FAG FLUOSP SPECTRO preliminary user manual

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Content

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The FLUOSP SPECTRO invisible inks spectrofotometer

The FLUOSP SPECTRO invisible inks spectrofotometer is the ideal Device to control the use of invisible and phosphorescent inks in Laboratory and the press room. The FLUOSP is equipped with two UV LEDs, at 365nm and 256nm and a Visible (White) LED and measures the Fluorescent Intensity, the Colorimetric parameters XYZ, xy, Lab, LCh, automatically detects Peaks in the spectrum, measures UV absorbion, reflection and luminiscence.

Important: This manual describes the current version of the FLUOSP hardware and software. Future enhancements or modifications are reserved.

Safety Instructions

For safety reasons, it is absolutely necessary to read the entire user's guide and all of the instructions it contains. If the safety recommendations and instructions in this User Guide are not complied with, measurement errors or data loss or physical injury or property damage may result.

The FLUOSP is not intrinsically safe. Therefore, the device cannot be used in an environment with explosive vapors where there is a risk of spark ignition or in an area with strong electromagnetic fields. It should be protected against chemicals, corrosive vapors, strong mechanical vibrations and impacts

The FLUOSP is equipped with UV LEDs. Never Ever look directly into the Aperture of the device while on UV LED is turned on! UV Light might hurt your eyes!

Use the FLUOSP in ambient temperatures between 20°C(68°F) and 25°C (77°F), and do not expose the device to direct sun light.

The FLUOSP should never be opened as there are no user-serviceable parts inside. Doing so voids the guarantee. Contact your authorized dealer if repairs are necessary.

To avoid incorrect handling, the FLUOSP should only be used by trained personnel.

Use original PERET spare parts and accessories only.

Use the original packaging exclusively when transporting.

DECLARATION OF CONFORMITY

The undersigned representing the following manufacturer: PERET GmbH/S.r.L, Forch Str. 6, 39042 Vahrn, ITALY herewith declares that the product FLUOSP is in conformity with the provisions of the following CE directives including all applicable amendments:

77/23/EEC Electrical equipment for use within specified voltage limits.

89/336/EEC Electromagnetic compatibility and the standards and technical specifications referenced overleaf have been applied.

Vahrn, December 2017

PERET GmbH
Vahrner See Weg 17
I-39040 Vahrn-Varna
UID: IT02646920211

Konrad Silbernagl,
01.05.2024

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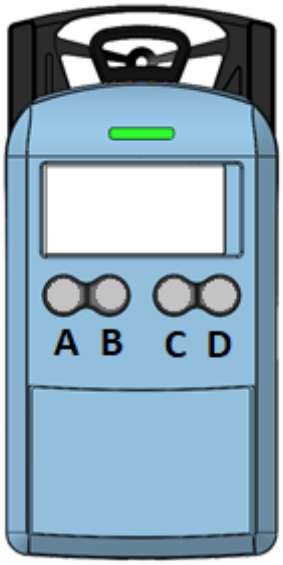
This Manual



The manual describes the functions of the Device using a A,B,C,D labelling of the keys. A is the left most key, D the right most key.

HARDWARE RESET of the DEVICE

On the bottom of the device you can find the RESET key. Press this key to perform a Hardware RESET.

After a Hardware Reset the FLUO DX will show the key information about the device such as Serial Number, Device ID and Firmware version.Next to the Firmware version a character displayes the internal calibration version currently in use:

H : Hamamatsu wavelength calibration

L : Lumilass wavelength calibration

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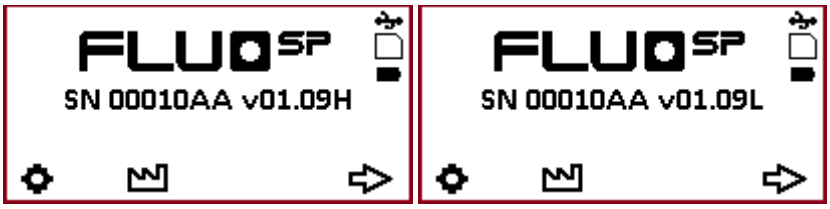

Key A: Settings.

Key B: Reset the device to Factory defaults.

Key D: Next screen

This screen can also be reached from almost any screen without pressing the RESET key from the bottom as follows:

- Press and hold key A
- Click key D

Device Status information

Whenever appropriate the device status information will be displayed on the right top corner:

USB is connected.

Data memory used, empty to full.

Battery empty, change Batteries.

Battery nearly empty. Change battery at the end of the measurement sequence.

Battery still ok.

For accurate measurement it is recommended to use the device with Batteries.

Device internal Settings

Click Key A at the Start Screen to enter the device internal settings configuration mode

Use the settings to select the device language

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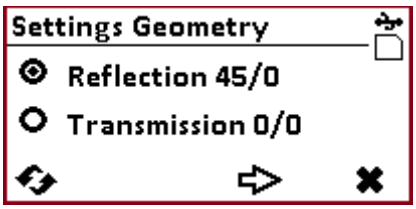
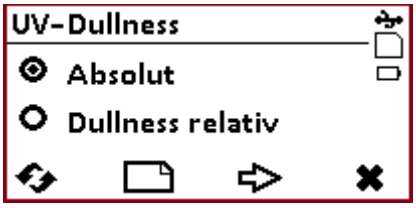
- Click Key A to select the next language. The FLUOSP is preconfigured with four languages: English, Française, Deutsch, Italiano. Any of those can be replaced by another language. At the moment there are available in addition the languages Español and Polsky.
- Click Key C to select the next settings mode

The FLUOSP Spectro can be configured to measure in reflection using the 45°/0° geometry and internal light sources, or in Transmission, using an external light source.

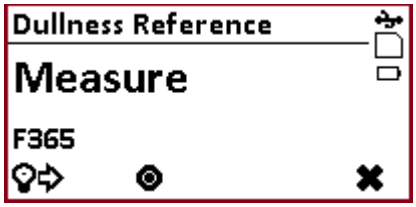


- Click Key A to toggle between Reflection and Transmission mode. In Reflection mode there will be used the embedded LED illumination for exposing the sample to 256nm light, 365nm light, or White light. In Transmission mode a proper light table is required.
- Click Key C to select the next settings mode.

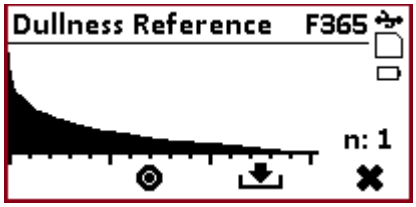
The FLUOSP can be configured to measure absolute or paper relative. In paper relative mode, there can be measured and stored the fluorescence spectral curve (Dullness) of the paper. Any spectral measurement in F365 or F256 will be displayed subtracting the Dullness.



- Click key A to toggle between absolute and Dullness relative measurement mode
- Click key B to measure the Dullness reference



  - Click key A to toggle between F365 and F256 illumination
  - Measure on paper
  - Multiple measurements can be performed. The average will automatically be calculated.



  - Click key C to save the Dullness reference spectral curve permanently into the device memory.
  - Click key D to exit.

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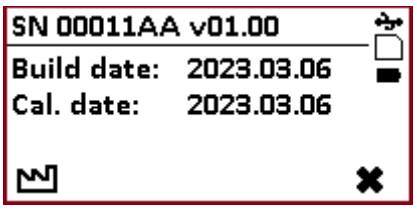
Factory Default reset

Click key B on the start screen to enter the Factory Default mode

The Device Build date and the last calibration date will be displayed.



Click key A to

- Delete all references stored in the device
- Empty the measurements memory space
- Reset all settings regarding Language, Peak recognition, Dullness specification, Tolerances
- Mark ID

Handle this with care, as you can not undo the reset.

