DC Current Transducers

# CT-BOX

CAENels
Gear for Science

# CT-BOX Viewer
# Quick Start Guide


PRECISION CURRENT TRANSDUCERS


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**CAEN ELS s.r.l.**
Via Karl Ludwig Von Bruck 32– 34144 Trieste (TS)
Italy
Mail: info@caenels.com
Web: www.caenels.com

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| Document Revision | Date | Comment |
|---|---|---|
| 1.0.0 | July 21st 2015 | First Release |
| 1.1.0 | November 2022 | Redesigned GUI |
| 2 | August 7th 2024 | Updated address and revision numbering |
| 3 | August 21th 2024 | Redesigned GUI<br>Add User calibration section |

# 1. Introduction and Installation

The ***CT-BOX Viewer*** allows for an easy remote control of the CT-BOX using a Graphic User Interface (GUI). The CT-BOX Viewer allows controlling one or more CT-BOX units at the same time, acquiring and plotting current (measured through a matched DCCT head) and temperature readings via the Ethernet interface.

The CT-BOX Viewer software is available for both Windows and Linux platforms.

To install the CT-BOX Viewer software on Windows platforms, it is necessary to run the installer *ct-box-viewer-js Setup x.x.x.exe* as Administrator. Then follow the procedure [see **Figure 1.1.1(a)**]. To uninstall the software, follow the conventional procedure from the window ***Start>Settings>App***.

Concerning Linux platforms, the user firstly needs to make executable the file *ct-box-viewer-js-x.x.x.AppImage*, either checking the box "*Allows Executing file as program*" in the ***Properties/Permission*** tab when right-clicking on the file, or by the terminal console via the command:

- *chmod +x ct-box-viewer-js-x.x.x.AppImage*.

Once the file has been made executable, from the file directory, run the file as administrator via the command:

- sudo *./ct-box-viewer-js-x.x.x.AppImage*

and then follow the procedure [see **Figure 1.1.1(b)**]. In this case, since the application is portable, it is not necessary a proper uninstallation. Anyway, if the user would like to completely remove it, remove the configuration folder *$HOME/.config/ct-box-viewer-js*.

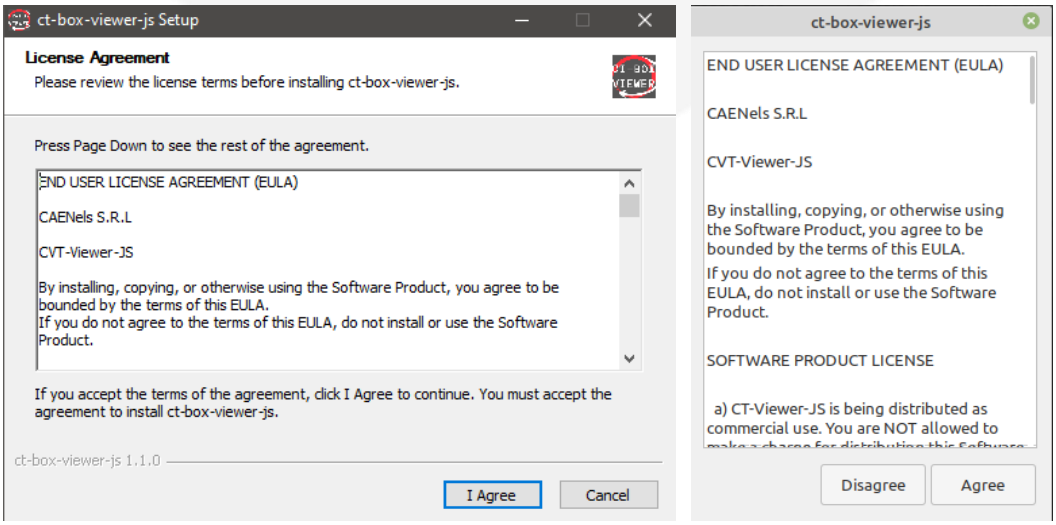


**Figure 1.1:** CT-BOX Viewer Setup for (a) Windows and (b) Linux platforms, respectively.

# 2. Quick Start

## 2.1 Establishing a connection

Remote communication is guaranteed by means of an Ethernet 10/100 auto-sensing socket present on the frontal side of the CT-BOX unit.

In the CT-BOX Viewer main window (**Figure 2.1**), it is possible to manage one (or more) CT-BOX device(s) by means of the yellow hamburger menu at the left upper corner. At the bottom of the window instead, you can select the CT-BOX viewer mode, namely Data-Logger (set by default at the opening) or Oscilloscope. The hamburger menu at the right-upper side gives access to either the Current and Temperature Limits in Data-Logger mode (see **Sec. 2.3.1**), or the Channel and Trigger options when in Oscilloscope Mode (see **Sec. 2.3.2**). Furthermore, the horizontal stripe menu (at the right upper side of the viewer) allows an easy access to the main visualization options (e.g. zoom, autoscale, pan) and saving options (e.g. save a screenshot of the viewer as png, export a CSV) as well.

