INSTYTUT FOTONOWY

Micro Fading Tester

Operation manual

Version 3.10

Updated on 2020-09-30

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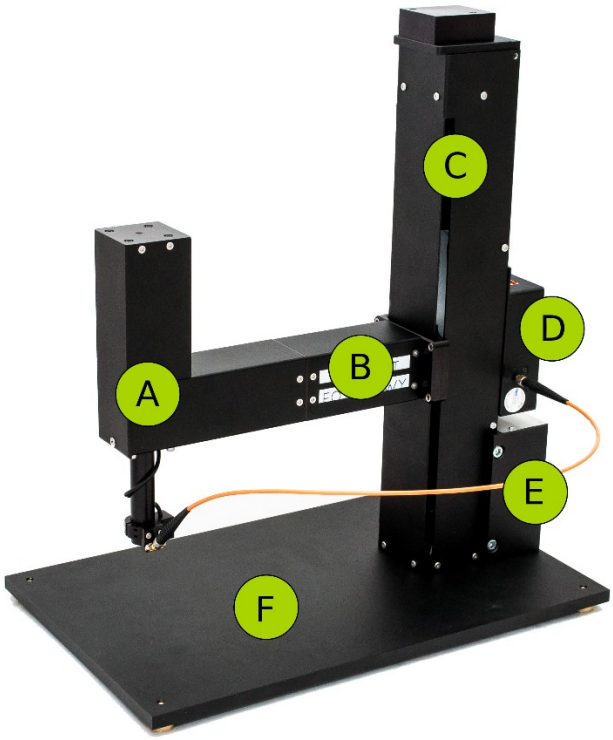
1. Introduction

Micro Fading Tester (MFT) is a device which measures the degree that a sample will fade when exposed to light. It uses a high-power LED diode to illuminate the sample, a photodiode for determining the focal length, a spectrometer to measure sample's color change, and a digital camera (optionally) to locate a suitable measurement point prior to the measurement.

2. Main parts



A – Optical head

B – Horizontal arm

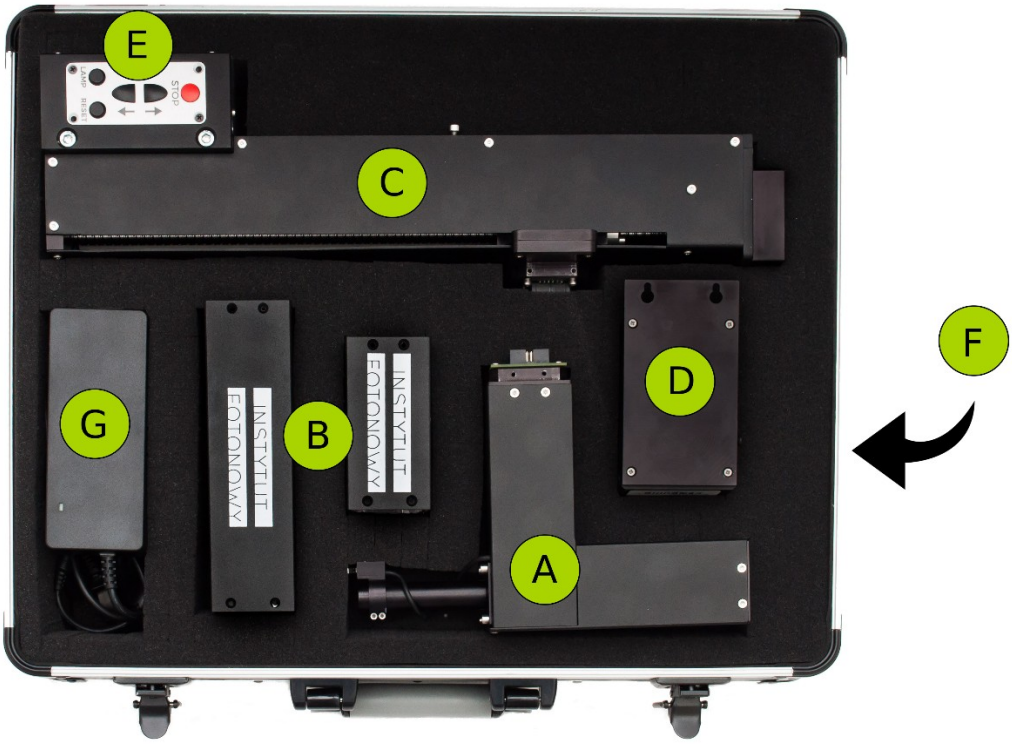
C – Positioning pillar

D – Spectrometer

E – Driver

F – Base

Inside transportation case:



A – Optical head

B – Horizontal arm (2 exchangeable lengths)

C – Positioning pillar

D – Spectrometer

E – Driver

F – Base (underneath)

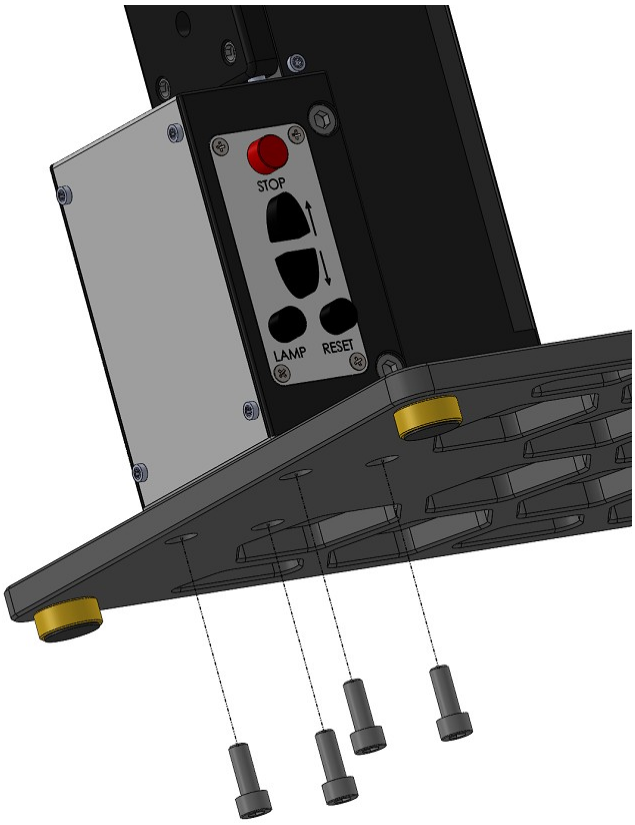
G – Power supply

Optionally:

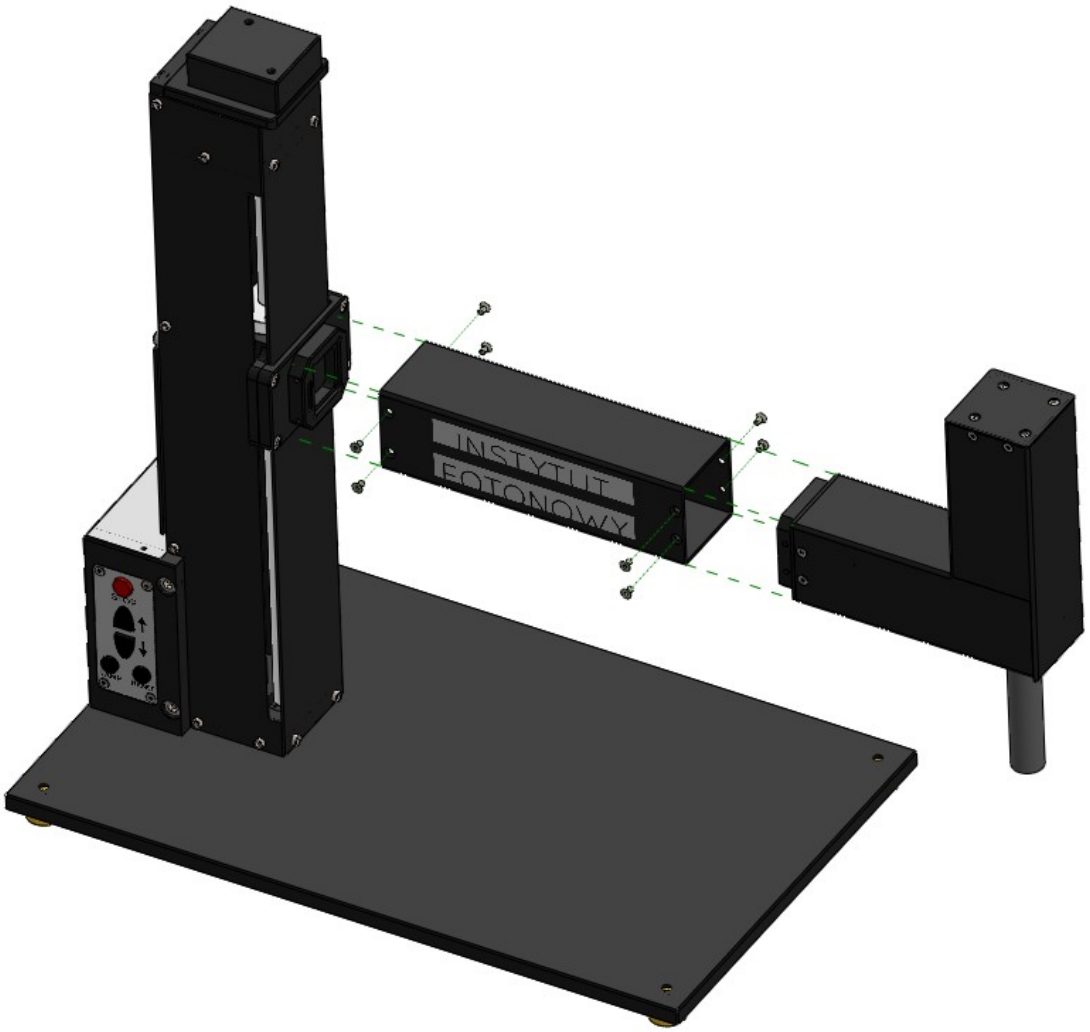
- Camera (stored inside the long horizontal arm)

3. Installation
a)Device assembly

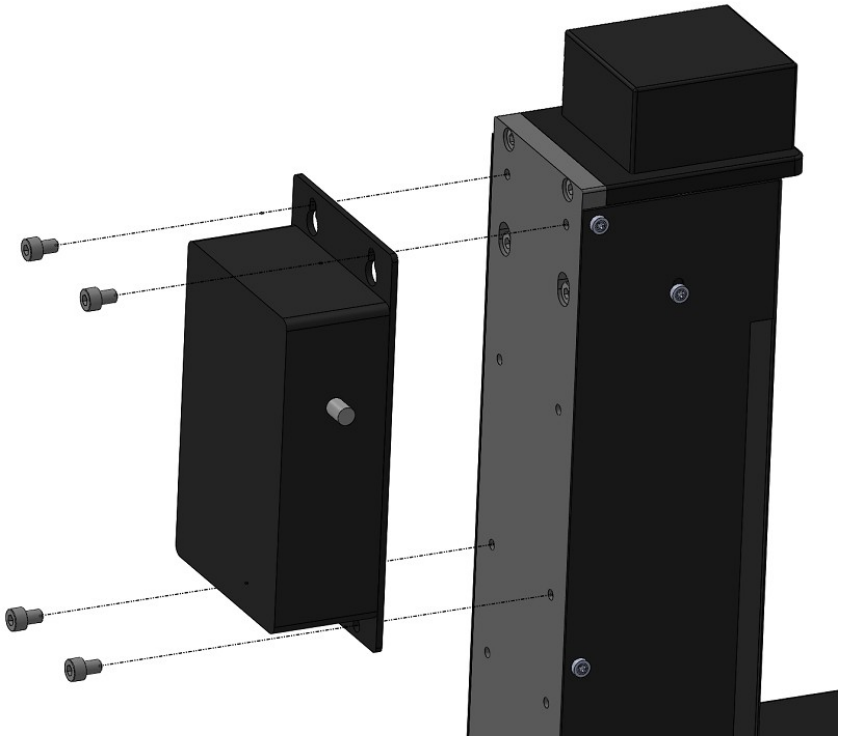
1. Take all elements out of the transportation case.
1. Take out the base platform which is underneath the foam lining.
2. Mount positioning pillar (connected already with the driver) to the base platform with 4 hex screws (see an image below).



3. Mount chosen (short or long) horizontal arm to the positioning pillar using four cross screws (see an image below). Pass the ribbon cable through the horizontal arm.
4. Connect ribbon cable with the optical head.
5. Mount horizontal arm to the optical head using 4 cross screws.



6. Mount spectrometer to the positioning pillar using 4 hex screws (see an image below).
7. Connect the optical head and the spectrometer with an orange optical fiber.
8. Connect the spectrometer with the driver using short USB cable (the SPECTROMETER socket in the driver).
9. Plug in power supply into the 12 V DC socket.
10. Connect the computer with the driver using USB cable (the COMPUTER socket in the driver).



Camera assembly (optionally):

1. Mount the camera to the optical head (side handle) with one cross screw.
2. Connect the camera with the driver using camera USB cable (the CAMERA socket in the driver).

b) First launch

MFT software

‘MFT.exe’ file should be copied from the USB drive to the chosen folder (the folder will constitute the main MFT software directory). To run the software, open the ‘MFT.exe’ file (**the software should be run using administrator level permissions**).

MFT drivers

MFT consists of two main devices: spectrometer and MFT controller. Both devices have separate drivers.

The Spectrometer driver installation:

1. Plugin Spectrometer device into the USB ports of the user's computer.
2. Open the Device Manager (Windows).
3. The "Unknown device #1" should be visible under the "Other devices" branch.
4. In the MFT installation directory, go into the "drivers" directory.
5. Run "zadig-2.3.exe"
6. Select "Unknown device" from the combo box.
7. Select and install WinUSB drivers.
8. Press "Connect" button on the MFT program menu - it will not be successful.
9. Now there should be a new device visible under the USB controllers branch in the Device Manager.
10. Run "zadig-2.3.exe" again and select the new device from the combo box.
11. Select and install WinUSB drivers.
12. Press "Connect" button on the MFT program menu - it should be successful this time.

The MFT controller driver installation:

MFT controller uses the FTDI chip for the USB communication. Drivers are available on the manufacturer's site: https://www.ftdichip.com/

Exact page is: https://www.ftdichip.com/Drivers/VCP.htm

One option is to download CDM21228_Setup.exe file for automatic driver installation, but it is not signed, the integrity of the executable file cannot be verified. It is up to the customer discretion to use it.

The recommended option is to install drivers manually. User needs to download the "CDM v2.12.28 WHQL Certified.zip". Once unpacked it will contain all the necessary files. Files with *.dll, *.sys and *.cat extensions are signed (right click on a specific file, go to properties and then the "Digital Signatures" tab).

Once plugged in and powered, the MFT controller should be listed under the USB devices (as an unknown device). Right click on the device and click "update driver" option. In the consecutive dialog the user needs to navigate to install the driver from the desired location.

Please restart computer, the MFT controller should be visible in the device manager under the “COM LPT” devices.