Click key D to exit.

Connect to the FLUOSP Spectro

Connect the FLUOSP Spectro via USB to your computer. The Status LED will go on red followed by green and go off. The Display will flash twice. Wait until the status LED goes of and the flashing of the Display has finished.

Run the FLUOConnect.exe software.

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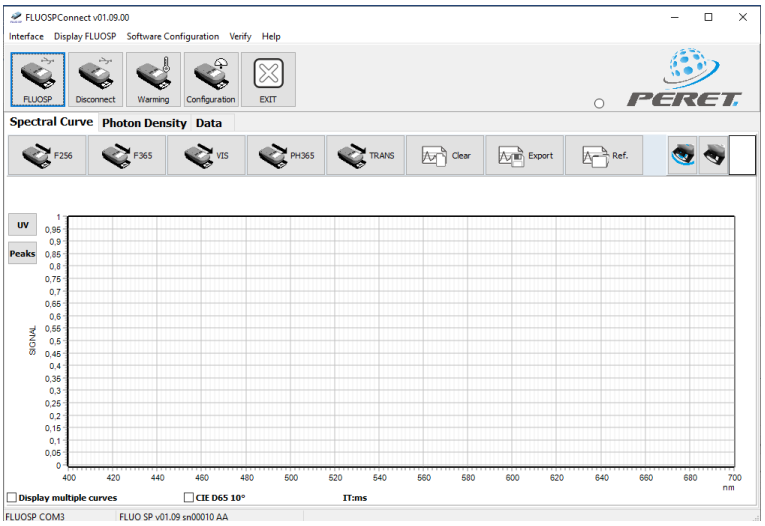

click FLUOSP to connect the Software to the device.

before un-plugging the USB cable from the device it is strongly recommended to Disconnect the device by clicking the disconnect button. Windows, (especially Windows 7 and 8.1) will not properly free the serial interface creating problems when connecting another device.

If the device was stored in a cold place, it is recommended to run the warming up process once. The warming up will warm up the LEDs such as a temperature drift in the readings is minimal. The current temperature measured on the main board of the device is displayed in the status bar on bottom of the window. The temperature should not be lower than 22°C.

Device settings that can be configured by Software

The FLUOSP can be connected to the FLUOSPConnect Software via USB Interface.

Click the Configuration Icon to open the Device Configuration Window.

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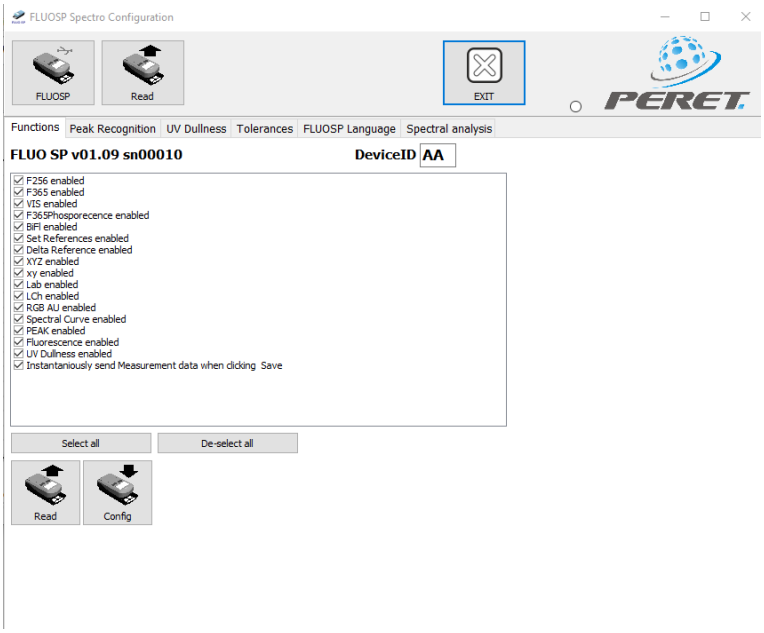
Enable or disable available functions



The FLUOSP offers a wide range of functions and measurement modes. To make the use of the device simpler, functions, that are not required, can be hidden by removing the check of the proper function and clicking the Config Icon.

- F256 enabled
- F365 enabled
- VIS enabled
- F365Phosporecence enabled
- BiFl enabled
- Set References enabled
- Delta Reference enabled
- XYZ enabled
- xy enabled
- Lab enabled
- LCh enabled
- RGB AU enabled
- Spectral Curve enabled
- PEAK enabled
- Fluorescence enabled
- Instantaneously Measurement data when clicking save

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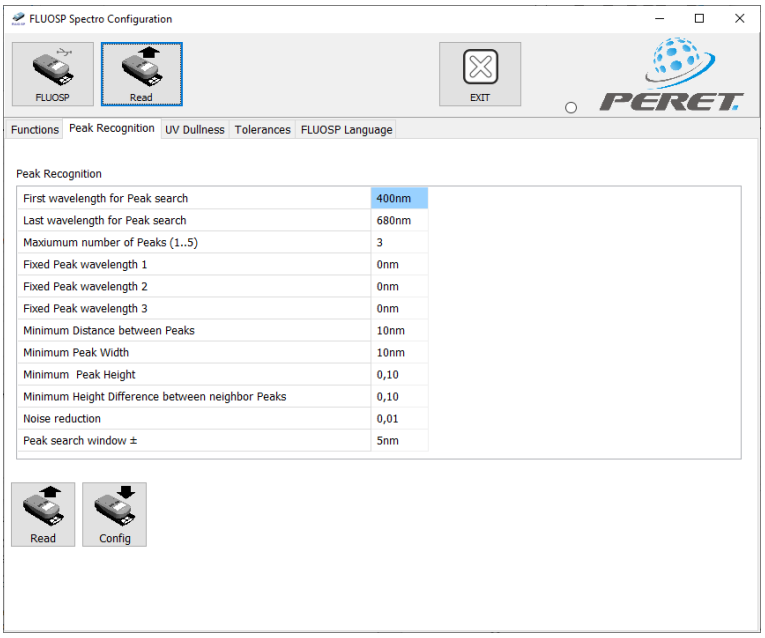
Configure the Peak recognition



First wavelength for Peak search	Ignore peaks at lower wavelength than specified
Last wavelength for Peak search	Ignore peaks at higher wavelength than specified
Maxiumum number of Peaks (1..3)	Ignore peaks after the specified number of peaks (sorted by Intensity) have been detected.
Fixed Peak wavelength 1	Pre-define the peak wavelength for max. 3 Peaks
Fixed Peak wavelength 2	
Fixed Peak wavelength 3	
Minimum Distance between Peaks	Ignore Peaks closer to an already detected peak than specified
Minimum Peak Widht	Ignore narrow peaks, more narrow than the specified width
Minimum Peak Height	Ignore Peaks with lower intensity than specified
Minimum Height Difference between neighbor Peaks	Ignore Peaks with a neighbor peak of almost same hight
Noise reduction	Sooth spectral curve before searching peaks
Peak search window ±	Once a peak has been detected, look for a dominant average wavelength close to the detected single wavelength peak.