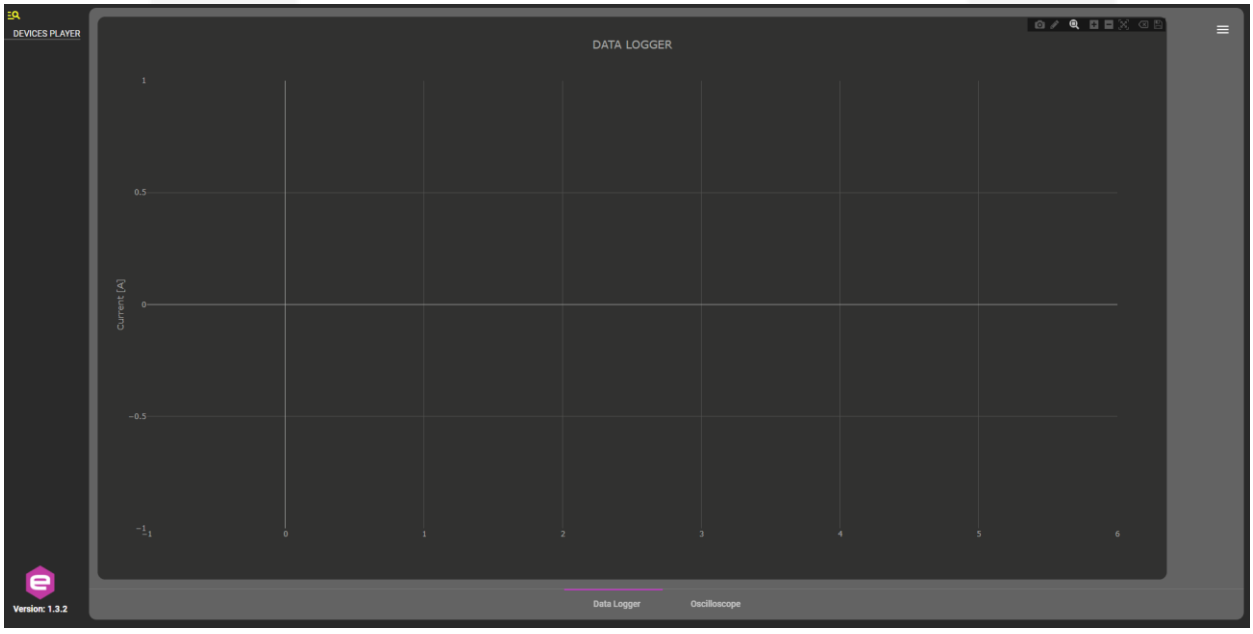


**Figure 2.1:** CT-BOX Viewer's Main window.

When clicking on the yellow hamburger menu, a popup displays all the connected and detected devices (**Figure 2.2**). User can select a CT-BOX from the list of devices found by simply clicking the socket shape icon corresponding to the CT-BOX IP address and update the list with the refresh icon.

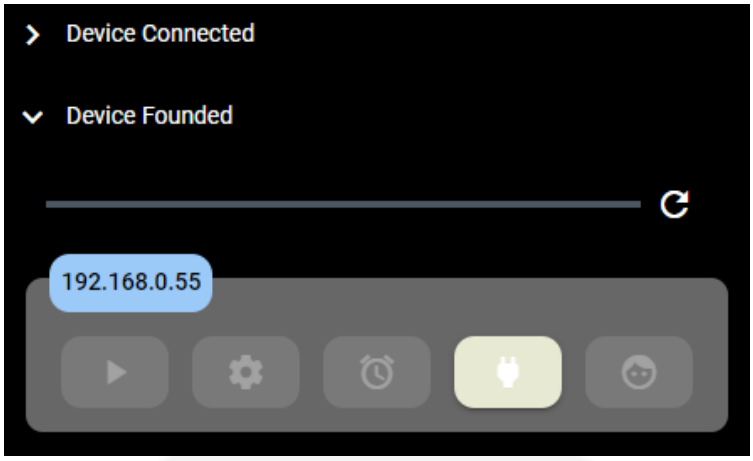


**Figure 2.2:** Popup menu for device founded and connected.

A new popup menu is available for every single device. To go back at the main window, click on the empty space of the screen.

As mentioned, it is also possible to manage multiple CT-BOX units to the software in order to control and configure them simultaneously via their corresponding popup menu.

## 2.2 Device Popup Menu

Once you have connected a CT-BOX, a device popup menu displays the five icons shown in **Figure 2.3** (starting from the left):

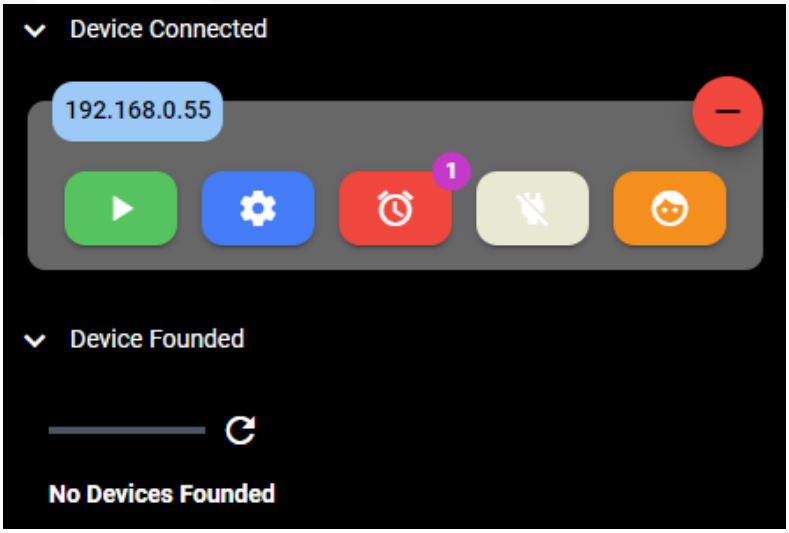


**Figure 2.3**: Popup menu for CT-BOX connected.

- **START/STOP:** the data acquisition in the currently operation mode (Data-Logger or Oscilloscope);
- **SETTINGS MENU:** (see **Sec. 2.2.1** for details);

- **FAULT STATUS:** it shows the status of the connected device and eventual faults (see **FAULT** for details);
- **CONNECT/DISCONNECT:** it allows to start and stop the communication with the connected unit (N.B. through this icon the CT-BOX is temporarily disconnected, to definitely remove the device click on the red circle).
- **LOGIN WITH PRIVILEGES:** (see **Sec. 2.2.3**);

To go back at the main window, click on the empty space of the screen.