It is recommended to check the drivers' signatures with the „sigverif" tool after the installation.

c) Tripod installation

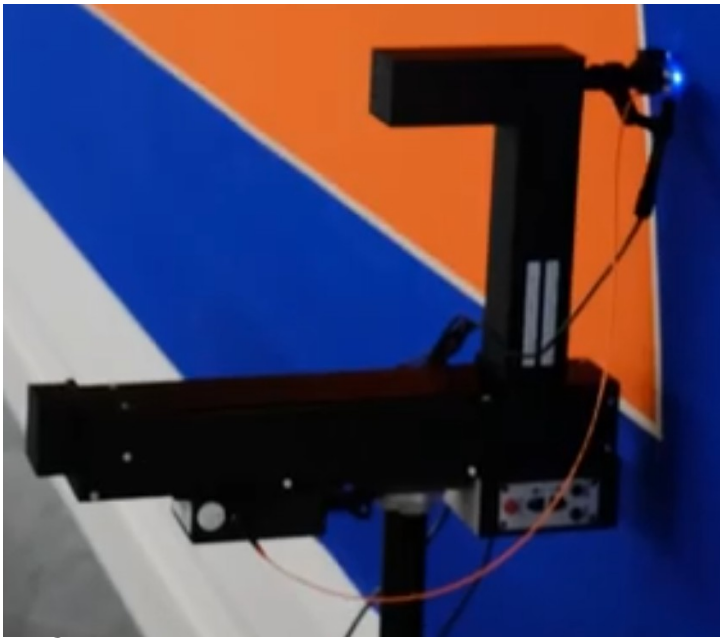
When masterpiece that is intended to be examined by the MFT is a large object, it is helpful and advisable to use a tripod. Any stable tripod with **3/8-16 UNC screw** can be used. The tripod adapter is located on the back of the MFT vertical motion column, see the picture below.

To mount the device to a tripod:

1. Remove the base (element 7 in the set)

2. Fasten the tripod with the bolt **3/8-16 UNC** to the side of the MFT using one of the screw holes in the adapter.

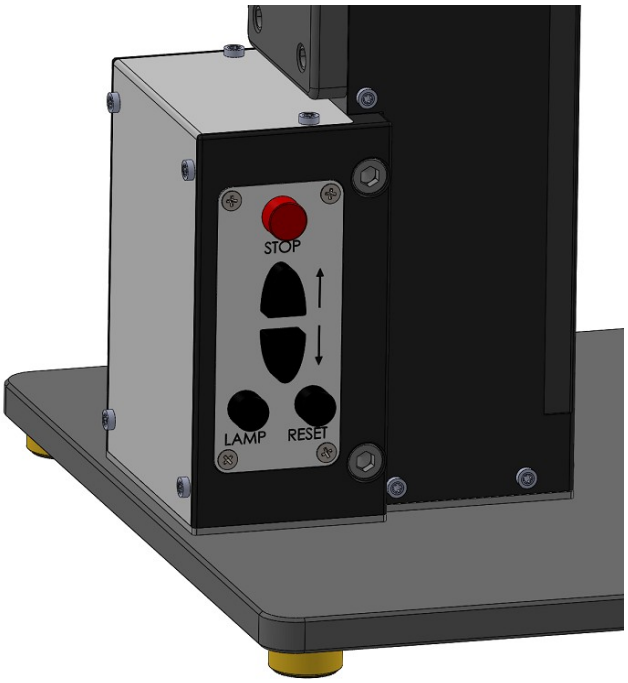
MFT with tripod:



4. Device operation

a) Keyboard

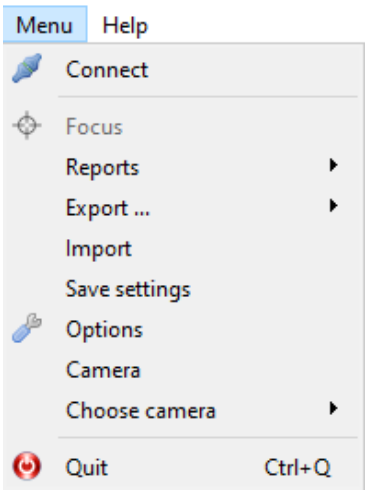
- The STOP button lets the operator to immediately stop device operation and turns of the light. MFT is then in a blocked state until RESET button is pressed.
- The UP and DOWN buttons allow the arm movement.
- The LAMP button turns the LED lamp on:
    - Short press – turns on positioning beam (low light intensity),
    - Long press – turns on measurement beam (maximum light intensity).
- The RESET button turns the device from the blocked to the active state.



a) PC Software

- **To use all of the available options, the software should be run using administrator level permissions. To run the program, right click the 'MFT.exe' file and choose '<u>Open as administrator</u>'.**

The main **Menu** contains following options:



Connect – allows to establish connection between the instrument and the computer.

Focus – initiates focusing procedure.

Reports – allows to save a report containing data collected for measurements visible in the **Aging** sub-tab. Report can be saved in a pdf or csv file. The exact content of the report file is set in the **Options** menu.

Export – allows to store data files for current spectrum or aging curve.

Import – allows to up-load the stored data files which are then shown in the **Aging** tab. N.B. Time series of spectra cannot be imported (*-spect.txt files).

Save settings – saves all the settings set in **Options**

Options – redirects to MFT settings

Camera – shows an image captured by the chosen camera

Choose camera – allows to select a camera from all cameras connected to the computer

Below Menu bar there is a bar with shortcuts allowing quick access to the main commands and settings:

 Connect (left) and disconnect (right) buttons

 Options button

 White reference measurement button

 Stop button – stops the ongoing measurement or other action

 Focus button – starts focusing procedure

 Light on/off button (switch on LED with maximum light power)

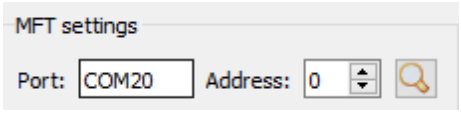
 Move down (left) and up (right) button

b) MFT settings

MFT settings can be accessed through the **Option** tab in the main menu (Menu → Options) or by pressing the wrench icon on the main bar.

MFT settings

Instrument connection settings



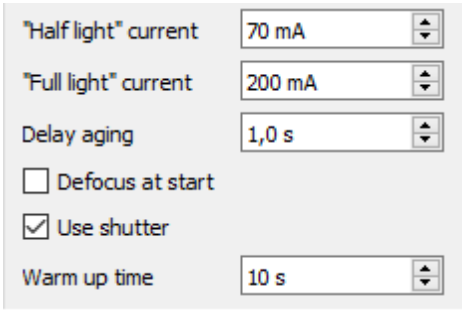
Port & Address are the serial port and address prefix which should be used for communication with the device. If you don't know the port and address for the instrument, or if the computer is unable to locate the instrument, press the 'loupe' icon for automatic detection.

Light power settings

User can select light power used for beam positioning and focusing on a sample ('Half-light'). Recommended value is 70 mA.

User can set maximum light power used for aging tests ('Full-light'). Upper limit is 1000 mA. Recommended current value is 700 mA to ensure a long life of the LED light source used.

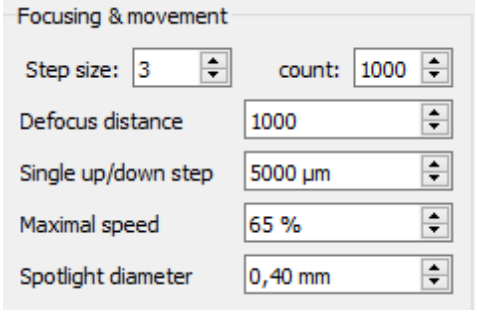
If a **LED changer** is used, the "Full-light" current values should be determined separately for each LED from respective calibration curves. User should be careful not to choose values that saturate LED light outputs. Otherwise, light stabilization will not be possible.



When the instrument light (LED) is switched on, its light power slightly overshoots the final value and reaches steady level within few seconds. To counteract this phenomena and let the light power of LED to stabilize, 'Delay aging' together with "Defocus at start" options can be used. 'Delay aging' time determines how long the LED will glow before starting the measurement (both white reference as well as aging measurements). To protect the sample during that time 'Defocus at start' option may be used. It causes defocus of the LED light during the delay and focus of the light just before the aging measurement. This option is recommended for objects which are sensitive to light and within first seconds of aging would change its color above ΔE76=0.2 (equivalent to Blue Wool No. 1 and 2).