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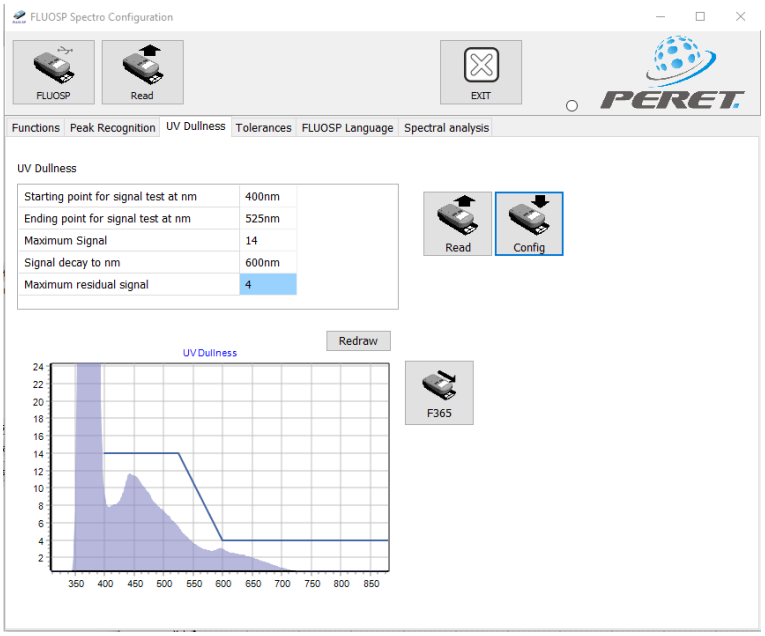
UV-Dullness Pass Fail conditions



Click the F350 Icon to measure the reference paper dullness. Adjust the values such as the reference curve will totally fit into the space below the dullness limit curve.

Starting point for signal test at nm	Ignore the signal with lower wavelengths
Ending point for signal test at nm	Fail if the signal between starting point and ending point is higher than the maximum signal defined in the next row on at least one wavelength
Maximum Signal	Maximum Signal tolerance for the range between starting point and ending point
Signal decay to nm	Fail if the signal is higher than the linear Signal decay tolerance after ending point until the defined wavelength on at least one single wavelength
Maximum residual signal	Fail if the signal is higher after the end of the decay specs than this residual signal on at least one single wavelength

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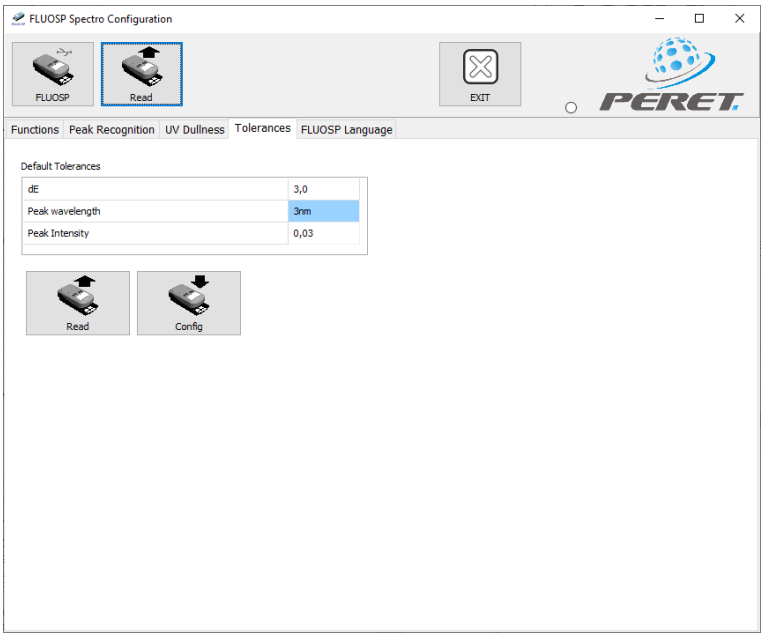
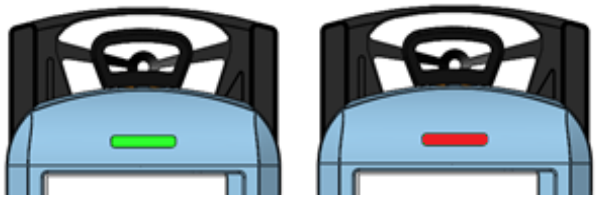
Tolerance specification for the Pass/Fail indicator



In case measurements are taken against a reference, this tolerances are used to control the pass fail indicator of the device.



If the dE between reference and sample is less than the specified tolerance and the Peaks nm and Peak intensities are in tolerance, the pass fail indicator does flash green.

If the dE between reference and sample is less than the specified tolerance and the Peaks nm and Peak intensities are out of tolerance, the pass fail indicator does flash yellow.

If the dE between reference and sample out of tolerance the pass fail indicator does flash red.

The current tolerance settings are stored with a measured reference at the time, when the measurement reference is stored into the device memory. In order to use different tolerances for different references, before measuring a reference, set the proper tolerances by software. References, already saved to the device memory will not be modified.

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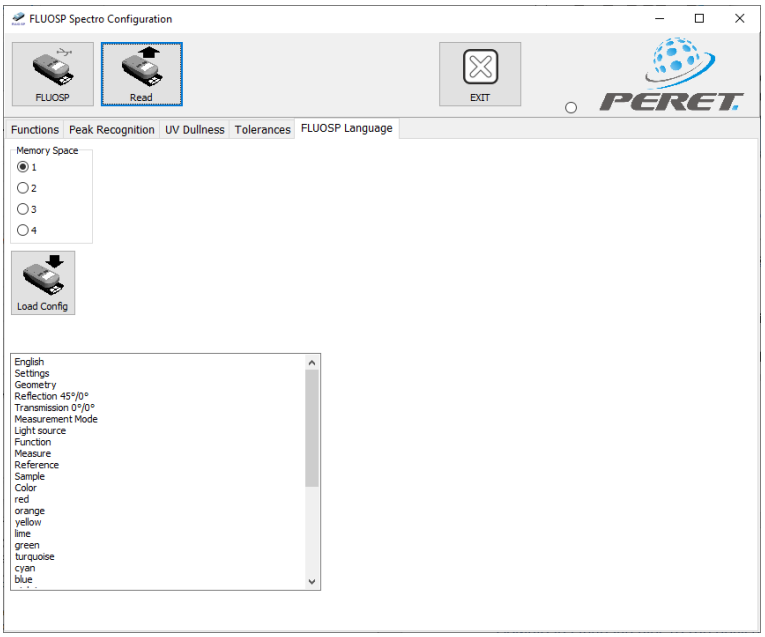
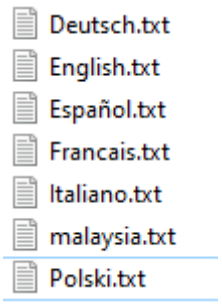
Download language files to the device memory.



The FLUOSP Spectro can store up to 4 language files for the Device GUI. By default there are loaded English, Deutsch, Francaise, Italiano.

The following languages are available



Select one of the 4 memory spaces. Click Load Config and select the language file. The current language located in the the selected memory space will be replaced.