### 2.2.1 SETTINGS

#### GENERAL

In the GENERAL tab (see **Figure 2.4**) of the *Settings* window, the *serial number* of the CT-BOX and the matched head (i.e. the DCCT head that must be used for the current sensing) are shown, as well as the loaded *firmware version*. At the bottom, three editable text fields are present, referred to the *name of the device*, the *system date* (in the format *mm*/*dd*/*yyyy*) and the *system time* (in the format *hh*:*mm*:*ss*), respectively.

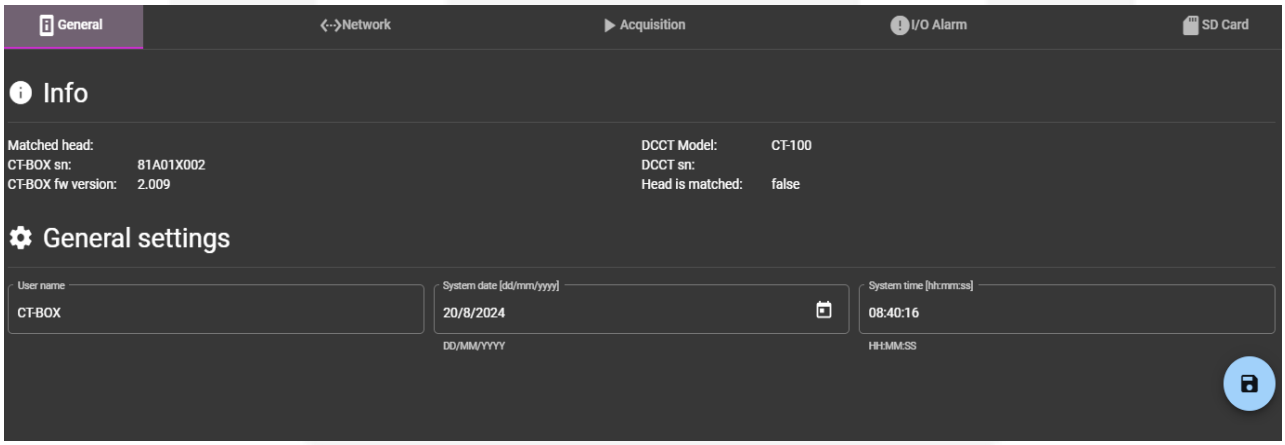


**Figure 2.4:** General settings tab.

#### NETWORK

In the NETWORK tab (see **Figure 2.5**), it is possible to change the *IP address* of the CT-BOX, the relative *netmask* and the *gateway* address. If any changes are made, the CT-BOX must be reloaded again in the viewer by following the initial procedure explained in **Sec. 2.1**.


**Figure 2.5:** Network settings tab.

## ACQUISITION

In the ACQUISITION tab (see **Figure 2.6**), the user can select the operation mode (among Data-Logger and Oscilloscope) and change the relative settings, namely:

- when **Data-Logger** mode has been selected, it is possible to set (i) the *acquisition frequency* (expressed in [Hz], N.B. resolution is 0.1 Hz), (ii) to choose whether if acquire or not the *head temperature* (i.e. matched DCCT) and the *external temperature* (through an external temperature sensor), (iii) as well as to save the acquired data on an eventual *SD card* (if it is not already done, it mounts the SD card, see also the **SD Card Manger** part in this section). Furthermore, at the bottom, by means of the refreshing icon, it is possible to read the *instantaneous current* and to reset an eventual *offset* after a power cycle of the CT-BOX. This last procedure must be performed when no primary current is flowing.
- concerning the **Oscilloscope** operation mode, the user can set the *sampling time* (expressed in [μs], N.B. resolution is 10 μs).

In the same tab and for both operation modes, by changing the *Ip-turns* parameter, the user can set the scaling factor for the primary current readings (i.e. the number of windings of the primary conductor fed in the hole of the DCCT head).

N.B. Once back on the main window by clicking on an empty space (see **Figure 2.1**), the highlighted mode at the bottom of the viewer must agree with the one just selected in the *Acquisition* tab of the *Settings*.