If the MFT is equipped with a shutter, the "Warm up" option should be used instead of "Delay aging" and "Defocus at start". The shutter is enabled when "Use shutter" option is selected. The "Warm up time" determines how long the LED will shine before starting the measurement (both white reference as well as aging measurements). During that time, the shutter is closed and the sample is not illuminated.

Focusing & movement



This menu allows to adjust the way in which optical head of the MFT is moved and how the focusing procedure is performed.

The 'Step size' parameter regulates precision of the movement. Recommended value is 3.

The ‘Count’ parameter determines the distance (number of steps) by which an optical head will move up when the **Focus** button is pressed.

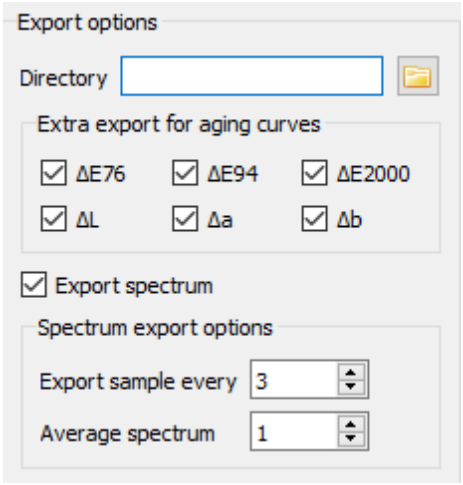
The ‘Defocus distance’ parameter is active when ‘Defocus at start’ option is selected in **MFT settings** menu. It regulates number of steps used during defocusing procedure at the beginning of the measurement.

The ‘Single up/down step’ value determines the distance by which an optical head will move up and down by pressing the ‘Move up’ and ‘Move down’ buttons.

‘Maximal speed’ regulates speed of the optical head movement.

‘Spotlight diameter’ value is precisely measured and given by the manufacturer. It is used to determine the dose values. If the MFT is equipped with six LEDs changer, ‘Spotlight diameter’ parameter for each LED will be presented.

Export options



‘Directory’ – allows the user to set the location of the directory where data files will be stored.

In the result file, basic colorimetric CIE Lab values (L*, a*, and b*) are stored automatically. For additional information, in ‘Extra export for aging curves’ field user can select other color difference values, including C calculated according to CIE 1976 and CIE 2000 formulas. It is recommended to keep all options selected.

For an in-depth analysis of changes in the reflectance of a sample a series of spectra can be exported. To do this, ‘Export spectrum’ option should be selected. The field ‘Export sample every’ describes the samples at which spectrum will be recorded (e.g. the value 3 means that at every 3rd sample spectrum will be exported). The number of the exported samples and the interval time can be determined taking into account ‘Sampling period’ and ‘Aging time’.

Files structure

Generated files are stored in a text format (ASCII characters).

Color change file (CIElab results) contains a header (3 top lines starting with #) and measured data. First two lines give an information about the object and measured spot as given by user in the **Aging/Aging curves** tab. Third line presents an information about the current and light power used in the test (in mA, watts and lux). Measured data are arranged in columns.

Spectra files
The spectra will be saved in two files. The file names will follow the same base as the corresponding CIELab result file with added suffixes:

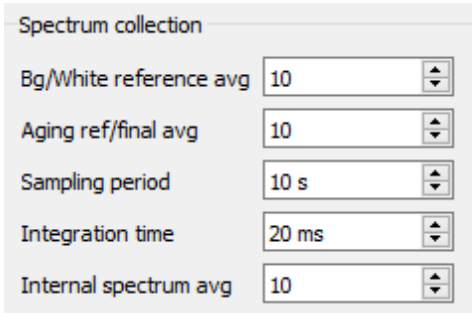
- ‘-spect’ suffix – file contains raw data (The spectra are arranged in consecutive rows – the first one contains wavelength values, second and third contains spectra recorded for the most recent measurement of the white reflectance standard and the background, respectively. Following rows contain spectra recorded for the tested sample.)

- '-spect'_convert' suffix – file contains the transposed data with added column headings indicating the recording time of the given spectrum

All the recorded and exported spectra, excluding only spectrum of the background, **are background corrected** (the background spectrum is subtracted from each recorded spectrum).

Spectrum collection

This menu is used to set spectrometer parameters and parameters important for the fading test.



There are two main parameters determining the way of data collection: 'Integration time' and 'internal spectrum avg'.

The 'Integration time' parameter determines signal intensity. It should be set to a maximum value before data saturation. Saturation of the data is achieved when the maximum of the spectrum reaches or exceeds the intensity value of 65 536 and is manifested by a flattening of the maximum of the spectrum. A white reflectance standard and maximum light power ('full-light') should be used to set the integration time value.

The 'Internal spectrum avg' parameter determines the number of consecutively measured points (i.e. spectra of the sample) taken for averaging. This averaged spectrum is presented as one measurement point. This parameter allows to keep a satisfactory signal to noise ratio.

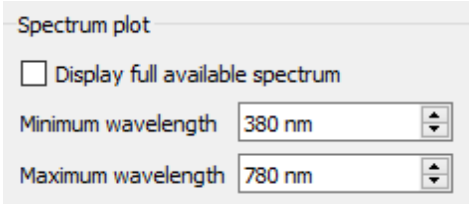
The background and white reference spectra, and spectra of the initial and final measurement point in the aging test may be additionally averaged.

The 'Bg/White reference avg' parameter determines the number of consecutive measurement points of the Background and White reference taken for averaging. 'Aging ref/final avg' determines the number of consecutive measurement points taken for the initial and final spectra in the aging test used for averaging. Since all color difference values would be derived from these averaged spectra, recommended value is at least 3.

The 'Sampling period' parameter regulates the time between the measurement points. Minimal sampling period during aging tests is 1 second.

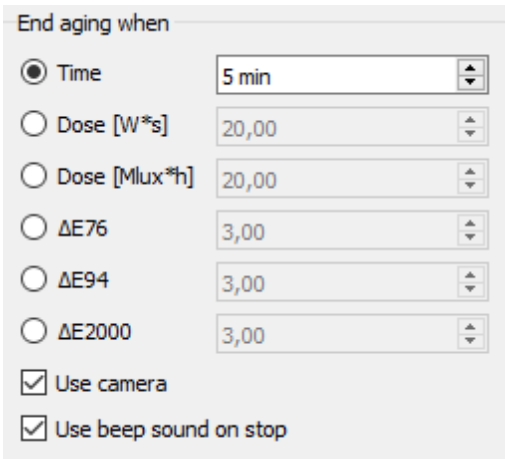
Spectrum plot

In the **Spectrum plot** menu user can decide on the span of the wavelength axis shown in the **Spectrum** tab. Since the spectrometer is detachable, it can be used for other purposes than the aging.



End aging when

In the **End aging when** menu user can decide what criteria will be used to stop the experiment (and switch off the light). For the most light-sensitive objects in typical testing time (5-15 minutes) color change could rich values well above the just-noticeable-difference threshold. For such objects, especially if they have smooth, uniformly colored surface, a faded spot could become visible to a naked eye. In such cases a



maximum ΔE value should be set to stop the measurement before any traces of the test are visible.

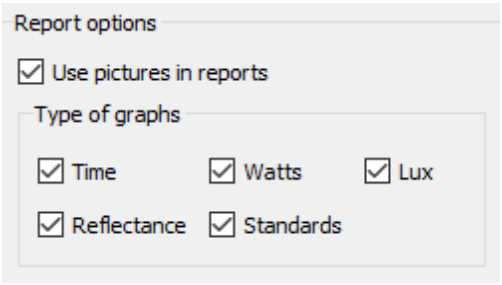
User can choose whether or not to use the camera to take a photo of the measured spot (‘Use camera’ option).

