Short Instructions

Spectroradiometer

specbos 1201/ 1301/ 1401

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1. Introduction

specbos 1x01 are easy to use spectroradiometers for various applications. Their miniaturized shape makes them suitable for laboratory and industrial use. The spectroradiometer *specbos 1201* can measure luminance/ radiance as well as illuminance/ irradiance. Furthermore colorimetric data (CCT, chromaticity, color purity, dominant wavelength, CRI) are calculated from the spectral data. Therefore it is suited for the test of light sources as CRT screens, for the measurement of room illuminance and for the measurement of the total optical power of light sources.
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 300 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 measure directly with the instruments 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 the SCPI compatible firmware commands. The command list is also available on the CD.
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 color depth recommended
- Windows XP; Vista or Windows 7, Windows 8; Excel 2000 (for data transfer)

The spectroradiometer *specbos 1201/ 1301/ 1401* packages includes:

- Basic device spectroradiometer *specbos 1201*with protection cap
- Cosine corrector head-piece
- Short 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*)

2. Installation of Hardware

Unpack the spectroradiometer *specbos 1x01* carefully and check the delivered parts.
Connect the device to an USB interface of the PC using the enclosed USB cable as shown in the following figure:

*specbos 1201*can be used with the tripod or attached to a suited base with M 4 screws. The positions of the threads you find in chapter Technical Data on page 40.

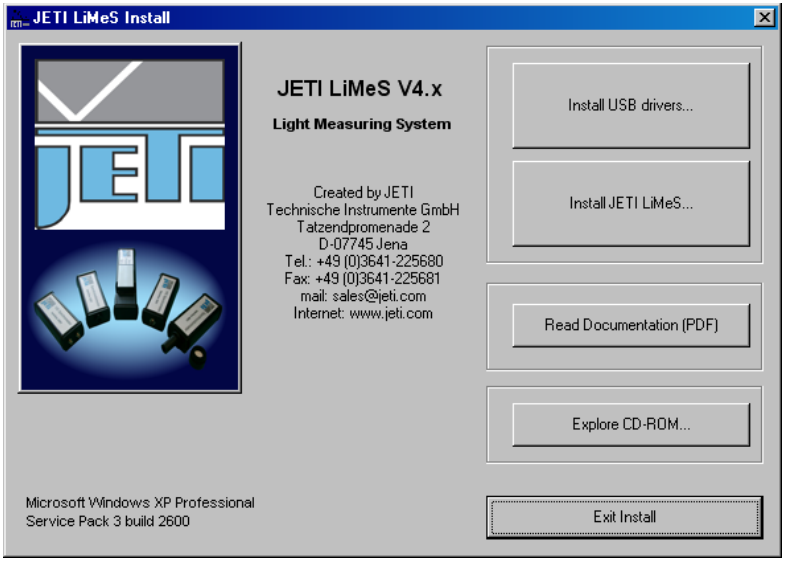
2.1. Installation of Driver Software

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

This chapter describes the installation procedure of the USB driver

2.1.1 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.

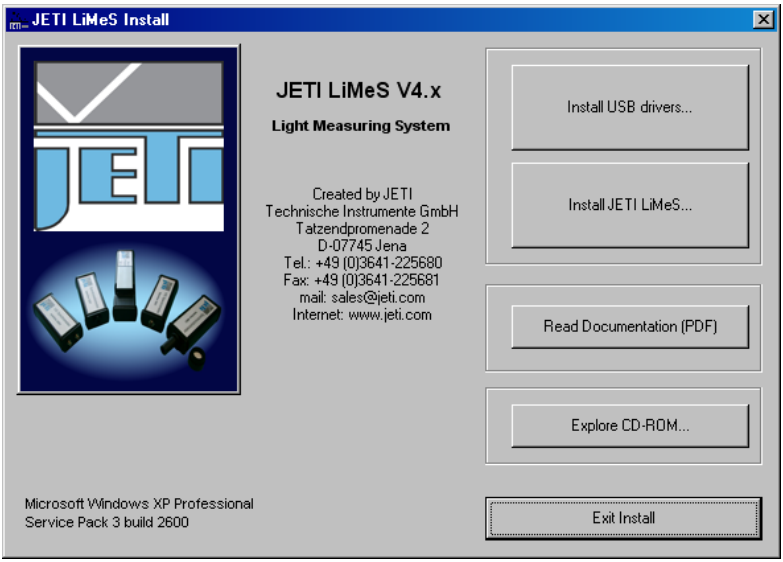


3. Click the Install USB drivers... button and follow the instructions to install the drivers.
4. If a warning window appears that the software has not passed Windows Logo testing, press Continue Anyway.
5. After finishing connect your device to an USB-port.
6. A ‘New Hardware found’ wizard should appear. 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.

