

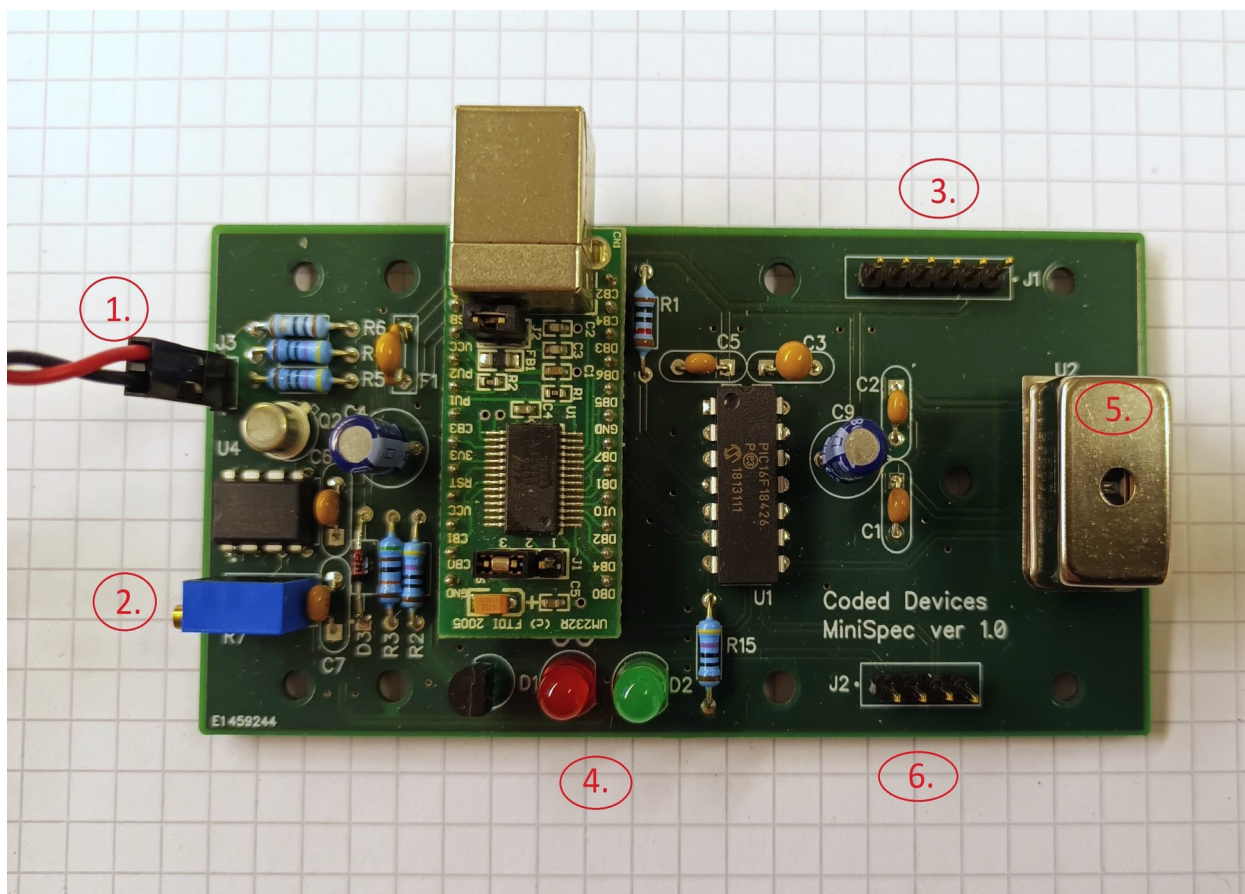
# Mini Spectrometer User Guide

edit : 2026-05-22

## Index

The Hardware	2
About the Mini Spec App	4
How to Begin	6
How to Record a Spectrum	8
How to Calculate a Relative Absorption	10
Time D – what is it?	12
System Settings	14
Testing	15

## The Hardware



Note! The instrument is designed to be used with a plastic enclosure. The electrical connections are accessible from the bottom and a short circuit may occur if the instrument is placed on conductive material or parts. If your application requires using the device without the enclosure, ensure there is no risk of short circuits by using insulating sheet or pads underneath.

In the picture above, we have numbered the parts of the instrument that the user should be aware of.