The beep sound indicating the end of the measurement may be also switch on or off (‘Use beep sound on stop’ option).

Report options

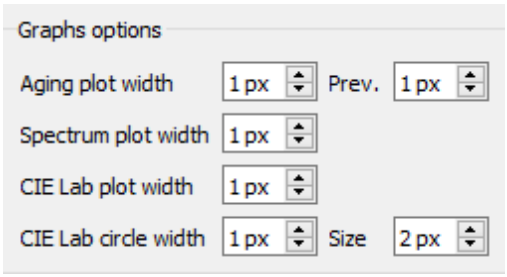
In the **Report options** menu, user may choose whether or not the pictures taken by the camera will be included in the reports.

User may also select the type of graphs that will be included in the reports.



Graph options

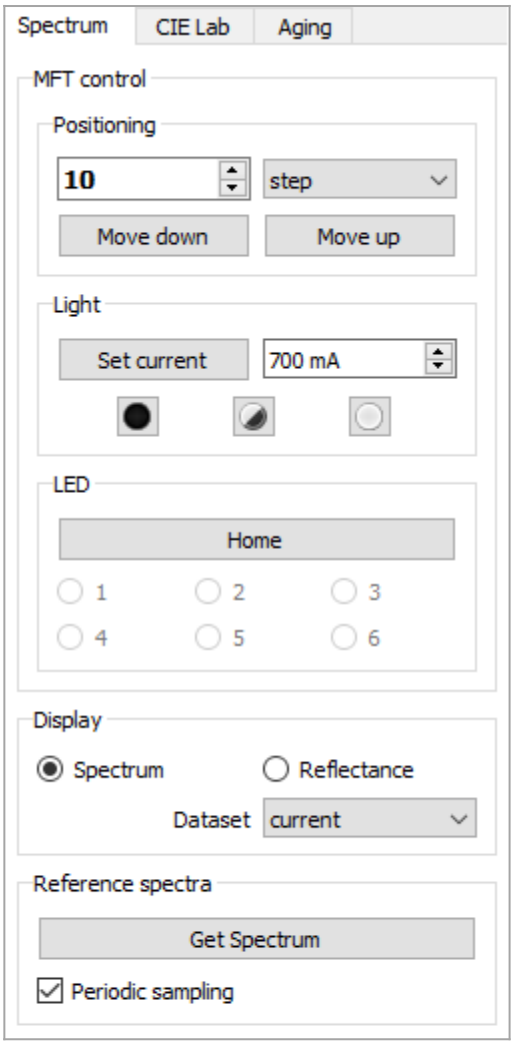
The **Graph options** menu allows the user to set the parameters of the graphs presenting measured values (thickness of the lines and size of the points).



c) Main window

In the main window of the MFT software three tabs are available: **Spectrum**, **CIE Lab** and **Aging**.

Spectrum tab



The **MFT control** menu contains **Positioning** and **Light** sections. Using buttons in the **Positioning** section (‘Move up’/ ‘Move down’) user can move optical head up and down by a selected distance. Distance can be adjusted by typing a value and selecting the unit (steps or mm).

The **Light** section allows to set manually power of the MFT light (‘Set current’) in mA. Light may be turned off (left button) and turned on with ‘half-light’ power (middle button) or with ‘full-light’ power (right button) – both light power values are adjusted in ‘Options’ menu.

The **Display** menu allows to switch between spectrum presented in intensity unit (‘Spectrum’) and reflectance spectrum (‘Reflectance’). To obtain the reflectance spectra background and white reference spectra must be recorded (see White Reference calibration). During the aging measurement, user may select which dataset (‘Dataset’) should be presented: **current** (last measured spectrum), **aging ref** (spectrum of the first point of the aging measurement), and **aging final** (spectrum of the last point of the aging measurement.

To get the current spectrum ‘Get spectrum’ button should be pressed. To constantly refresh the Spectrum window with the data measured by the spectrometer, the "Periodic sampling" box should be selected.

If the MFT is equipped with six LEDs changer, **LED** section appears in **MFT control** menu. In this section user may select which LED should be used for the measurement.

CIE Lab tab

The **CIE Lab** tab collects colorimetric data for the measurement points of the studied object. The colorimetric data are available after White reference spectrum collection. L*, a*, b*, C*, h*, sRGB, and ΔE values are presented in ‘Colorimetric data’ section. L*, a* and b* values are also presented in a graphical form as a point (small circle) in the a*-b* plane of the CIE Lab space and as the dash on the L* scale (grayscale vertical bar). During the aging measurement, color of the first, last and selected point of the measurement is presented as points and dashes of various colors.

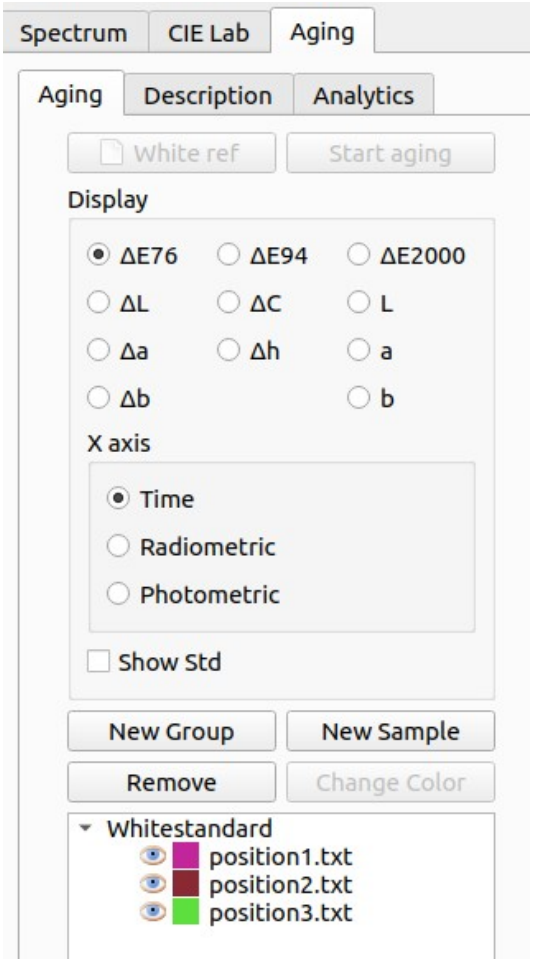
Initial and current colors of the measured spot are also shown as colored rectangles at the upper right corner of the tab. The rgb representation shown here is only an approximation of the real color of the object due to the limitations of the rgb gamut and computer screen.

During and after the aging measurement, user may check the colorimetric data for each measured data point by moving the slider in ‘Aging history’ section.

Aging tab

Aging tab contains three sub-tabs: **Aging curves, Descriptions** and **Analytics**.

Aging sub-tab



This tab is used to initiate measurements and to browse the collected data. Note that a new background measurement will be collected at the focus point prior to initiating the fading testing for each sample point on an object. This feature allows for surface texture and reflectivity to be better compensated for in the measurements.

The ‘White ref’ button initiates the white reference measurement, which must be performed prior to the aging measurement using white standard as a sample. ‘Start’ button is active only when the instrument is calibrated for white reference.

The **Aging** tab allows to set the names of planned measurements (samples). All measurements for a given object can be set as a group, having a common name and description. Before starting the aging measurement, a group and a sample should be created by pressing the ‘New Group’ and ‘New Sample’ buttons, respectively. To remove any group or sample, select the desired object by left-clicking on it and press ‘Remove’ button. To adjust the color of the aging curve, select the desired sample and press ‘Change Color’ button – ‘Change color’ menu will be opened.

For starting the aging measurement, press the ‘Start’ button. If the ‘Delay aging’ option is selected in the ‘Options’ menu, the LED will glow for the set time before starting the measurement.