2.1.2 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.

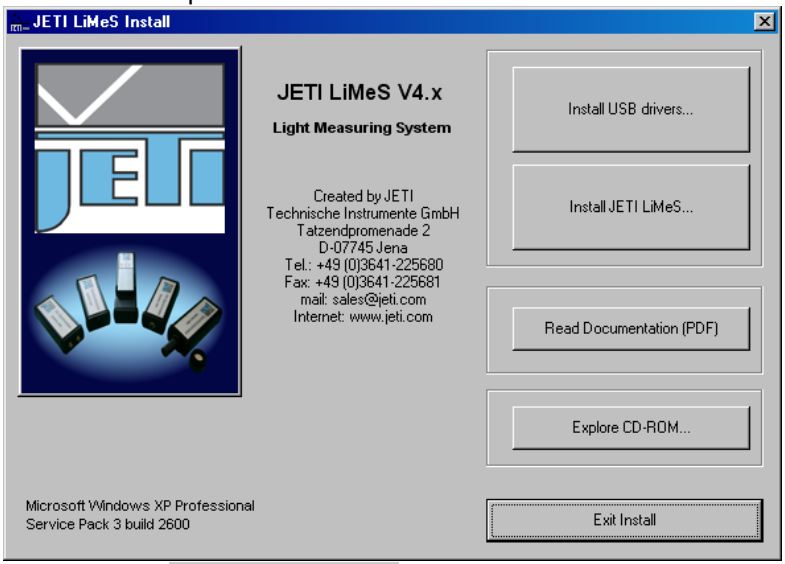
2.2. PC- Software

2.2.1 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.

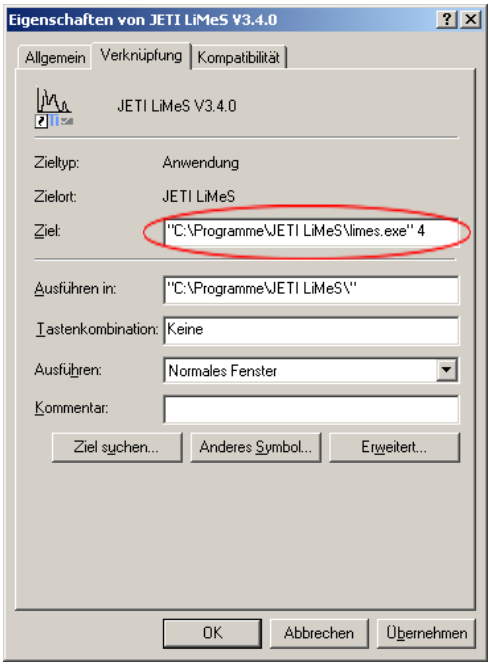


- Click the Install JETILiMeS... and follow the instructions to install the program.

3. Start the Software

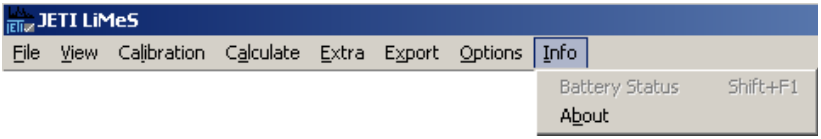
- Start Windows and then activate the Start menu
- Select JETI LiMeS under Programs

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:

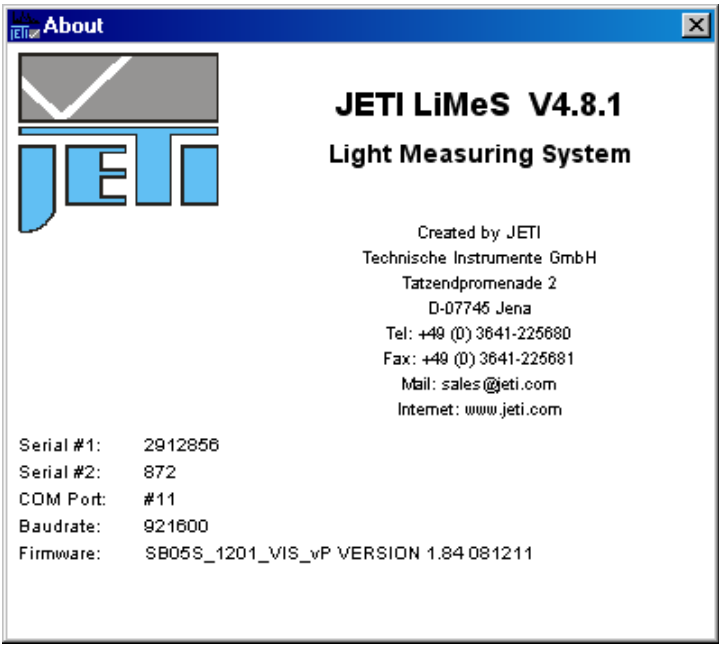


Type the number of the COM port to use after the filename of the executable in the 'Target' box (4 for COM4 in this example). Use a space sign between the filename and the COM port number.
If no device could be found on the specified port the software asks to perform an automatic scan.
In case of an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