1. LED connector. The red wire is connected to the anode of the LED.

2. LED current adjustment. You can manually adjust the LED voltage using this trimmer. Note that the voltage can also be controlled via software (LED intensity 0...31). One recommended method is to first set the intensity value in the software to its maximum (31), and then manually adjust the trimmer to achieve the highest usable level.

3. Microcontroller programming connector. Connect the Microchip PICKit programmer so that the black triangle on the programmer points to the rightmost pin of this connector. For more information about programming the microcontroller, refer to the separate instruction titled "Programming the microcontroller of Mini Spectrometer".

#### 4. Signal LEDs.

The red LED indicates that the resettable fuse has cut the current flow due to an over current situation. Ensure that there are no short circuits and that an excessive amount of current is not being drawn through the connectors J1, J2 and J3.

The green LED flashes twice when the connection to the PC is established and the PC app is started.

5. The aperture of the spectrometer. In the center of the top surface is a circular window through which light enters the spectrometer.

6. Extension connector. A peripheral device, such as a sensor or switch, can be connected to the microcontroller via this connector. The pins are connected as follows from left to right: +5V, GND, microcontroller pin nr 11 (RA2), microcontroller pin nr 3 (RA4). Drawing more than 20 mA of current through this connector may cause the resettable fuse F1 to cut the current flow.

## About the Mini Spec App

Company Coded Devices Oy (Helsinki, Finland) holds the copyright for the Mini Spec App used with the Mini Spectrometer instrument.

The application for the Mini Spectrometer (Mini Spec App) is licensed under GNU, granting users the freedom to modify it and distribute their own versions. Feel free to edit, improve and share your customized version without restrictions.

The Mini Spec App can be used in two ways:

- As a standalone executable for Windows (no Python installation required) or
- As Python source files for Windows or Linux.

You can find the Mini Spec software in the GitHub repository at the following URL:

<https://github.com/codeddevs/mini-spec-app>

### **Standalone executable, Windows only:**

The standalone package contains the complete application in a single executable file. No separate Python installation or additional libraries are required.

### **Python source files, Windows and Linux:**

The application is written in Python 3. To run it, you will need the following additional Python 3 libraries:

- Matplotlib,
- tkinter and
- PySerial.

Other libraries are either included in the standard Python 3 package or delivered with the Mini Spec App files.

Download the following Mini Spec Python files:

```
-mini_data.py
-mini_file_operations.py
-mini_gui.py
-mini_instrument.py
-mini_main.py
-mini_temp.py
-mini_timed_multi_data.py
-mini_defaults.py
```

Note!

On some recent Linux systems, it is recommended to install Python dependencies like PySerial in a virtual environment. Creating a dedicated virtual environment for the Mini Spec App can help avoid conflicts with system-wide packages.

Additionally, on Linux, you need to be a member of the dialout group to enable communication with the device. Without this, the application will not be able to access the serial port. You can add yourself to the group using the following command: `sudo usermod -a -G dialout $USER`  
Then log out and log back in.

# How to Begin

## 1. Connect the Mini Spectrometer to the PC using a USB cable.

Both Windows and Linux support the FTDI USB-to-serial chip used in the Mini Spectrometer. An internet connection may be required for automatic driver installation.

## 2. The spectrometer will indicate readiness by blinking the green LED twice.

## 3. Settings in `mini_settings.ini`

Your system-specific settings are stored in the file `mini_settings.ini` usually found in the same folder as the main program. If you are running the program for the first time this file may be missing. It will be created automatically and filled with the default values.

Note! In order to get accurate measurements you need to enter the calibration values specific to your device. You can find them in the device registration document provided with the device or by contacting Coded Devices ([info@codeddevs.com](mailto:info@codeddevs.com)).

## 4. Identify the COM Port Used by the Mini Spectrometer

- **Windows** : open the Device Manager and navigate to Ports (COM&LPT). Find USB Serial Port (COM 3) or a similar entry. Note the COM port number (e.g., COM3).
- **Linux** : open the terminal and execute the command `sudo dmesg | grep tty`. Look for a line like: FTDI USB Serial device converter now attached to `ttyUSB0`. Note the port name (e.g., `ttyUSB0`).