The ‘Display’ section of the **Aging** tab allows the user to switch between different colorimetric values calculated on-the-fly for the tested objects from their measured reflectance. X axis can represent the aging time (in seconds) or the dose, expressed in radiometric (watt seconds) or photometric (mega lux hours) units.

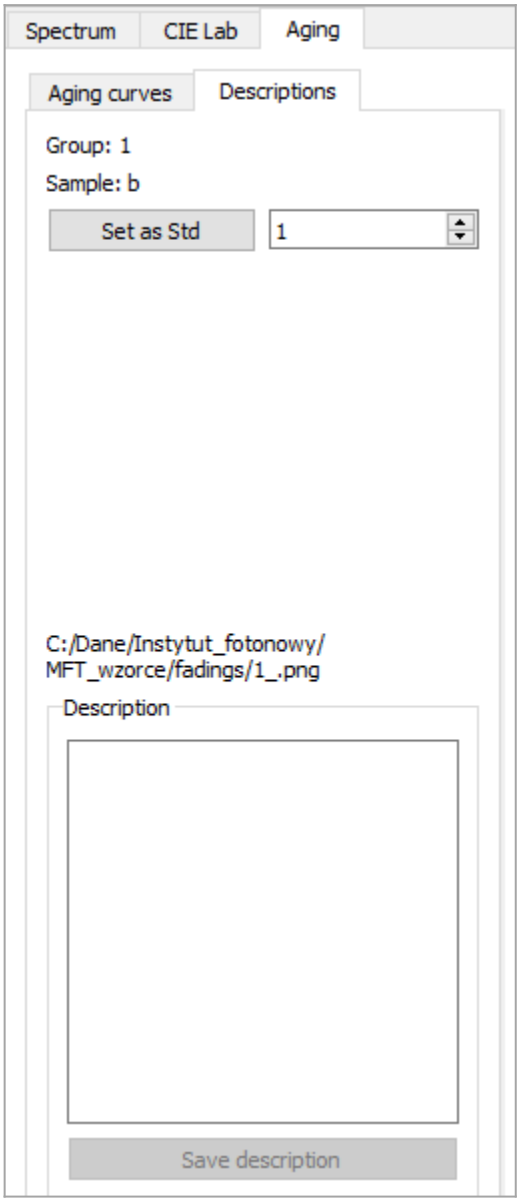
The ‘Show Std’ option allows to overlay the recorded data with the data collected for standards (e.g. Blue Wool Standards), which can be defined in the **Descriptions** sub-tab.

In the **Aging** tab the data collected in previous test sessions can also be displayed – the user can import old files through the main menu (‘Menu’ – ‘Import’).

Descriptions sub-tab

This tab allows to give comments to the planned measurements. Field ‘Description’ allows to write comments for the group and each sample in that group. The data file for each measured sample will contain both descriptions in the top 2 lines.

In the **Descriptions** sub-tab, by pressing the ‘Set as Std’ button, the user can assign the aging curve of any of the measured samples (previously selected in the **Aging curves** sub-tab) as a standard. The number selected in the field will be used in recalling this data. It is recommended to use this option to store data for Blue Wool Standards. The data files of samples selected here as standards are saved the main directory of MFT software. If the ‘Show Std’ option is selected In the **Aging curves** sub-tab, data for standards will be presented together with curves recorded for tested objects.

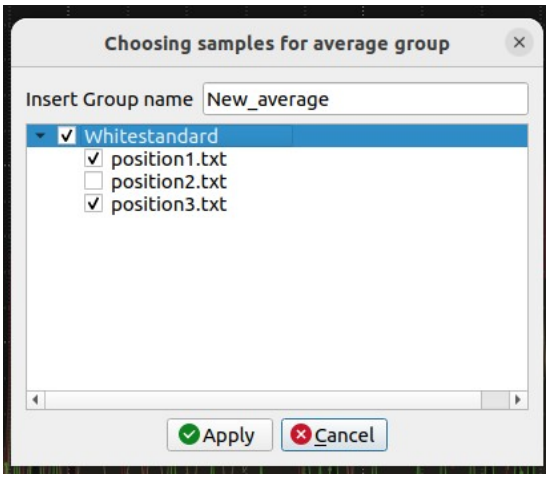


Analytics sub-tab

This tab enables postprocessing of collected aging curves. Curves may be freely grouped by user. For each created group software provides statistic data (average and standard deviation).

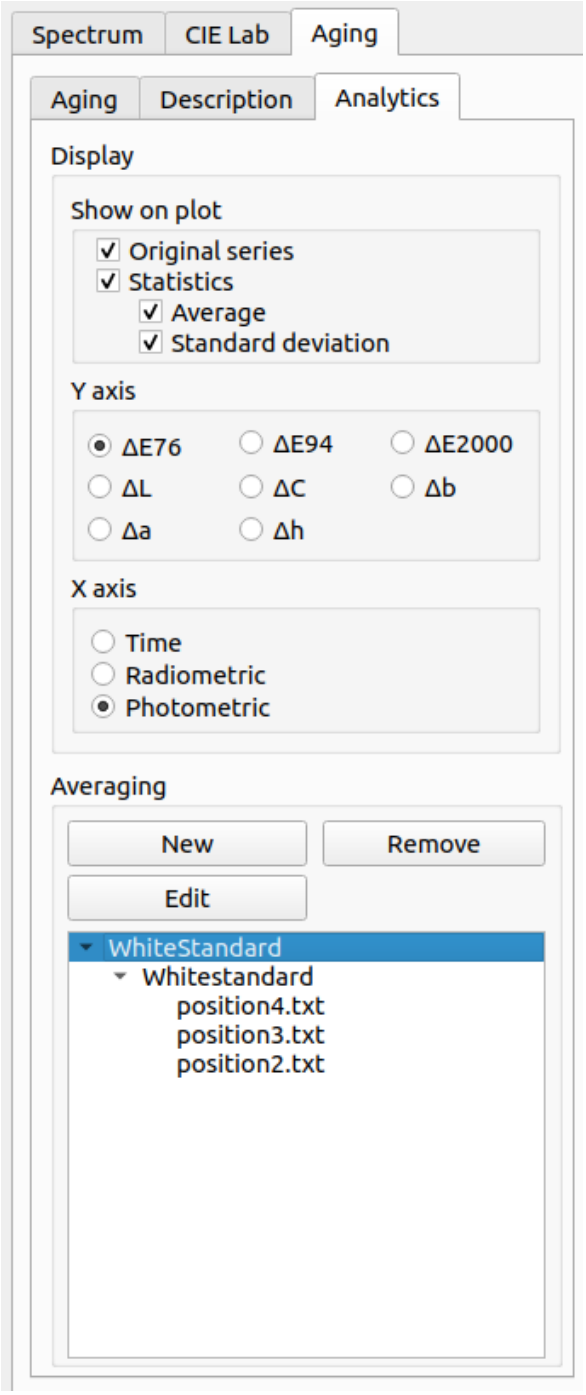
After pressing “New” button user may choose samples for new group via Dialog with accessible samples tree and specify the name of the group. Chosen samples for selected group may be freely changed by user after pressing “Edit” button or double-click on average name in tree located in Averaging section. Samples that may be selected can both come from recent measurements or can be loaded from files.

“Remove” button removes selected group from tree in Averaging section. This button does not remove any loaded / measured sample from Aging tab.