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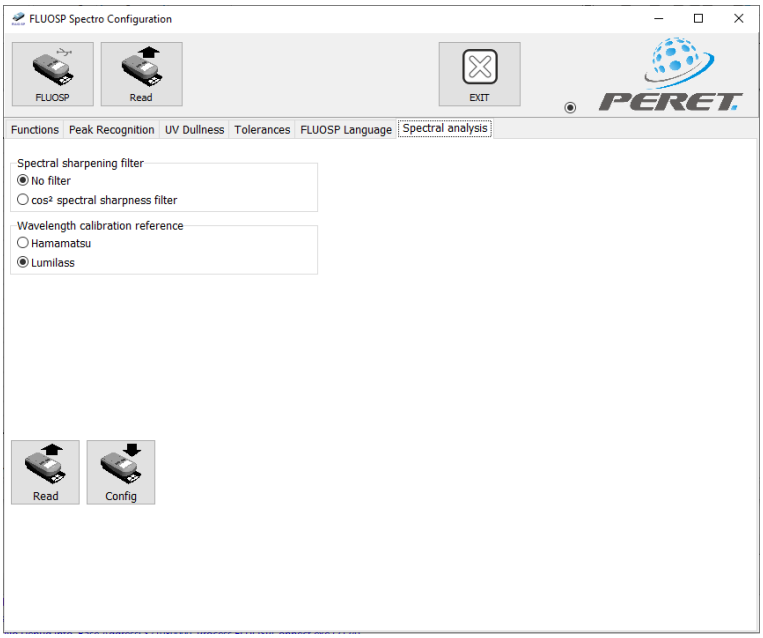
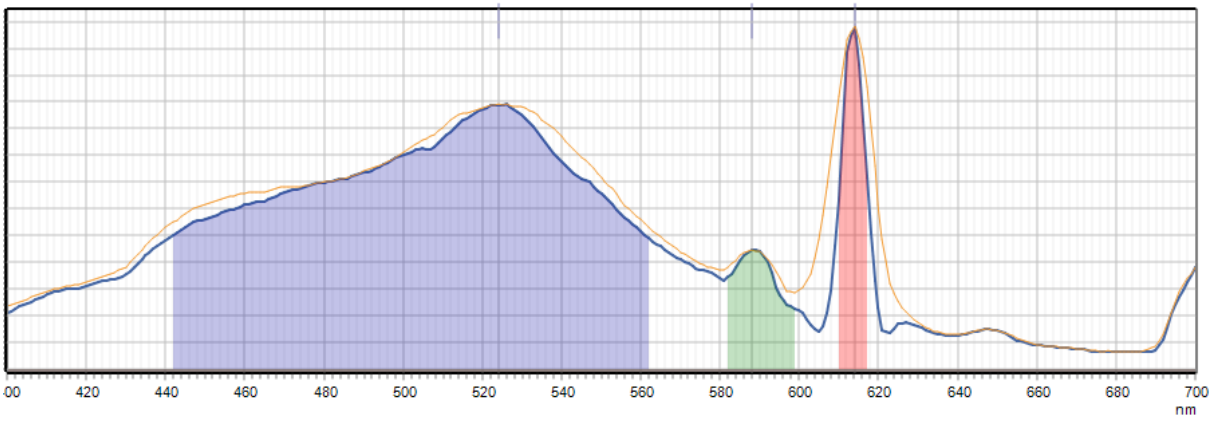
Spectral Resolution Filter



A spectral resolution enhancement filter can be applied, enhancing the spectral sharpness resolution using a cos² approach.



Yellow line : no Filter

Blue line : cos² Filter

The Filter does not change the peak wavelength, but can show neighborhood details which are not visible in No Filter mode.

Select the wavelength calibration mode as required between Hamamatsu and Lumilass.

Click Config. Enter FLUOSP when you get prompt for the password.

Reflection mode measurements

Click key D at the Start Screen to enter the measurement modes

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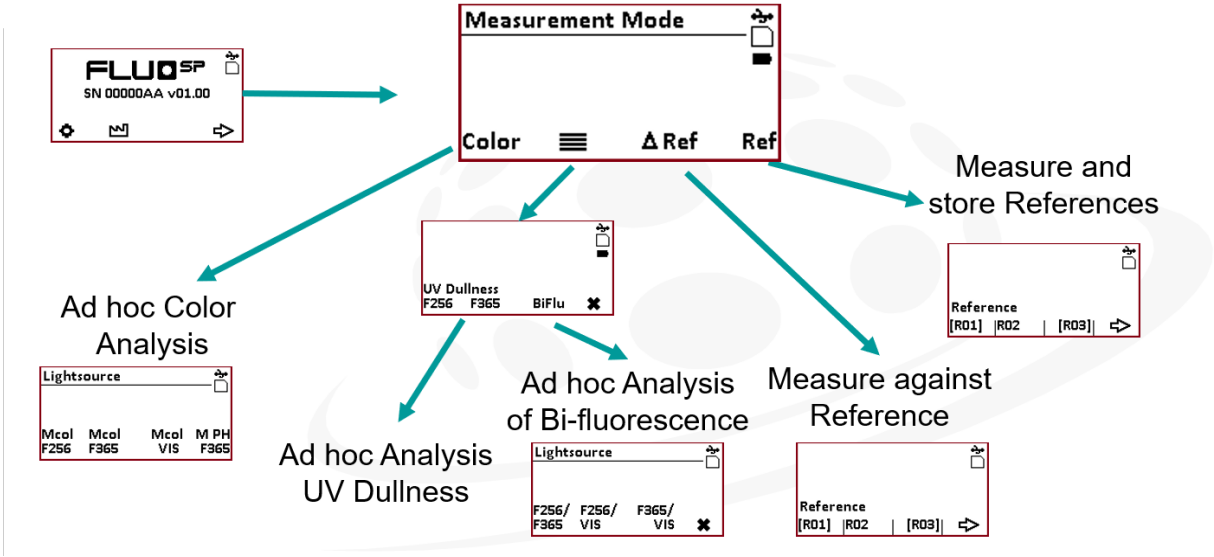
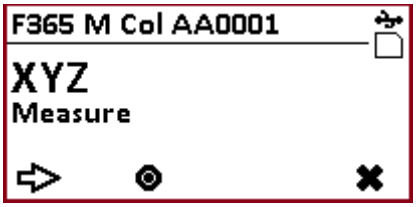
The main screen for the reflection mode measurements offers 3 or 4 menu items.

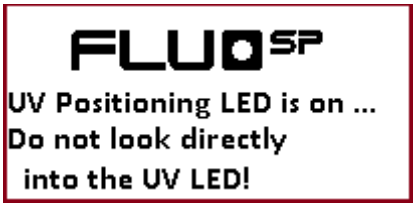


Positioning LED

Whenever the device is in measurement mode you can use the positioning LED in front of the device to find the measurement position on the invisible ink. Press and hold Key B. The positioning LED will go off upon release of Key B or after 20 seconds.



Never ever look directly into the UV positioning LED as this might hurt your eyes. The device display shows a proper warning.



In order to turn the positioning LED on, the following conditions have to be met;

- Device is in the flat position.

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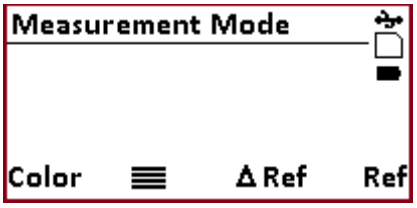
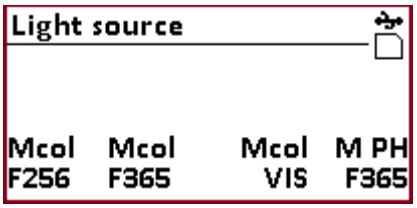
- Device is not in the measurement position but in parking position.
- After 20 seconds on, the UV positioning LED turns off. In order to switch it on again release and press Key B. Release Key B to switch the positioning LED off.

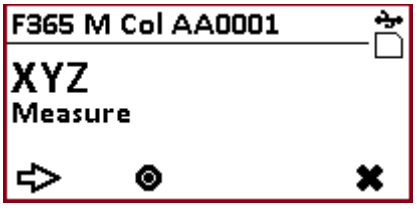
Ad hoc Color Analysis



Click key A to select the Ad hoc Color Analysis mode



Select the light source you would like to use by clicking the button below the proper menu text: F256, F365, VIS or PH365. PH365 is illuminating the sample with F365 for a longer time to make sure, the sample glowing is in saturation.