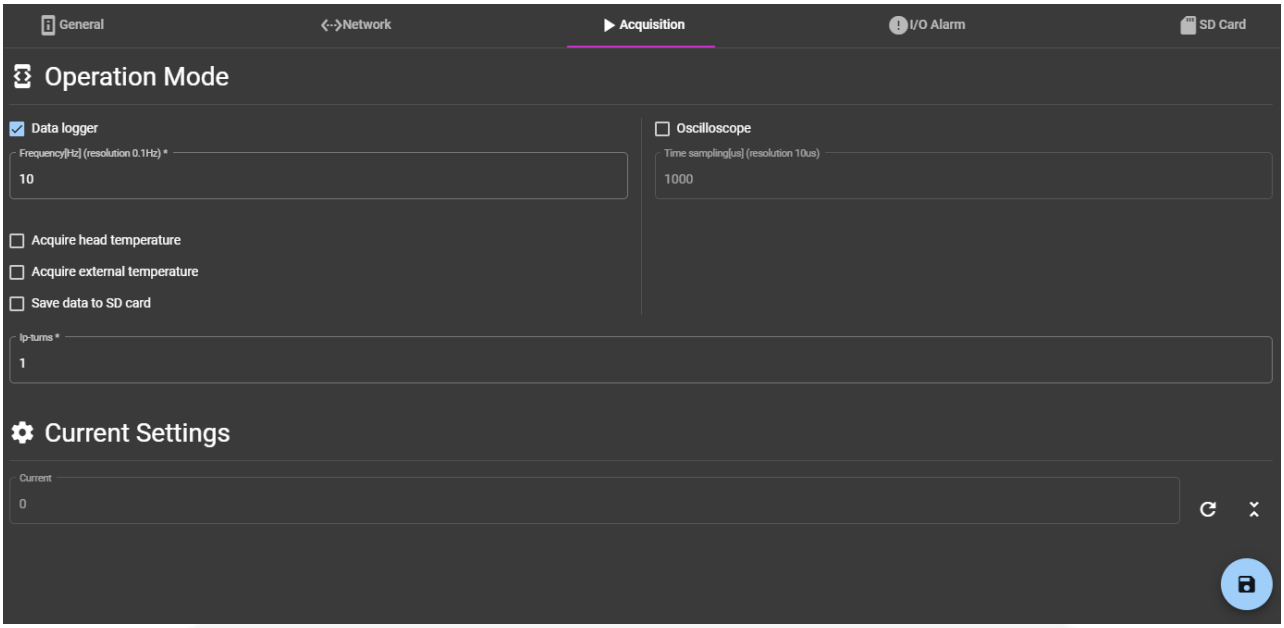


**Figure 2.6:** Acquisition tab settings.

## I/O ALARM

In the **I/O ALARM** tab (see **Figure 2.7**), the user can set both an *I/O Trigger* and the limit values to generate an *alarm*, namely:

- *Trigger Source Settings*: when I/O Trigger checkbox is selected, there is the possibility to choose either the *Generation of an Output Trigger* or the use of *External Trigger* to start the acquisition;
- *Alarm*: when selected, it enables the alarm and the possibility to set both *Upper* and *Lower limits* (both expressed in [A]) for the read current.

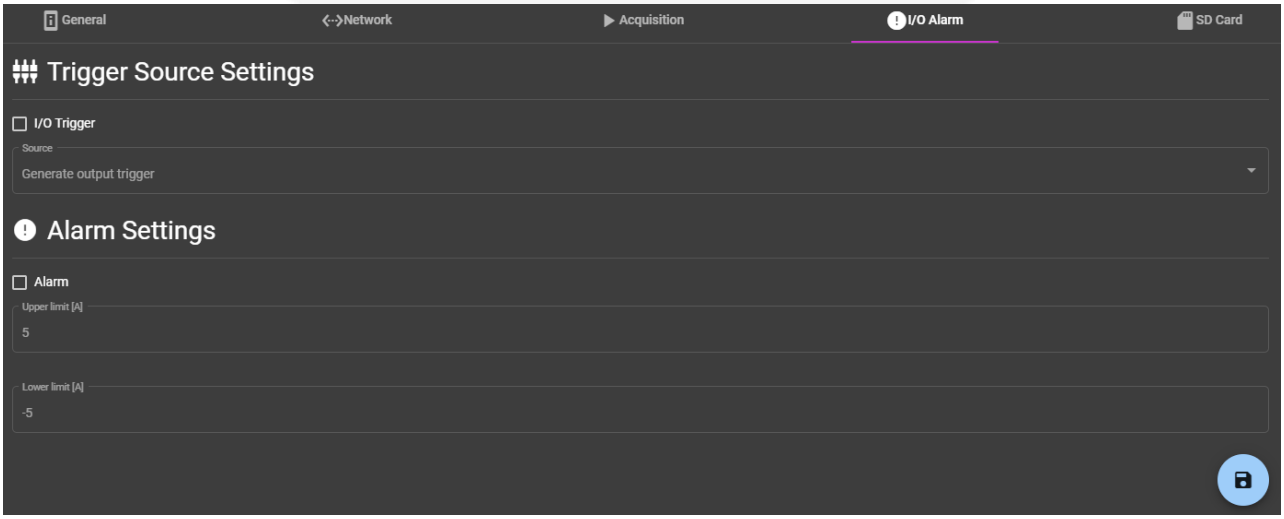


**Figure 2.7:** I/O Alarm tab settings.

## SD CARD MANAGER

In the **SD CARD** tab (see **Figure 2.8**), a further icon w.r.t. previous tabs is present at the right-bottom to mount/unmount an eventual SD card in the CT-BOX. Once the SD Card is mounted, the user can type the name of the text file to save the acquired data.

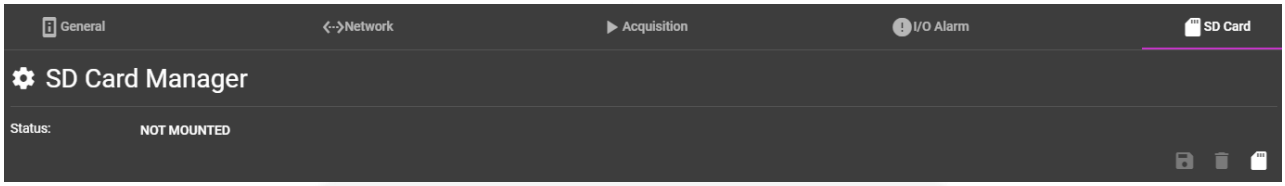


**Figure 2.8:** SD Card Manager tab settings.

### 2.2.2 FAULT

The FAULT icon, normally yellow colored, in red when a fault occurs as in (**Figure 2.9**) reveals the status of the CT-BOX, showing eventual errors (left column) and/or alarms (right column) when the current value is outside the limits (see I/O Alarms in Sec. 2.2.1).

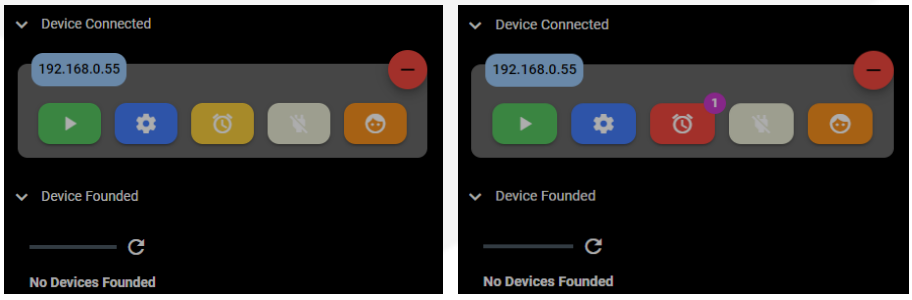


**Figure 2.9**:No-Fault/ Fault icon colour status.

The reset button on the Status window allows to reset the Alarm and Error conditions of the CT-BOX. Reset button is shown if and only if the CT-BOX unit is not acquiring data.

