Operating Instructions

Spectroradiometer

specbos 1xx1

JETI LiMeS

Software Version: 4.x

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1. Introduction

specbos 1201 and *specbos 1211* are easy to use spectroradiometers for various applications. Their miniaturized shape makes them suitable for laboratory as well as industrial use. They can measure luminance/ radiance as well as illuminance/ irradiance. Furthermore colorimetric data (CCT, chromaticity, colour purity, dominant wavelength, CRI) are calculated from the spectral data. Therefore they are suited for the test of light sources as CRT screens, for the measurement of projectors and of room illuminance.
specbos 1201 is a spectroradiometer for VIS wavelength range.
specbos 1211 covers the wavelength range of 350 … 1000 nm and is approx. 10 times more sensitive than *specbos 1201.* The version *specbos 1211 UV* extends the wavelength range to 250 nm.
The indication of the measuring spot on the target in case of luminance/ radiance measurements will be proceeded with a pilot laser circle. Irradiance measurements are done with a cosine corrector head-piece. The software switches automatically to the appropriate measuring mode depending from the attached measuring head.
Measurement of radiant flux can be done with *specbos 1301*, which contains an integrating sphere (diameter selectable from 50 to 500 mm).
specbos 1401 is suited for the radiant intensity measurement of LED's according to CIE 127. Both instruments can measure in luminance and illuminance mode as well.
Acquisition and analysis of data is done by the PC software JETI LiMeS. The connection to the PC is via USB interface (virtual COM port). It is also possible to communicate directly with the instrument without the PC program. Virtual Instruments for LabView are contained on the CD as well as radiometric and spectrometric DLLs. Detailed helping information for both applications is included. Furthermore the instruments can be driven by SCPI compatible firmware commands. The command list is also available on the CD.
specbos 1211 is available with other interfaces:

Serial interface	*specbos 1211-RS*
Bluetooth interface	*specbos 1211-BT*

specbos 1201 is optionally available in two special versions – *specbos 1201 flash* for pulsed source measurements and *specbos 1201 focus* for measurement of small spots from 0.5 to 3 mm diameter.

PC requirements:

- Pentium 4/ AMD Athlon XP or higher, min. 512 MB RAM
- Graphic resolution: 1024*768, 16 bit colour depth recommended
- Windows XP, Vista or Windows 7

The device packages includes:

- Basic device *specbos 1xx1* with protection cap
- Cosine corrector head-piece
- Operating instructions
- Tripod
- Transport box
- CD-ROM with PC software JETI LiMeS, DLLs, LabView Virtual Instruments, operating instructions and firmware command list
- USB cable
- Trigger connector
- Integrating sphere for Luminous flux measurement (only *specbos 1301*)
- Tubes and integrating sphere for Luminous intensity measurement (only *specbos 1401*)
- Bluetooth antenna, bluetooth adapter and a rechargeable lithium polymer battery EasyPack 3.7V (EZPack XL) (only *specbos 1211-BT)*

2. Operation of Device

2.1. specbos 1211

The instrument will be switched on automatically if the USB connection to the PC is established.
Pressing the illuminated switch switches on the target marking if the instrument is in Radiance mode. Repeated pressing switches the target marking off.

2.2. specbos 1211-BT

The **specbos 1211-BT** will be powered by battery if the wireless interface is used. The battery will be charged when the instrument is connected to the PC via USB. Alternatively it can be charged with the power supply.
The switch on the rearside has the following functions:

- Pressing if instrument is switched off: Switch on the instrument
- Short pressing if the instrument is switched on: Switch on/ off the target marking
- Long pressing if the instrument is switched on: Switch off the instrument
- If the instrument is switched off and connected to power supply or to PC by USB:
  - Short flashing – battery will be charged
  - Continuous illumination – battery is fully charged
- If the instrument is switched on:
  - Continuous illumination with short breaks – battery will be charged
  - Continuous illumination – battery is fully charged

Remark: The USB connection between PC and instrument needs to be established if the battery shall be charged via USB.

Automatic switch off:

The instrument will be switched off if there is no connection to the PC for more than 15 min., e.g. if the operator forgot to switch it off. If the software LiMeS is running the instrument will be not switched off automatically.
The battery powered **specbos 1211-BT** will be automatically switched off if the defined operating time without any communication is elapsed. The device send in this case a enquire code (0x05).

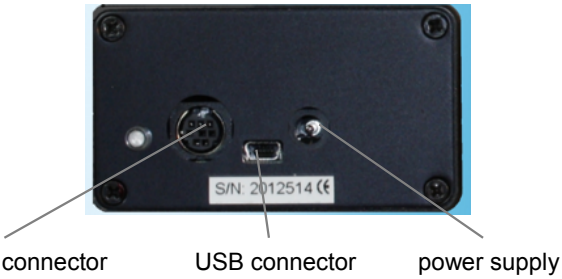
Battery down:

If the battery charge is below the low value a enquire code (0x05) will be sent, and a timer for time out starts.
After time out the device send again the enquire code and switched power off.

3. Installation of Hardware

3.1. Installation of USB Device

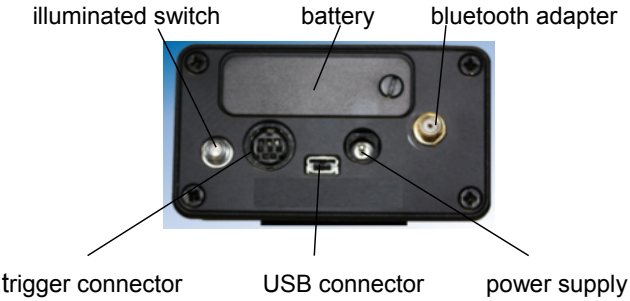
Unpack the spectroradiometer *specbos 1211* carefully and check the delivered parts.

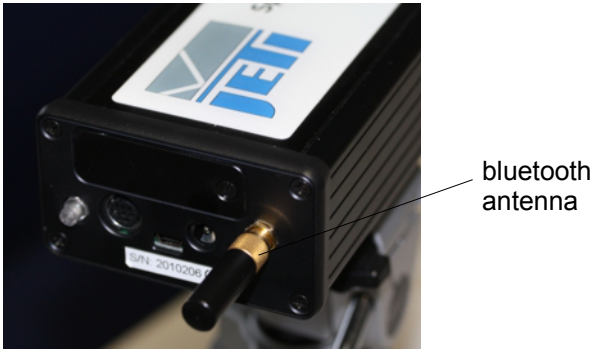


Connect the device to an USB interface of a PC or laptop using the enclosed USB cable.

3.2. Installation of Bluetooth Device (*specbos 1211 BT*)

specbos 1211 BT can be used alternatively via bluetooth or USB. Press the rearside switch until it is shinning in blue.

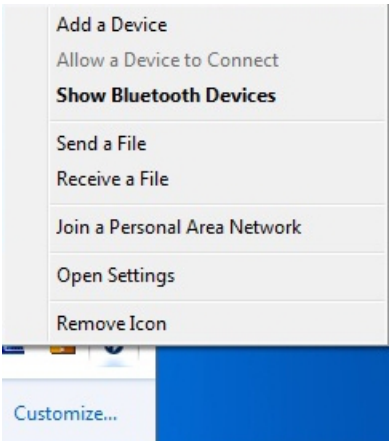




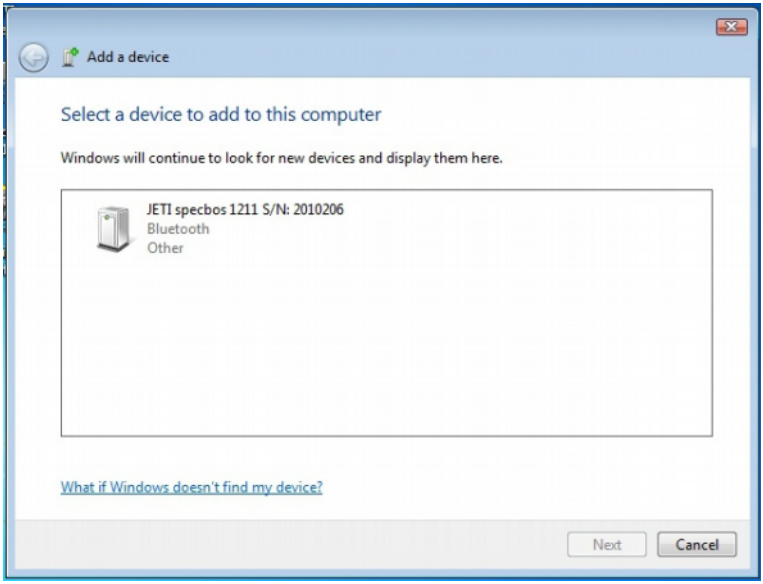
The package of the device includes the bluetooth antenna. Please connect it to the instrument as it is shown below.
The bluetooth interface is often integrated into modern computers. If your computer is not equipped with it you need to use the bluetooth antenna (included in the delivery).
The software directs you through the installation.

- Click on the symbol

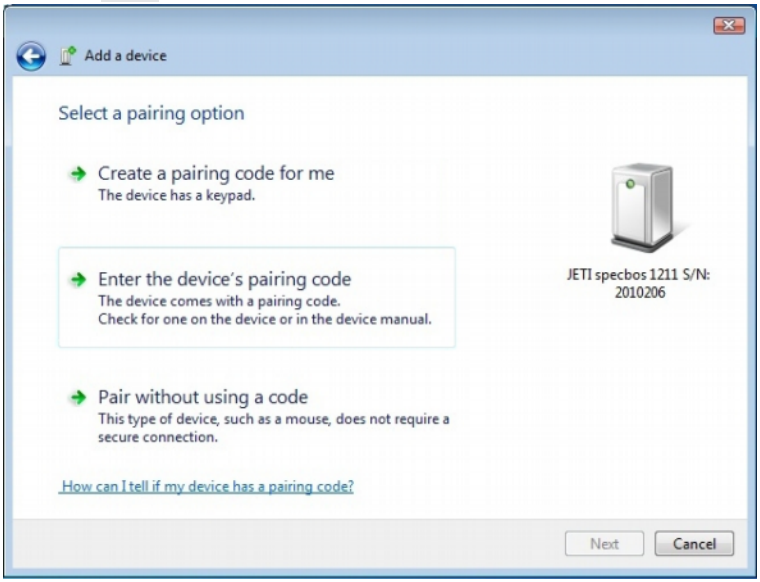
- Click Add a Device



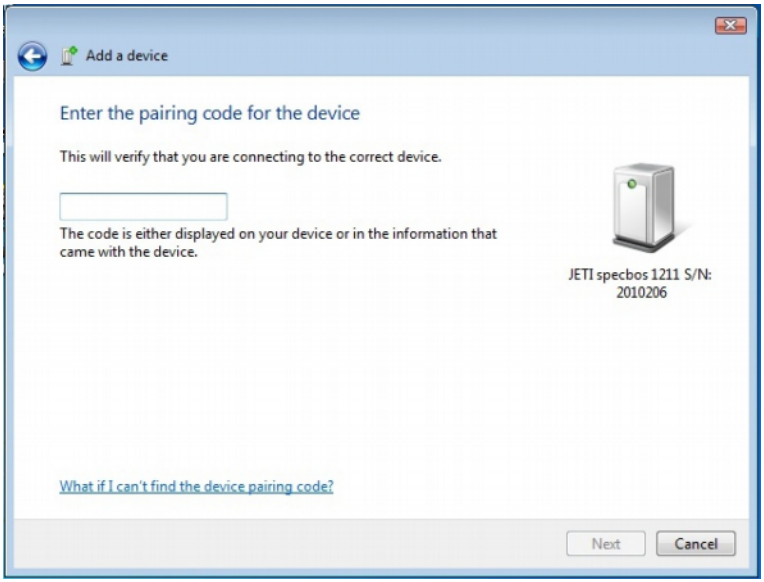
- Click Continue and select JETI *specbos 1211*



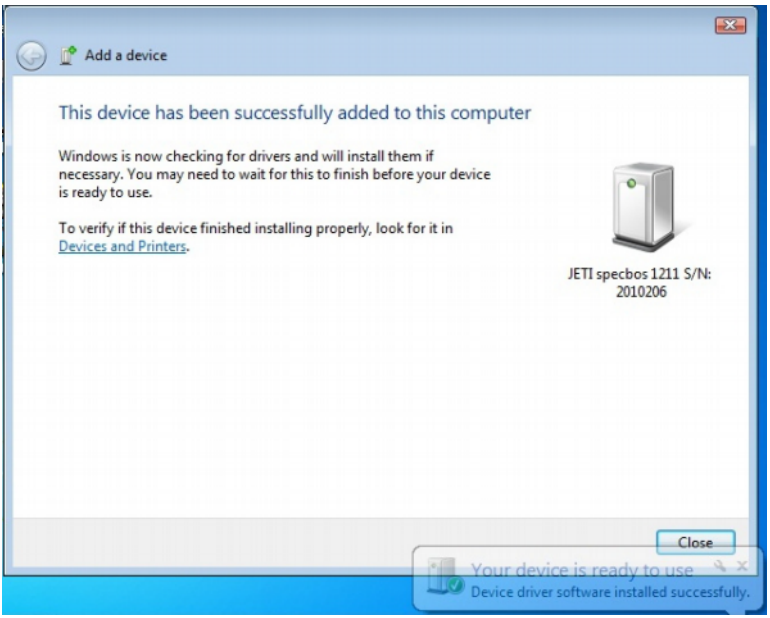
- *Click Next*



- Insert the device's pairing code: 0000



The next window finalizes the installation.



3.3. Installation of RS Device (*specbos 1211 RS*)

Connect the device to a PC or laptop using the enclosed RS cable and the power supply (9 V):

power supply RS232 connector

3.4. Network settings for specbos 1211 LAN

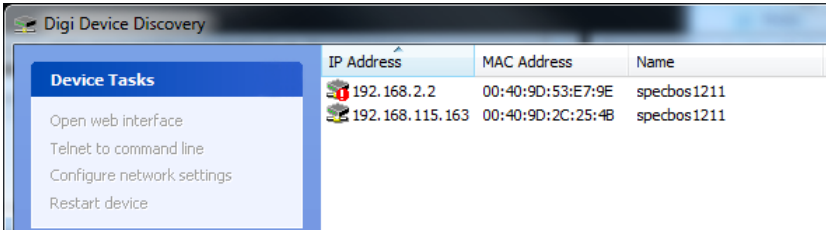
illuminated switch

trigger connector mini USB connector power supply 5V

To communicate with the specbos 1211 LAN via a network connection the specbos device and the controlling PC have to use the same network address space.
The default network setting of the specbos device is set to DHCP (obtain network settings automatically). If a DHCP server is running in your network the device will obtain an IP address from within the local network address space, and no further steps are required.
If no DHCP server is available (e.g. direct connection to a PC) or you want to give the device a fixed IP address for some other reasons, the network setting of the specbos device has to be changed by a tool called "Digi Device Discovery", which is available on the installation CD.
Please note that you must have administrator privileges!

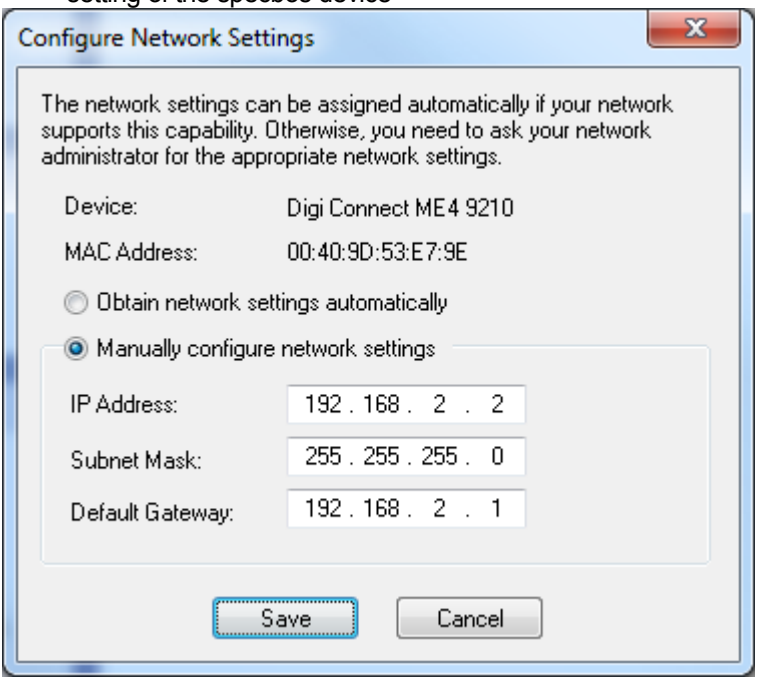
1. Connect specbos 1211 LAN to the power supply and to the LAN (1:1 as well as crossed cables can be used)
2. Go to directory 'Tools\Device Discovery' on the installation CD and run 'dgdiscvr.bat

3. The tool will search all devices in your LAN and display it on the screen



Digi Device Discovery screen with two attached devices (devices are distinguished by their MAC address)

4. Devices, which are not configured properly to be controlled via your LAN, are marked with a red exclamation mark
5. Right-click on the device to configure and select 'Configure network settings' from the menu
6. A window will appear where you can configure the network setting of the specbos device



7. After clicking on 'Save' a message appears that the device must be restarted
8. If no more red exclamation mark is visible, the device is configured properly to work in your LAN

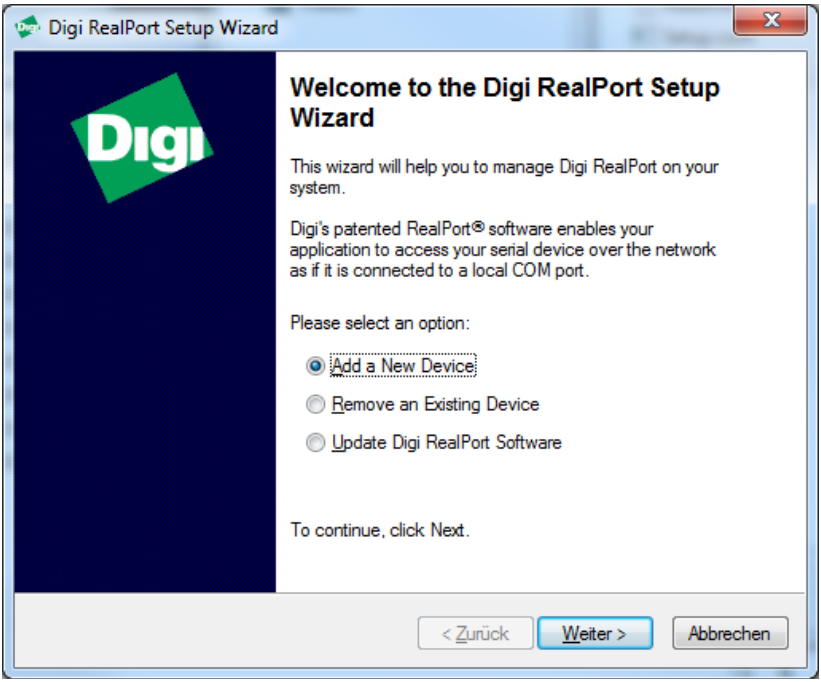
Remark: The IP address of a PC can be found using cmd.exe in the command line and the command ipconfig.

3.5. Installing RealPort Driver

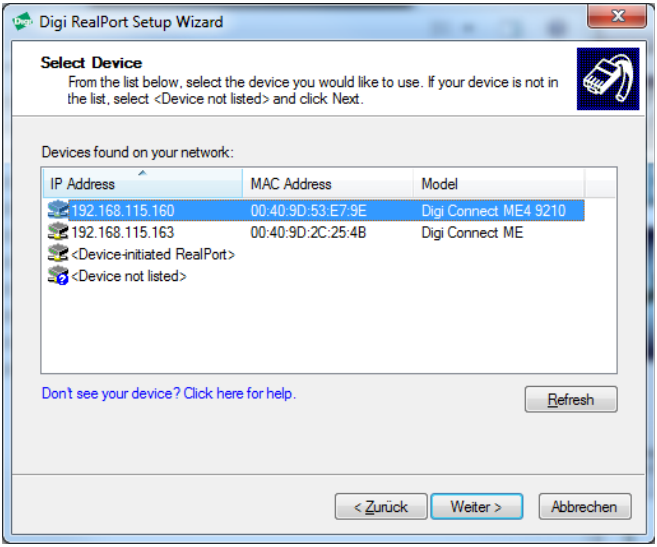
Please note that you must have administrator privileges to install the driver!

If you want to run JETI LiMeS software controlling a specbos 1211 LAN device via a network connection, a special driver has to be installed. This so-called 'RealPort Driver' provides a virtual serial COM-port, which JETI LiMeS and also serial terminal programs can use to communicate.
This chapter describes the installation procedure of the RealPort driver.

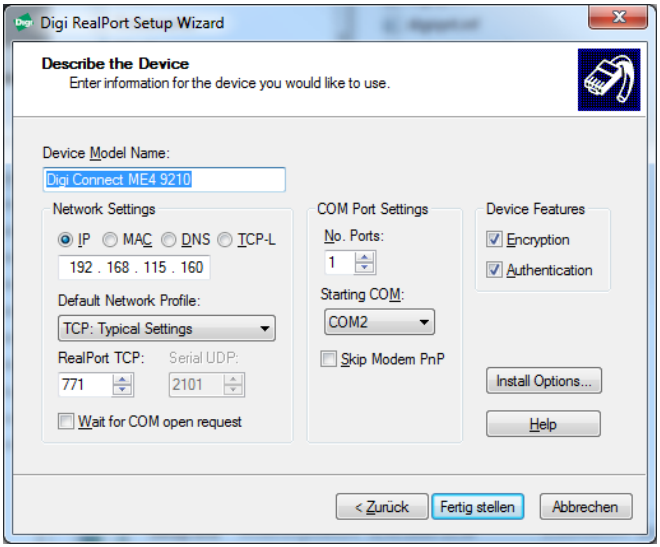
1. Go to directory 'RealPort Driver' on the installation CD and run 'setup.exe'
2. Select 'Add a New Device' and click on 'Next'



3. A list with the found network devices will appear. Please select the device a RealPort driver shall be installed and click 'Next'.



4. **If the desired device didn't appear in the list, you have to check the network settings of the device. See chapter "Network Settings For Specbos 1211" for details.**
5. Don't change the suggested settings and click 'Finish' to start the installation.



