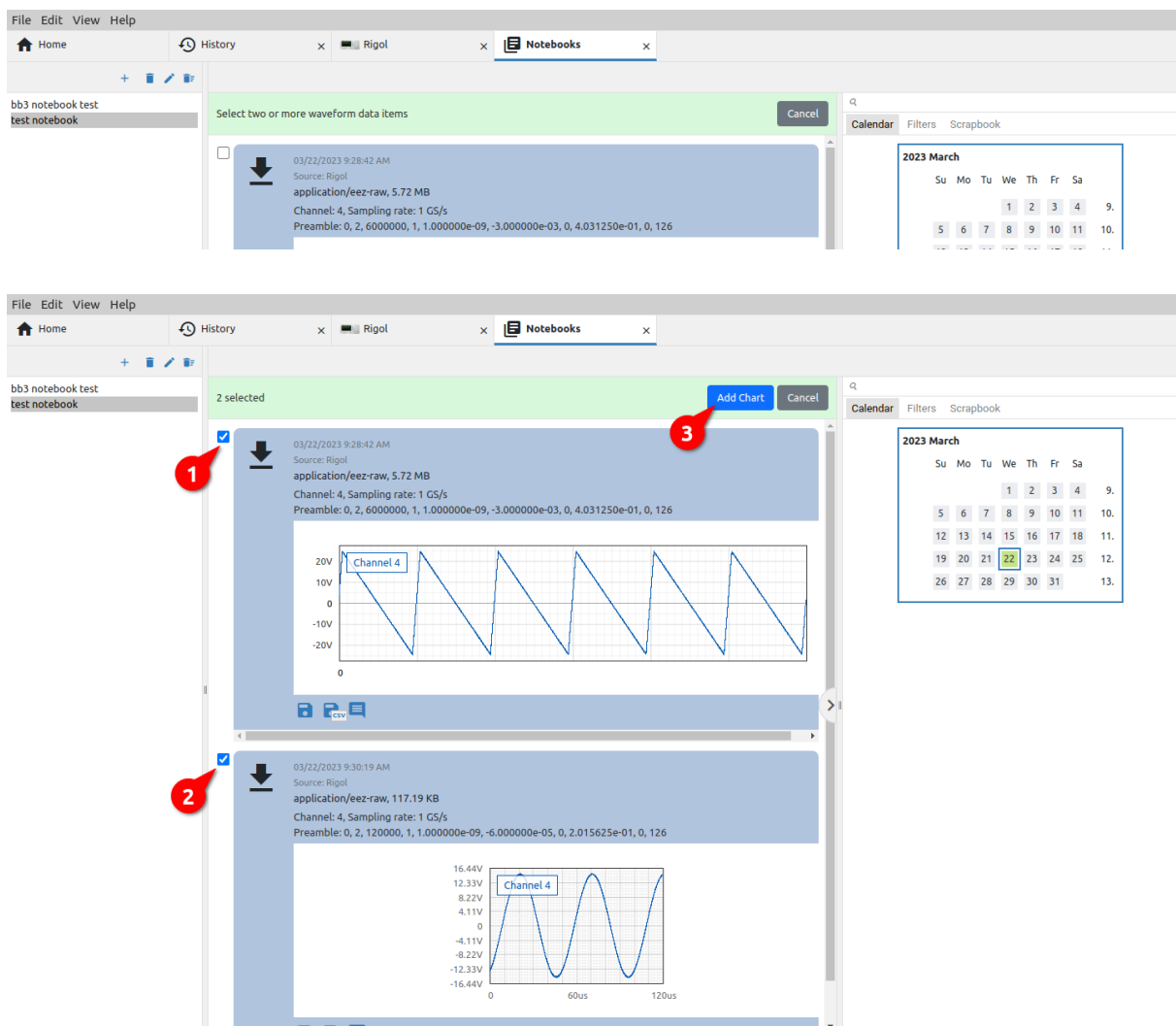


Fig. 15: A selection of graphs to add to the notebook

A successfully created graph will appear at the end of the notebook and will have a graph icon in the upper left corner (Fig. 16).