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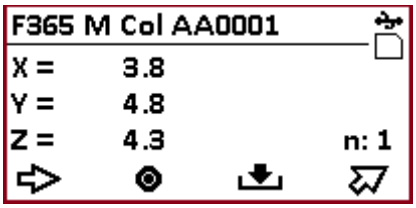
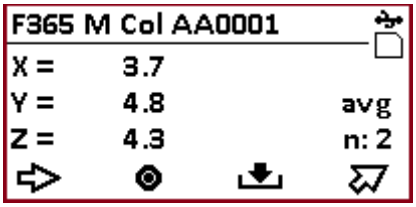
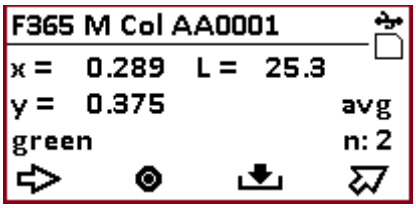
Take a measurement by moving the Device top over the aperture. Keep the device in measurement position until the measurement result does appear in the display.

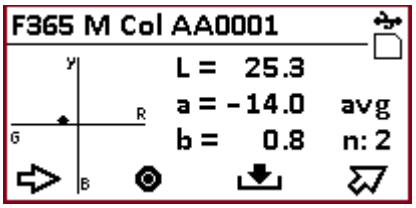


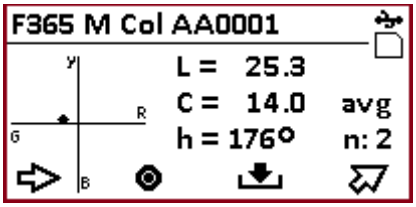
Taking an additional measurement will automatically calculate the average and display the average reading.

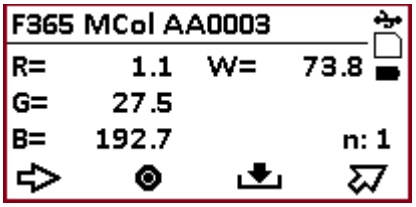


Click key A to move to the next color representation display.

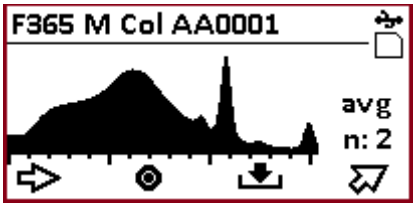






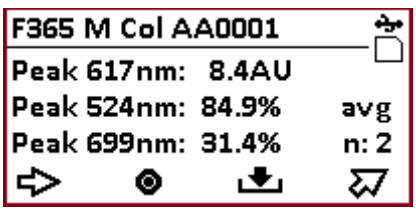


The spectrum graph displays the spectrum starting with 400nm and ending with 710nm



The Peak display shows up to 3 peaks found in the wavelength range configured using the FLUOSPConnect Software. The dominant peak is displayed on top including its intensity in AU.

The other peaks are displayed in relation to the dominant peak in %



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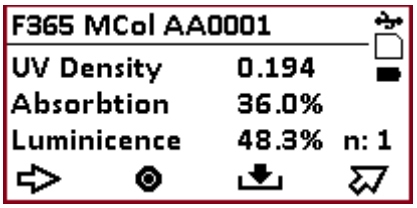
In case of F365 illumination there is calculated the UV Absorption compared to a 99% reflecting reference. The reflected (100% - absorption) is analyzed and the quantity of energy transformed into luminescence in the visual range is displayed in %. The fluorescence behavior of the sample is expressed in three characteristics:

$$UV\ Density = -log_{10}\left(\frac{\int_{391nm}^{860nm} Sample}{\int_{310}^{860} Calibration}\right)$$

$$Absorption = 100 * (1 - \frac{\int_{310}^{860} Sample}{\int_{310}^{860} Calibration}) \%$$

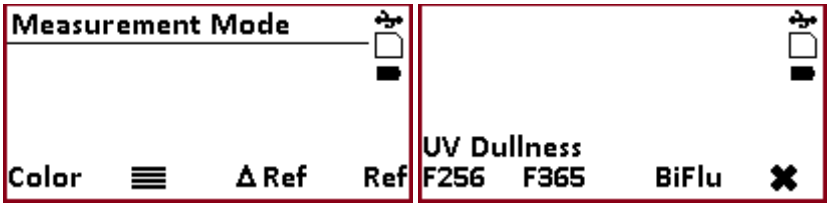
$$Luminicence = 100 * \frac{\int_{391nm}^{860nm} Sample}{\int_{310}^{860} Calibration} \%$$



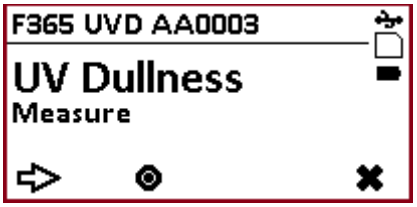
Click key C to save the measurement data to the device memory.

Click key D to start a new measurement without saving the current measurement.

Ad hoc Analysis of UV-Dullness



Click key B on the main menu and key A or B on the next menu



Measure the paper. If the emitted light is below the UVDullness reference curve on any wavelength, there will be displayed UV Dullness OK. Below the OK there will be displayed the AUI value of the current reading followed by the specified AUI.

AUI is the normalized integral of the emitted light within the specification of the UVDullness reference. The integral window goes from the starting point of the reference definition to the end of

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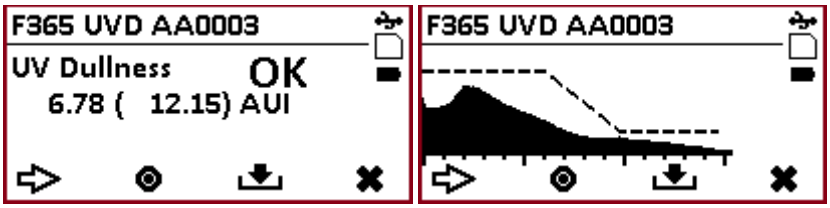
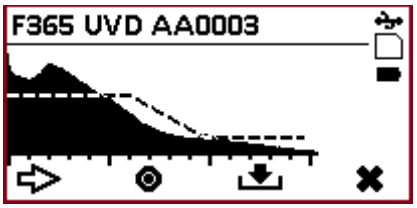
the decay. The signal on wavelengths shorter than the starting point and the residual signal after the decay specification is ignored.



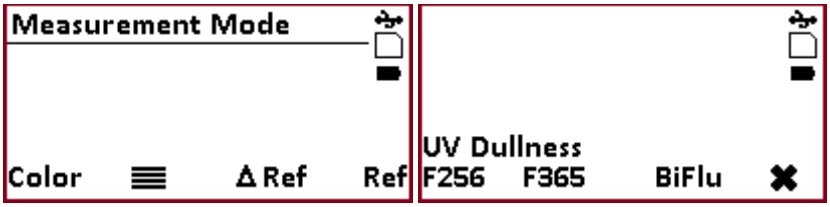
If the emitted light at one single wavelength is higher than the reference specification, the Display will show a FAIL.

Allthough the AUI is still lower than the reference AUI, at 400nm the emitted light exceeds the reference for the first time.

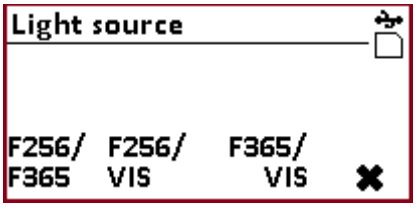
Click key A to display the curve.



Ad hoc Analysis of bi-fluorescent inks



Click key B and on the next menu key C to select the Bi-Fluorescence measurement mode.



Select the illumination combination by clicking the proper key A, B, or C.

Click key D to exit.