6. After a while a dialog box should appear that the driver was successfully installed.

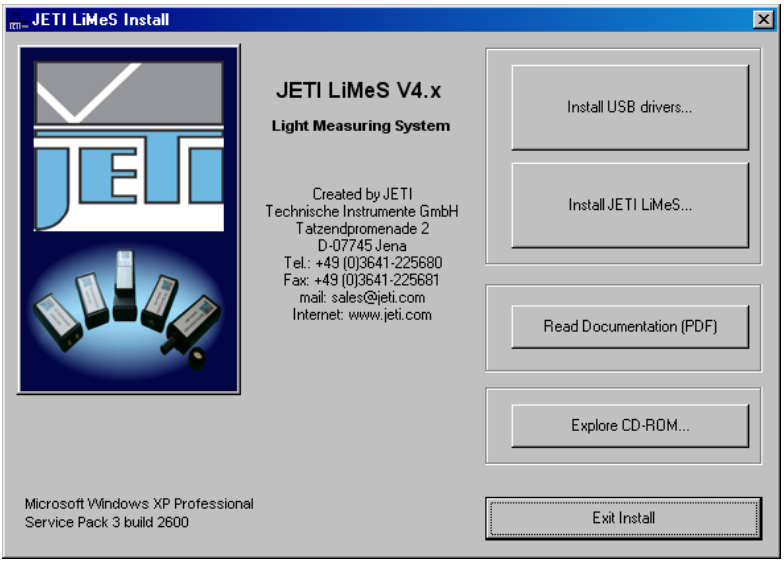
3.6. Installation of Driver Software

Please note that you must have administrator privileges to install the device driver!

This chapter describes the installation procedure of the USB driver

3.6.1 Installation under Windows XP

1. Insert CD-ROM delivered with your device into the CD/DVD drive.
2. If Autorun is enabled on your PC the following window appears. Otherwise run install.exe from the CD.

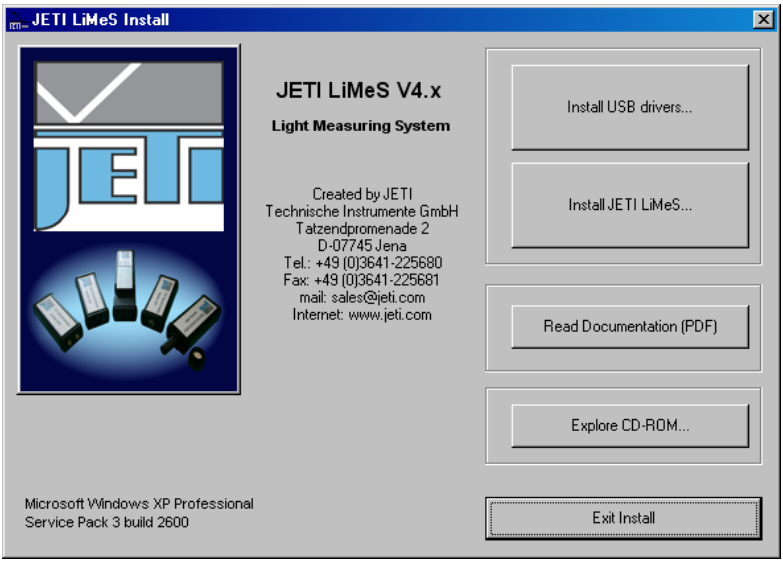


3. Click the Install USB drivers... button and follow the instructions to install the drivers.
4. If a warning window appears that the software has not passed Windows Logo testing, press Continue Anyway.
5. After finishing connect your device to an USB-port.
6. A ‘New Hardware found’ wizard should appear. If it asks to connect to Windows Update answer with No.
7. Select Install software automatically (recommended) and press Next.

8. Windows should complete the driver installation automatically. If a warning window appears that the software has not passed Windows Logo testing, press Continue Anyway.

3.6.2 Installation under Windows Vista and Windows 7

1. Insert CD-ROM delivered with your device into the CD/DVD drive.
2. If Autorun is enabled on your PC the following window appears. Otherwise run install.exe from the CD.



3. Click the Install USB drivers... button and follow the instructions to install the drivers.
4. If a warning window appears that 'Windows can't verify the publisher of this software', click on Install Anyway.
5. After finishing connect your device to an USB-port.
6. Windows should complete the driver installation automatically.

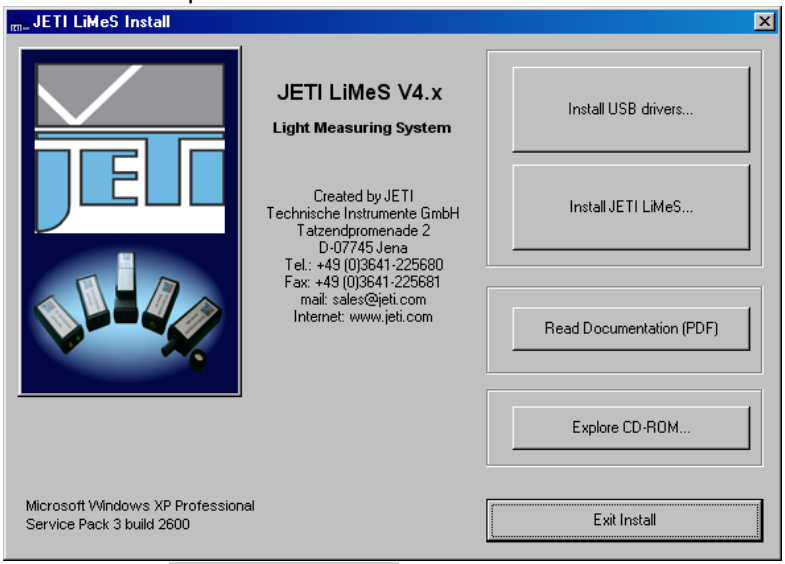
3.7. PC- Software

3.7.1 Installation under Windows

Please note that you must have administrator privileges to install the device driver!

Execute the following steps on the PC to install the software *JETI LiMeS* :

- Start Windows 7/ XP/ Vista
- Insert the CD in the CD-ROM drive
- The following window appears, if the autostart function of Windows is activated.
  Otherwise press install.exe in the Install folder of the CD ROM.

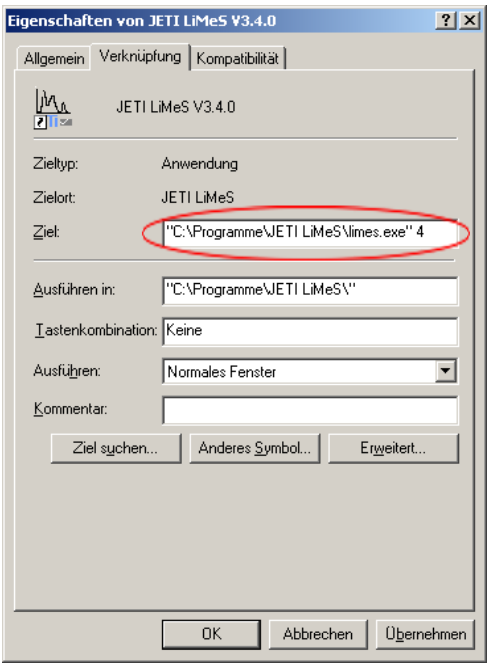


- Click the Install JETILiMeS... and follow the instructions to install the program.

4. Start the Software

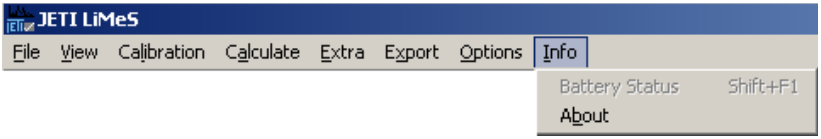
- Start Windows and then activate the Start menu
- Select JETI LiMeS under Programs

The software will automatically find the COM port and the baudrate (standard: 921 600 baud) after starting the program, if a spectroradiometer *specbos* is connected to the PC with its USB cable.
In some cases the automatism doesn't work properly, especially if there are other COM ports (Bluetooth serial ports, USB virtual com ports,…) installed on the PC.
The software JETI LiMeS accepts an argument at starting time which defines the COM port to use. If no argument is given (standard) the automatic will be used. Otherwise pass a value from 1 to 256 for the corresponding ports COM1 to COM256.
To set the argument the shortcut which starts the program has to be edited. To edit right-click the 'JETI LiMeS' icon on the desktop and select 'Properties'. The following dialog appears:

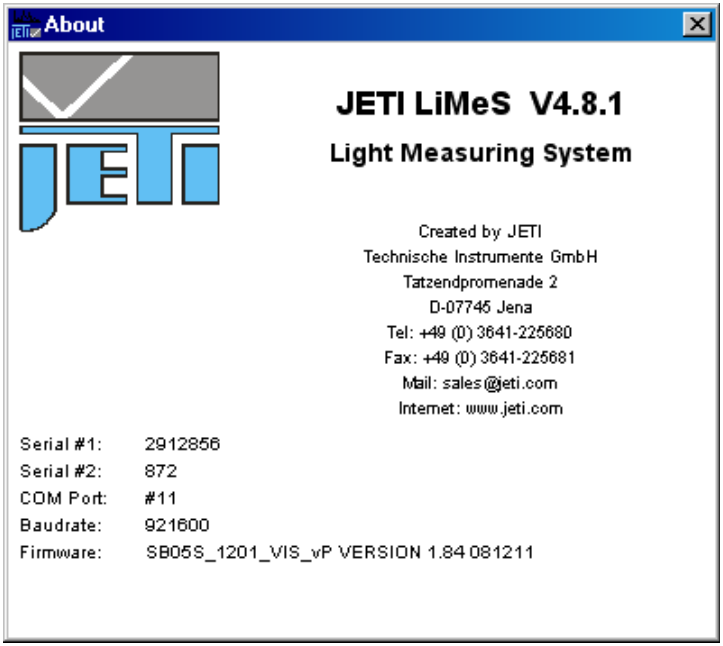


Type the number of the COM port to use after the filename of the executable in the 'Target' box (4 for COM4 in this example). Use a space sign between the filename and the COM port number.
If no device could be found on the specified port the software asks to perform an automatic scan.
In case of an error, this error will be displayed (see chapter Maintenance and Error Messages).

About



Click Info/About! shows the following window with the software version, the serial numbers, the used COM port, the baudrate and the firmware version.

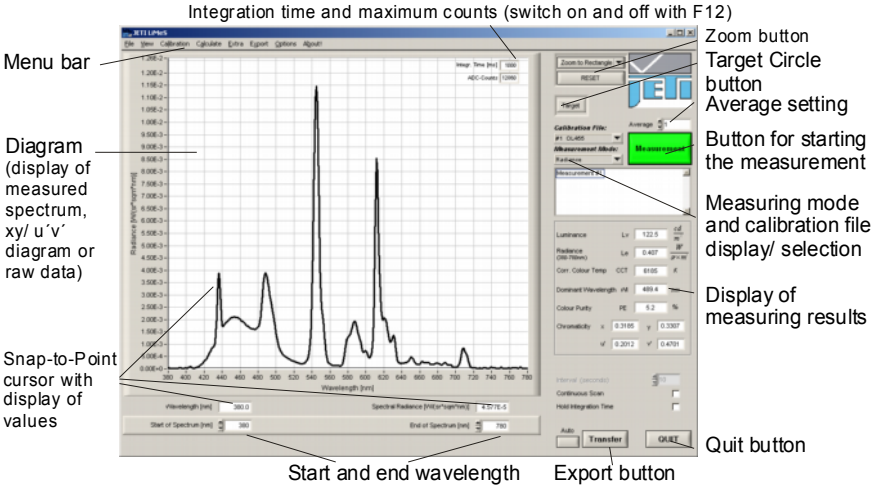


Press x to close the window.

5. Quick Start

- Connect specbos 12x1 to a PC, laptop or netbook
- Start JETI LiMeS under Programs in the Start menu

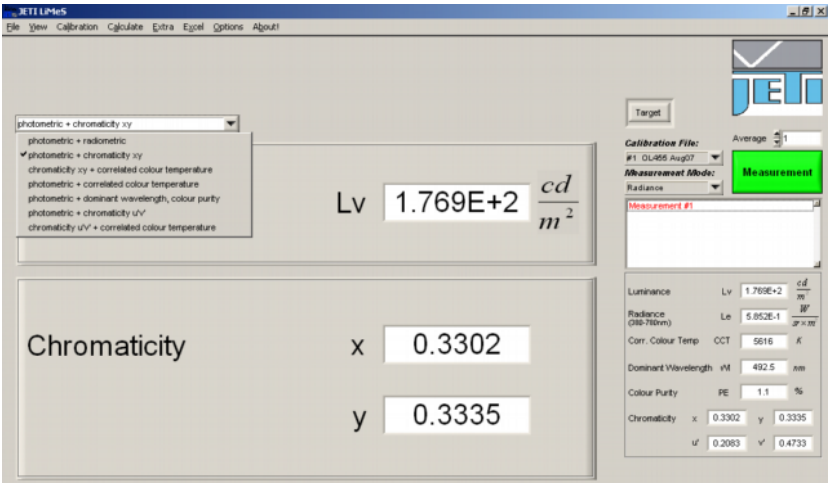
Measuring mode luminance



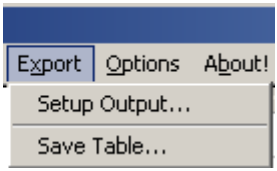
Attention: **Do not look into the laser beam or direct the laser to another person! Do not look into the beam with optical devices as telescopes or collimator lenses!**

- Click the Target circle button (or press the illuminated switch of *specbos 1211* shortly) and adjust the instrument viewing to the desired position
- Click the Measurement button to start a luminance measurement
- Maximum measuring time is 120 s
- Press Esc to interrupt a running measurement
- Spectrum and measuring values are shown
- Click View/ Diagram/ Numeric values in the menu bar to open a window, which shows the measuring values in a jumbo format

- Select the desired combination of values from the ring control



- Switch between SI and imperial units using the Options/ Photometric units menu point



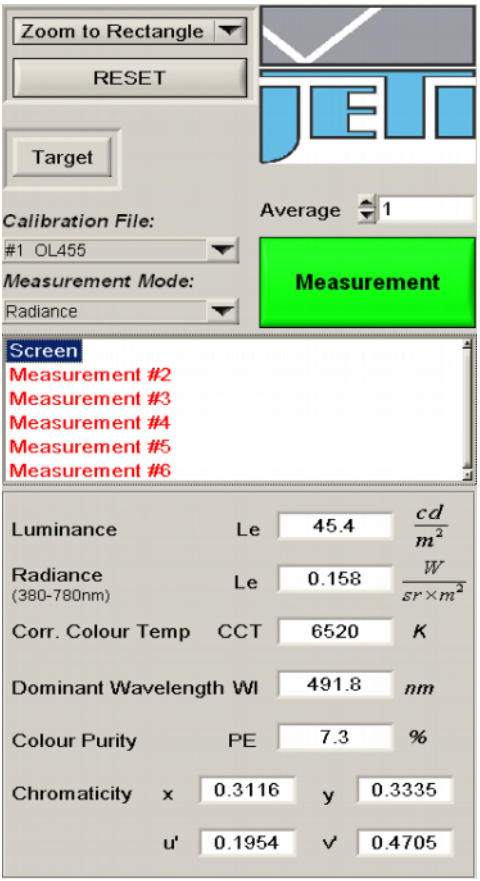
- Measuring data transferred into the table view can be stored in csv or xls file format.
- Use Export/ Save Table, select the file name, format and storage location of the file and press OK.
- Proceed further measurements by clicking on the Measurement button again
- Scroll between different measurements in the legend by clicking on the name

Change measuring mode to illuminance

- Attach the diffusor cap to the device
- Use the program as before (except of target marker)

6. Measurement

6.1. Procedure



The measurement procedure consists of a first spectra acquisition with a fixed integration time, a subsequent calculation of the best integration time for a well-driven spectrum, a second measurement with this time and a final dark spectrum measurement. In some cases more adaptation steps are necessary. You will be informed about the status of the measurement (Adaption to exposure, Performing measurement) and about the remaining time. The maximum integration time is 60 s, therefore the maximum measuring time for low intensity sources is approx. 120 s (adaption time + max. integration time + max. dark measuring time). The measured spectrum as well as the radiometric, photometric and colorimetric data, calculated from the spectrum are displayed. Furthermore the number of the measurement is shown in the legend.

Following measurements will be shown with their values. Clicking on the spectrum line displays the data of former measurements. A thick line always indicates the actual spectrum.

Pressing Esc can interrupt a started measurement.

6.2. Measurement with Additional Interfaces

6.2.1 Measurement with specbos 1211-BT

The **specbos 1211-BT** will be powered by battery if the wireless interface is used. The battery will be charged when the instrument is connected to the PC via USB. Alternatively it can be charged with the power supply.

The switch on the rearside has the following functions:

- Pressing if instrument is switched off: Switch on the instrument
- Short pressing if the instrument is switched on: Switch on/ off the target marking
- Long pressing if the instrument is switched on: Switch off the instrument
- If the instrument is switched off and connected to power supply or to PC by USB:
  - Short flashing – battery will be charged
  - Illumination off – battery is fully charged
- If the instrument is switched on:
  - Continuous illumination with short breaks – battery will be charged
  - Continuous illumination – battery is fully charged

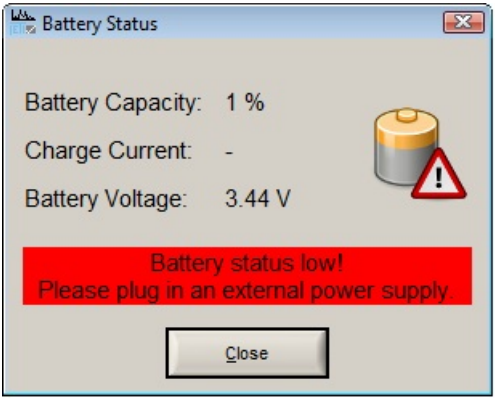
Remark: The USB connection between PC and instrument needs to be established if the battery shall be charged via USB.

The battery status is shown in the software JETI LiMeS in the title bar.

Automatic switch off:

The instrument will be switched off if there is no connection to the PC for more than 15 min., e.g. if the operator forgot to switch it off. If the software JETI LiMeS is running the instrument will not switched off automatically.

Battery down:
If the battery is down during operation the following window will appear:

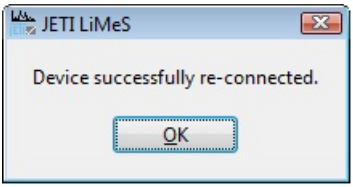


After 3 minutes the connection will be cut and JETI LiMeS goes to offline mode. Now it is possible

- to save all previous measured data and finish JETI LiMeS

or

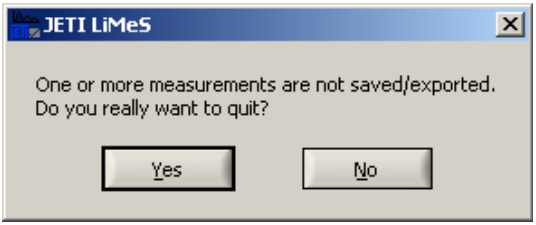
- to connect the instrument to external power (USB or power supply), press CRTL I to reconnect and continue the in measurements with JETI LiMeS.



Operate without software JETI LiMeS

The battery powered **specbos 1211-BT** will be automatically switched off if the defined operating time without any communication is elapsed. The device send in this case a enquire code (0x05).
If the battery charge is below the low value a enquire code (0x05) will be sent, and a timer for time out starts.
After time out the device send again the enquire code and switched power off.

6.2.2 Finishing the Program

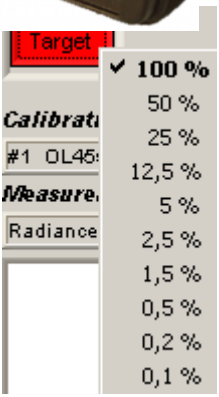


The program can be closed by selecting the Quit button or by typing Alt Q on the keyboard. If one or more measurements were not stored the following window appears to avoid data loss.

6.3. Measuring Modi

6.3.1 Luminance Mode

- Connect the instrument to the PC
- Start the software
- Click on Target (or press the illuminated switch of *specbos 1211* shortly)

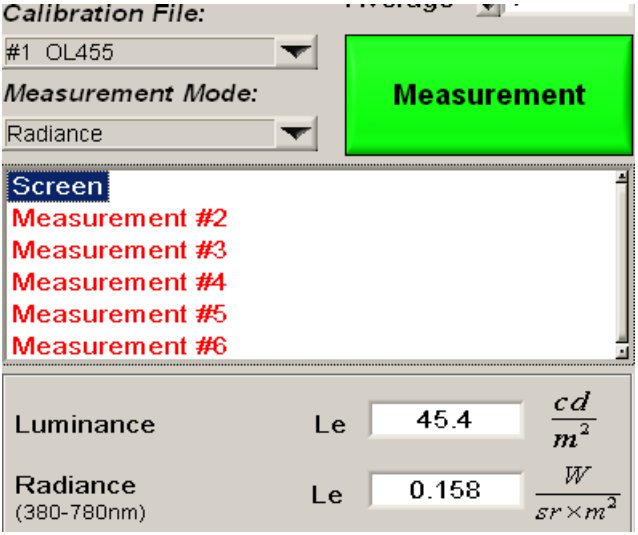


Target – Indication of the Measuring Area

In luminance mode appears a Target area button. It becomes red when the laser is switched on.
specbos 1211: Alternatively the switch on the rear side of the instrument can be used. Press shortly to switch on/off the target marker.
The diameter of the measuring spot can be adjusted by changing the distance to the measuring object. The inside of the red circle marks the measuring area.

Adjust the instrument that the laser circle is placed on the desired measuring location. After switching on the laser is shortly flashing to catch the attention of the user. Afterwards it shines continuously. A right mouse click on the target button allows to reduce the laser intensity.

Attention: Do not look into the laser beam or direct the laser to another person! Do not look into the beam with optical devices as telescopes or collimator lenses!