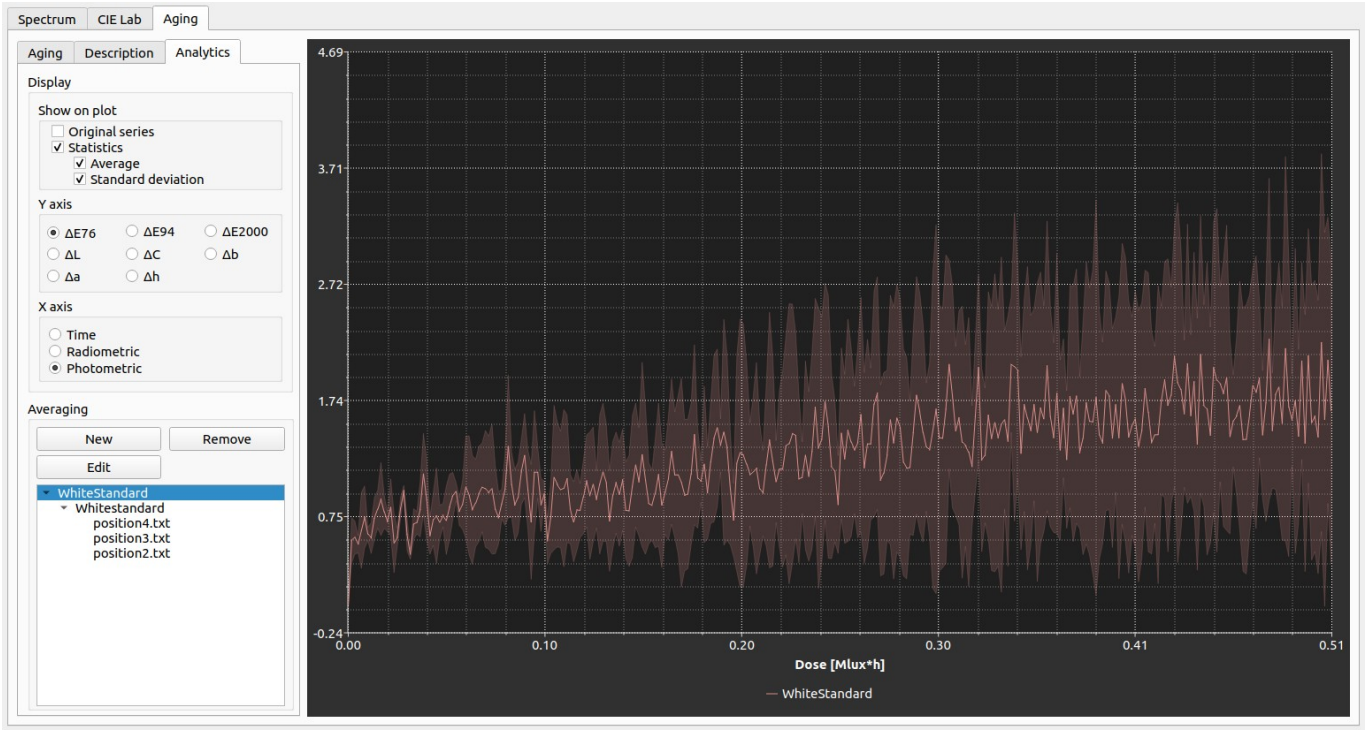
After creating new group, average curve and standard deviation (semi – translucent area) emerges on the plot. Section “Show on plot” enables to swich curves shown on plot.

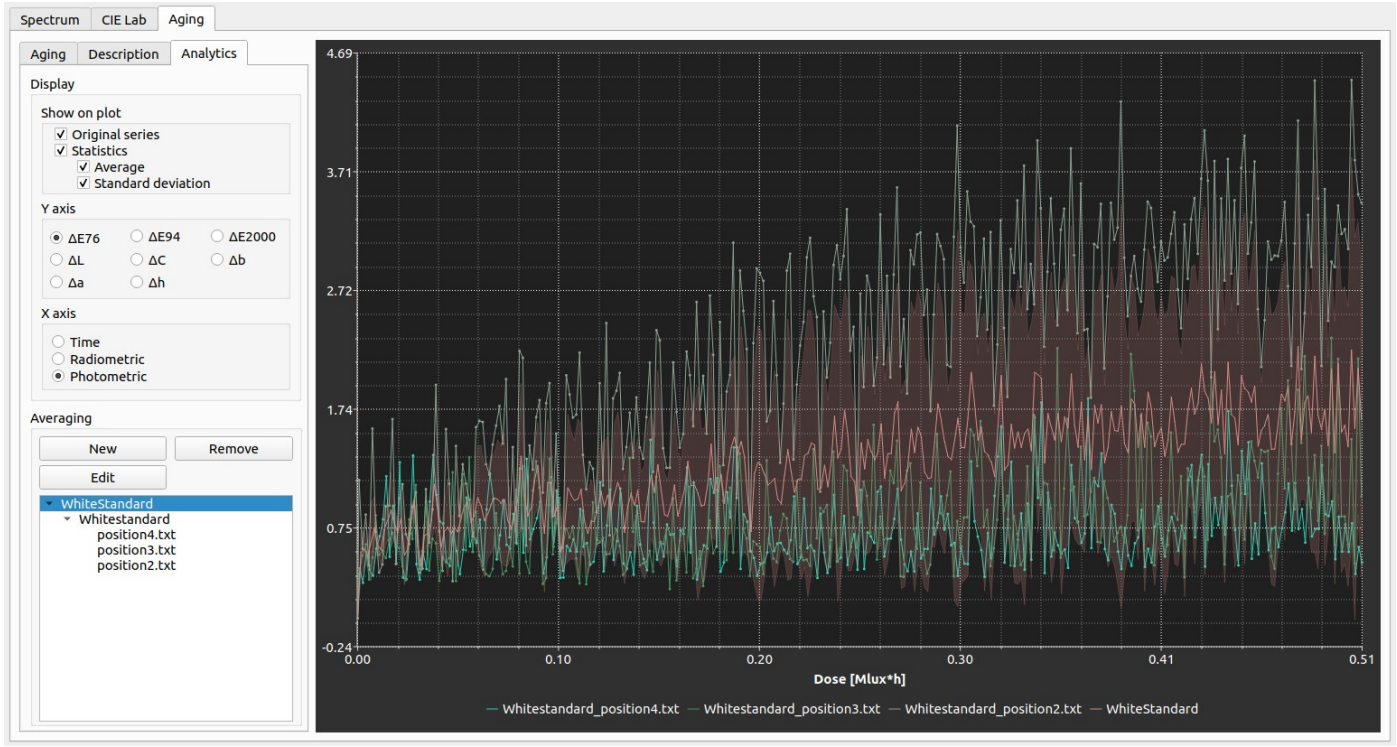
Statistic data for each average group may be exported via Menu to .dat file and to .pdf report file.



Average curve (and standard deviation values) are calculated after interpolating points of each sample of aging curve in group so x values (time / radiometric / photometric dose) for all samples and its average are unified. Average curve has as many points as the shortest sample series in group.

On the section Y axis and X axis user may choose the units of presented data.





5. Focusing and White Reference calibration

a) Focusing procedure

The focusing procedure should be performed before each measurement, if the sample or reference sample has been moved or changed. To perform the procedure, place the object (or white standard) under the optical head and switch on the light at the ‘half-light’ power of the LED. By using “Move up” and “Move down’ buttons move the arm to close vicinity of the sample. During focusing, the optical head always moves away from the object, so for the procedure to be successful the initial distance of the optical head from the surface of the sample should be shorter than the focal length but without the probe touching the object. The focusing procedure is initiated by pressing the ‘Focus’ button. During focusing, the optical head moves up and the signal from an internal photodiode (intensity of the reflected light) is collected and displayed in the main screen in the **Spectrum** tab. When the optical head passes through the focus the signal reaches its maximum. At the end of the focusing procedure the optical head quickly returns to the determined distance. The absence of the maximum in the curve shown during the focusing procedure may indicate that the procedure was started too far below the focus (focus could not be reached during one focusing procedure), or that the focusing was started from a point above the focus.

To protect the studied objects, the optical head is equipped with a sensitive touch switch, which stops movement of the arm just before reaching the surface of the tested object.