**Figure 2.10** shows an example of a fault condition during the CT-BOX operation.

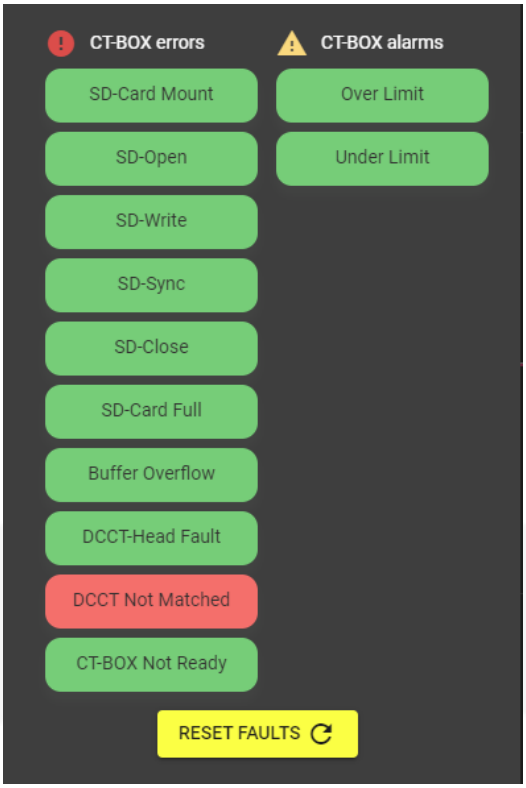


**Figure 2.10:** Errors and Alarms that can occur during the CT-BOX operation.

### 2.2.3 LOGIN WITH PRIVILEGES

The login with privileges icon provides access to CT-BOX calibration parameters, by entering a client password in the authentication popup menu (**Figure 2.11**).
The password to be entered (the same for all CT-BOXes) is*: cal-admin*

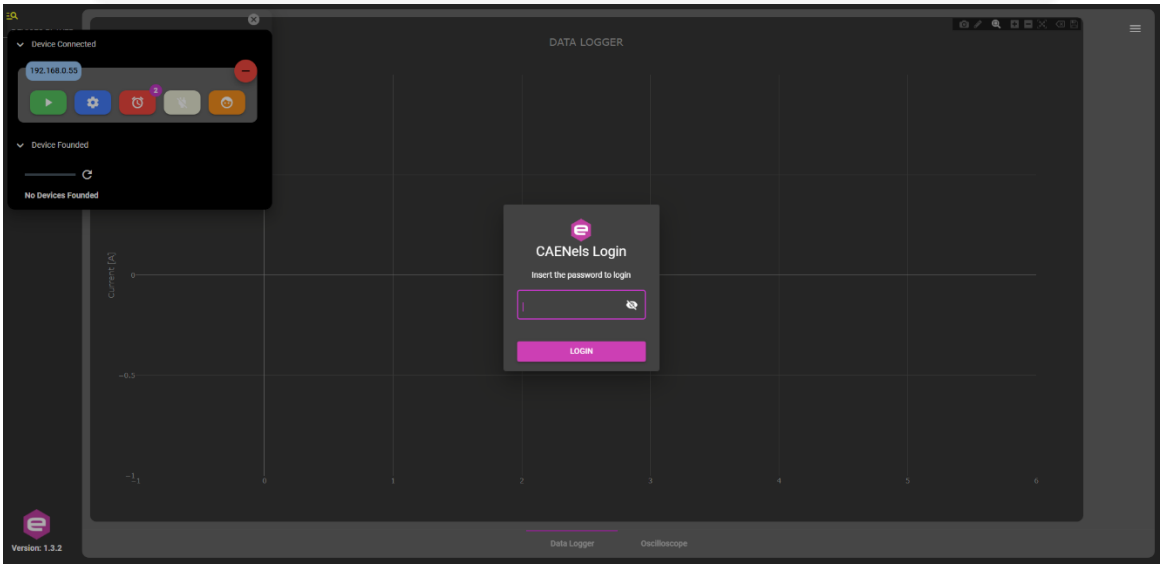


**Figure 2.11**: Authentication popup menu.

After logging in, the authentication icon switch from  to  and the device popup menu displays the login with privileges status (**Figure 2.12**).

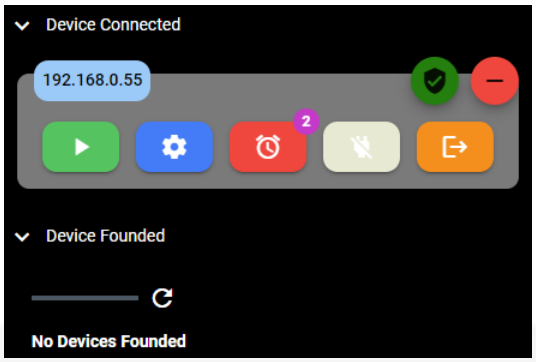


**Figure 2.12**: Login with privileges popup menu.

Now, by clicking on the settings icon, you gain access to a CALIBRATION section in the upper right side of the settings popup menu (**Figure 2.13**).