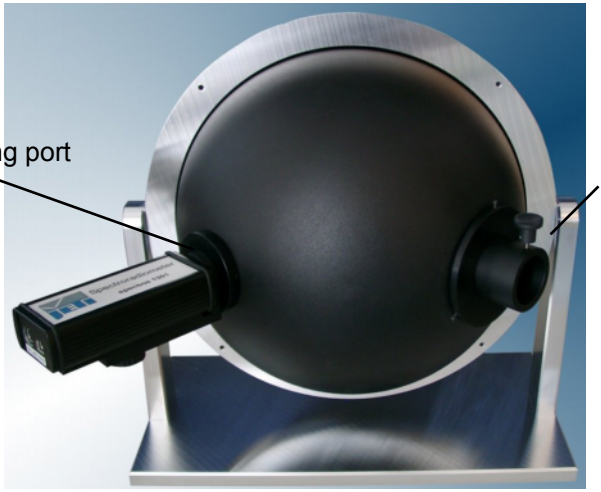
- Click on Measurement or alternatively use the trigger connector to activate a measurement. The measured data will be shown below the measurement button.
- Esc key can interrupt a running measurement
- Only for information:
  Press F12 shows the used integration time and the measured counts
- If needed:
  - Rename the measurement
  - Save the measurement or
  - Save the measurement as reference
- Quit ends the program

6.3.2 Illuminance Mode

- Connect the instrument to the PC
- Attach the diffusor and locate the instrument in the desired measuring position
- Start the software, it will automatically switch to illuminance mode
- Click on Measurement or alternatively use the trigger connector to activate a measurement.
  The measured data will be shown below the measurement button.
- Esc can interrupt a running measurement
- Only for information: press F12 shows the integration time and the counts
- If needed:
  - Rename the measurement
  - Save the measurement or
  - Save the measurement as reference
- Quit ends the program

6.3.3 Luminous Flux Mode – specbos1301 and 1311

- Attach the device to the integrating sphere
- Connect the instrument to the PC

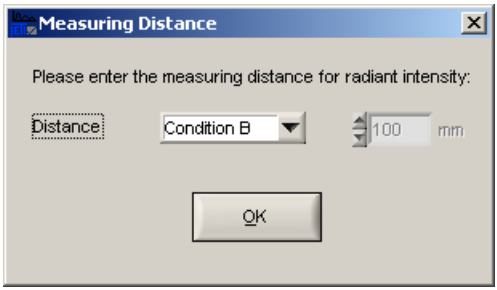


- Start the software, it will switch to Luminous flux mode
- Switch on the probe and insert it into the sample port of the integrating sphere
- Click on Measurement or alternatively use the trigger connector to activate a measurement
  The measured data will be shown below the measurement button.
- Esc can interrupt a running measurement
- Only for information: press F12 shows the integration time and the counts
- If needed:
  - Rename the measurement
  - Save the measurement or
  - Save the measurement as reference
- Quit ends the program

6.3.4 Luminous Intensity Mode – specbos1401

- Connect the instrument to the PC and to the measuring set up

- Start the software, it will switch to Luminous intensity mode
- Type in the measuring distance
  It will be requested automatically, if the program is started with the attached measuring head. Use CTRL D if the distance shall be changed during the measurement.



- Default values are 316 mm (condition A of CIE 127-2007) and 100 mm (condition B of CIE 127-2007). Other values are also possible, if you don´t use the tubes.
- Insert the probe into the holder and switch it on
- Insert the holder into the port
- Click on Measurement or alternatively use the trigger connector to activate a measurement.
  The measured data will be shown below the measurement button.
- Esc can interrupt a running measurement
- Only for information: press F12 shows the integration time and the counts
- If needed:

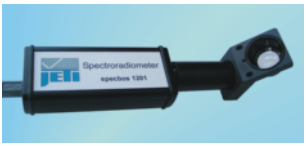
- Rename the measurement
- Save the measurement or
- Save the measurement as reference

- Quit finishes the program

6.4. Special Measurements

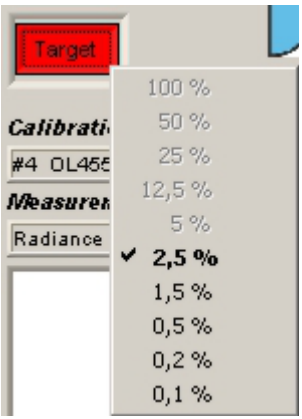
6.4.1 Small Luminance Sources (only specbos 1201 / 1211 focus)

specbos 12x1 focus can be used with special attachments (focusing optics) for measuring small sized lighting areas, e.g. alphanumeric displays or signs. Therefore different add-ons for spots of 3 mm, 1 mm and 0.5 mm diameter are available.

Name	Meas. diameter	Meas. distance	Field of view	Length
Focusing optics 3	3 mm	70 mm	2.1°	77 mm
Focusing optics 1	1 mm	26 mm	1.9°	26 mm
 Focusing optics 0.5	0.5 mm	46 mm	0.6°	77 mm

The attachments will be screwed on the flange of **specbos 12x1 focus**. The device detects the measuring head automatically and calls up the corresponding calibration file.

- Connect the instrument to the PC
- Start the software
- Click on Target
  A right mouse click on the target button allows to reduce the laser intensity. Use 0.2%, 0.5% or 1.5% for best viewing conditions with the focusing optics.
  The device has to be positioned in the right measuring distance (focus) for measurement. For the right measuring distance use the table above. The measurement process itself is the same as without additional optics.
- Adjust the device that the laser circle is placed on the desired measuring location, attach the loupe when using the focusing optic 0.5mm
- Click on Measurement or alternatively use the trigger connector to activate a measurement.
  The measured data will be displayed below the measurement button.
- Esc can interrupt a started measurement
- Only for information: press F12 shows the integration time and the counts
- If needed:
  - Rename the measurement
  - Save the measurement
  - Save the measurement as reference
- Quit exits the program



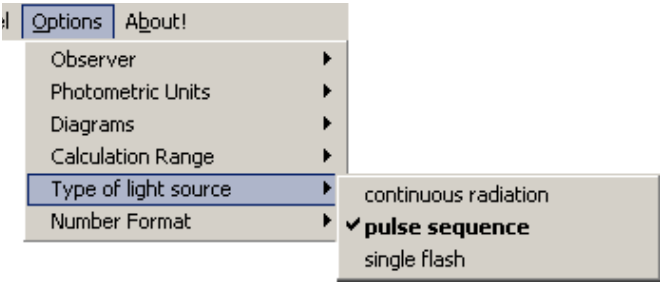
6.4.2 Pulsed Sources (only specbos 1201 flash)

Flash measurements are only possible with **specbos 1201 flash**. Continuously pulsed sources as well as single flashes can be measured.

- Connect the instrument to the PC and attach the diffusor
- Start the software, it will switch to illuminance mode

Measurement of Continuously Pulsed Sources

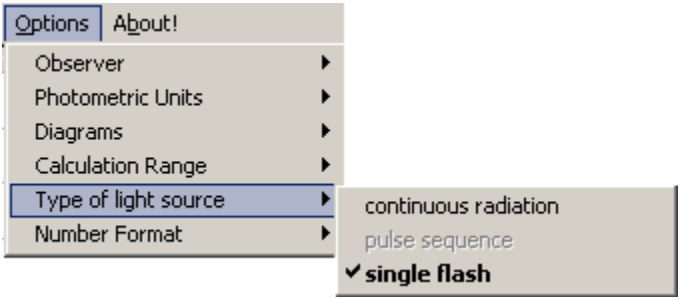
specbos 1201 flash is equipped with an additional detector in the frontside, which measures the period of the source. This cycle time is used as time basis for the adaption of the exposure. The frequency can lie between 0.2 and 20 Hz.



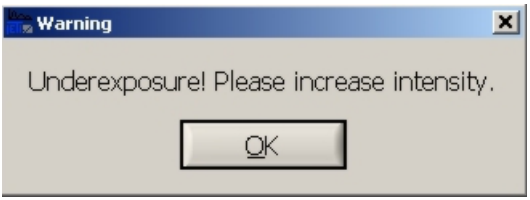
Please ensure that the measuring light hits this detector without obstructions.
First switch in the menu point Options/ Type of light source to Pulse sequence (this is only possible if the instrument is in illuminance mode).
Now the unit is ready for the measurement of repetitively pulsed sources. Press the Measurement button to start a measurement. The photometric and radiometric values will be given as exposure and the units are lx s and J/ m2. Furthermore the measured cycle time will be displayed left of the logo. If the intensity is too high (already overexposure with one pulse) this will be shown in a special window. Reduce the intensity by increasing the measuring distance.

Measurement of a single flash (with pulse length in µs-range)

It is also possible to measure a single flash. In this case it is necessary to trigger the flash by the *specbos 1201 flash* unit.



See chapter Trigger Functions for the pinout of the rear side connector and connect it with the trigger input of the flash lamp. Switch the unit to Options/ Type of light source/ single flash. Now press the measuring button to start a measurement. The integration time is fixed to 200 ms. Again the photometric and radiometric data are displayed in exposure units. It will arise a special window in case of over or under exposure.



Adjust the intensity by decreasing or increasing the measuring distance. Regardless of under exposure the measurement is valid. In case of overexposure the results are not valid and will not be shown. The effective intensity I_{eff} [cd] of a single flash (with neglect able pulse length) can be calculated from the measured Luminous exposure H_v [lx·s] by the following equation (d – measuring distance [m]):

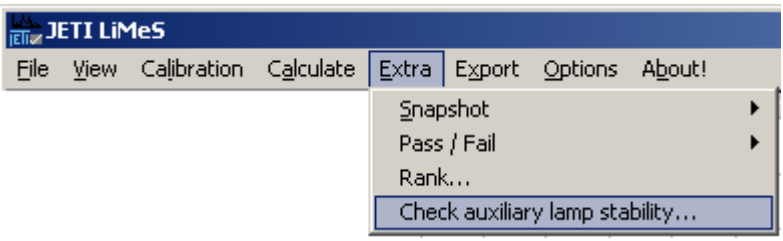
$$I_{eff} = \frac{H_v}{0.2} \cdot d^2$$

6.4.3 Luminous Flux measurement mode with self absorption correction (only specbos 1311 with hinged sphere and auxiliary lamp)

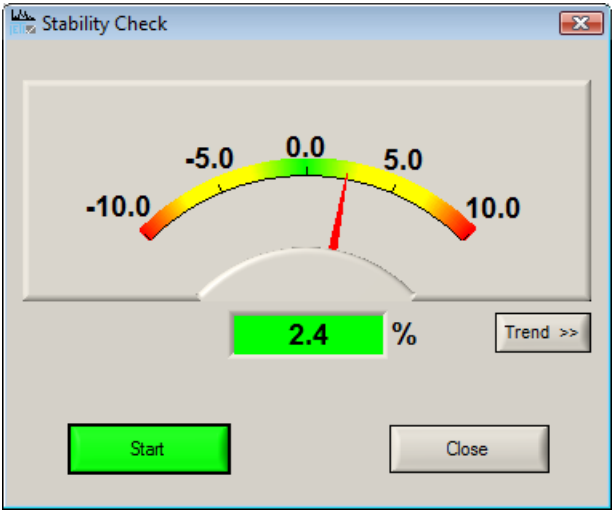
If the integrating sphere is equipped with an auxiliary lamp, this lamp can be used to compensate the self absorption of the sample. This function is mainly applied if the 4π measuring geometry is used.

The auxiliary lamp JLQ3 is described in an extra instruction.

- Switch on the auxiliary lamp (connect the power supply) and open the manual shutter
- Monitor the stability of the lamp using the menu point Extra/ Check auxiliary lamp stability …



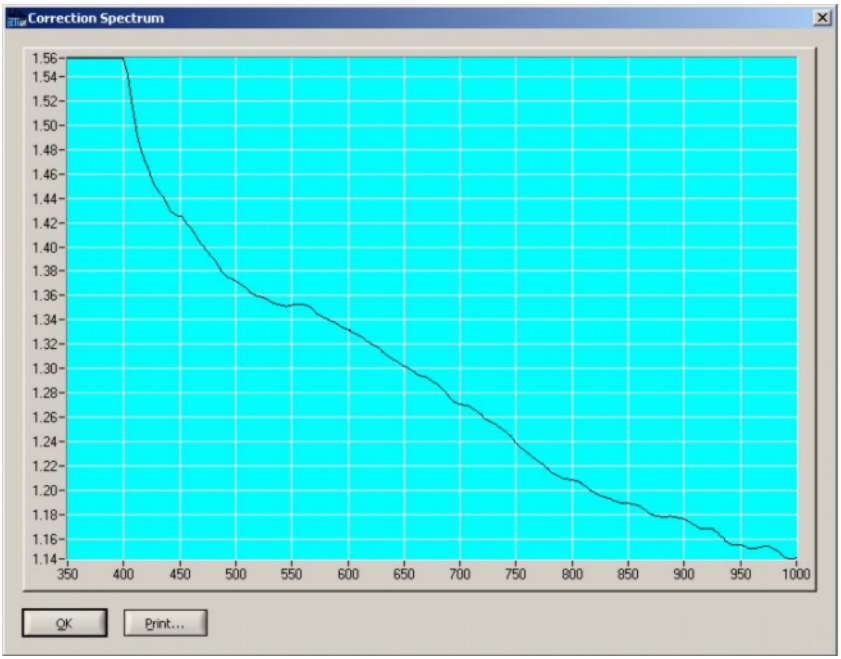
The stability check mode proceeds a measurement every 30 seconds and the difference between two successive measurements is shown in percent. The button Trend allows to see a table with all difference values.



Remark: This check can also be used to monitor the temporal behaviour of other lamps.

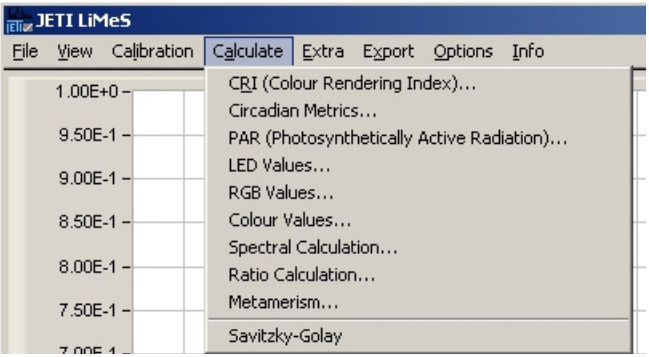
- Stop the stability check by pressing the Close button, if the desired stability, e.g. 0.5 % is reached.
- For the following step the sphere has to be without a sample and closed.
- Select the menu point Calibration/ Determine correction factor (this is only possible if the instrument is connected properly to the sphere) and start a first measurement of the auxiliary lamp.
- Open the sphere, install the measuring sample (leave it switched off) and close the sphere, afterwards start the second measurement
- Close the auxiliary lamp shutter when the measurement was executed and finish the correction measurement.
- The correction spectrum will be calculated, stored and applied to all following measurements in flux mode. This will be marked by a yellow background of the calibration file headline. Furthermore every measurement where the correction was used will be marked yellow in the legend.

Remark: The correction data can be used for all following measurements if the type of sample was not changed. Otherwise the auxiliary lamp measurement has to be repeated for the new sample type.



- The correction data can be removed using the menu item Calibration/ Reset correction factor. The data will not be stored if the measuring mode was changed or JETI LiMeS was closed.
- The correction spectrum can be visualized using the Calibration/ Show correction spectrum … menu item.
- Switch on the power supply of the sample and proceed the measurement as described in chapter Luminous Flux Mode – specbos1301/ 1311

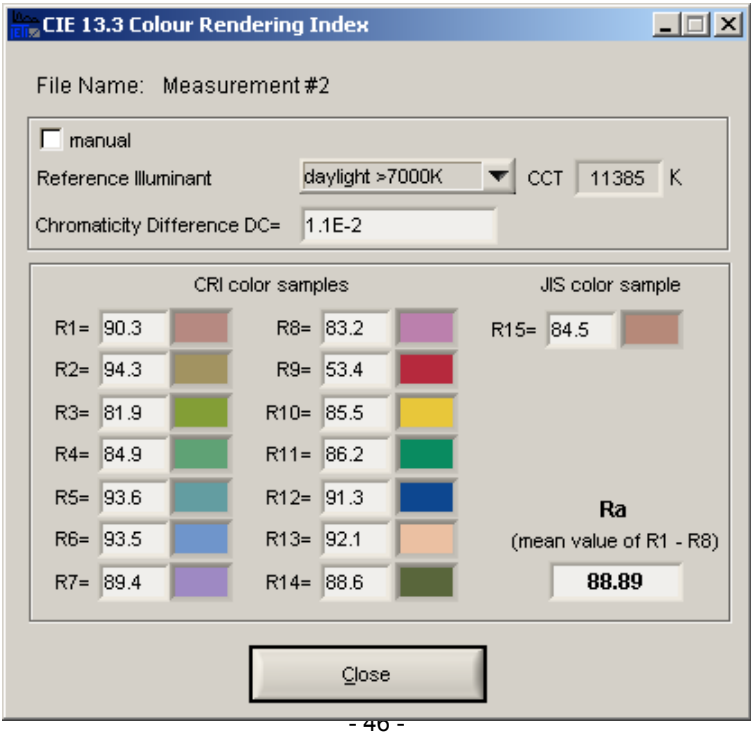
6.5. Special Calculations



6.5.1 Colour Rendering Index (CRI)

The calculation of the colour Rendering Index is done according to the CIE report 13.3-1995.

Simply click on the menu point Calculate/CRI (Colour Rendering Index)… after a measurement and the window will be opened.



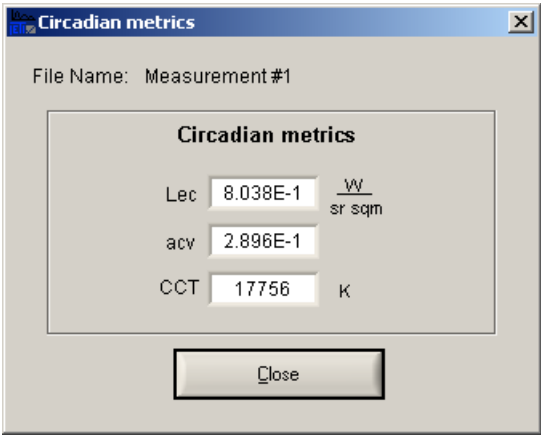
The General colour Rendering Index R_a as well as the Special Indices R_1 ... R_{14} and the JIS R_{15} are calculated. Furthermore the chromaticity difference DC between the source to be tested and the reference illuminant is shown. This reference illuminant is automatically calculated from the Planckian law, if the colour temperature of the sample is below 5000 K and from a daylight approximation, if it is above 5000 K. The measured CCT will be used for the reference calculation.

Remark: If the CCT of a light source cannot be calculated, because the chromaticity location is too far from the Planckian curvature, then the colour Rendering Index calculation is also not possible.

It is also possible to select the reference illuminant manually by clicking the appropriate box. Then another CCT than the measured one can be used. If the manual option was selected, successive measurements will use the selected value of CCT. If DC is greater than $5.4 \cdot 10^{-3}$ the resulting colour Rendering Indices may be expected to become less accurate.
Furthermore it is possible to use standard illumination spectra as reference (illuminant A, B, C, D65, TL33, TL84).
The CRI Window can be left open for observation during further measurements.

6.5.2 Circadian Metrics

The action spectrum for circadian effects due to suppression of melatonin is implemented in the software. Therefore it is possible to calculate the circadian radiant value (X_{ec}) and the circadian action factor (a_{cv}) of a light source. This is possible in all measuring modes.



Select Calculate/ Circadian … in the menu. In addition there will be indicated the measured CCT due to their correlation to a_{cv}.
If the circadian values are of further interest the window can be left open for following measurements.

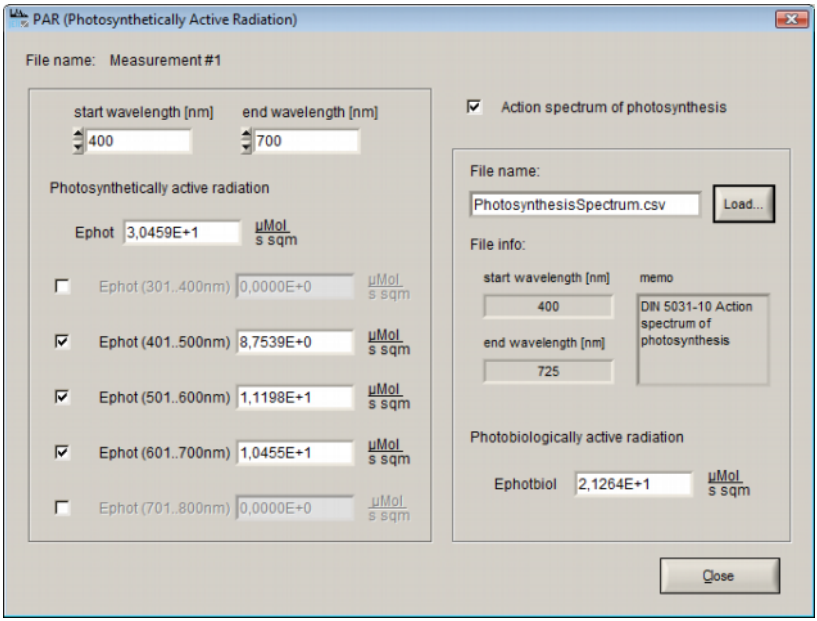
6.5.3 Photosynthetically Active Radiation (PAR)

The general PAR value E_{phot} is the number of photons emitted by a light source in one second regardless of their individual frequency and of their impact on the biological system. It will be calculated according to the following formula and can be obtained in the menu Calculate/ PAR…:

$$E_{phot} = \frac{1}{h \cdot c} \int_{\lambda_1}^{\lambda_2} E(\lambda) \cdot \lambda \cdot d\lambda$$

$E(\lambda)$ – measured spectral distribution, $\lambda_{1,2}$ – wavelength range, h – Planck constant, c – speed of light

The standard wavelength range for PAR is 400 to 700 nm, but the borders can be changed. Furthermore it is possible to calculate the PAR value in limited wavelength ranges of 100 nm.