## 5. Set COM setting into the settings file `mini_settings.ini`

- Open the `mini_settings.ini` file. Look for the key value `[device] comport_name`.
- **Windows** : `comport_name = COM3` (replace with the actual COM port number).
- **Linux** : `comport_name = /dev/ttyUSB0` (replace with the actual port name).
- Save changes

## 6. Set calibration coefficients into the settings file `mini_settings.ini`. Locate the correct calibration coefficients in the device registration document.

- Open the `mini_settings.ini` file.
- Locate and edit the values of the calibration coefficients under the **[calibration]** key (`a0 : 3.105747633e2`, `b1 : 2.692683654`, *etc.*) to match the values specified in the registration document you received with the device.
- Save changes.

## 7. Launch the program

- For Windows standalone version: double-click the executable file.
- If using python source files execute command `python mini_main.py` in Windows or `python3 mini_main.py` in Linux.

**8. Following text will appear in the terminal or command prompt:**

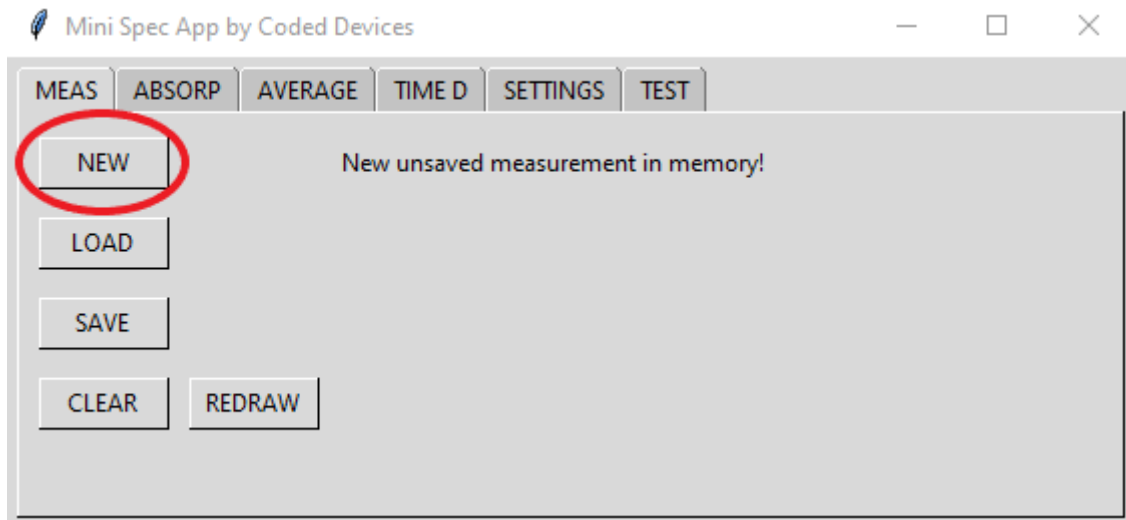
```
*** Mini Spec ***  
Copyright (c) 2024 Coded Devices Oy  
PC Software version 2024-3-28  
Connecting to hardware...
```

```
Firmware version : 1.0.3.1  
Source intensity : 5
```