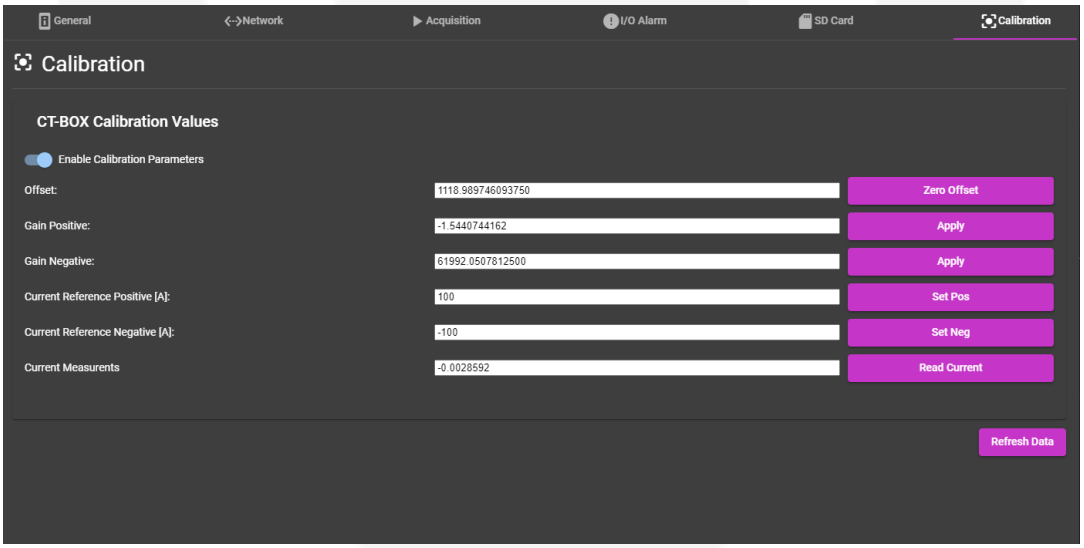


**Figure 2.13**: Calibration section in Settings popup menu.

This section allows the user to manage the CT-BOX Calibration Values, including setting (i) the Zero Offset, (ii) and (iii) Positive and Negative Gain values, (iv) and (v) Positive and Negative Current Reference (expressed in[A]), as well as obtaining (vi) instantaneous Current Measurement.

## 2.3 CT-BOX Viewer Main Window

Once at least one unit has been selected, from the Viewer Main Window (see **Figure 2.1**) the user must to choose either Data-Logger or Oscilloscope viewer mode ensuring that it agrees with the one selected in the **ACQUSITION** tab in the *Settings* menu (**Sec. 2.2.1**).

### 2.3.1 Data-Logger Mode

When the CT-BOX unit is connected and configured as Data-Logger mode, the plotter on the Viewer Main Window shows the acquired current (referred to the left y-axis) and the temperatures (referred to the right y-axis) depending on the previous configuration. As already mentioned in **Sec. 2.1**, by clicking on the right hamburger icon, a column panel on the right opens: the user can easily set both the *current limits* (upper green box) and *temperature limits* (lower red box) used in the plot or use the auto-scale function (see **Figure 2.14**). To quickly apply the auto-scale function, double-click on the plotter (alternatively use the horizontal stripe menu, **Figure 2.1**); to come back to the previous view, double-click again on the plotter.
To hide/show a single trace, click on the corresponding legend. On the other hand, to isolate a single trace, double click on the corresponding legend.

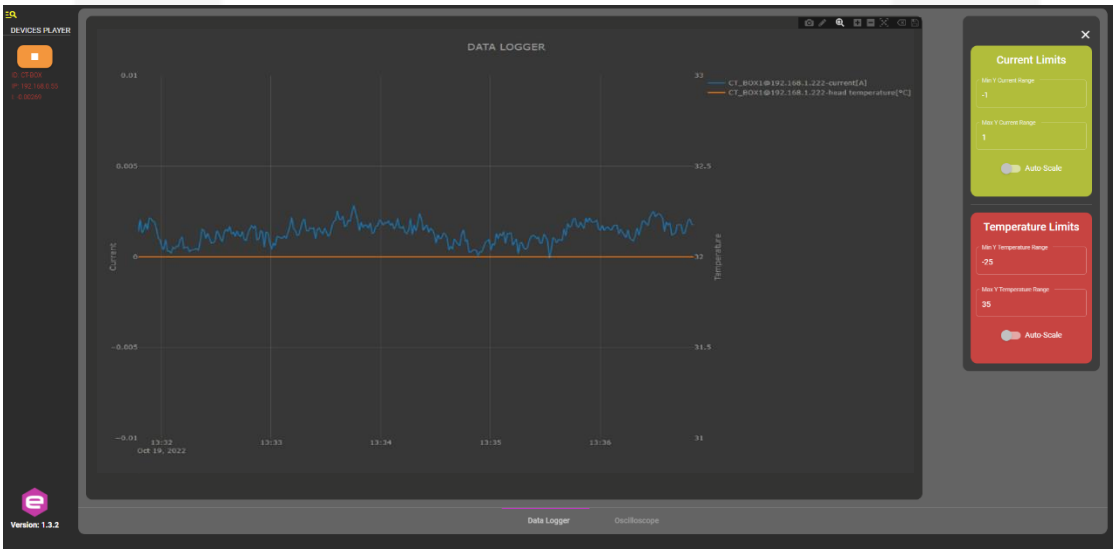


**Figure 2.14:** Example of acquisition in Data-Logger mode

### 2.3.2 Oscilloscope Mode

When the CT-BOX unit is connected and configured as Oscilloscope mode, the plotter on the Viewer Main Window shows the acquired current (expressed in [A]). By clicking on the right hamburger menu icon, it opens the channel, the trigger and the view trace settings (see **Figure 2.15**).