Additionally it is possible to calculate an effective PAR number $E_{photbiol}$, if Action spectrum of photosynthesis is checked. It uses an action spectrum of photosynthesis and weights the effect of the photons depending from their wavelength. The following formula is used (s(λ) – action spectrum):

$$E_{photbiol} = \frac{1}{h \cdot c} \int_{\lambda_1}^{\lambda_2} E(\lambda) \cdot s(\lambda) \cdot \lambda \cdot d\lambda$$

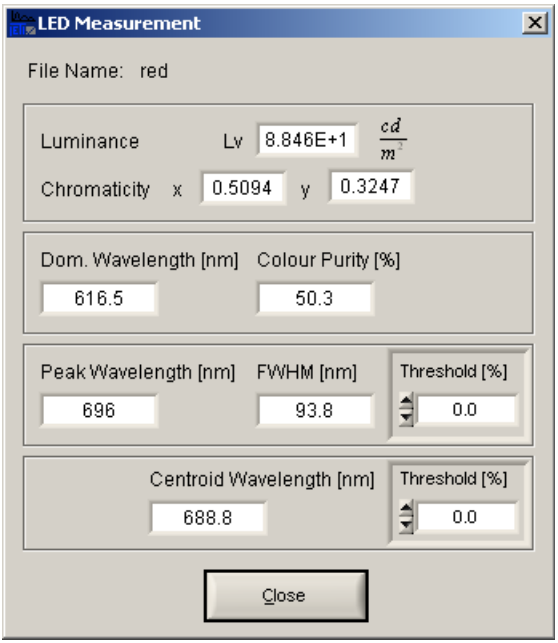
The action spectrum according to DIN 5031-10 must be loaded if it use at first. The file is locate in the JETI LiMeS folder under functions. In future it is used by default, but every other spectrum can be loaded. A user defined curve has to be stored as .csv file taking care on its structure: it must be the same as in other function files.

If the value is of further interest the window can be left open for following measurements.

Remark: The PAR values are measured physically correct, if the instrument is used in Illuminance mode.

6.5.4 LED Values

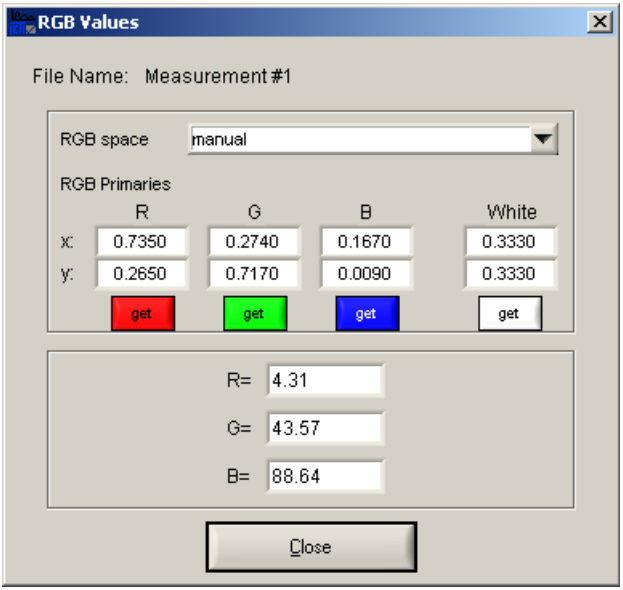
The menu point Calculate/ LED Values … offers the possibility to display the main optical values of LEDs in one window.



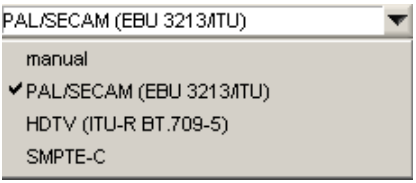
Peak and centroid wavelengths are combined with a threshold setting. This threshold cuts the bottom of a measured spectrum at the selected percentage of the maximum. It can be used to reduce the influence of a noisy baseline.
The LED Window can be left open for observation during further measurements.

6.5.5 RGB Values

The menu point Calculate/ RGB Values … offers the possibility to set RGB primaries and measure the RGB numbers of a display.



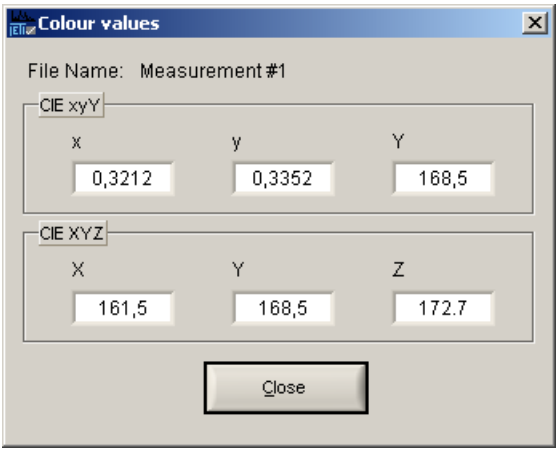
Use one of the predefined data sets (EBU, HDTV or SMPTE-C) or type in user specific x and y values for the primaries and the white illumination (manual).



Furthermore it is possible to measure the primaries with specbos 12x1 and transfer the results into the RGB window using the Get buttons (always the actual measurement will be transfered).
The RGB values of the actual or marked measurement will be calculated. It is possible to export these results in Excel.
The RGB Window can be left open for further measurements. The settings of the primaries and the white illuminant are stored when the program will be finished.
JETI offers the special software MoDiCaL with extended features for monitor measurement.

6.5.6 Colour Values

The menu point Calculate/ Colour Values … offers the possibility to see the chromaticity values xyY and tristimulus values XYZ on one window.

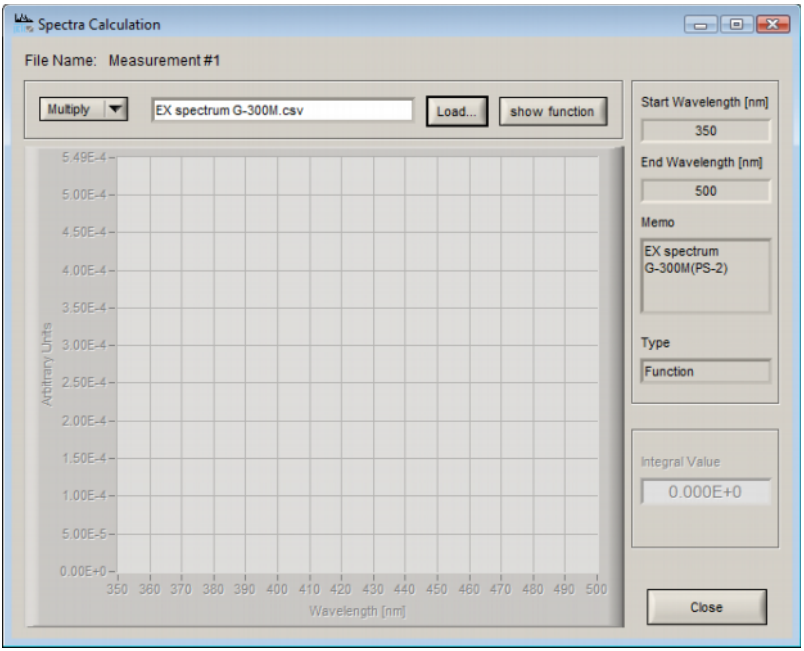


The window can be left open for further measurements.

6.5.7 Spectra Calculation

The menu point Calculate/ Spectral Calculation … allows to proceed spectral calculations with two spectra or a measured spectrum and a weighting function. The basic operations of +, -, * and : are possible.

Select the operation with the appropriate button in the upper left corner of the window.



The first operand is the active spectrum and the second one can be a reference spectrum (see paragraph 8.2) or a weighting spectrum in csv format according to the following structure:

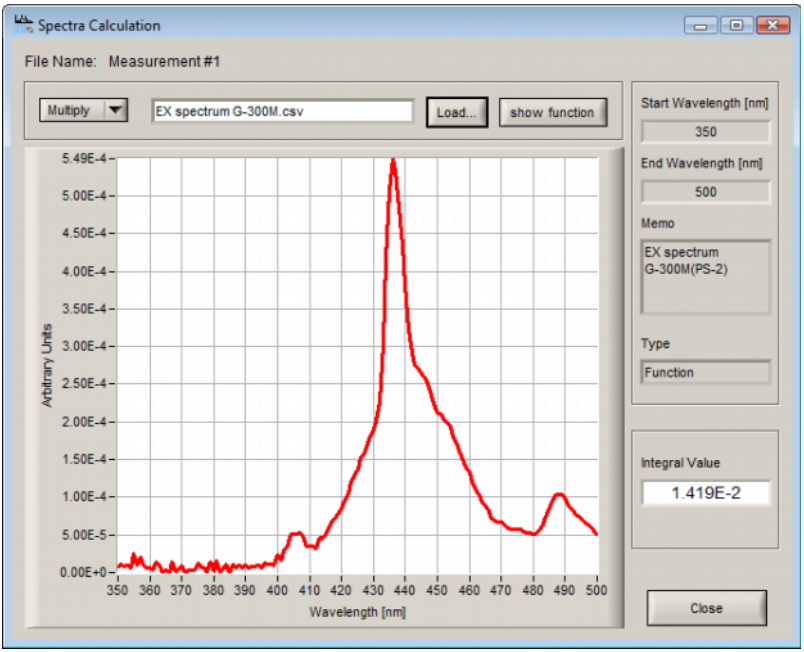
```
TYPE,FUNCTION
Start Wavelength [nm],350
End Wavelength [nm],500
Number of points,151
Memo,EX spectrum G-300M(PS-2)
Unit, none

Wavelength,Relative Intensity
350,0.987719
351,0.988889
352,0.990643
353,0.992982
354,0.995906
355,1.000000
```

```
356,0.999415
357,1.000000
358,0.998830
359,0.998830
360,0.996491
...
```

The wavelength step width can be 1 or 5 nm. If the unit is specified with “none” the unit of the weighted spectrum will be displayed, otherwise the unit a.u. (arbitrary units) will be used.

The second spectrum / weighting function has to be loaded with the Load button and can be viewed using the show function button.
The spectrum resulting from the calculation is shown in the diagram. Furthermore an integral value is calculated by integration.



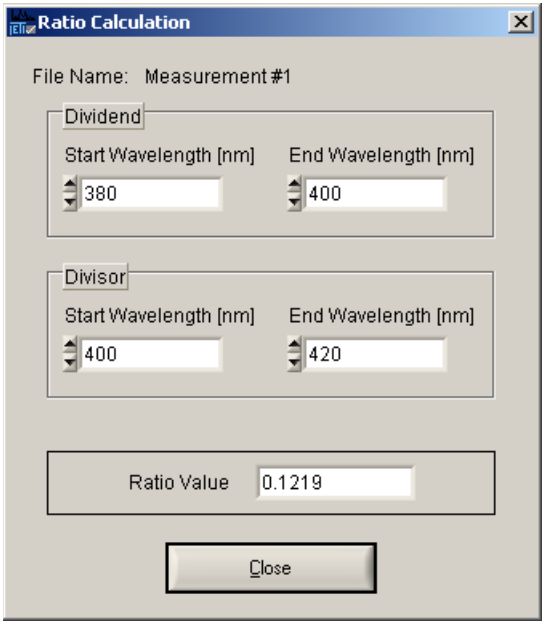
The settings of spectra calculation will be stored.
Examples for the application of weighting functions are the measurement of

- Effective radiation for plants in greenhouses
- Damaging radiation for artwork
- Hazardous optical radiation for humans according to directive 2006/25/EC (the weighting functions are contained on the software CD)
- Charging radiation for phosphorescence displays

The calculated integral value is indicated without dimension unit, it represents the corresponding value according to the application. Due care has to be exercised during measurements with weighting functions to obtain accurate results.

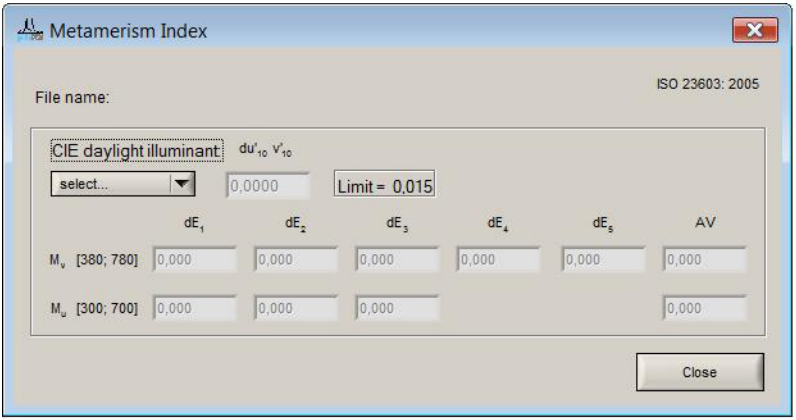
6.5.8 Ratio Calculation

The menu point Calculate/ Ratio Calculation … allows to calculate the ratio of an integral spectrum in two wavelength ranges. The specified wavelength ranges will be stored for each measurement separately.

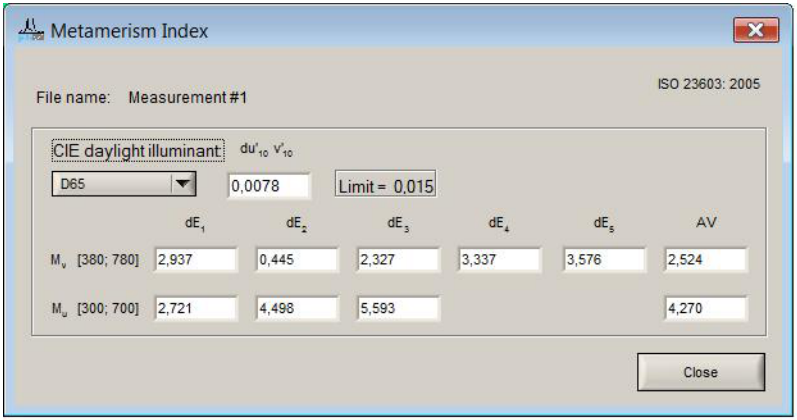


6.5.9 Metamerism

The menu point Calculate/ Metamerism allows to calculate the metamerism values M_v and M_u according to ISO 23603:2005. M_u is only calculated if a specbos 1211 UV is used.
First of all it is necessary to select the daylight reference illuminant.



Afterwards the color difference $du'_{10}v'_{10}$ of the actual spectrum and the selected reference illuminant is calculated. It is marked in red when the limit of 0.015 is exceeded.
The individual dE of the metameric samples are shown in addition to the average values M_v and M_u.



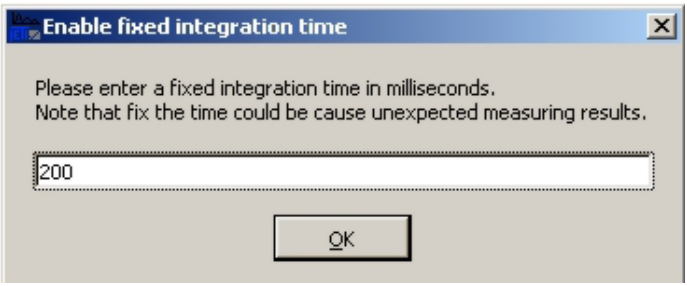
7. Software Settings

7.1. Measurement Settings

7.1.1 Integration Time

The instruments adapts the integration time automatically to the measuring conditions.

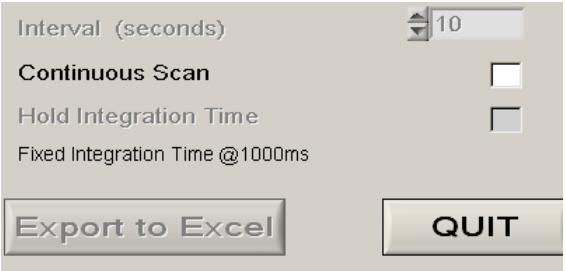
It is possible to hold an once determined integration time for further measurements. This is mainly interesting in case of measuring objects with similar intensity. Simply click the box Hold Integration Time. There will shown a warning if over and underexposure occurs (Couldn't hold integration time). Then a new adaptation will be processed and the time will be hold for further measurements.



In some cases it is desirable to set the integration time to a fixed value. This can be done with CTRL T. Afterwards write the desired time (in ms) into the appearing window.
Following measurements will use this integration time without any adaption.
A suitable value for the integration time can be found after a first measurement with activated adaption by pressing the F12 button (Tint).
Deactivate the fixed integration time function by pressing CTRL T again.

7.1.2 Continuous measurement

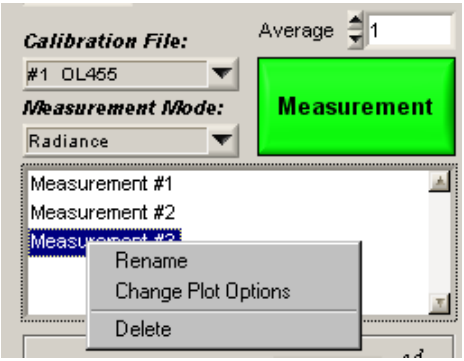
If you want to measure continuously you have two options. If you select Continuous Scan and the interval [s] the measurement procedure is like described in chapter 6.1.
If you select Hold Integration Time and Continuous Scan the measurement is without adaption. Normally the integration time at start will be hold for all subsequent measurements.



It will be adapted without warning in case of over or under exposure. This can influence the difference of time between the successive measurements. If you want to get a constant repetition rate you have to use the CTRL T option (fixed integration time).

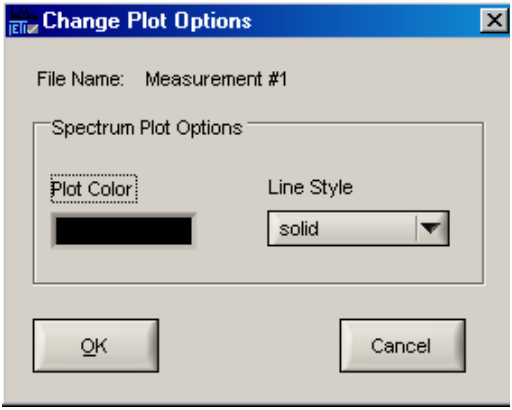
7.1.3 Change measurement name

The proceeded measurements will be named with consecutive numbers. It is possible to change this standard name.



- Make a right mouse click on the desired measurement name in the legend to open a panel

- Rename changes the measurement name
- Change Plot Options open the following window:



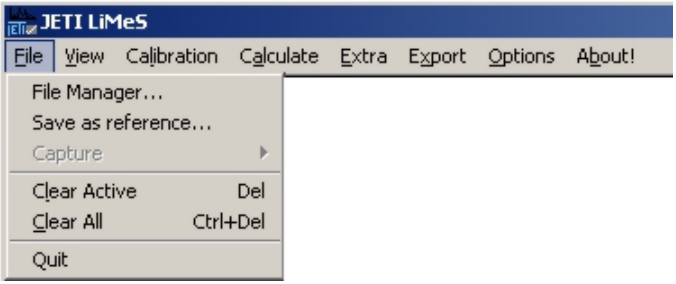
The plot color can be change and also the line style.

- Delete deletes the measurement
- Pressing the DEL key also deletes the actual or marked measurement

There will always appear a confirmation window until the data will be deleted.

7.1.4 Delete Measurements

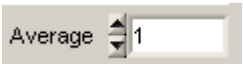
The active measurement or all measured data can be deleted under the menu point File.
A single measurement can also be deleted with the DEL key after selecting it in the legend with a left mouse click. It is also possible to delete a number of measurements using the CTRL or SHIFT keys in the usual manner. All measurements can be deleted together with CTRL DEL.



There will appear a confirmation window before the data will be deleted.

7.1.5 Averaging

The Average setting between JETI logo and measuring button can be used to obtain the spectrum as the mean value from up to 32 successive measurements.



7.1.6 Observer

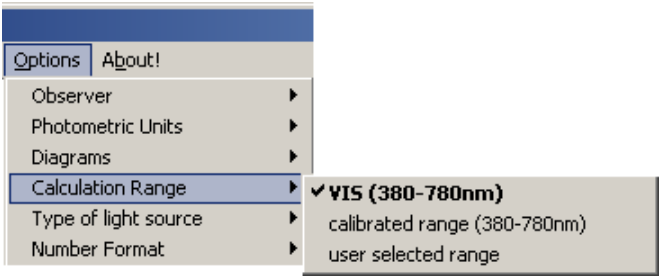
The menu point Options/ Observer can be used to switch between the 2° and 10°. In case of 10° all relevant data will get the index 10.

Attention:	The CRI and CCT calculation is only possible with the 2° setting.

Please keep in mind that *specbos 12x1* in luminance mode has a field of view of nearly 2°!

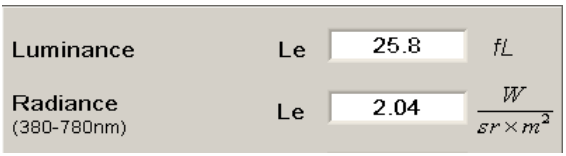
7.1.7 Calculation Range

The menu point Options/ Calculation Range allows to specify if the radiometric value will be calculated from the entire calibrated wavelength range (specbos 1201 380 … 780 nm; specbos 1211 350 … 1000 nm) or only from the limited (displayed) range (user selected range).



See chapter Spectra Calculations how to change the wavelength range.

7.1.8 SI Units/ Imperial Units



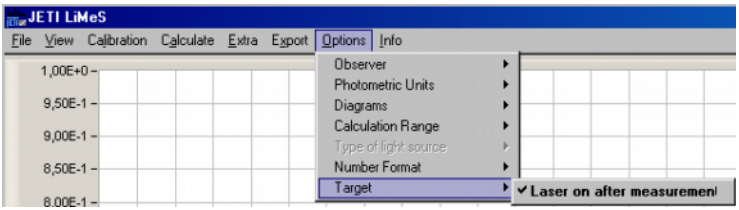
It is possible to switch between SI and imperial units using the Options/ Photometric units menu point. In case of Imperial units luminance will be shown in footlamberts (fL) and illuminance in footcandle (fc).

7.1.9 Number Format

The option Number fFormat allows to switch between scientific and floating point notation.

7.1.10 Target

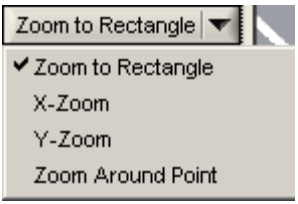
The target laser will be switched off automatically, if a measurement will be started. Afterwards it will not be switched on again.
The Options/Target/ Laser on after measurement causes that the target laser will be automatically switched on again after a measurement. This feature can be used for a new adjustment of the measuring area.



The feature is active after each single or continuous measurement.