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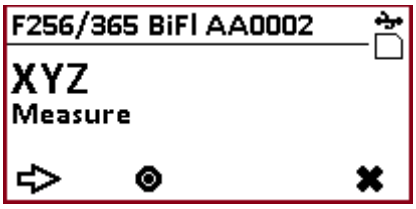
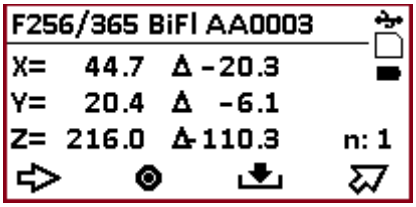
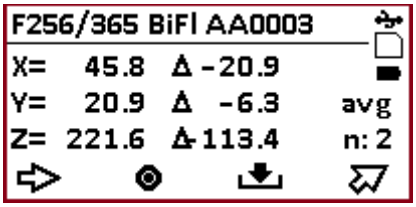


Take a measurement by moving the Device top over the aperture. Keep the device in measurement position until the measurement result does appear in the display.

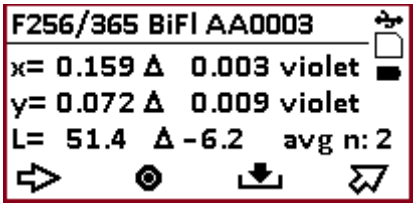


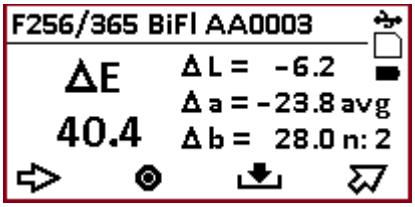
The display shows in the left column the measured values using the illumination displayed first in the head line (F256). The right column shows the difference between the two illumination reading (F256 minus F365 reading). A negative value therefore tells you, that illuminating the sample with F256 will make it glow LESS than if illuminating the sample with F365.

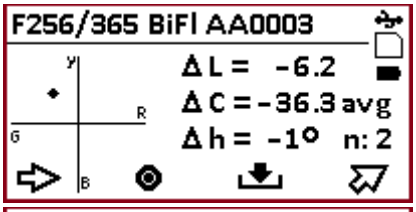
If you take more than one reading, the device automatically calculated the average for any illumination and shows the average numbers.

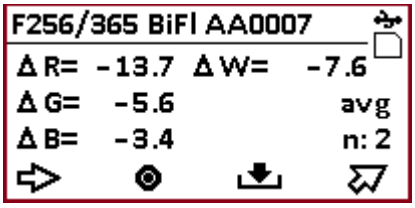


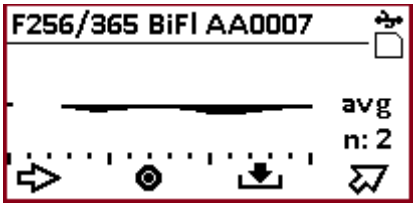
Click key A to get the next display











Click key C to save the measurement data to the device memory.

Click key D to start a new measurement without saving the current measurement.

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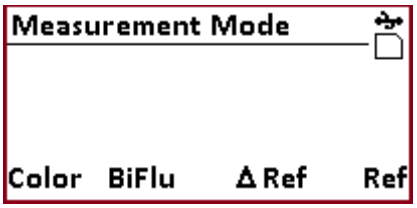
Measure and store References into the device memory

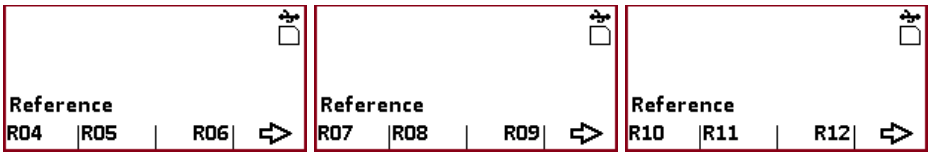
The FLUOSP SPECTRO can store up to 12 references inside its memory.



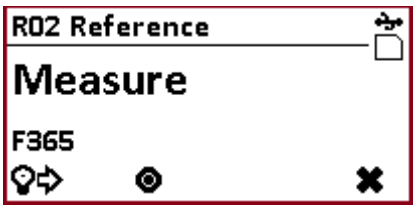
Click key D to open the reference measurement mode

In case there is already a reference saved in a reference memory space, the proper reference number will be displayed in brackets f.e. [R01]. At any point in time, this reference can be overwritten.

If All reference spaces are used on a screen, click key D to display the next 3 reference spaces.

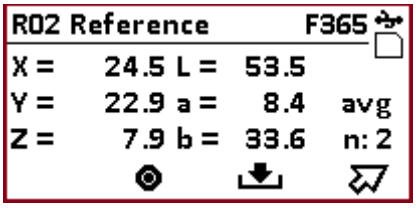


Select a reference memory space by clicking the proper key below the space number (A, B, C)



Any reference is linked to a illumination (F256, F365, VIS or PH365).

Now take a couple of readings on your target. The measurement results will be averaged and the average is displayed.



Click key C to store the reference permanently into the device memory. Storing takes some time, as the entire spectral curve is saved.

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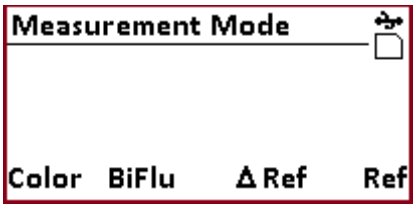
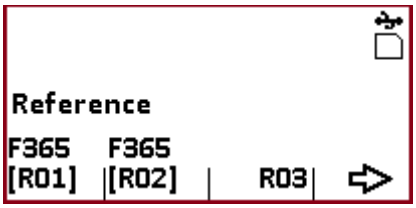
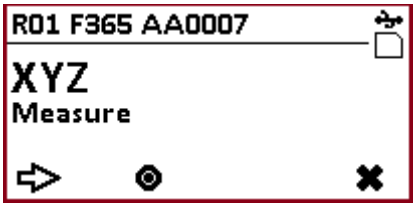
Measure a sample against a reference



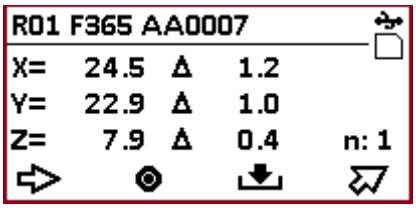
Once there are references available in the device memory, the key C (Delta Ref) is enabled. Click key C to select the reference, the sample should be measured against.



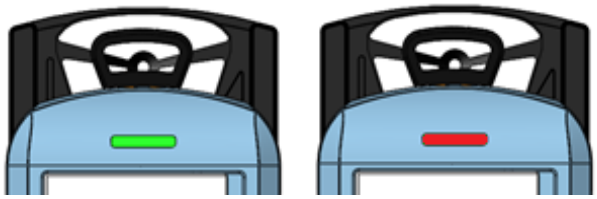
Only available references (in brackets) can be selected.



Take a reading on your sample.



There can be taken a couple of measurements on the sample. The average is automatically calculated and displayed. If the reading is in tolerance, the pass/fail indicator will flash green, if it is out of tolerance, the pass/fail indicator will flash red.



Click key A to switch to the next representation of the reading.