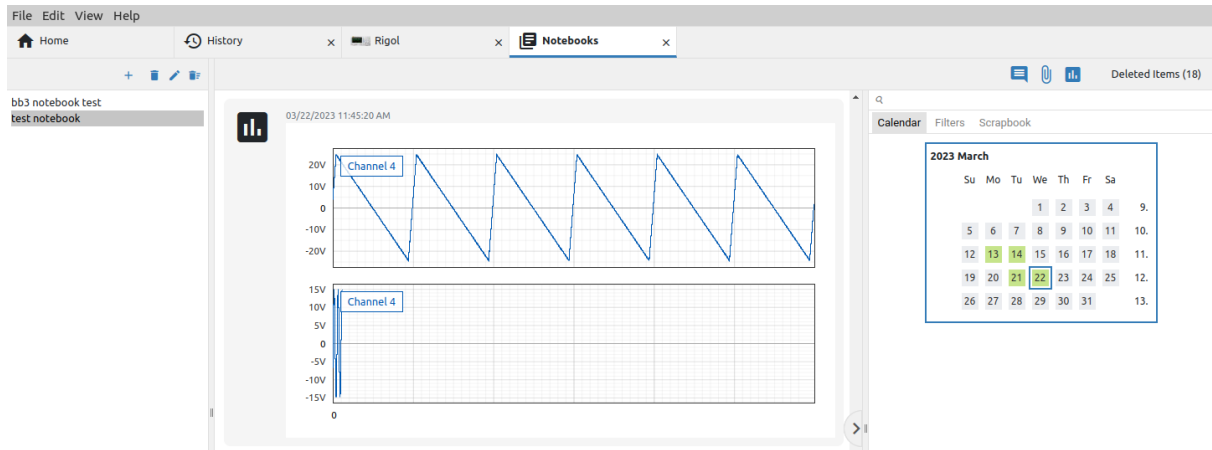


Fig. 16: Newly created graph added to notebook

#### 6.4. Items purge and restore

Items that are removed from the list are not immediately deleted from the database, which leaves the possibility to restore them if needed. The counter of deleted items that can be restored appears in the right corner as shown in Fig. 17.

The counter can be seen in *Notebooks* but also in the *Terminal* tab of the currently selected instrument, and the same rules apply to restore or purge items in both places.



Fig. 17: Deleted items counter

When there are items to delete, they can be accessed by clicking on the counter, when the option to purge all items will first appear (Fig. 18).

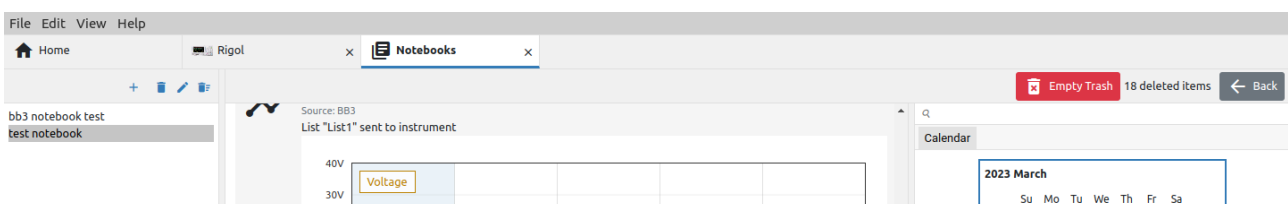


Fig. 18: Empty trash option (no selected items)

If one or more items are selected from the list of deleted items, options for restore (2) or purge (3) will appear (Fig. 19).