7.2. Display Settings

7.2.1 Zoom

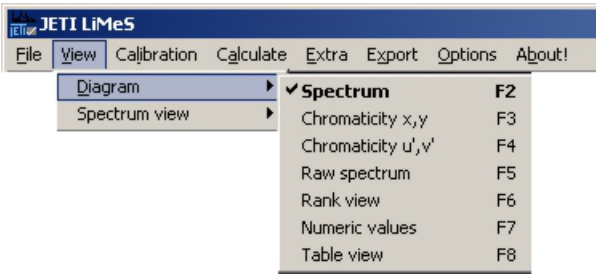


Diagrams can be zoomed with the cursor by pressing CTRL. The kind of zoom can be selected in the pop up menu left to the JETI logo. X-Zoom and Z-Zoom is only valid for the spectrum diagram.
Zoom out by pressing RESET below the Zoom pop up menu.
The start and the end of the displayed spectrum can alternatively be adjusted at the screen edge below the diagram with Start of Spectrum and End of Spectrum. In addition of using the up/down arrows, the displayed spectral limits can be typed in using the keyboard number pad. The maximum interval for *specbos 1x01* is between 380 nm and 780 nm. Always the full spectral range of the device is used for a measurement.

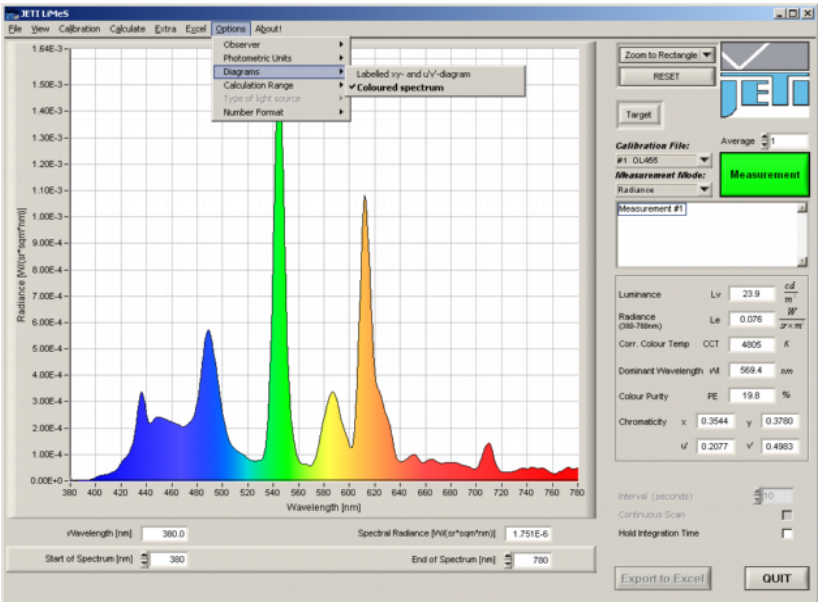
Remark: The start and end wavelength settings will be used for the calculation of the radiometric value if its calculation range is set to user selected range.

7.2.2 Diagram Options

Selecting View/ Diagram in the menu bar opens a window, where the display of the spectral data, the xy and u´v´ diagrams, the classification screen or the display of enlarged numerical values can be selected.



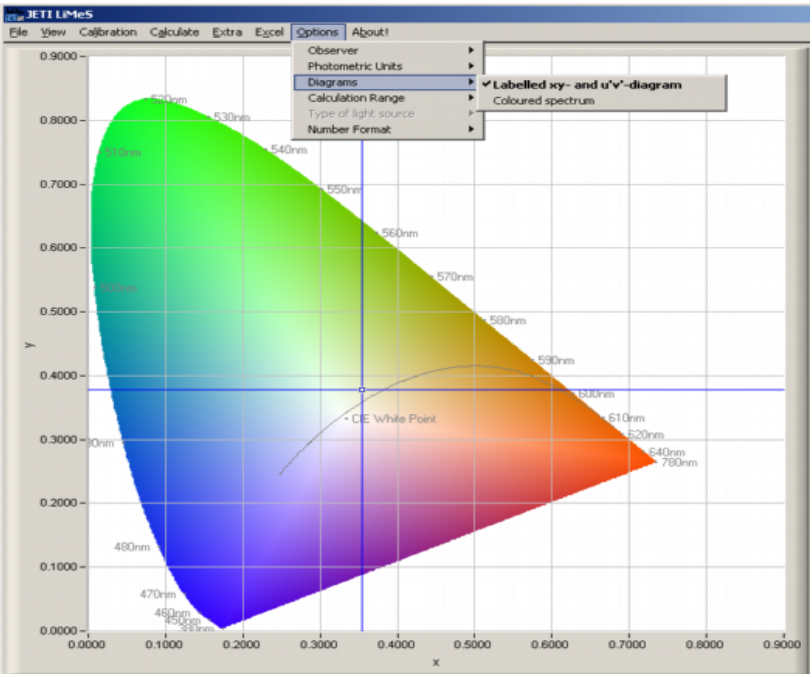
- The menu item View/ Diagram/ Raw spectrum allows to display the raw data of the spectrograph. This can be useful sometimes, e.g. if the general characteristics of the measured spectrum outside the calibrated range is of interest. The raw spectrum is the basis for all radiometric calculations.



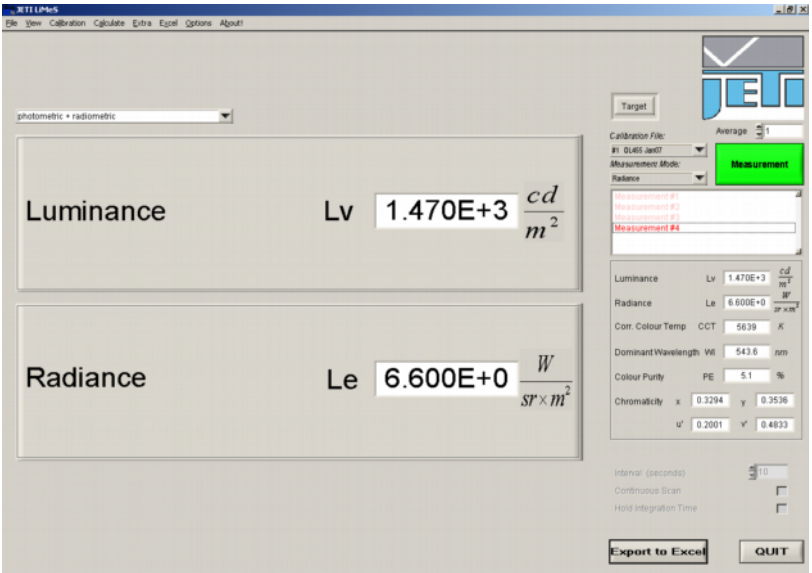
- The colour coordinate diagrams contain the Planckian curvature for orientation. The actual measuring values will be indicated in the diagrams.

In both colour diagrams zooming is possible with the Zoom function appearing left of the JETI logo.

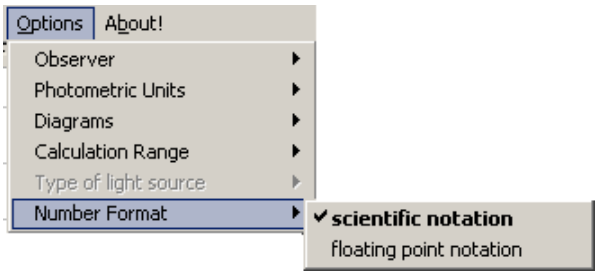
- It is possible to switch on and off the dominant wavelength scale at the curved border of both colourimetric diagrams with Options/ Diagrams/ Labelled xy- and u´v´-diagram.



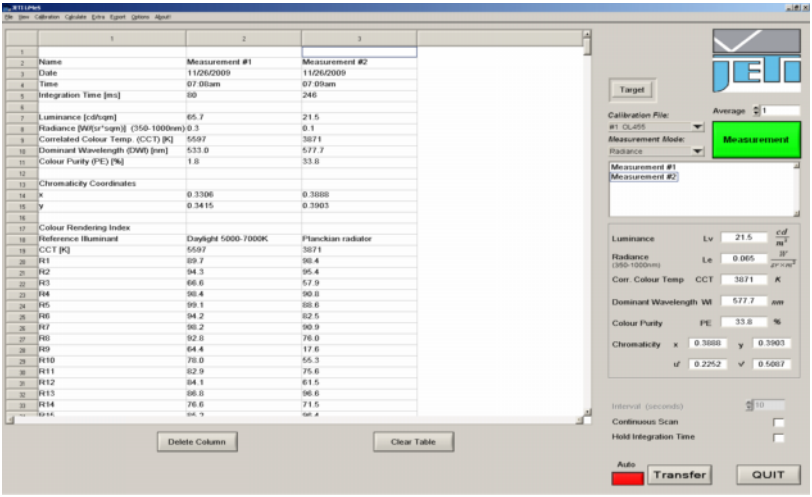
- The Rank view shows the result of the classification after defining and enabling it in the Extra/ Rank… menu point. (Chapter 8.2)
- Numeric values switches to a large display mode of selected values. The kind of data can be selected in the pop up menu above the values.



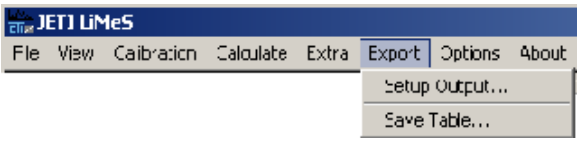
The number format for luminance/ radiance, illuminance / irradiance, luminous/ radiant flux (with specbos 13x1) and luminous/ radiant intensity (with specbos 1401) can be change between scientific and floating point notation.



The last item of the View menu is the data table (View/Diagram/ Table view). It can be used to display the measuring data and to save them in .xls or .csv files.

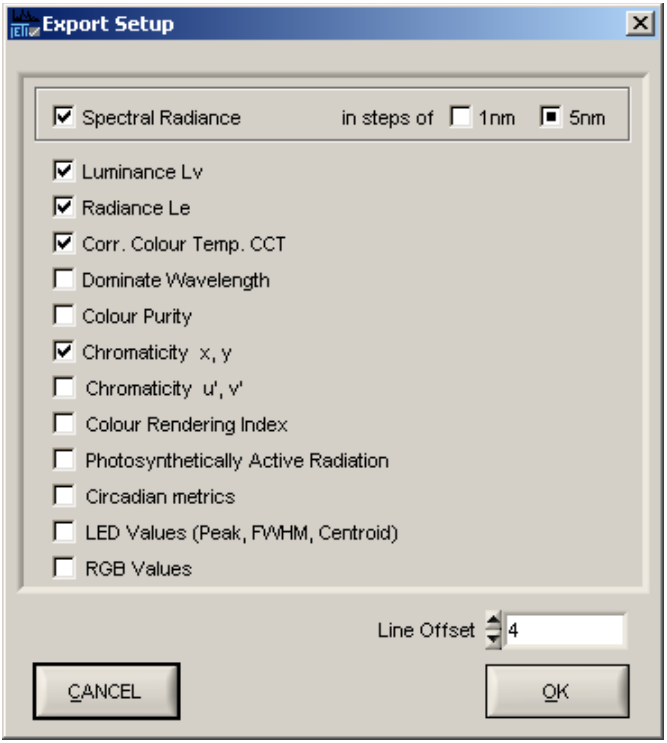


- Select Export/ Setup Output and choose the desired data to be transferred into the table.



Remark: The boxes Spectral Radiance/ Irradiance/ Radiant Flux/ Radiant Intensity, Luminance/ Illuminance/ Luminous Flux/ Luminous Intensity and Radiance/ Irradiance/ Radiant Flux/ Radiant Intensity appear in dependence from the attached measuring head.

- In case of selection of the spectral data the user has to click on the desired wavelength step width for the transfer (1 or 5 nm). Line Offset in Table shifts the transfered data downwards. Finally click on the OK button to close the window.



Click Transfer to export the data to a table (F8 shows the table)

- The marked measurement will be transferred. It is possible to mark several measurements simultaneously by using CTRL or Shift as usual; using CTRL marks single measurements and Shift marks a block of measurements.
- If a measurement was already identified by an individual name this name will be used as column header in the table. If not changed the automatically generated measurement number will be used.
- It is also possible to store loaded reference spectra in the same manner.

- If the button Auto is activated, all following measurements will be transferred automatically.

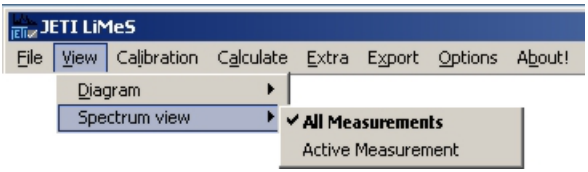
The cells of the first lines can be edited. The number of these lines has to be selected in the “Line Offset” setting.
See chapter Shortcut Keys for shortcut keys to switch between different display modi.

7.2.3 Snap-to-Point Cursor

Single data points of the acquired spectrum can be viewed using the Snap-to-Point Cursor option, if the spectral diagrams are displayed. The respective wavelength and the spectral value of the selected data point are displayed below the wavelength axis.

7.2.4 Screen Mode

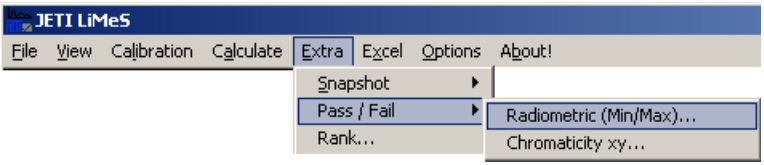
There are different spectrum display options that can be selected under the View menu:



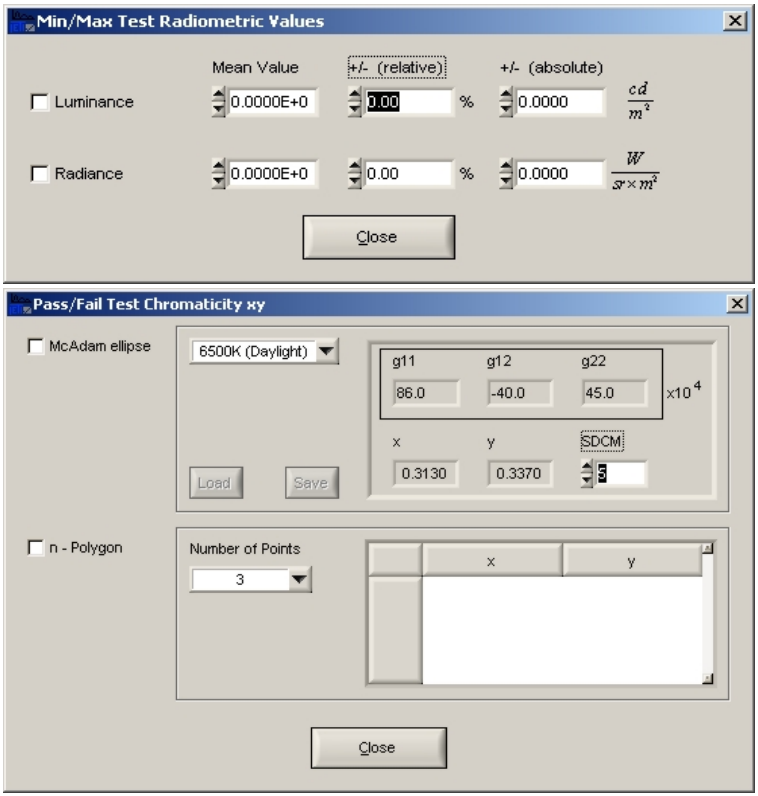
All Measurements	All measured spectra are displayed in the diagram.
Active Measurement	Only the active measured spectrum is displayed in the diagram.

8. Selection Procedures

8.1. Pass/ Fail Monitoring



The Pass/ fail monitor can be activated in the menu point Extra/ Pass/Fail. It is possible to select one or both radiometric quantities and/ or the chromaticity xy. The radiometric quantities are characterized by a value and a tolerance (relative or absolute alternatively). The tolerance of xy can be characterized by a polygon with 3… 8 vertexes or by a McAdam ellipse.



The ellipse is defined by:

- the central xy value
- the McAdam coefficients g_{11}, g_{21} and g_{22}
- the colour step (SDCM, maximum 10)

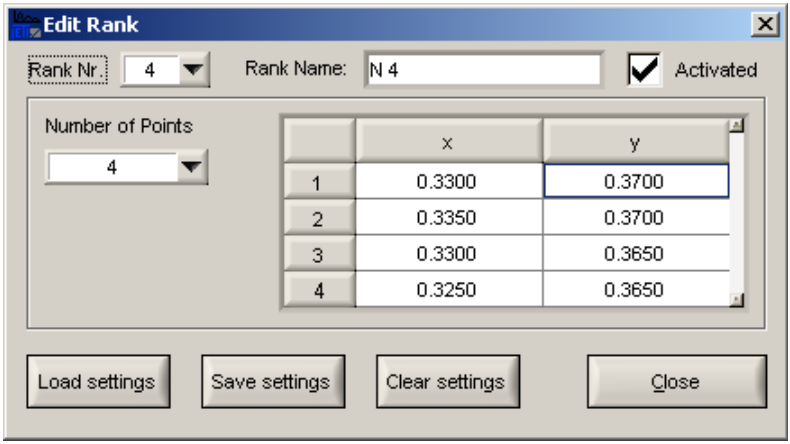
The standard values for the McAdam ellipses of different CCTs (EN 60081:1998 and ANSI C78.376-2001) are included. Furthermore it is possible to define user specific ellipses and store the data in a SET file for further use. The Pass/ fail check can be activated by clicking on the check box left of the category. All specified values are stored and available after new start of the program.
After a measurement the Pass/ fail results will be given by a green or red background colour in the appropriate value boxes. Additionally the result of the radiometric values will be indicated in the Pass/ fail window by a green check mark (Pass indication) or a red cross (Fail indication).

8.2. Classification (Ranking)

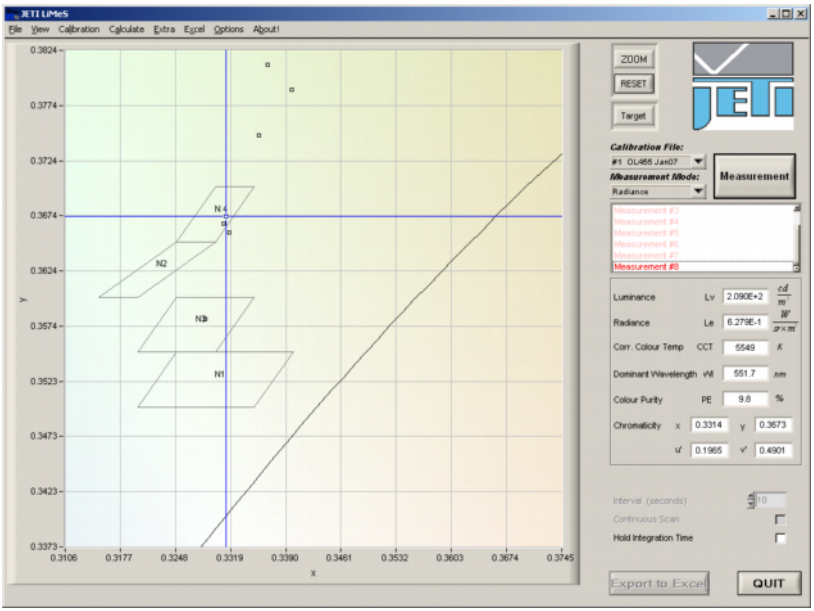
In addition to the pass/ fail monitoring it is possible to classify light sources according to their xy chromaticity coordinates. The procedure consists of the preparation of the ranks and the measurement itself.

Preparation of Ranks

There can be arranged up to 12 different ranks, which are summarized in one rank file. Each rank has to be defined by an area in the xy diagram, which can have up to 8 corners. The menu point Extra/ Rank… opens the following window.



Here it is possible to select the rank number, the number of corners (points), the xy coordinates of the corners and the rank name. If the data of all ranks are specified store the ranks together within a file with Save settings. Several groups with up to 12 ranks can be stored in different files. Use a distinguishing name for each file. Click Load settings and select the appropriate file if you want to use the ranks for classification. If not all ranks of a file are needed deactivate the not necessary ones with the Activated check box. The not activated ranks will remain in the file for further use.
The activated ranks will be shown in the xy diagram.

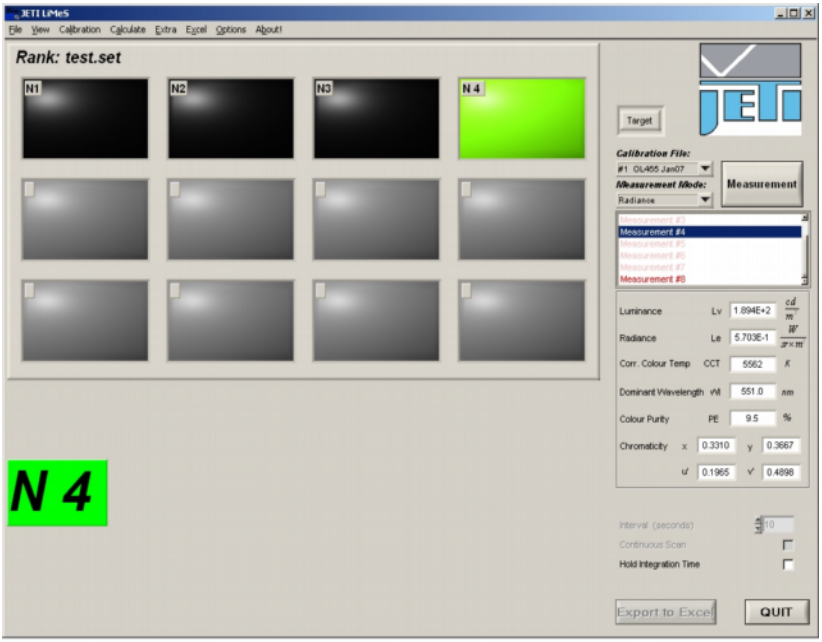


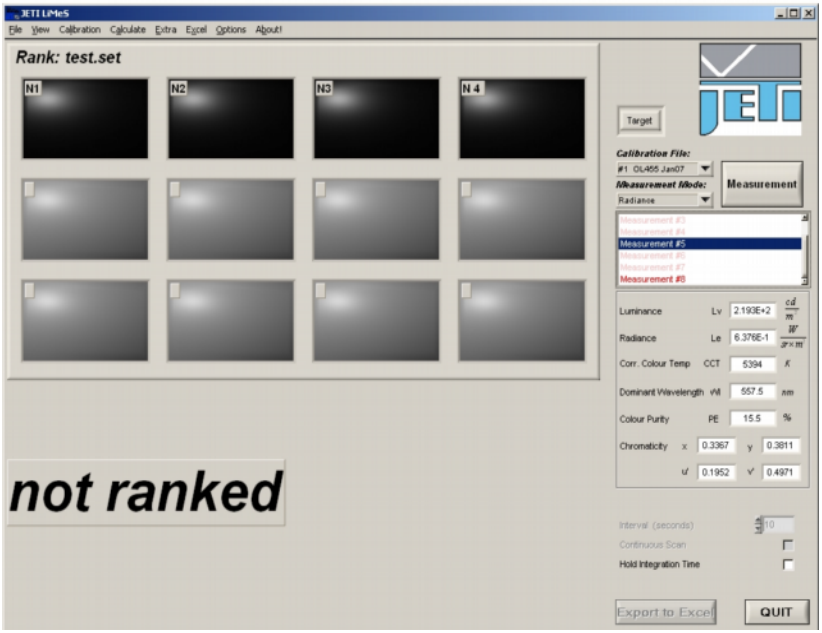
A demo video showing the preparation of the classification can be found on the web site http://www.jeti.com/cms/index.php/led/ranking .