Some parameters controlling the performance of the focusing procedure can be set by the user in the **Options** menu.

d) White Reference calibration

Prior to any measurement the spectrometer should be calibrated for both, a background and a white reflectance standard. Such calibration enables to present spectrometer readings as Reflectance as well as calculate color values (CIE L*a*b* and sRGB) and color changes (ΔE). After the calibration is completed the ‘Reflectance’ option in the **Spectrum** tab becomes active, the color values for the current reading are presented in the **CIE Lab** tab, and ‘Start’ button in the **Aging** tab is active (if the name of the group and sample are given and the sample is selected for the next test).

To perform white reference calibration, place the white standard under the optical head, perform focusing procedure and press ‘White ref’ button in the **Aging/Aging curves** tab. The background calibration will be performed automatically prior to the collection of the white reference.

Instytut Fotonowy optionally provides its own white reference standard based on Fotolon (Instytut Fotonowy’s own formula, similar to Spectralon) or **$BaSO_4$** material. Please contact your Instytut Fotonowy distributor or Instytut Fotonowy directly for more details.

6. Power calibration

Each Fotonowy automatic MFT is calibrated and delivered with a power calibration file. The power calibration allows the MFT to automatically plot colour change and all other parameters as a function of a dose expressed in Mega Lux hours (MLux hr) and Watt seconds (W s). The dose-response curves allow to relate the MFT data to lighting/display policies.

The supplied calibration is valid for 6 + months depending on usage. After 6 months the MFT is still usable, but the estimated dose may be less reliable. After this time, it is recommended to perform a power calibration.

To perform power calibration the Fotonowy calibration unit is necessary. It is an optional accessory that can be purchased either with the instrument or separately at a later time. The power calibration unit consists of a photodiode sensor, a calibration unit controller, BNC and USB cables, and two mounting posts.

Fotonowy Automatic MFT can be also recalibrated by shipping the instrument back to Instytut Fotonowy or by making an appointment with a Instytut Fotonowy representative (please contact your Instytut Fotonowy distributor or Instytut Fotonowy directly for more details).

Recalibrating a Fotonowy automatic MFT with a calibration unit

Prior to the power calibration, white reference measurement should be performed. For the calibration procedure and when the white reference is collected an ambient light should be minimised.

If the MFT is equipped with six LEDs changer, the calibration will be performed automatically for each LED and the calibration file containing the data collected for all LEDs will be saved.

1. Assemble the calibration unit by connecting the photodiode sensor to the controller through the BNC cable and the control unit to the computer using the USB cable.
2. Establish the connection between the instruments (MFT and calibration units) with the computer.
3. Set the light source to ‘full-light’ power and let it warm up for at least 5 minutes.
4. Focus the MFT onto the white reference standard.
5. Perform the white reference measurement.
6. Lift the optical head and remove the white standard.
7. Install the two mounting posts on the baseplate by screwing them into the two small holes near where the samples are placed.
8. Mount the photodiode sensor on the posts using the two set screws.
9. Turn the MFT light source at the ‘half-light’ power and position the optical head so that the spot of light is completely within the photodiode sensor. It is not necessary to focus the light on the sensor. A spot with a diameter of ca. 2-3 mm is desirable.
10. Open the **Options** menu and select the ‘Calibrate’ button to open the calibration wizard.

11. The wizard confirms that: i) the calibration unit is connected, ii) the white standard has been collected, and iii) the spot of light is completely within the photodiode sensor. Each step should be confirmed by clicking the ‘Next’ button.

12. If all the conditions are fulfilled, the calibration procedure is performed. The current powering the LED is changed from 0 to 950 mA (with step: 100 mA), and the calibration unit records the optical output power at each step.

13. The collected calibration curve for that particular light source is saved as a **power.cfg** file in the same directory as the MFT control software. This file can be opened in Notepad or other .txt file readers.

    - There is a check box that can be selected to preserve the previous power calibration file. It is recommended to keep the previous power calibrations to document changes in the light intensity of the used LED.

14. When the calibration is complete, select ‘Finish’, and exit the **Options** menu.

7. Digital camera

The digital camera is an optional unit compatible with Fotonowy automatic MFT. This camera can be used to locate a suitable measurement point before the measurement as well as to document the measurement points and include their images in the generated reports. Prior to use, the camera needs to be positioned and focused on the surface of the object so that the measurement point is visible and focused. If an error message, appears, please ensure that the camera is connected to the **USB port** labelled **'CAMERA'** in the instrument's driver, and that the Lenovo EasyCamera driver is installed correctly. If the view in the camera window is from the device's web camera and not the MFT camera, go to 'Menu' -> 'Choose Camera' and select 'Lenovo EasyCamera'.

Using the camera to find a measurement point on the object under the MFT.

1. Focus the MFT light on the object at the 'half-light' power setting.
2. Go to the 'Menu' and select 'Camera'. The window with the live view from the camera should be opened. It is possible to change settings of the camera such as brightness etc.
3. If needed camera light can be turned on using the wheel switch located on the camera cable. Remember to turn the flood light off before taking any measurements or reference spectra as well as before focusing.
4. Using the camera live view window, position the object so that the spot is within the area of interest and focus the image using the knurled knob at the distal end of the camera.
5. Close the camera window.
6. Refocus the MFT.
7. Reopen the camera window and confirm that the measurement spot is still within the region of interest.
8. Repeat steps 4-8 if necessary.
9. Once the measurement point is confirmed and the focus is acceptable, close the camera window. Turn off the camera and MFT light sources.
10. You are ready to perform the measurements.

Using the camera to document the measurement point for report generation

1. In the **Options** select the '**Use Camera'** option to include image of the measurement spot in the report.
2. After completing the aging measurement or stopping it manually, the camera window will open automatically, and the LED light intensity will be reduced to the 'half-light' power level.
3. If necessary, camera light can be additionally turned on.
4. Press the **Capture** button to take an image.
5. Press the **Close** button to close the camera window and turn off the LED light.
6. The image is automatically saved as a PNG file (together with the fading data and spectra) with the name, "Group Name Sample Name", as for the sample. The file is saved in the file directory specified in **Export options** in **Options** menu.

8. Quick user guide

1. Connect the instrument with the computer
2. Set Options parameters in the **Option**s menu: specify the file directory in the **Export options**, specify type of stored values (i.e. which color difference values are to be stored), set the end-of-aging criteria.
3. Place the white standard under the optical head and perform focusing procedure (set the light source to ‘half-light’ power).
4. Perform white reference measurement.
5. Place the studied object under the optical head. Perform focusing procedure on the object (with light source set to ‘half-light’ power to prevent object from fading during the procedure).
6. Set the names for the group and individual measurement (sample) in the **Aging**/**Aging curves** tab. Enter additional information in the ‘Description’ field in the **Aging**/**Descriptions** tab.
7. Perform the aging test (press the ‘Start’ button in the **Aging**/**Aging curves** tab). Note that a new background measurement will be collected at the focus point prior to initiating the fading testing for each sample point on an object. This feature allows for surface texture and reflectivity to be better compensated for in the measurements.
8. To save the report in a pdf file go to **Menu/ Reports/Report pdf view** and press **Save**. To save the report in a csv file go to **Menu/ Reports/Report csv export**.

9. Troubleshooting

In case of any problems, please contact Instytut Fotonowy.

If the problem lies in the operation of the program (the program works incorrectly or crashes during or after the measurement), please save the log file and send it to Instytut Fotonowy with an information about the symptoms.

To save the log file, go to **Help** menu and choose **Debug tracing** - debug dialog will be opened (see below). Select ‘debug all’, and ‘text file’ options. Press ‘Ok’.

The log file will be saved after closing the software. It will be saved in the ‘**Logs’** folder, which will be created in the main directory of the MFT software. If there is any problem with saving a log file, check if the program works from the administrator position.