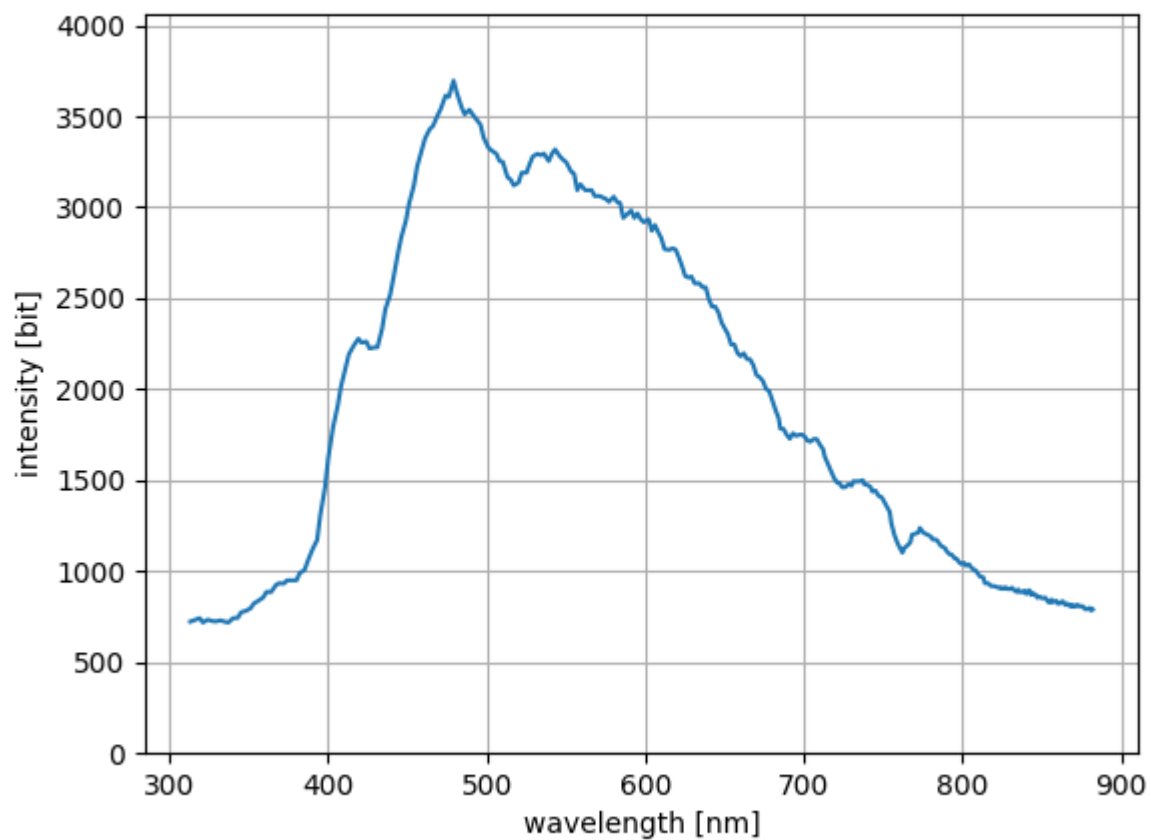
And the Mini Spec App control panel opens on the screen. **You are ready to start.**

## How to Record a Spectrum

On the *MEAS* page, press the *NEW* button.



After about three seconds a newly recorded spectrum will appear in the *ABSOLUTE GRAPH* window. Below is an example of daylight spectrum measured indoors.



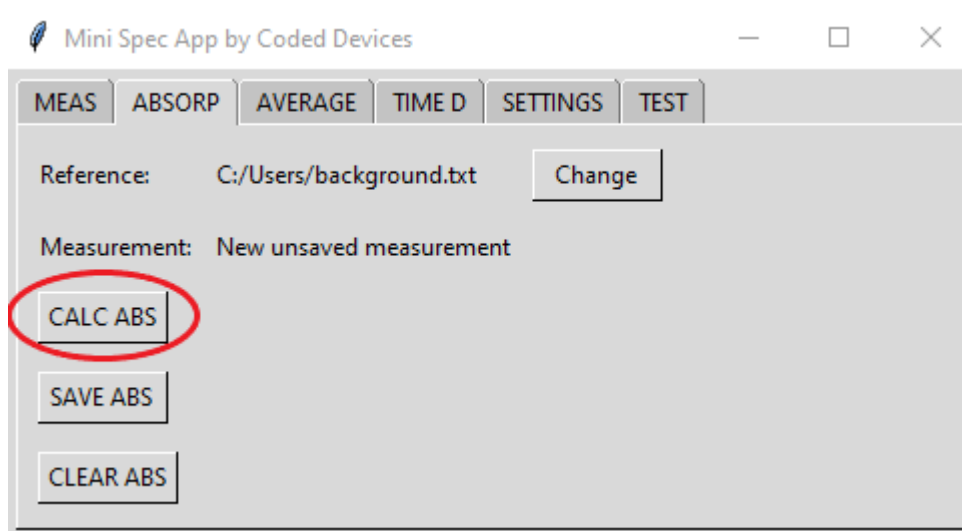
Now, you can decide whether to save the spectrum into a file, add it to an average spectrum, or use it in an absorption calculation.

## How to Calculate a Relative Absorption

First, you need a reference spectrum that lacks absorption in the region of interest. Then, you measure a spectrum that shows absorption in that region.