Usage of Ranks

Open the menu point View/ Diagram/ Rank view or press F6. There will be opened a window showing different boxes for the ranks in addition to the measuring values. After a measurement the rank where the measured xy coordinates belongs to is lighted in green colour.

Furthermore this rank is shown below the boxes. If the measuring result does not fall into a specified rank, the message not ranked will be shown.


JETI LiMeS
File View Calibration Calculate Extra Excel Options About!
Rank: test.set
N1
N2
N3
N 4
Target
Calibration File:
#1 OL455 Jan07
Measurement Mode:
Radiance
Measurement
Measurement #4
Measurement #8
Luminance Lv 1.894E+2 cd/m
Radiance Le 5.703E-1 W/sr×m
Corr. Colour Temp CCT 5562 K
Dominant Wavelength λd 551.0 nm
Colour Purity PE 9.5 %
Chromaticity x 0.3310 y 0.3667
u' 0.1965 v' 0.4898
Interval (seconds) 10
Continuous Scan
Hold Integration Time
Export to Excel
QUIT
N 4

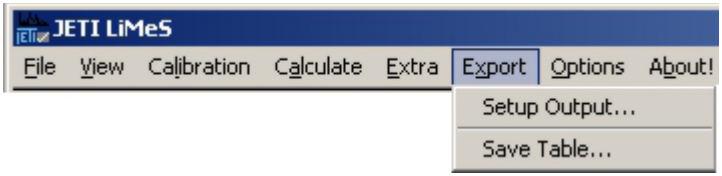

JETI LiMeS
File View Calibration Calculate Extra Excel Options About!
Rank: test.set
N1
N2
N3
N 4
Target
Calibration File:
#1 OL455 Jan07
Measurement Mode:
Radiance
Measurement
Measurement #5
Measurement #8
Luminance Lv 2.193E+2 cd/m
Radiance Le 6.376E-1 W/sr×m
Corr. Colour Temp CCT 5394 K
Dominant Wavelength λd 557.5 nm
Colour Purity PE 15.5 %
Chromaticity x 0.3367 y 0.3811
u' 0.1952 v' 0.4971
Interval (seconds) 10
Continuous Scan
Hold Integration Time
Export to Excel
QUIT
not ranked

Remark: If the xy coordinates lie on a border line belonging to two different ranks the first rank in the sequence will be selected.

9. Data Storage

9.1. Data Transfer

Measuring data transferred into the table view (chapter Display Settings) can be stored in csv, xls or xlsx file format (Excel 97 or higher).

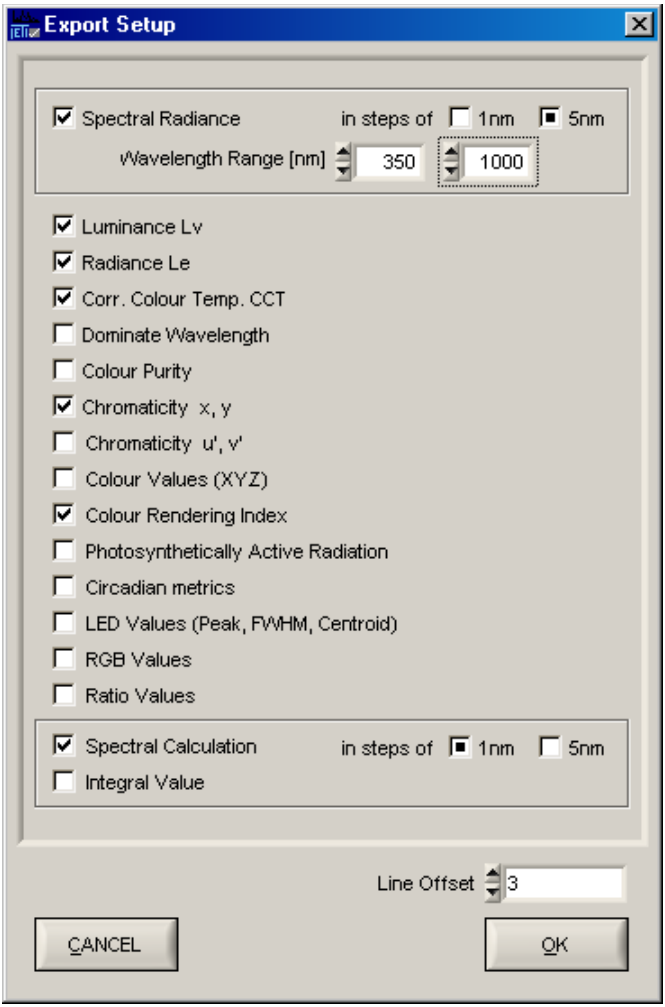


Remark: Excel installation isn't necessary.

Select Export/ Setup Output and choose the desired data to be transferred into the table.

Remark: The boxes Spectral Radiance/ Irradiance/ Radiant Flux/ Radiant Intensity, Luminance/ Illuminance/ Luminous Flux/ Luminous Intensity and Radiance/ Irradiance/ Radiant Flux/ Radiant Intensity appear in dependence from the attached measuring head.

In case of selection of the spectral data the user has to click on the desired wavelength step width for the transfer (1 or 5 nm). Line Offset in Table shifts the transferred data downwards. Finally click on the OK button to close the window.

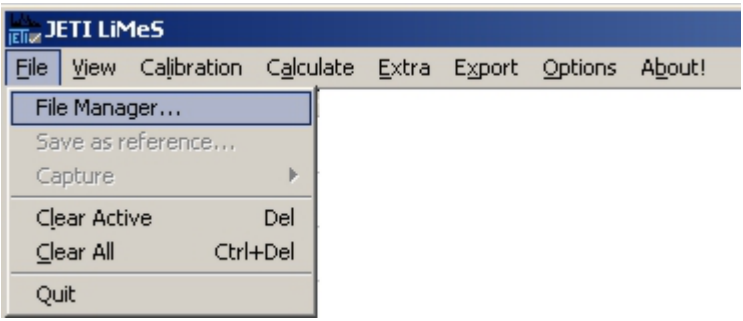


Use Export/ Save Table, select the file name, format and storage location of the file and press OK.

Remark: Reference Spectra can be directly used for Spectra Calculations (see chapter Spectra Calculations).

Click Transfer to export the data to a table (F8 shows the table). The marked measurement will be transferred.

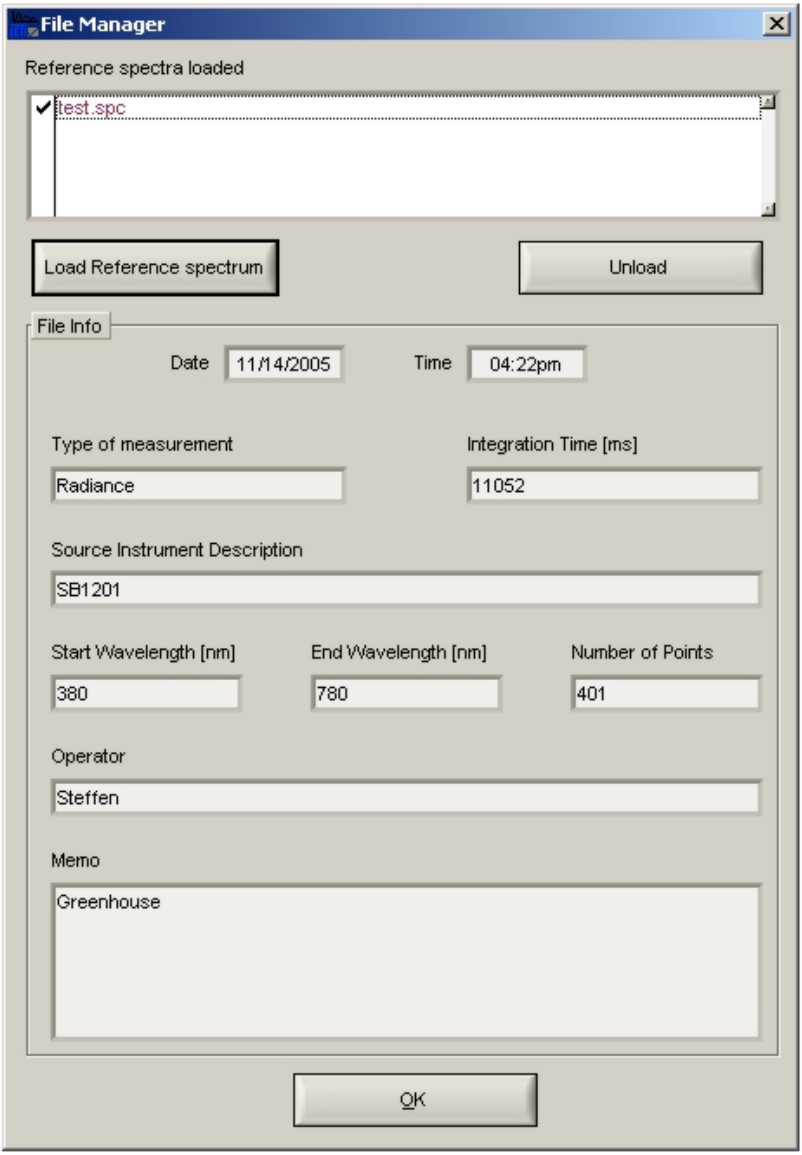
9.2. Store as Reference



The items File in the menu bar allows to store measured spectra as a reference for further measurements. There can be used two formats – Character Seperated Values (CSV, file extension .csv) or the Galactic SPC file format (GRAMS compatible, file extension *.spc)*.

Remark: Reference Spectra can be directly used for Spectra Calculations (see chapter Spectra Calculations).

A spectrum can be stored by clicking File/ Save as reference. First type in the name of the file and select the destination for storage. Afterwards user comments (memo) and the operators name can be written into the following windows.



If previously saved reference spectra should be displayed, click on File/ File manager. Spectra of both formats can be loaded into the list

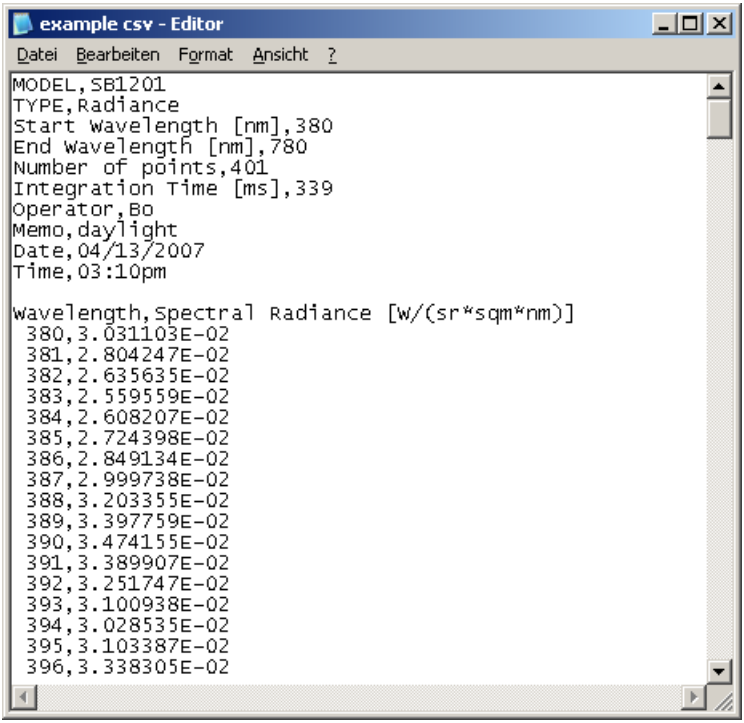
or unloaded from it. The information data of an actual file are displayed below the file list. Click into the column left of the file name to mark the desired spectra.
The plot options of each reference file can be changed by double click on the file name in the list. Then close the window. Now all marked spectra are shown in the diagram. If you click on a spectrum the corresponding measuring values are shown on the right side of the diagram.

Remark: It is only possible to load reference spectra of the same measurement mode which is selected. In offline mode it is necessary to switch manually to the appropriate mode.

To load reference spectra from other instruments into JETI LiMeS, you have to create a csv-file in the format shown below. For identification the first line has to made out to “MODEL, SB1201”. Every line has to end with new line. The TYPE line must be the measurement mode Radiance, Irradiance, Radiant Flux or Radiant Intensity. The start and end wavelength have to be between 380 and 780 nm and the step width is restricted to 1 nm (interpolate if necessary).
The operator line can have at most 63 characters and the Memo line 129 characters. The line integration time is necessary, but the quotation is irrelevant.

Remark The decimal symbol is depending from the settings of the computer.

The easiest way to create such file is to store an arbitrarily measured spectrum in CSV format and use this file as basis for the new one by overwriting the appropriate lines. This can be done in Excel. Afterwards it can again be stored in CSV format.

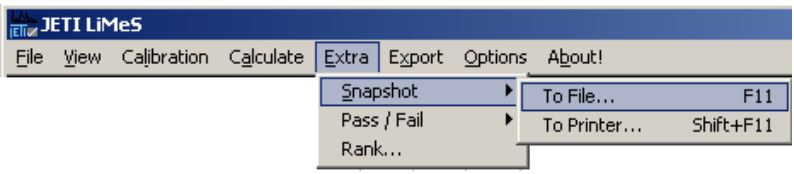



```
MODEL,SB1201
TYPE,Radiance
Start Wavelength [nm],380
End Wavelength [nm],780
Number of points,401
Integration Time [ms],339
Operator,Bo
Memo,daylight
Date,04/13/2007
Time,03:10pm

Wavelength,Spectral Radiance [W/(sr*sqm*nm)]
 380,3.031103E-02
 381,2.804247E-02
 382,2.635635E-02
 383,2.559559E-02
 384,2.608207E-02
 385,2.724398E-02
 386,2.849134E-02
 387,2.999738E-02
 388,3.203355E-02
 389,3.397759E-02
 390,3.474155E-02
 391,3.389907E-02
 392,3.251747E-02
 393,3.100938E-02
 394,3.028535E-02
 395,3.103387E-02
 396,3.338305E-02
```

9.3. Snapshot

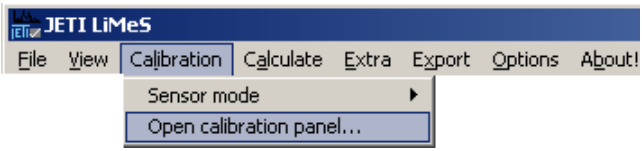
In the menu Extra/ Snapshot it is possible to store the actual screen in a file or to print it.



You can choose between the full screen or the diagram only. JPG, BMP and PNG files are possible. In case of printing you have to select the printer settings.
The alternative keys are F11 and Shift F11, respectively.

10. Calibration

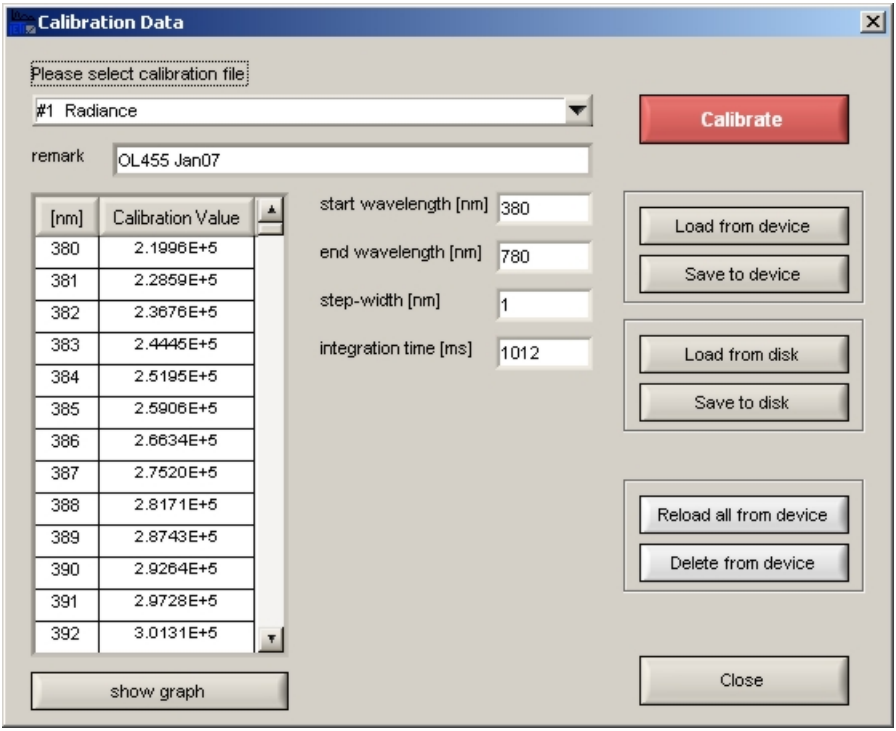
specbos 1xx1 will be delivered in calibrated status. The calibration data are stored in the device. It exists a separate file for each measuring mode.



The menu point Calibration/ Open calibration panel... shows the following panel. **This menu point is password protected.**

Load from device:

Load the selected calibration file from the device.



Save to device:

Save the selected calibration file to the device.

Load from disk:
Load a calibration file from the disk and show this at the selected file place.

Save to disk:
Save the selected calibration file to the disk.

Reload all from device:
Load all calibration files from the device.

Delete from device:
Delete the selected calibration file.

New Calibration

It is necessary to have a calibration lamp and to know the spectral data of this lamp in the appropriate quantity.
The lamp file needs to have the following structure in ASCII format:

Measuring mode (Radiance, Irradiance, Radiant flux or Radiant intensity)
Remark
Begin of wavelength
End of wavelength
Wavelength step (only 1 nm allowed)
First spectral value
Second spectral value
….
Last spectral value

The units of the spectral data have to be as follows:

Radiance	W/(m² ·sr ·nm)
Irradiance	W/(m² ·nm)
Radiant flux	W/nm
Radiant intensity	W/(sr ·nm)

Remark: All calibrations will be done independently.

First press the red Calibrate button. Now you are asked whether the right lamp is adjusted in a proper way in front of the instrument. If it is done, you have to confirm the calibration. Then you can repeat the same procedure for other modes.
The new calibration data are stored in a file with the extension *.cal* on the PC as well as directly in the instrument.

A calibration file has the following structure:

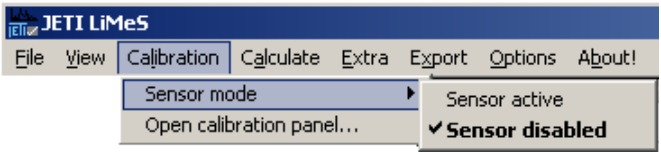
Measuring mode
Remark
Begin of wavelength range
End of wavelength range
Wavelength step
Integration time
First spectral value
Second spectral value
….
Last spectral value

The units of the spectral data are as follows:

Radiance	counts/ Ws/(m² ·sr ·nm)
Irradiance	counts/ Ws/(m² ·nm)
Radiant flux	counts/ Ws/nm
Radiant intensity	counts/ Ws/(sr ·nm)

Sensor mode

Two sensors in the measuring head automatically recognize the accessory attached to the instrument. If you want to use a calibration file regardless of the sensor signal, choose Calibration/ Sensor mode/ Sensor disabled. The calibration file itself can then be selected in the pull-down menu next to the measurement button.



Remark: If the sensor is disabled be always sure that the fitting calibration file is selected to obtain correct measuring results.

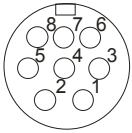
11. Shortcut Keys

F1	About box (including product/ vendor ID, virtual COM port number, baudrate, firmware version)
F2	Display of spectrum
F3	Display of xy diagram
F4	Display of u´v´diagram
F5	Display of raw spectrum (dark signal corrected)
F6	Rank view
F7	Large display of numerical values
F8	Open the data table
F9	Start of measurement
F11	Snapshot into file
Shift F11	Snapshot to printer
F12	Display of actual integration time and maximum counts in spectrum (including dark counts)
Alt Q	Finish the program
CTRL D	Open the distance panel of luminous intensity measurement
CTRL Del	Clear all measurements (with accepting window)
CTRL T	Open/ Close the panel for fixed integrating time
Del	Clear actual/ activated measurement
ESC	Abort a running measurement
CTRL + left mouse key	Zoom in (xy and u´v´diagrams)
Space	Start of measurement (only if measurement button is active)

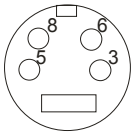
12. Trigger Functions

It is possible to trigger the measurement externally and to initiate a flash of a pulse light source.
The trigger female connector at the rear side of the instrument has the following pin out:

Mini DIN 8



Mini DIN 4



Pin out (view to female connector of the instrument):

3 Lamp out 5 V TTL signal (flash lamp trigger)
5 Measuring trigger input
6 not used
8 Ground

The fitting male connector is included in the scope of the device delivery.

External Control of Measurement

A measurement can be initiated externally by a short cut between pin 5 and 8. This can be done e.g. by a foot push-button. Furthermore it is possible to use a TTL signal to start a measurement. This is done with the falling edge of the signal.
Both triggering versions act similarly as pressing the green Measurement button of the software.

See the firmware description to change the settings.