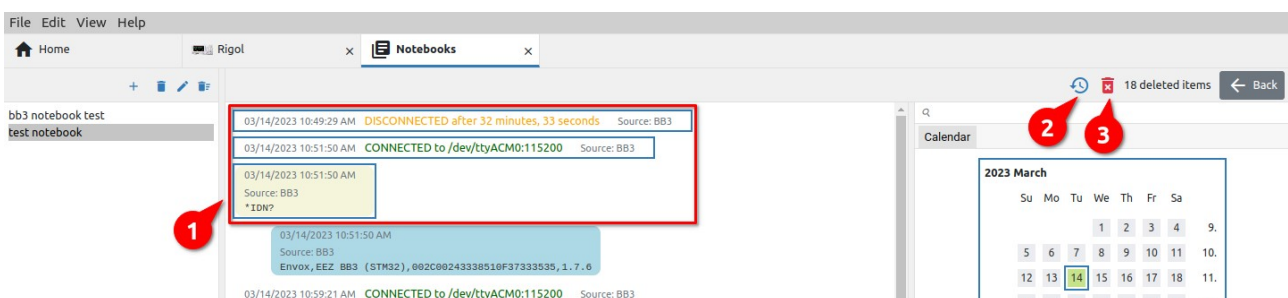


Fig. 19: Selection of deleted items for restore or purge

## 6.5. Instrument Extension (IEXT) Manager

The EEZ Studio use *Instrument Extensions* (IEXTs) to make communication and control of various instruments easier and more efficient. EEZ Studio comes with IEXTs for several instruments including EEZ H24005, EEZ BB3 as well as Generic SCPI which can be used for basic operations such as connection testing and sending commands and queries. (e.g. \*IDN?).