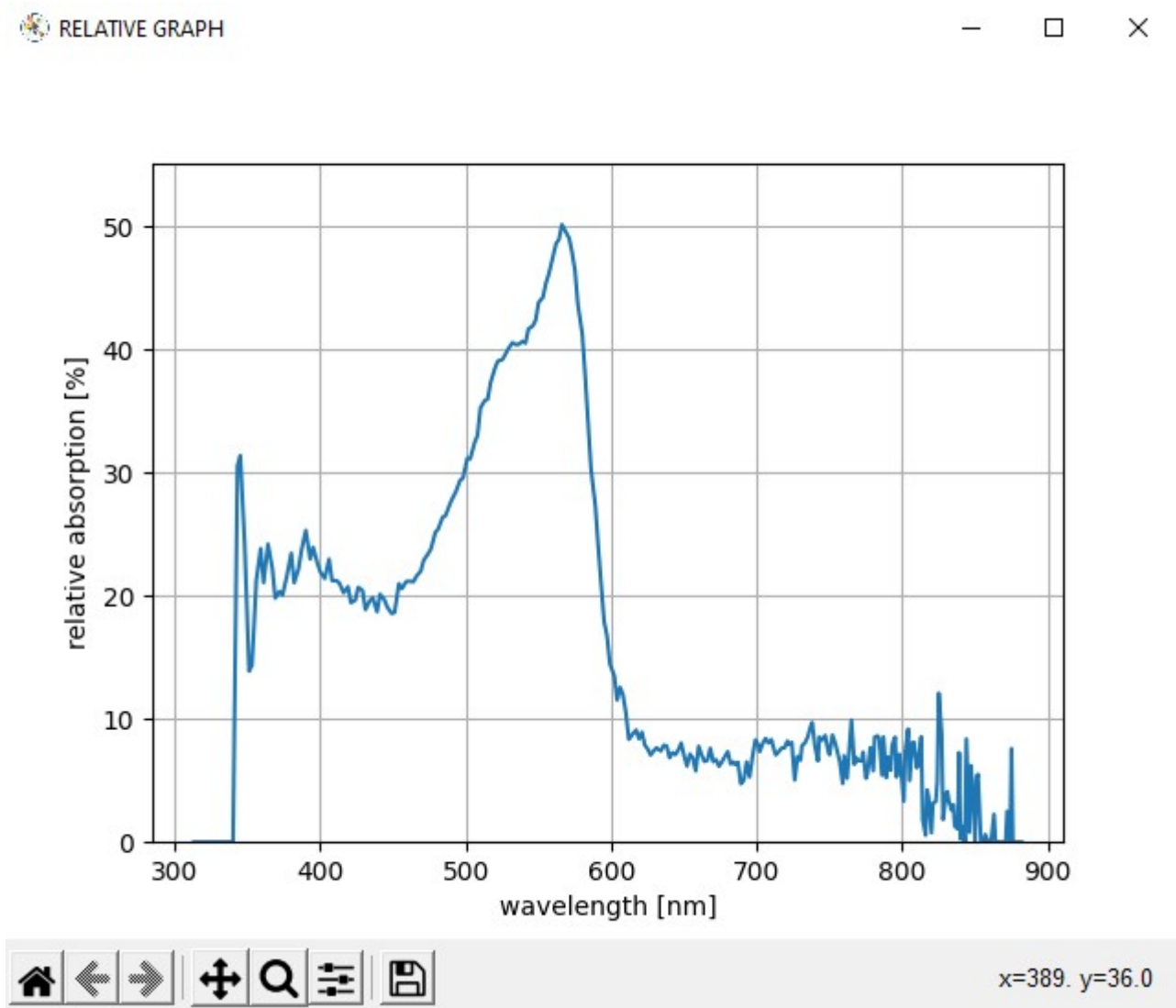
The relative absorption is calculated pointwise as  $(reference[i] - measured[i]) / reference[i] * 100$ .

Go to the *ABSORP* page. The file for the reference spectrum is displayed with the label *Reference*, while the actual measurement containing the absorption data is displayed with the label *Measurement*. The measurement is always the most recent one recorded or loaded on the *MEAS* page.