13. See and Click

13.1. Significance of the color Code

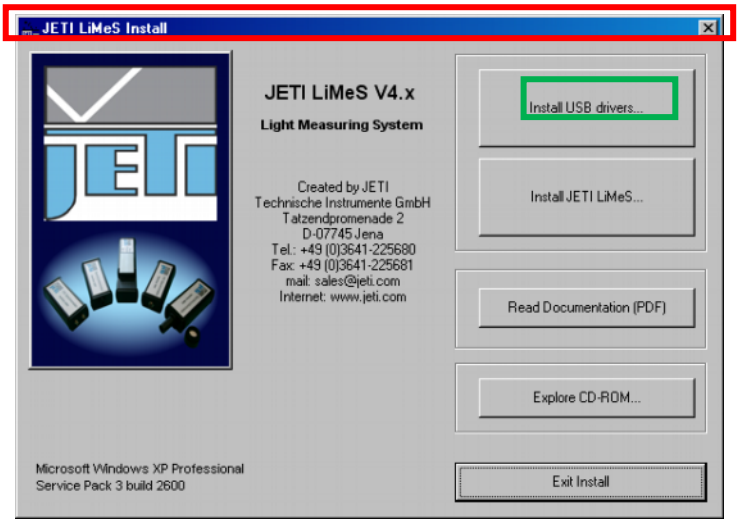
See

Wait

Click

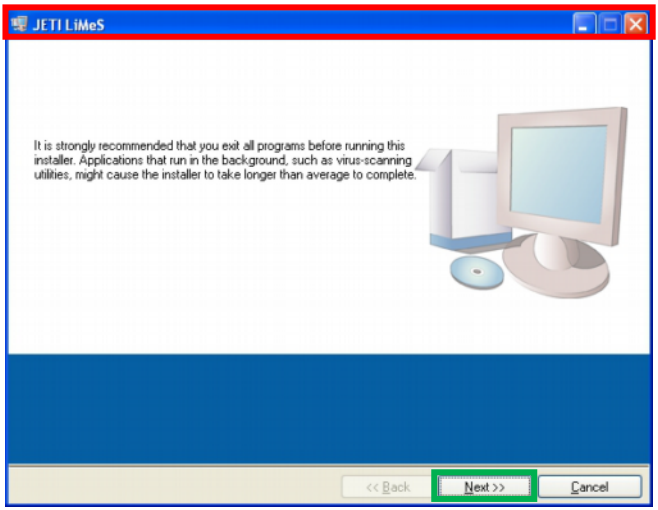
13.2. Software Installation

See: JETI LiMeS Install **See:** Install JETI LiMeS...



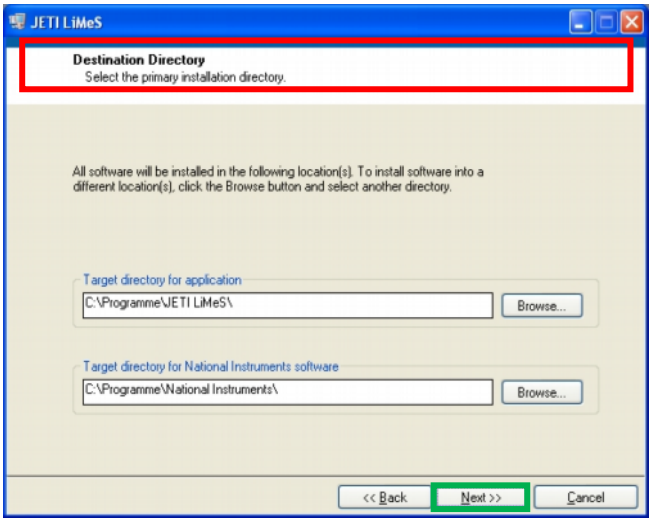
Click: Install JETI LiMeS...

See: JETI LiMeS **See:** Next



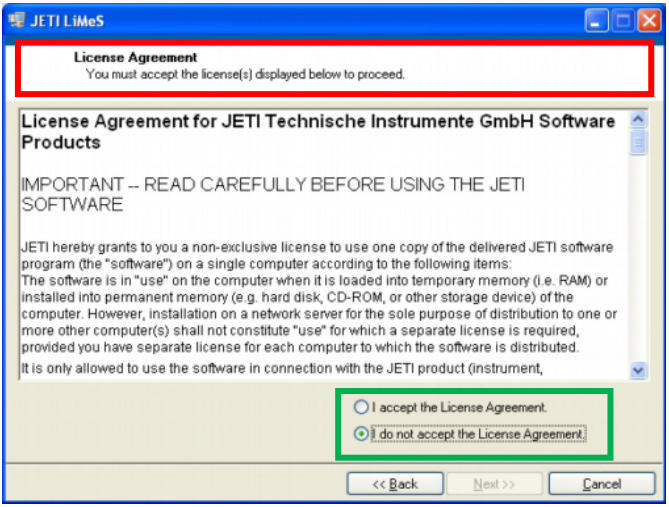
Click: Next

See: Destination Directory **See:** Next



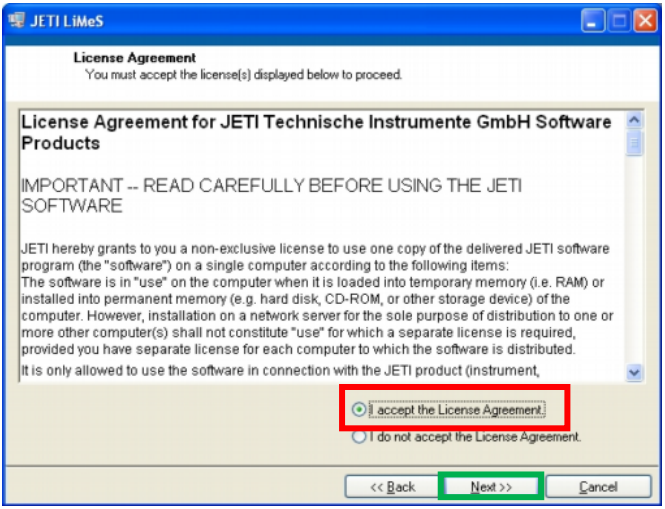
Click: Next

See: License Agreement **See:** I accept the License Agreement



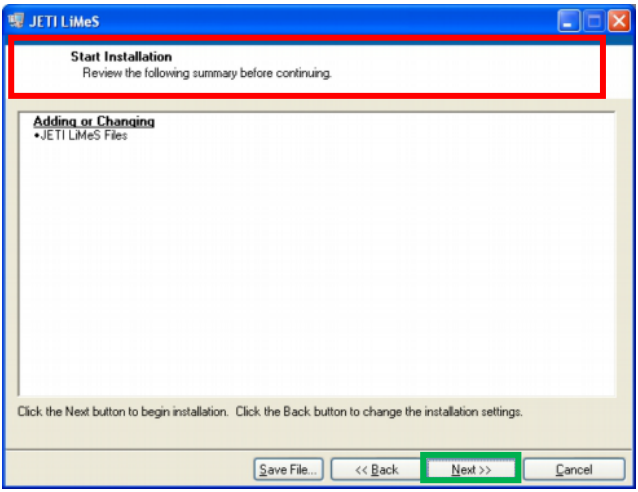
Click: I accept the License Agreement

See: I accept the License Agreement **See:** Next



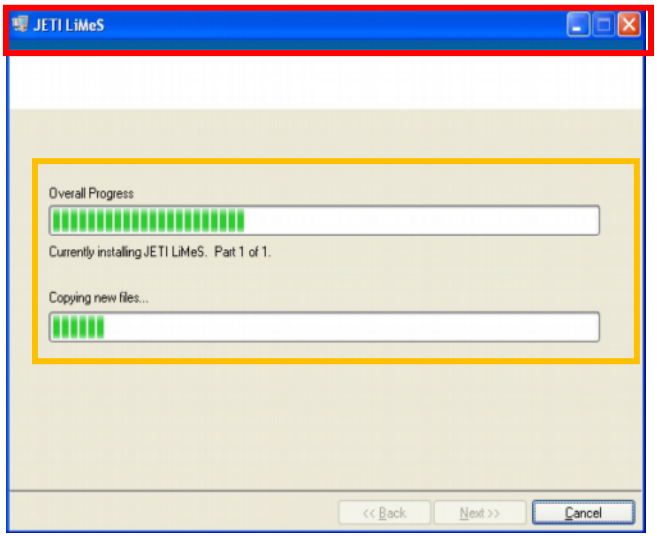
Click: Next

See: Start Installation **See:** Next



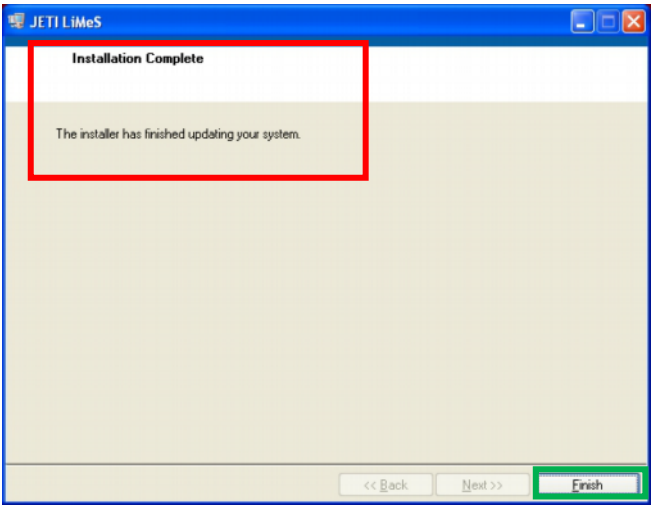
Click: Next

See: JETI LiMeS **See:** Overall Progress



Wait: Overall Progress

See: Installation Complete **See:** Finish

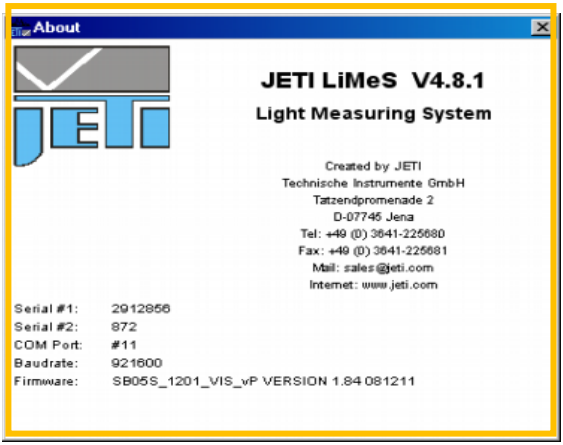


Click: Finish

See: Desktop **See:** JETI LiMeS Icon

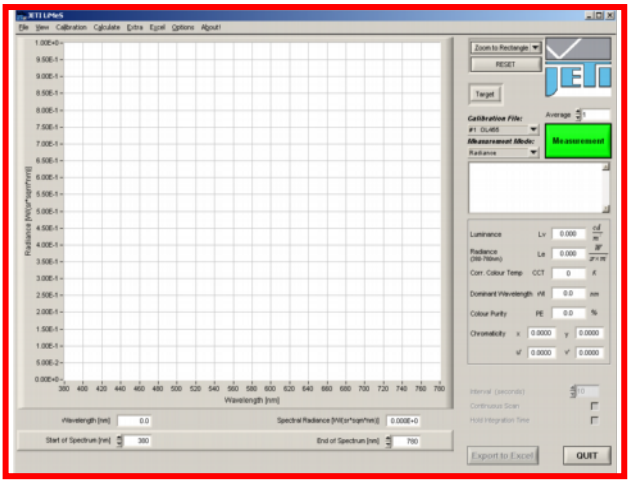
Click: JETI LiMeS Icon

See: Desktop **See:** JETI LiMeS



Wait: JETI LiMeS

See: JETI LiMeS



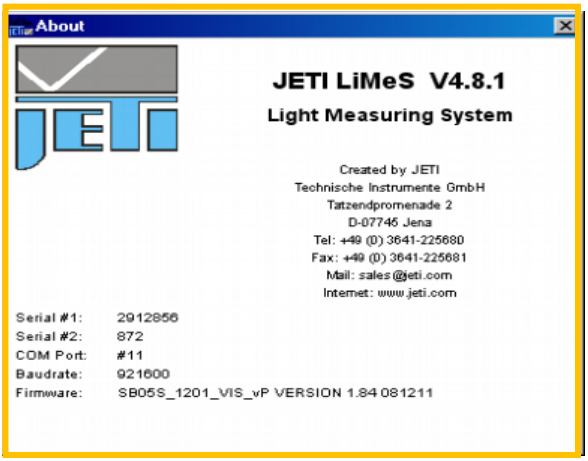
END

13.3. Start the Program

See: Desktop **See:** JETI LIMES icon

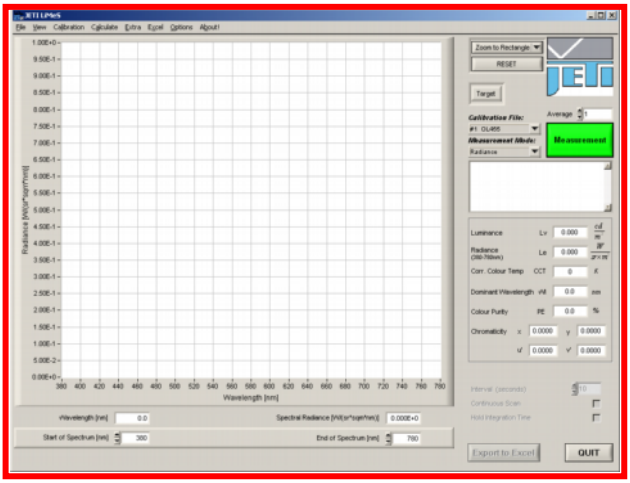
Double Click: JETI LiMeS

See: Desktop **See:** JETI LiMeS



Wait: JETI LiMeS

See: JETI LiMeS



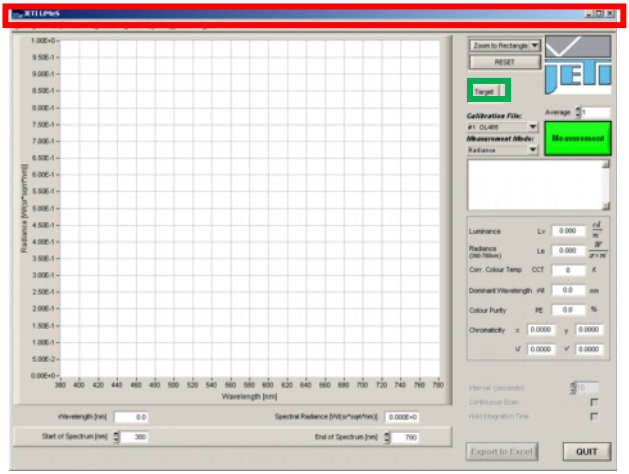
Start the measurement

13.4. Measuring Mode Luminance

See: Desktop **See:** JETI LIMES icon

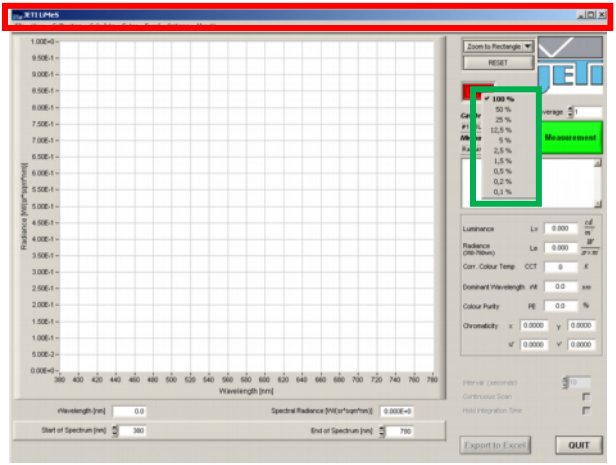
Double Click: JETI LiMeS

See: JETI LiMeS **See:** Target



Right-Click: Target

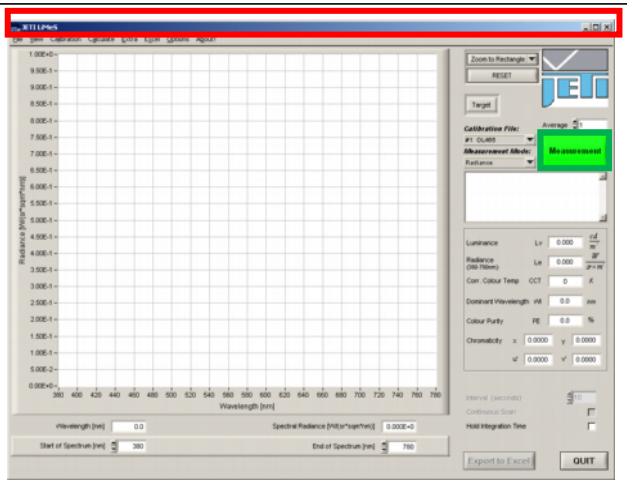
See: JETI LIMES **See:** %



Click: 100%

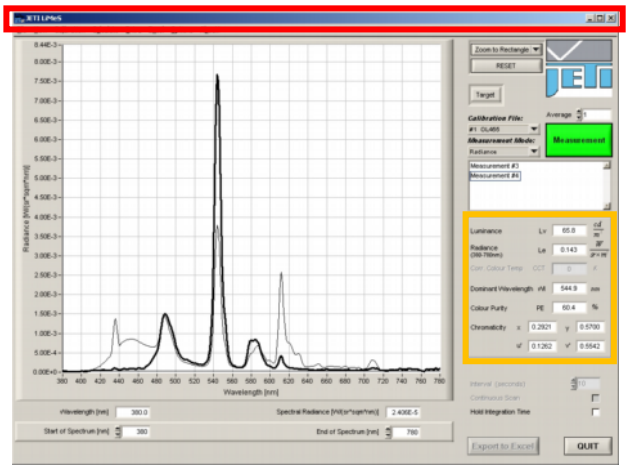
Adjust the device

See: JETI LIMES **See:** Measurement



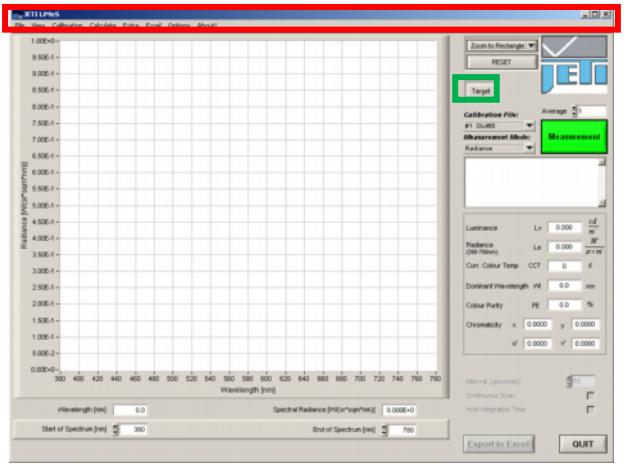
Click: Measurement

See: JETI LIMES **See:** Result



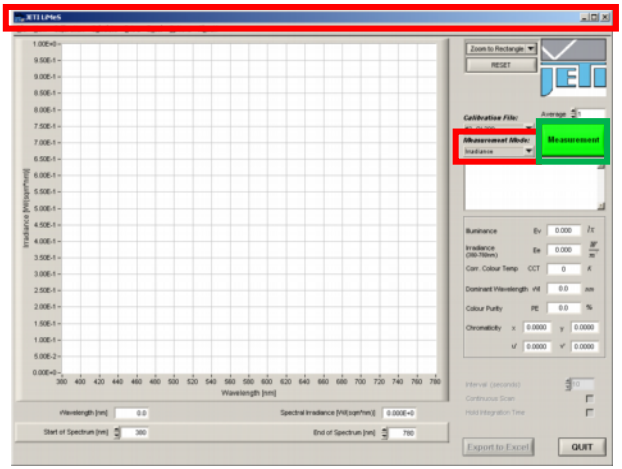
END

13.5. Illuminance mode

See: Desktop **See:** JETI LIMES icon
Double Click: JETI LiMeS
See: JETI LiMeS **See:** Target

Right-Click: Target
Adjust the device

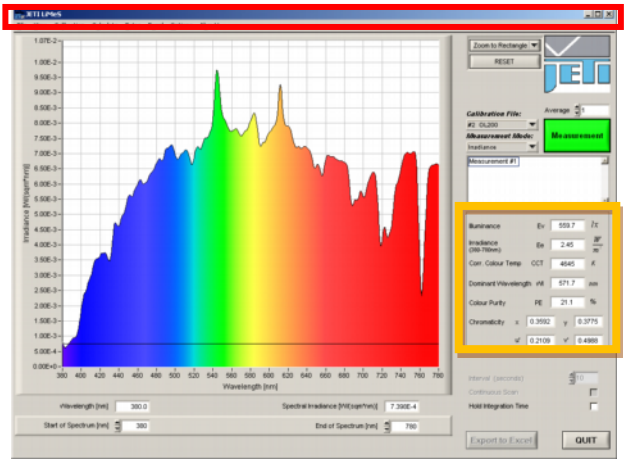
Attach the diffuser on the device

See: Irradiance **See:** Measurement



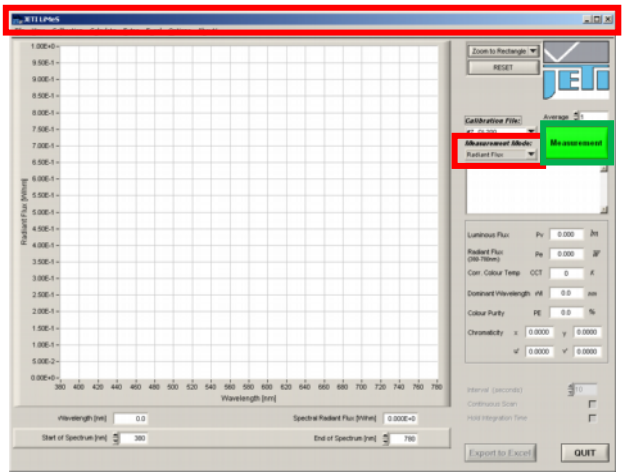
Click: Measurement

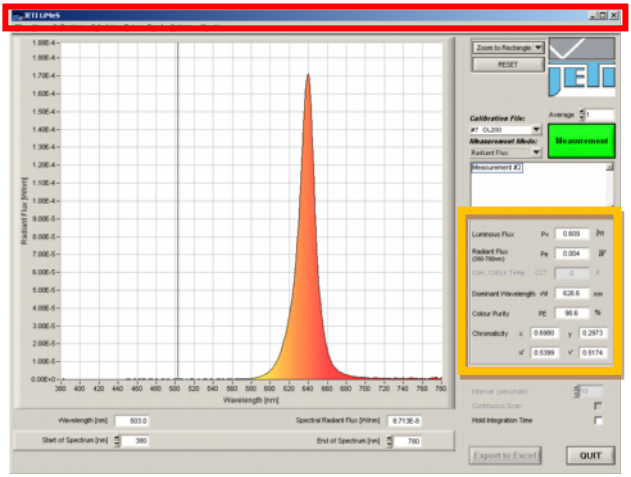
See: JETI LIMES **See:** Result



END

13.6. Luminous Flux mode – specbos13x1

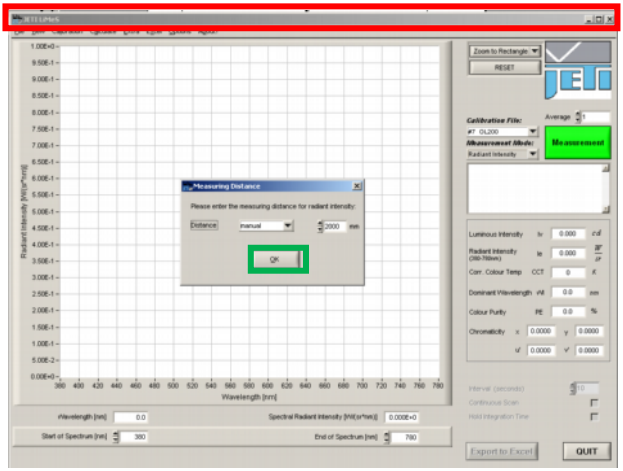
See: Desktop **See:** JETI LIMES icon
Double Click: JETI LiMeS
See: JETI LIMES **See:** Radiant Flux **See:** Measurement