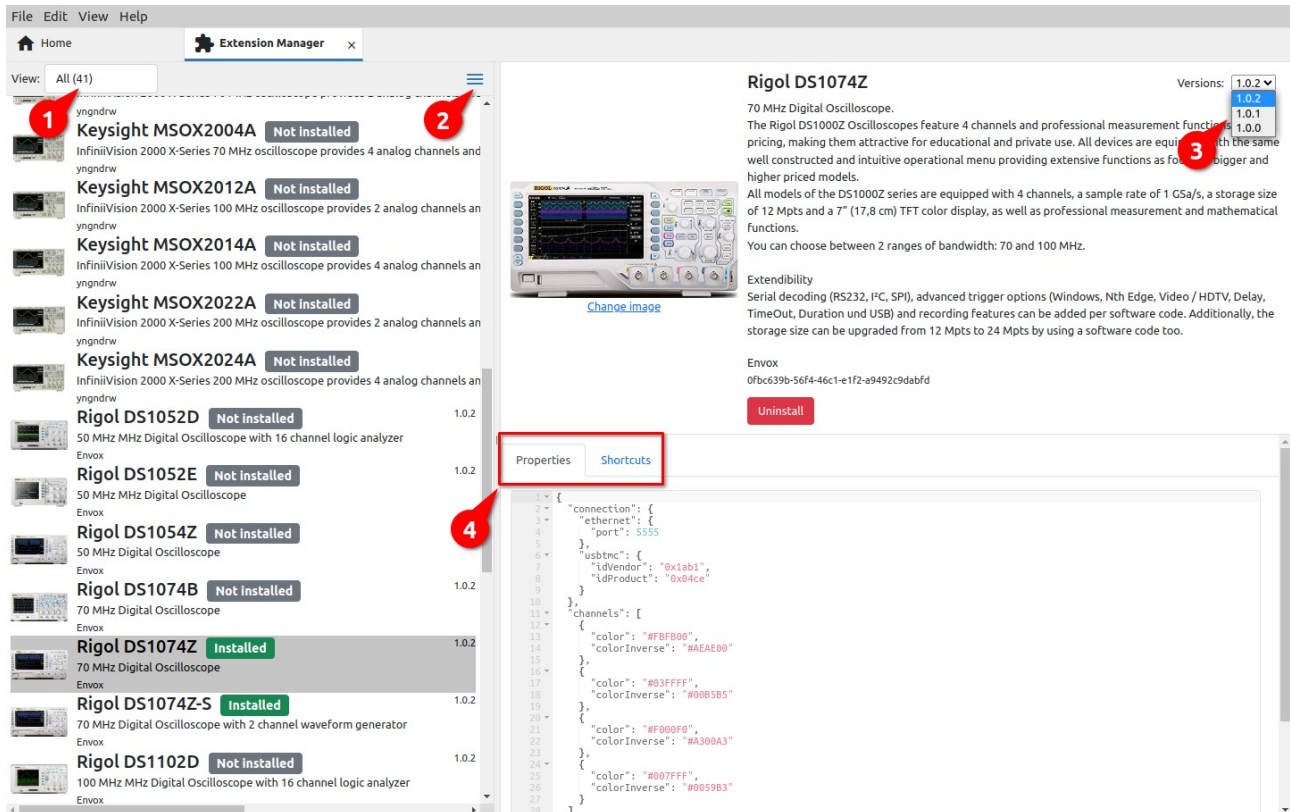


Fig. 20: Instrument extension (IEXT) Manager view

#	Option	Description
1	View	Filters for displaying IEXT in the list: it is possible to display all, only installed or only those that are not installed. The number of filtered IEXTs is displayed next to each option.
2	Update / Install actions	All approved IEXTs are in the catalog on GitHub, with which EEZ Studio synchronizes its catalog every time it is started. Synchronization with the IEXT catalog can also be started manually at any time using the <i>Upgrade Catalog</i> option. The <i>Install extension</i> option allows installing an IEXT that is not in the catalog (from local storage).
3	Versions	IEXT can have multiple versions. If there is more than one, it is possible to change the installed IEXT with one of the versions from the list. In this case, the <i>Replace</i> option will appear as in Fig. 21.

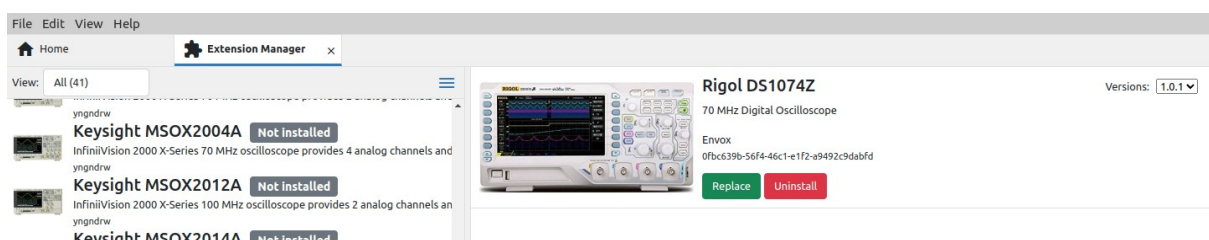


Fig. 21: Changing installed IEXT version



#### 4 Properties

IEXT for a supported instrument can have several properties that will be displayed below the IEXT description. All displayed properties are for informational purposes and cannot be changed here.

### 6.6. Add instrument

By using *Add instrument* (Fig. 6), only those instruments for which there is an IEXT in the IEXT catalog can be added to the workbench.