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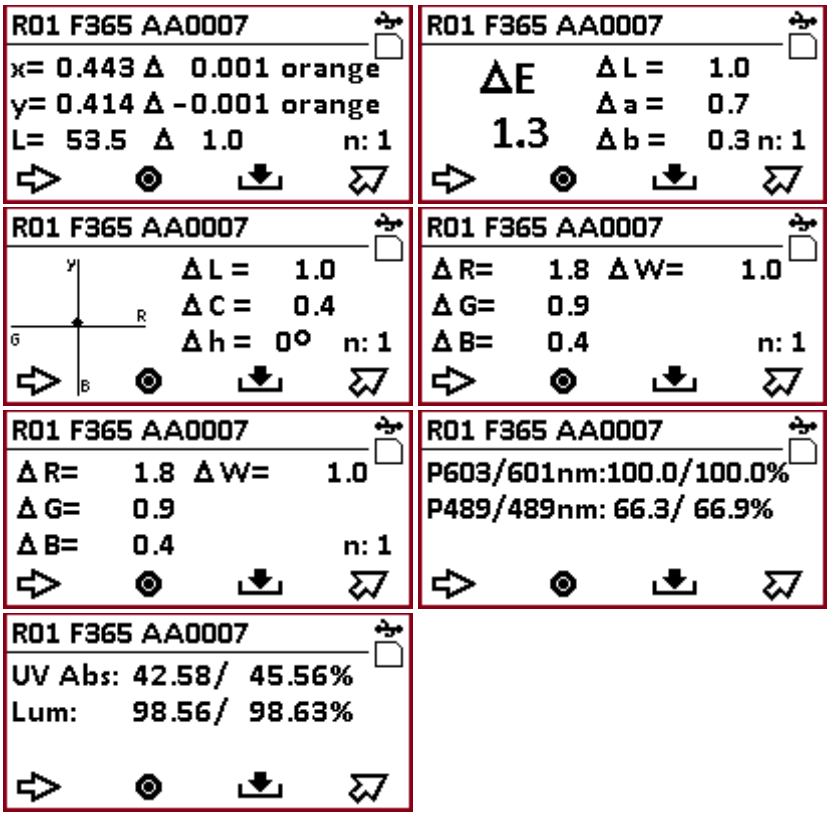

Click the SAVE Icon (key C) to save the measurement into the device internal memory for later upload.

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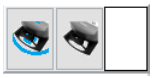
Remote measurement execution using FLUOSPConnect

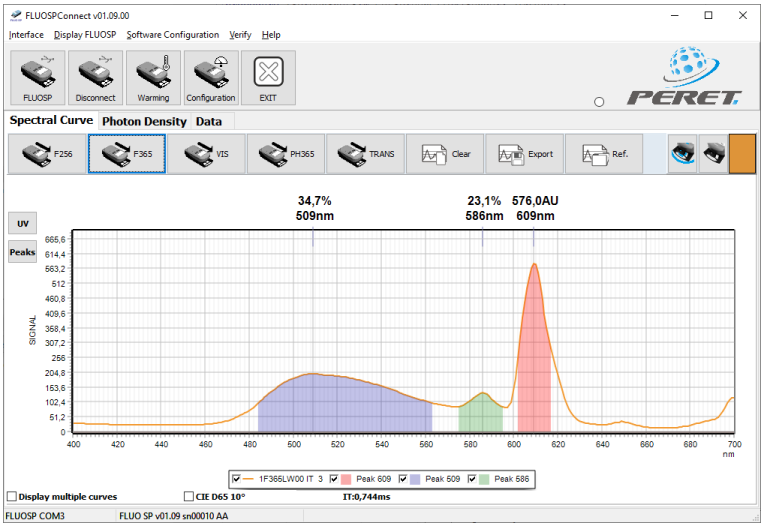
Switch the positioning LED on if required



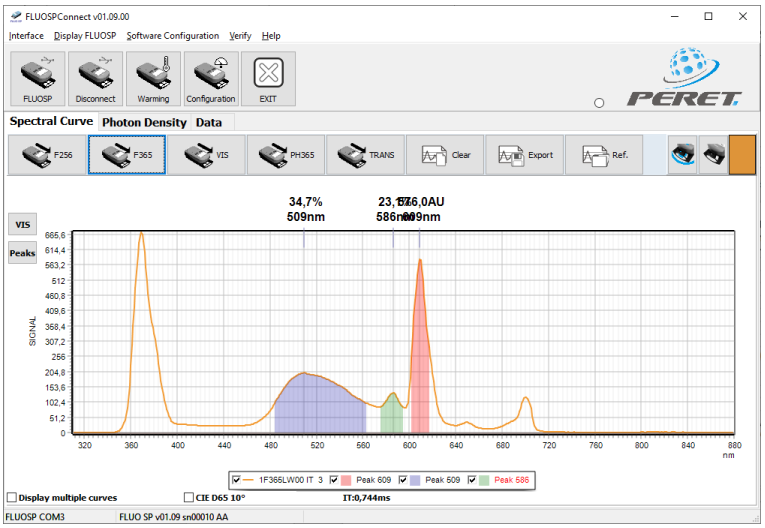
Position the device on the measurement location and move it to its front position.

Click F256, F365, VIS or PH365 to perform a spectral measurement. The positioning light goes off automatically.

The white rectangle in the right end corner of the tool bar turns black. After the reading is finished and the spectral curve is uploaded, this rectangle will display the measured color.



click the UV (VIS) Icon to toggle the spectral curve display range between UV including or just Visual range.



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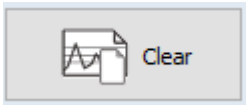
Click Clear to clear the graph.

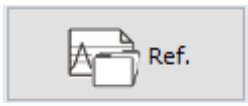


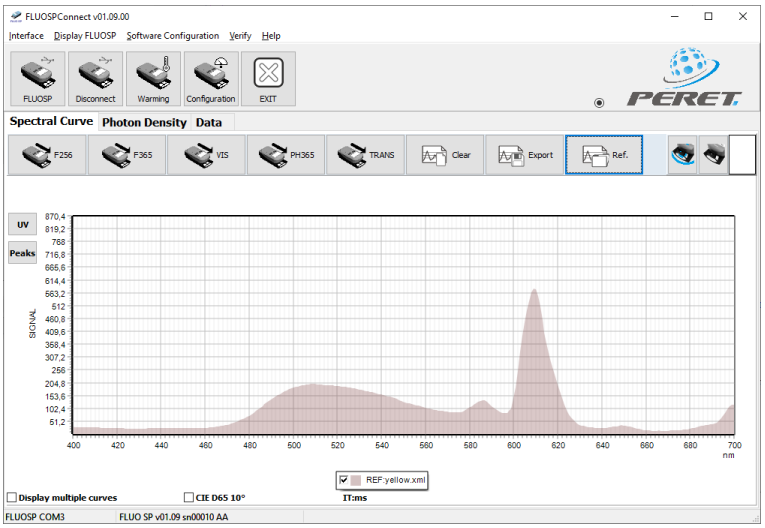
Click Export to export the curve data to a

- tab delimited text file
- excel sheet
- XML File

Measure against a reference

Any curve, that is saved in XML format, can be reloaded as a reference





Subsequent readings can now be visually compared to that reference:

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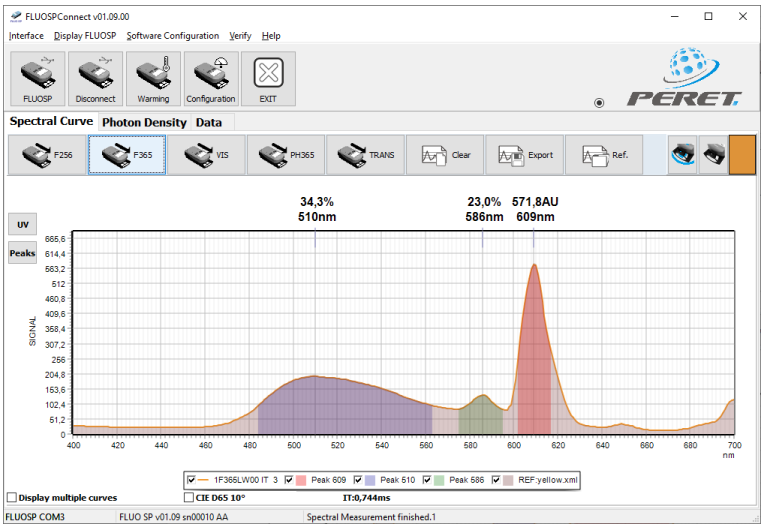
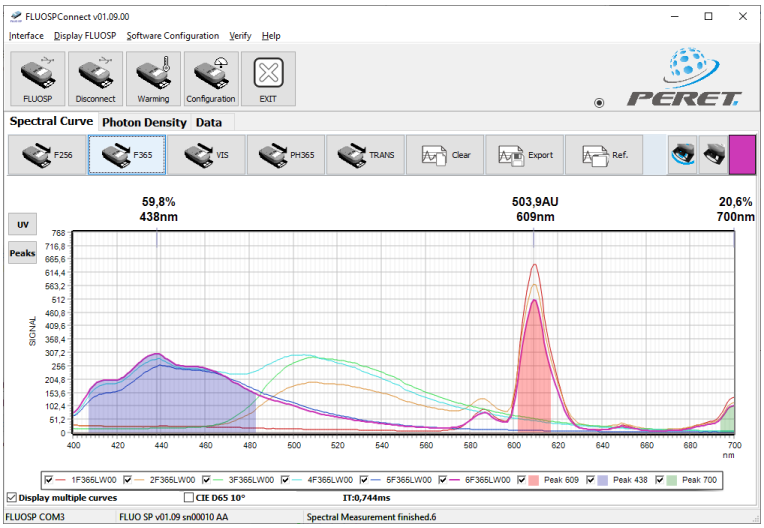