Click: Measurement

See: JETI LIMES **See:** Result

END

13.7. Luminous Intensity mode – specbos1401

See: Desktop **See:** JETI LIMES icon
Double Click: JETI LiMeS

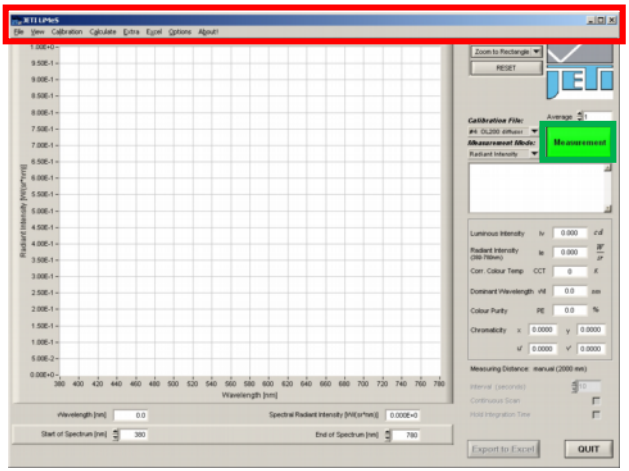
See: JETI LIMES **See:** Radiant intensity



Set measuring distance

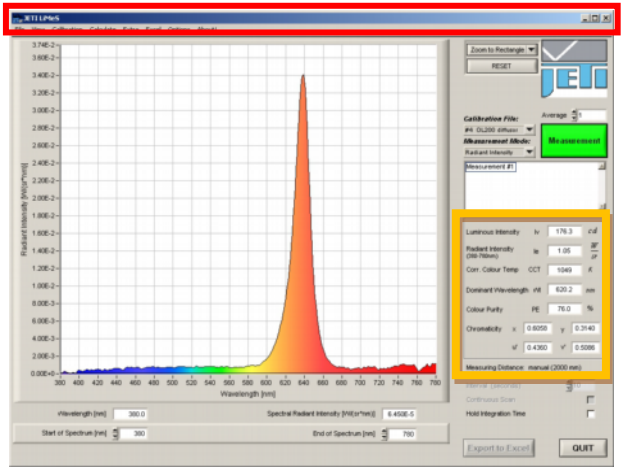
Click: OK

See: JETI LIMES **See:** Measurement



Click: Measurement

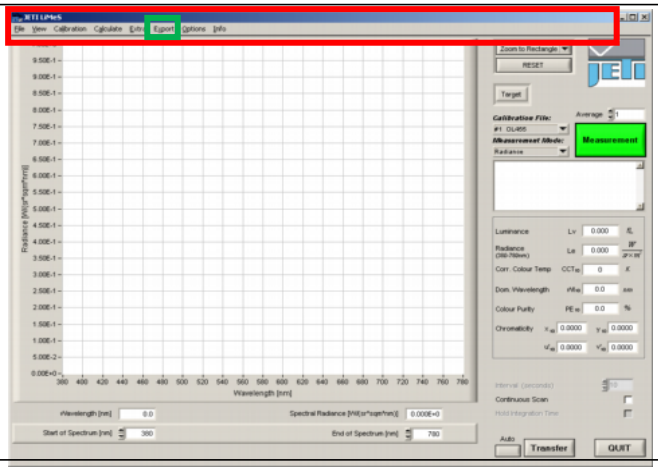
See: JETI LIMES **See:** Result



END

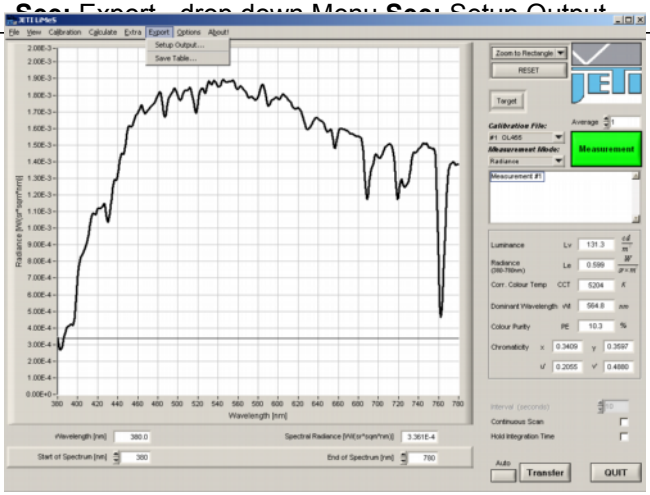
13.8. Export

See: JETI LiMeS **See:** Export



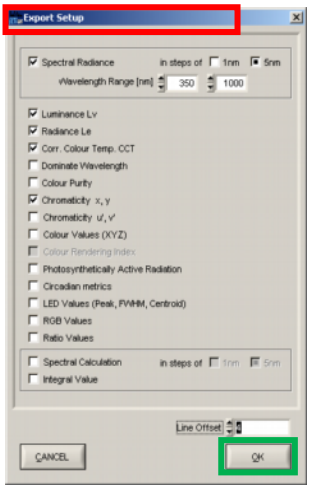
Click: Export

See: Export ... drop down Menu **See:** Setup Output



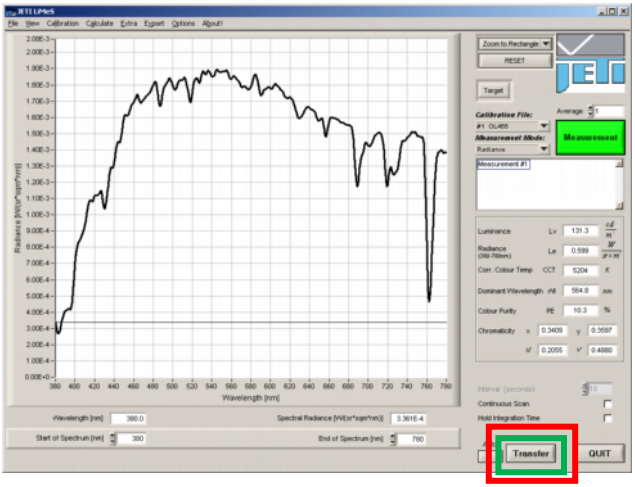
Click: Setup Output ...

See: Export Setup



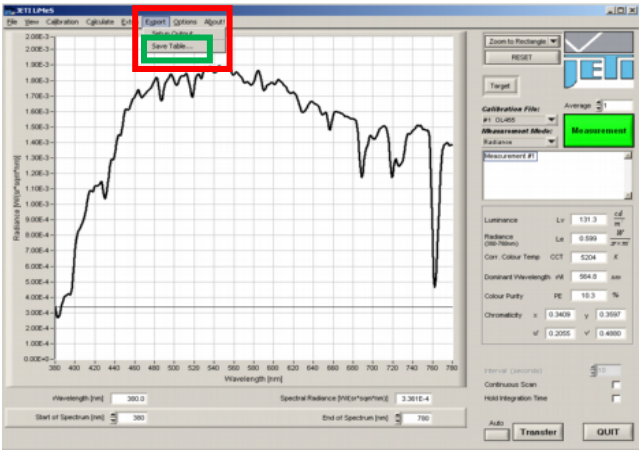
Set output parameter **Click:** OK

See: Transfer



Click: Transfer

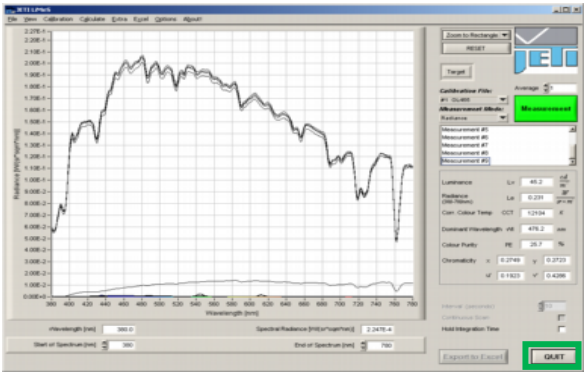
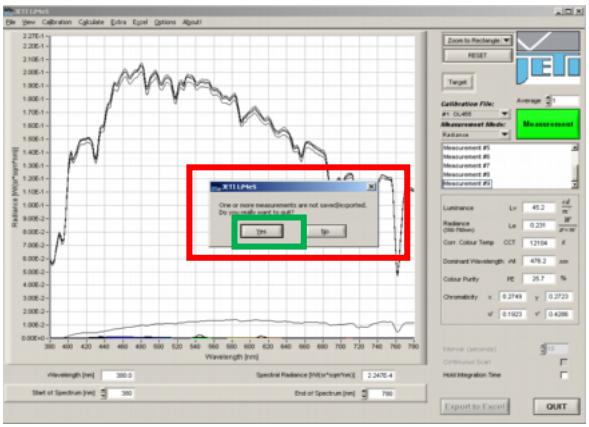
See: Export - drop down Menu **See:** Save Table ...



Click: Save Table...

END

13.9. Finishing the Program

See: Quit

Click: Quit
See: JETI LiMeS

END

14. Technical Data

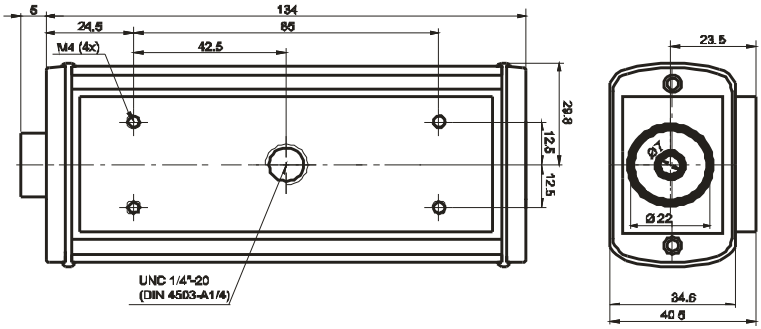
	specbos1201	specbos 1211
Applications	Measurement of diffuse light sources, screens etc., of room illuminance and of lamps	
Spectral range	380 ... 780 nm	350 ... 1000 nm (optional 250 …. 1000 nm)
Optical resolution (FWHM)	5 nm	4.5 nm
Wavelength accuracy	± 0.5 nm	
Calculated wavelength step	1 nm	1 nm
Digital electronic resolution	16 bit A/D (15 bit used, 14 bit displayed)	
Measuring values	Spectral radiance/ spectral irradiance/ (radiant flux with specbos 13x1/ radiant intensity with specbos 1401) Integral luminance/ integral radiance/ Integral illuminance/ integral Irradiance/ (integral luminous/ radiant flux with specbos 1301/ integral luminous/ radiant intensity with specbos 1401) Chromaticity x,y; u´,v´; Correlated Coulor Temperature; Dominant wavelength, Colour purity; Colour Rendering Index; Circadian metrics; Photosynthetically Active Radiation	
Measuring range luminance	2 ... 70 000 cd/m^2	0.1 ... 2 000 cd/m^2
Measuring range illuminance	20 … 50 000 lx	5 … 20 000 lx
Measuring range luminous intensity specbos 1401	cond. A 100 mcd … 300 cd cond. B 30 mcd … 100 cd	

	specbos1201	specbos 1211
Measuring range luminous flux specbos 1301	50 mm sphere: 30 mlm … 250 lm 150 mm sphere: 100 mlm … 800 lm	300 mm sphere: 20 mlm … 400 lm 500 mm sphere: 40 mlm … 900 lm
Viewing angle in luminance mode	1.8 °	
Measuring distance/ diameter in luminance mode	20 cm - ∅ 6 mm; 100 cm - ∅ 30 mm	
Accuracy photometric value	± 5 % (at illum. A)	
Reproducibility of photometric value	± 2 %	
Color chromaticity accuracy	± 0.002 x, y (at illum. A)	
Color reproducibility	± 0.0005 x, y	
CCT reproducibility	± 20 K (at illum. A)	
Integration time range	5 ms ... 60 s	
Dispersive element	Diffraction grating	
Light receiving element	256 pixel (128 pixel specbos1x01 M) photodiode array	2048 pixel binned CCD array
Operating conditions	Temperature 10 ... 40 °C Humidity < 85 % relative humidity at 35 °C	
Power supply	Hub powered	
PC interface	USB 2.0 fullspeed (12 Mbit/sec)	
Dimensions	150 mm x 58 mm x 34 mm (basic unit)	180 mm x 82mm x 53 mm (basic unit)
Weight	300 g (basic unit)	450 g (basic unit)
Pilot laser	Laser class 1, λ= 645 … 660nm (classific. accord. to EN60825-1/Oct. 2003)	

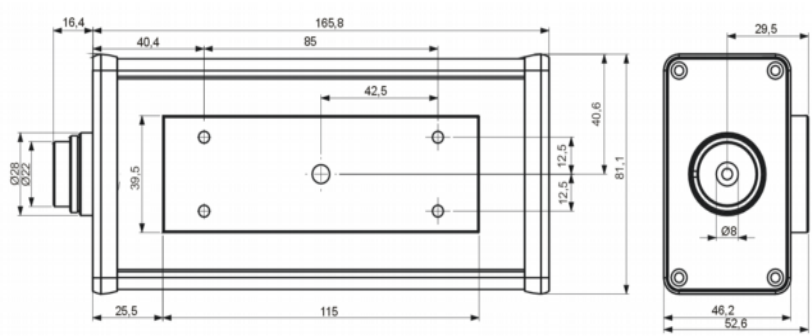
14.1. Mechanical Dimensions

The following drawings show the positions of the threads downside the device and some general dimensions of the instrument.

specbos1201:



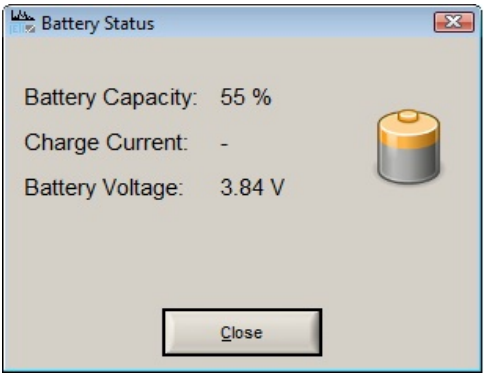
specbos 1211:



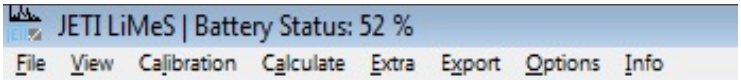
14.2. Battery charging (only specbos 1211-BT)

The battery can be charged using the power supply or using the USB port of a PC. In this case the instrument has to be installed via this interface to the computer.

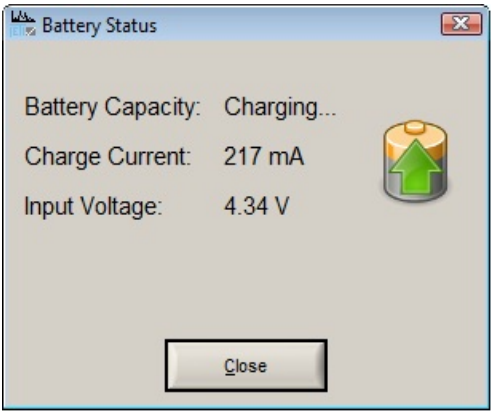
The menu point Info/ Battery status shows the charging level of the battery:



The charging level can also be seen in the active title bar of the main window.



If the instrument is in charging status the following window appears:



The battery is fully charged if the illuminated switch isn't flashing any more.

15. Maintenance and Error Messages

The instrument needs no permanent maintenance, if you use it carefully. It is recommended to recalibrate it every year. Ask your dealer or the producer (see chapter *19*) for details.

Error message	Reason	Removal
Device not found! Switched to offline-mode	Device not connected or USB driver not installed correctly.	Connect the device to the PC or check the installation of the device driver (see install.txt on Setup-CD).
Could not read calibration data from device!	It was not possible to read the data stored inside the instrument.	Contact your supplier.
Could not write calibration data!		Repeat calibration process.
Wrong lamp file!	Lamp file was not readable or did not fit the requirements.	Change lamp file or ensure the correct file access.
Overexposure! Measurement failed.	The measuring object overexposed the instrument.	Reduce the measuring intensity by calibrated filters.
Could not read parameter.	The software can not read the necessary parameters from the instrument.	Contact your supplier.
Could not read file!	It was not possible to read a selected reference file.	Check the readability of the file.
Could not write file!	It was not possible to write a measured file as reference.	
Error on USB-Transfer	It was not possible to read or write data via USB	Check the USB-connection and restart the software
Laser turn off after flash	Laser intensity has low intensity	See page 34

Error message	Reason	Removal
Could not open file! File contains irradiance/ illuminance data or Could not open file! File contains radiance/ luminance data	Device not in same measuring mode as reference file.	Switch to the correct measuring mode.
No message Software freezes in after start	Conflict with a blue tooth part	See page 17 chapter Start the Software

16. CE – Declaration of Conformity

No : **P-QK/EMV 019/2009**
We :

JETI Technische Instrumente GmbH
Tatzendpromenade 2
07745 Jena
GERMANY

declare that the product series

Spectroradiometer

specbos1201

to which this declaration relates is in conformity with the requirements of following documents:

- EU Electromagnetic Compatibility (EMC) Directive (December 2004) 2004/108/EC

EU Harmonised standards:

EN 61326-1 (2006-10)

EN 55011 (2007-11) class B

EN 61000-4-2 (2001-12); EN 61000-4-3 (2008-06); EN 61000-4-4 (2005-07); EN 61000-4-6 (2008-04)

EN 61010-1

The conformity of the product with the standards and directives mentioned above, is confirmed by the CE sign.

Jena, March 2009

JETI
Technische Instrumente GmbH
Tatzendpromenade 2
07745 Jena
Tel.: 03641/225680
Fax: 03641/225681

Dr. Steffen Görlich
General Manager

17. CE – Declaration of Conformity

No : **No : 101261076/ 101261077/ 101261078**
We :

JETI Technische Instrumente GmbH
Tatzendpromenade 2
07745 Jena
GERMANY

declare that the product serie

Spectroradiometer

specbos1211

to which this declaration relates is in conformity with the requirements of following documents:

- EU Electromagnetic Compatibility (EMC) Directive (December 2004) 2004/108/EC
- Low voltage directive 2006/95/EC

EU Harmonised standards:

EN 61326-1 (2006-10)

IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-11

CISPR 11

The conformity of the product with the standards and directives mentioned above, is confirmed by the CE sign.

Jena, January 2011

JETI
Technische Instrumente GmbH
Tatzendpromenade 2
07745 Jena
Tel.: 03641/225680
Fax: 03641/225681

Dr. Steffen Görlich
General Manager

18. Certificate of Warranty

Certificate of Warranty for

Model:	Spectroradiometer
Type:	specbos1201
	specbos1211
	specbos1301
	specbos1401

JETI Technische Instrumente GmbH (referred to as JETI) hereby warrants this equipment as follows:

If any part of this unit (except as described below) fails due to poor workmanship or material (determined by JETI) within TWO (2) years from date of delivery, that part will be exchanged at no charge.

This warranty is valid only when the unit is installed and adjusted according to factory specifications and serviced by competent authorized personnel.

JETI does not assume responsibility for any of the following, all of which are excluded from the coverage of this warranty:

1. Damage due to ordinary wear and tear, abusive use, or lack of proper maintenance
2. Damage due to harsh mechanical shock, e.g. falling to the floor
3. Loss or damage due to adverse environmental conditions or acts of God
4. Loss of wages or income due to repair, replacement, malfunction or damage

Warranty becomes void if serial number is removed or defaced, or the instrument was opened by the customer.

If a defect appears which the customer feel is covered by this warranty, a written notice describing the defect must be sent to JETI's office at the current address of record.

Upon receipt of customers written report of a defect, if the defective items are covered by this warranty, JETI will repair or replace it at no charge to the customer, within 30 days after receipt of the returned unit (provided there are no labor problems or materials shortages to cause delays). The choice between repair and replacement shall be determined by JETI based on actual conditions or circumstances. JETI reserves the right to substitute new and improved equipment or

parts at any time. The obligation to replace defective parts does not require replacement of the complete unit.

NO OTHER WARRANTY EXPRESSED OR IMPLIED IS APPLICABLE TO THIS UNIT .

This warranty shall be in effect for a period of 24 months, beginning one week after the date of delivery.

19. Service

Please contact in case of any question or technical problem:

JETI Technische Instrumente GmbH
Tatzendpromenade 2
D-07745 Jena
Tel. +49 3641 225 680
Fax +49 3641 225 681
e-mail: support@jeti.com
Internet: www.jeti.com

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16 January 2013