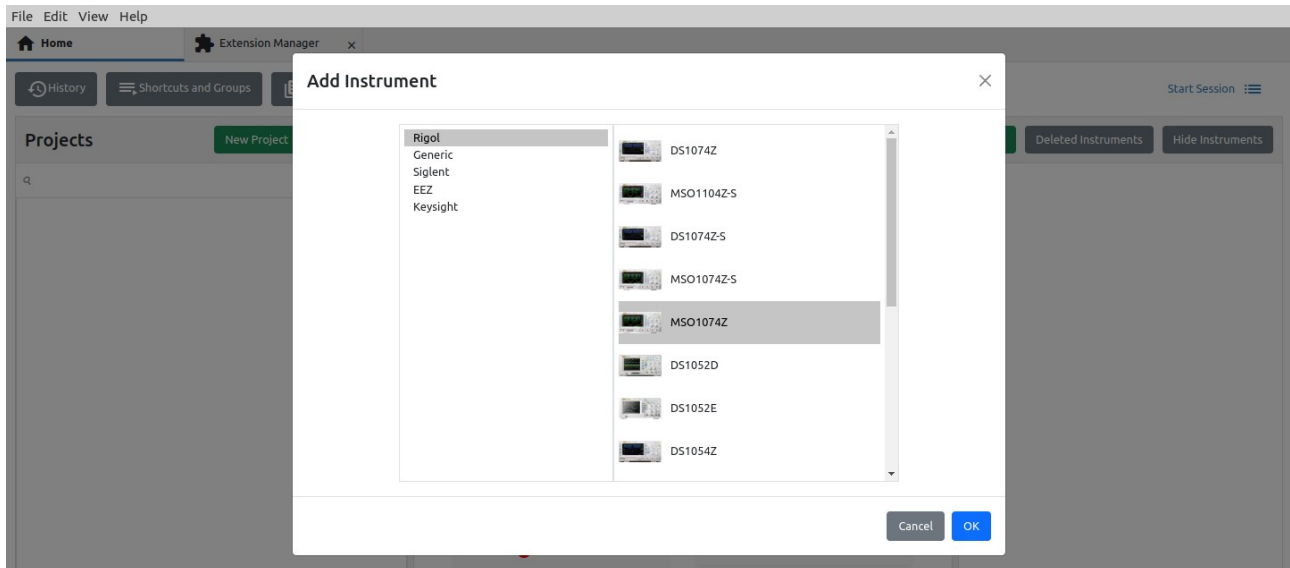


Fig. 22: Add instrument to workbench

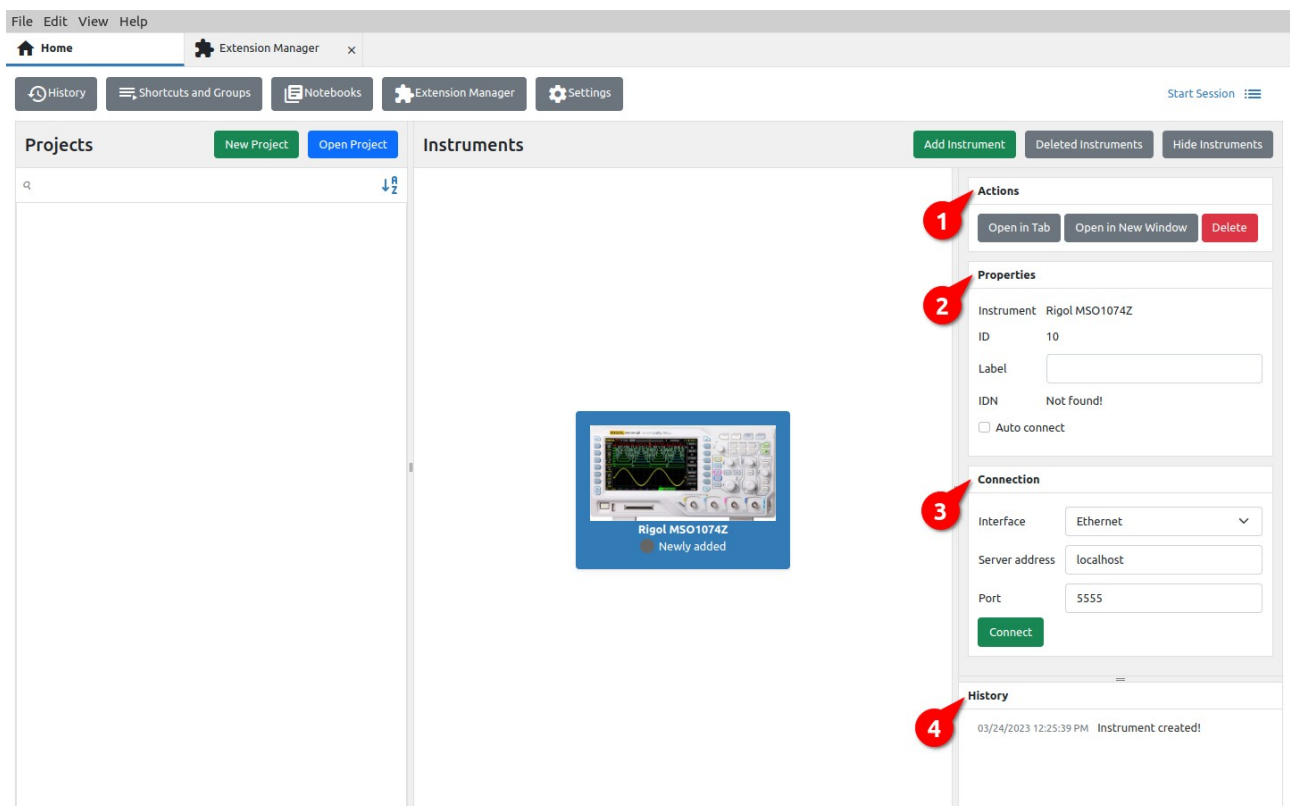


Fig. 23: New added instrument

A successfully added instrument will appear on the workbench (Fig. 23) with the label *Newly added*, and when selected, the sidebar will have the following sections:



#	Option	Description
1	<i>Actions</i>	Basic set of actions for displaying the instrument in a separate tab or new window and for removing it from the workbench.
2	<i>Properties</i>	The properties of the instrument contain information about the IEXT name, the internal ID, the instrument label that can be changed as desired, the identification string that the instrument returns in response to the SCPI query *IDN? and the option to automatically establish a connection with the instrument when starting EEZ studio.
3	<i>Connection</i>	Connection type. Connections to the instrument are defined in IEXT and there can be several of them. Depending on the type of connection (e.g. Serial, Ethernet, USBTMC, VISA), the associated connection parameters will also be displayed.

*Please note that the USBTMC and VISA interfaces are experimental and may not work properly on your computer.*

For normal communication via the VISA interface, it will be necessary to install a free [R&S®VISA](#) driver. In case it is not installed or there is some problem in communication with it, an error message will appear as in Fig. 24.

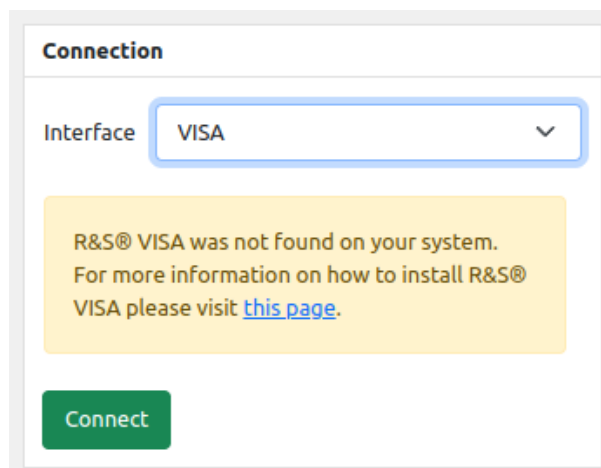


Fig. 24: VISA driver error message

4	<i>History</i>	Preview history of interaction with the instrument using <i>Terminal</i> .
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## 6.7. Establishing a connection with the instrument

Connection to the instrument added to the workbench will be possible as shown in Fig. 25: select the instrument from the workbench (1), select the interface in the Connection section (2) and click the Connect button (3).

If the Instrument tab (1) is open, as shown in Fig. 26 to establish a connection, it will be necessary to click on the *Connect* button (2) when a dialogue for choosing an interface will open in which the connection parameters are defined.