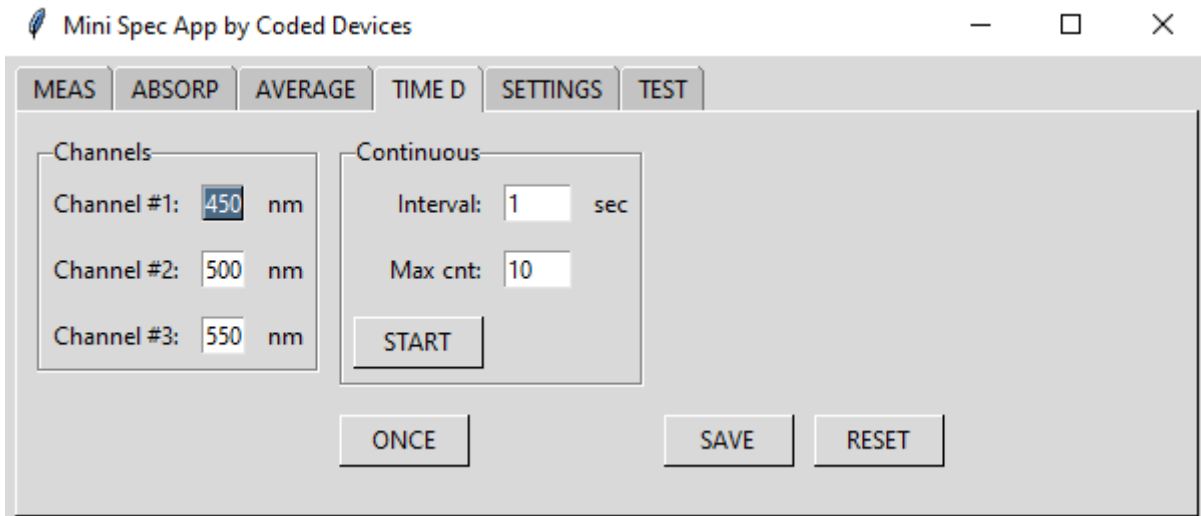
Press **CALC ABS** to make the absorption calculation, and the relative absorption spectrum will then appear on the screen.

Below is an example of an absorption spectrum of a pink colored plastic film.



You can save the absorption spectrum by pressing the **SAVE ABS** button. To load a saved absorption spectrum, navigate to the **MEAS** page and press the **LOAD** button.

## Time D – what is it?



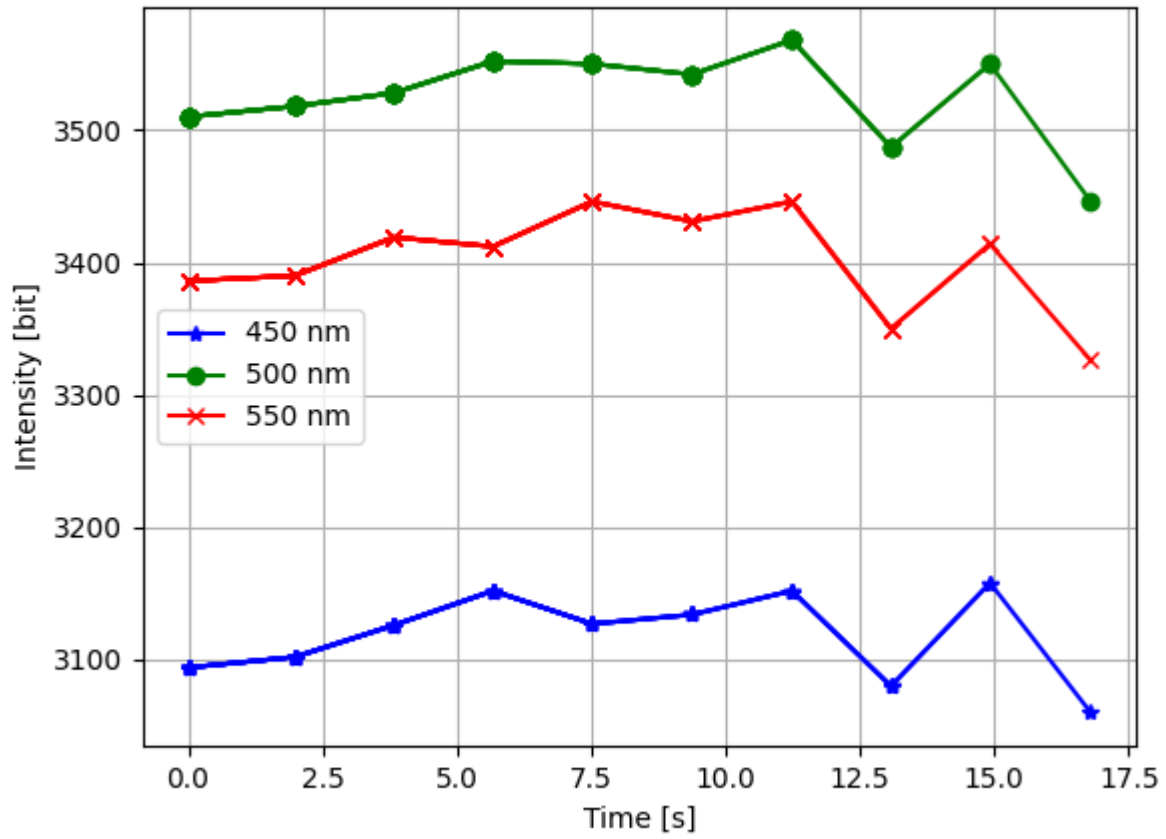
Time D is the page for making measurements in the time domain, specifically generating time series data for selected wavelengths.