Collect multiple readings in the graph

Select the box <Display multiple curves> and click the clear graph. The color of the curve will turn the color of the measurement. Up to 15 curves can be collected and finally exported to a excel file or a tab delimited text file.



Photon Density

In order to extract the power component from the Signal (y-coordinate) of the spectral curve display the Photon Density can be calculated:

$$p(\nu) = S(\lambda) \cdot \frac{\lambda^3}{c} \cdot \frac{1000}{\int S(\lambda)_{Ref} \cdot \lambda \, d\lambda} ‰$$

$$p(\nu) = S\left(\frac{c}{\nu}\right) \cdot \frac{c^2}{\nu^3} \cdot \frac{1000}{\int S(\lambda)_{Ref} \cdot \lambda \, d\lambda} ‰$$

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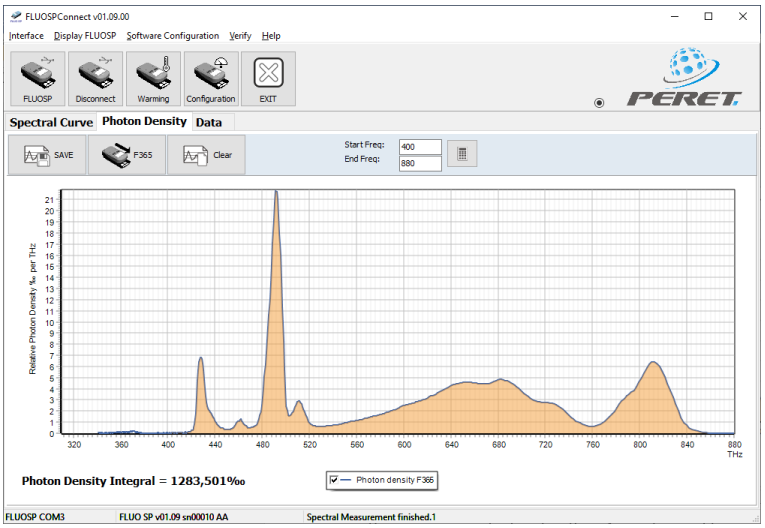
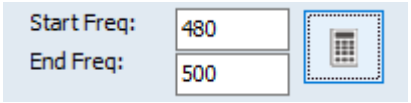
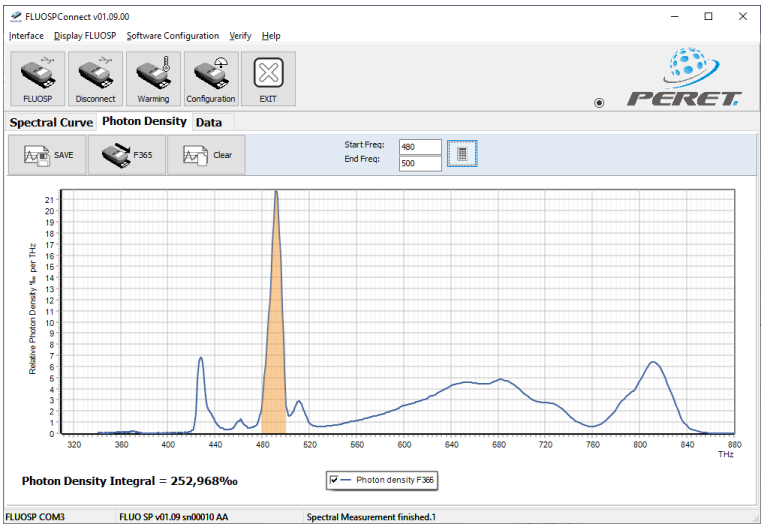


The power now is displayed on the x-Axis in Terms of frequency in THz. The Photon Density is displayed on the y-Axis.

The Photon Density within a defined frequency band can be calculated:



Select the frequency band and click the calculator Icon. The Photon Density within this frequency band is displayed.



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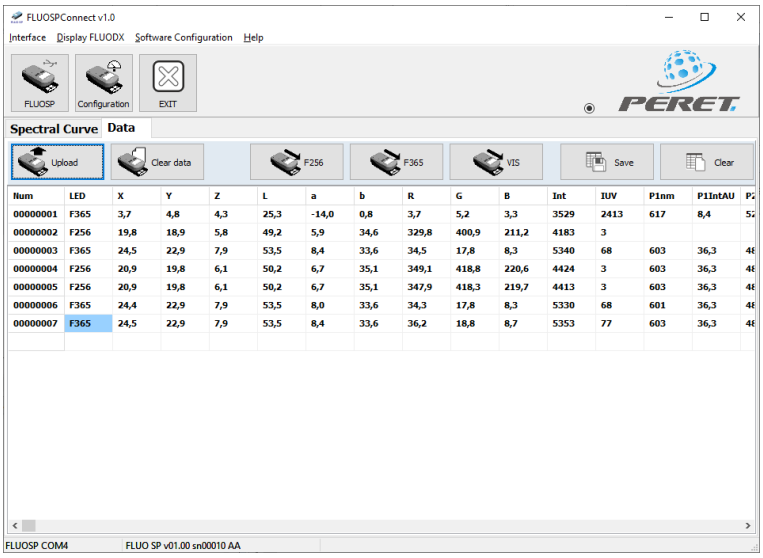
Upload data to the Software

Select the Data tab. Click the Upload Icon



Whenever a measurement is saved by clicking the save button of the device, the data is automatically sent via USB to the software and added to the table.

If the device is used without being connected to the software, the measurement data saved in the device memory can be uploaded at a later time by clicking the upload icon.

Click the clear data icon to empty the device memory from measurement data. References stored will not be affected by this operation.

Click F256, F365 or VIS to remotely perform a spectral measurement.

The measurement data contain the following values

- XYZ
- Lab
- RGB
- Int : Integral of Singal entire spectral range
- IUV: Integral of Signal UV range only
- Pinm : Peak wavelength
- P1IntAU : Peak signal intensity in AU
- PiInt%; Peak signal intensity in relation to dominant peak
- XYZ2: XYZ of second reading in case of BiFl or reference in case of dREF
- Lab2: Lab of second reading in case of BiFl or reference in case of dREF
- RGB2: RGB of second reading in case of BiFl or reference in case of dREF
- MODE
- REF (second light source in case of BiFl or Reference)
- Temp°

Click the Save Icon to save the table to a tab delimited text file, an excel sheet, or an XML file.

Click Clear to clear the table.

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