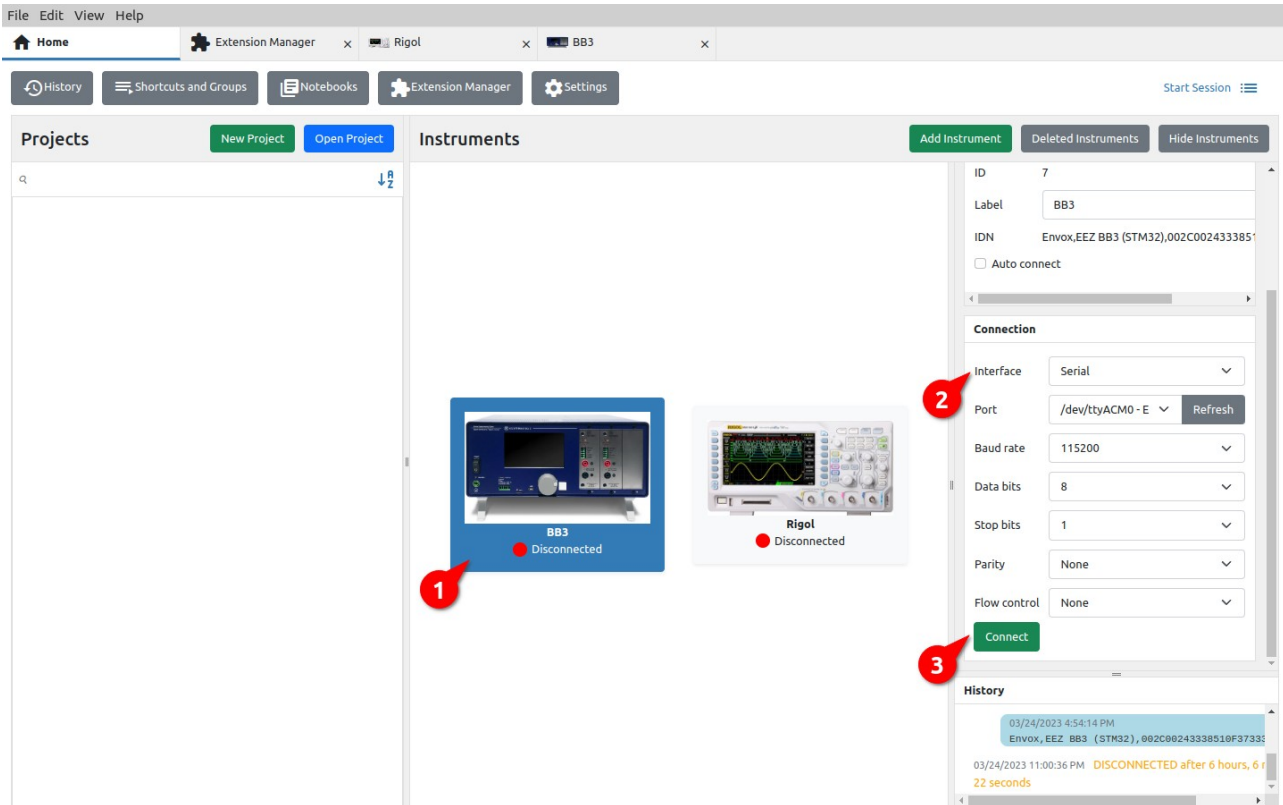


Fig. 25: Selecting an instrument on the workbench to establish a connection

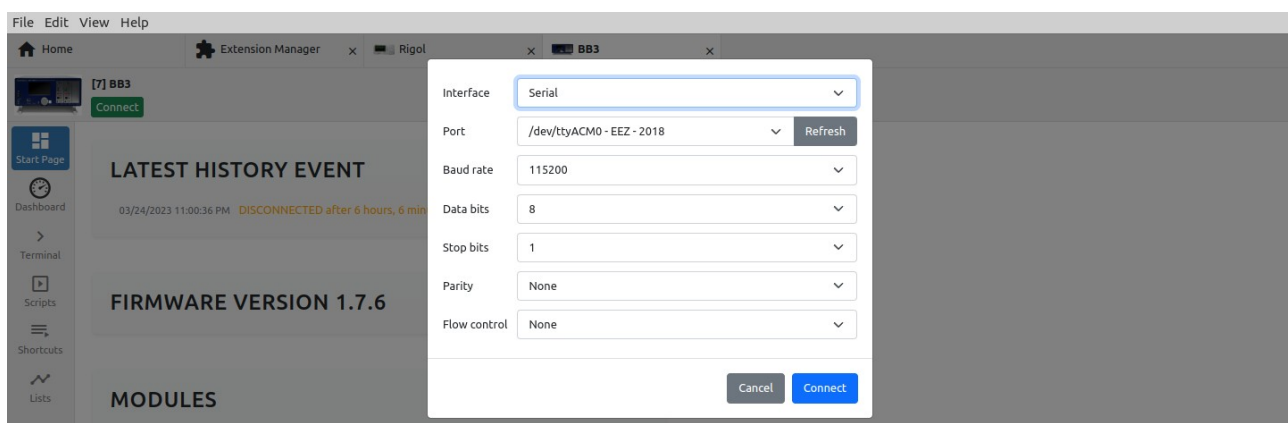


Fig. 26: Establishing a Connection from the Instrument tab

Once the connection is established, it will be possible to close the connection by selecting the Disconnect button (Fig. 27).



Fig. 27: Option to close the connection

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For more info visit: [www.envox.eu](http://www.envox.eu)  
File repository: <https://github.com/eez-open>

Version: M13 DRAFT  
Date: 2023-03-26