Specify the wavelengths you wish to measure to select the three channels. The software will then automatically determine the appropriate channel corresponding to each specified wavelength.

Press **ONCE** button to get one set of readings from the selected channels.

Press **START** to initiate the collection of the defined number of sets of readings (*Max cnt*). You can predominantly stop the series measurement by pressing **STOP**.

Below is an example measurement of daylight values of three selected channels measured indoors.

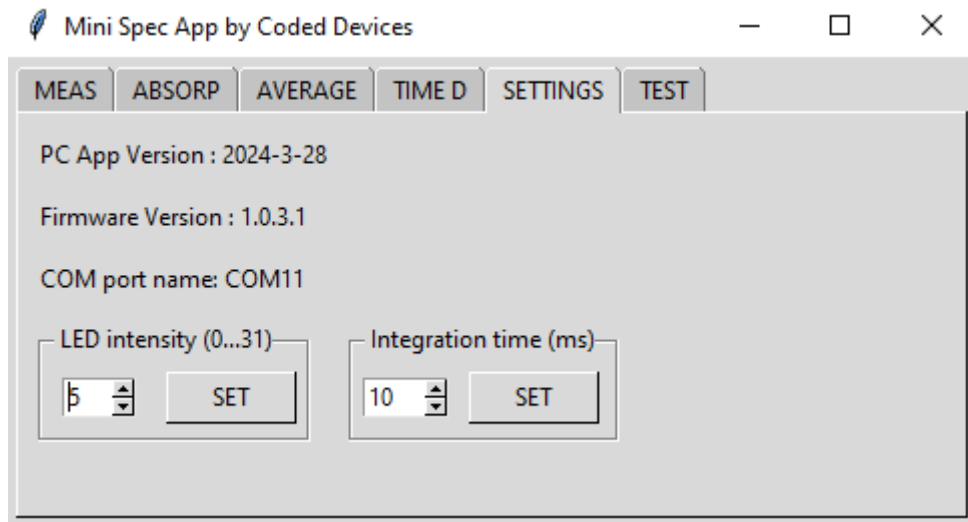


Navigation icons: Home, Left Arrow, Right Arrow, Pan, Zoom, Legend, Print.

x=8.73 y=3345.

# System Settings

System info and settings can be accessed via the *SETTINGS* page.



PC App Version is the value of a version variable in the `mini_main.py` file that serves as the general software version, although other files within the project may have their own distinct versions.

Firmware Version is the version of the firmware currently programmed into the micro controller.

COM port name is the name of the serial port currently used with the Mini Spectrometer. This can be set in the settings file `mini_settings.ini`.

LED Intensity (0...31) adjusts the output of the LED controller of the Mini Spec board. Max value 31 sets the output to maximum and min value 0 turns the source off.

The Integration time (ms) setting adjusts the integration time of the sensor head, which defines how long the sensor collects photons during a measurement. Dim targets may require a longer integration time for a clear spectrum, while with bright targets, a longer integration time may lead to a saturated measurement.

Note!

All settings are stored in the settings file `mini_settings.ini`, which can be edited manually. However, manually entered values may fall outside valid ranges and become overridden by the program.

## Testing page

The *TEST*-page is used for different tests and may change often. These tests include examples and quickly created solutions for specific applications. Therefore the documentation of the *TEST*-page may not be up-to-date or correct.