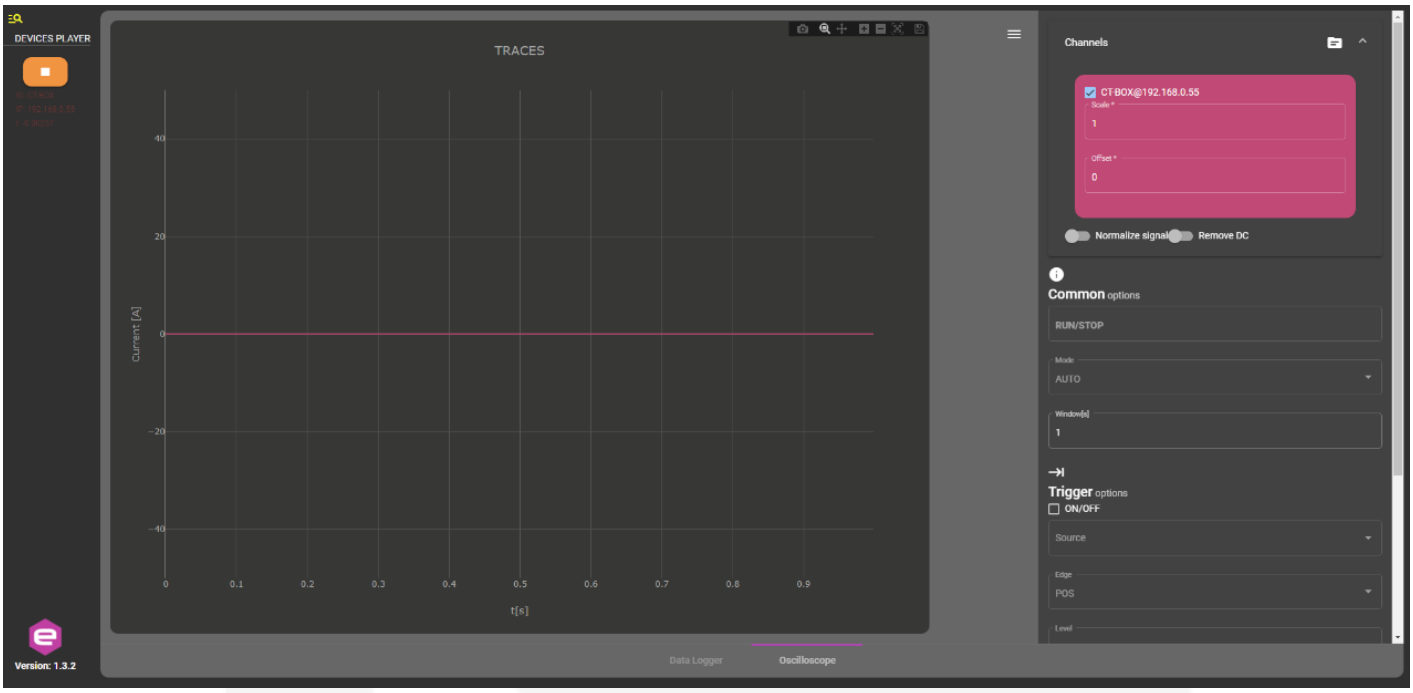


**Figure 2.15:** Example of a window acquisition in Oscilloscope mode.

#### CHANNEL SETTINGS

The software treats every CT-BOX as a single channel of a conventional oscilloscope. From the channel menu, the user can *show/hide* a channel, change the multiplication scaling factor (*Scale*, expressed in [1/A]) and the *Offset*. Furthermore, the user can enable the *normalization of the signal* (every channel is scaled w.r.t. its maximum of the absolute value of the acquired window) and eventually *remove its DC* value (again calculated considering the samples of the window).

#### COMMON AND TRIGGER SETTINGS

Once the trigger is enabled (see **Figure 2.16**), the user can add (i) the trigger *Source* choosing among the connected CT-BOX, (ii) the trigger *Edge* (positive, negative or both), (iii) the trigger *Level* (expressed in [A]) and (iv) its *Position* on the time axes (expressed in [sec]).
Concerning the time axes, the acquisition *Window* (expressed in [s]) can be changed in the Common options section. In the same section, the user can find the RUN/STOP

indication (to easily understand the status of the current acquisition) and the trigger *MODE*, that can be:

- NORMAL, it plots the signal any time the trigger condition is met, otherwise it does not update the waveform;
- AUTO, it automatically sets a trigger configuration in order to meet the condition;
- SINGLE, it plots the signal only the first time the trigger condition is met, then it stops the window updating;
- STOP, it forces the stop of the window updating.

## VIEW SETTINS

In the View Settings section, the user can choose the type of the waveform among *TRACES* (the current as a function of time) or its *FFT* (Magnitude or Phase) as a function of the frequency.

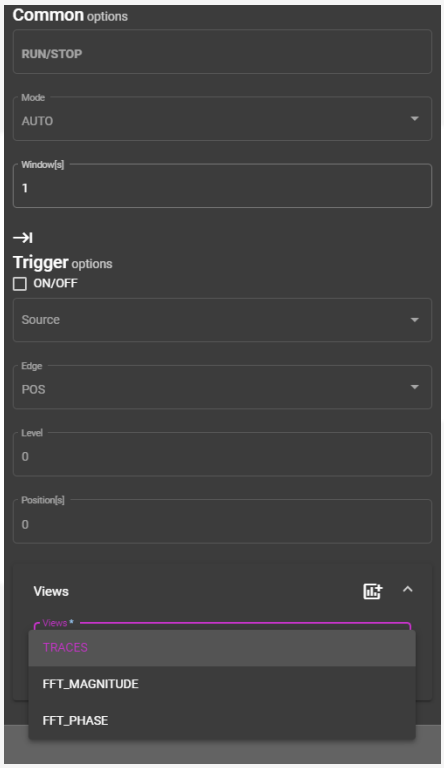


**Figure 2.16:** Trigger options in Oscilloscope mode.

# 3. CT-BOX Firmware update

The firmware of the CT-BOX device can be updated with a USB cable and using a Windows® OS. A specific third-party software is required to perform this operation, which can be download from the following link:

http://www.st.com/web/en/catalog/tools/FM147/CL1794/SC961/SS1533/PF257916

After downloading the DfuSE software, simply run the installer and follow the installation procedure. After installation, please prepare the CT-BOX for the firmware update following the described steps:

- Switch OFF the CT-BOX unit using the main switch present on the front panel of the device;
- Set the SWITCH #1 on the rear panel to be positioned high, as illustrated in Figure 3.1;


**Figure 3.1:** SWITCH position for update firmware.

- Connect the CT-BOX to the computer using the USB cable;
- Switch ON the CT-BOX using the main switch, present on the front panel of the unit;
- The Windows® OS shall find and install the driver for the USB port;
- Launch the DfuSe Demonstration software; this should automatically find the DFU Device (i.e. the CT-BOX) connected to the USB port;

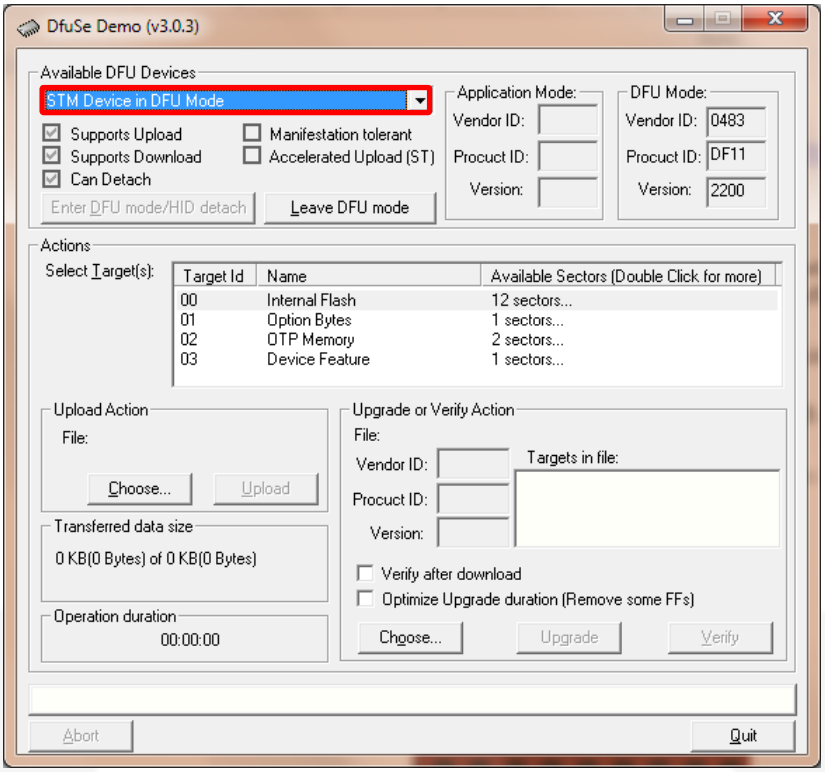


**Figure 3.2:** DfuSe Demonstration.

- Under ***Upgrade or Verify Action*** **(**Figure 3.3), click on "*Choose*" and select the new firmware file (.dfu) to be downloaded into the CT-BOX:

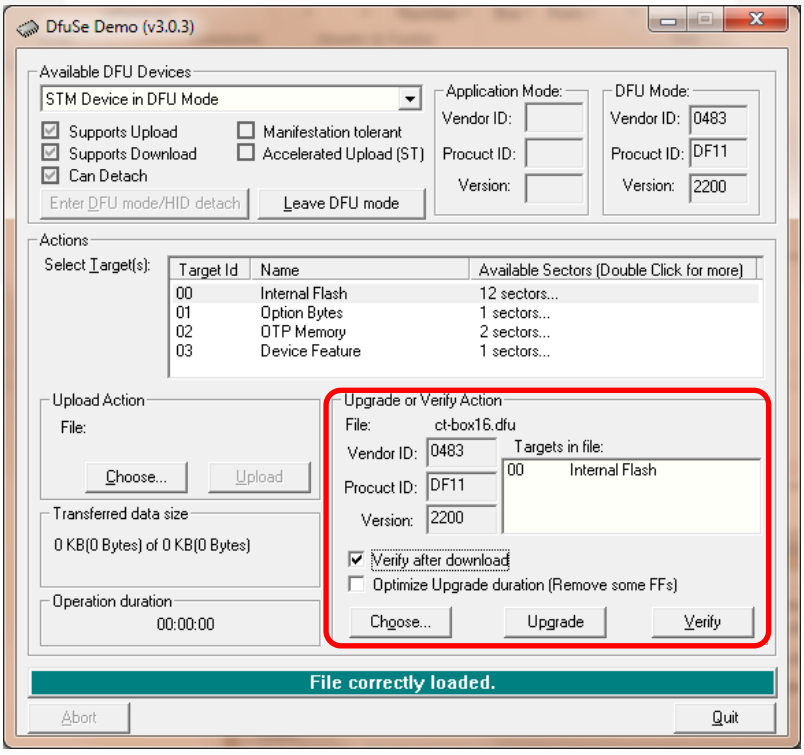


**Figure 3.3:** DfuSe Upgrade setup.

- Check the box "*Verify after download*" (Figure 3.3) and click "Upgrade";
- The DfuSe will download the new firmware in the CT-BOX and verify the operation;
- Switch OFF the CT-BOX;
- Set the SWITCH #1 on the rear panel to be positioned back low, as illustrated in Figure 3.4;


**Figure 3.4:** SWITCH position for normal use.

- Switch ON the CT-BOX. Now the CT-BOX is updated with the new firmware.