About



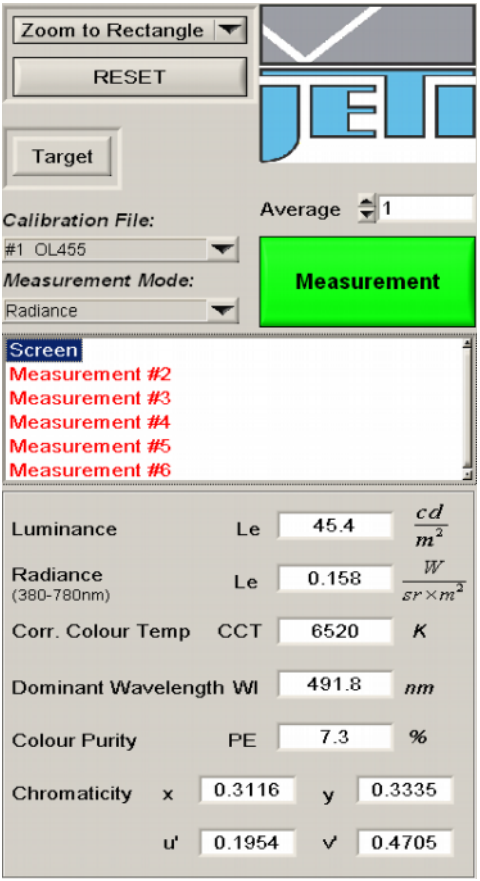
Click Info/About! shows the following window with the software version, the serial numbers, the used COM port, the baudrate and the firmware version.



Press x to close the window.

4. Measurement

4.1. Procedure

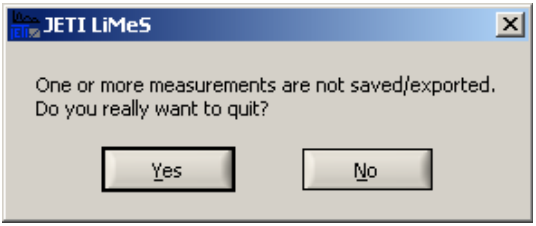


The measurement procedure consists of a first spectra acquisition with a fixed integration time, a subsequent calculation of the best integration time for a well-driven spectrum, a second measurement with this time and a final dark spectrum measurement. In some cases more adaptation steps are necessary. 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.

4.1.1 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.

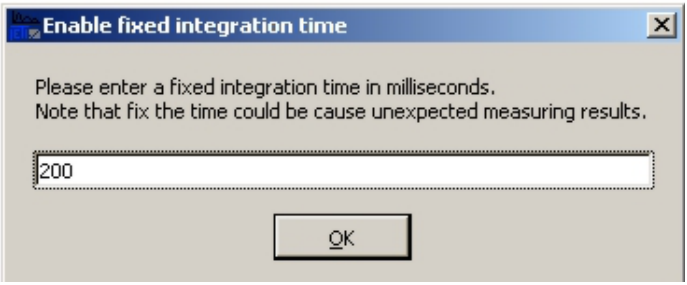
5. Software Settings

5.1. Measurement Settings

5.1.1 Integration Time

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

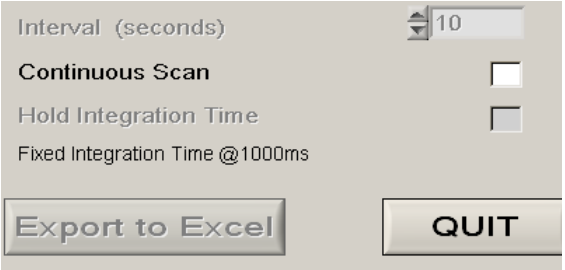
It is possible to hold an once determined integration time for further measurements. This is mainly interesting in case of measuring objects with similar intensity. Simply click the box Hold Integration Time. There will shown a warning if over and underexposure occurs (Couldn't hold integration time).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

5.1.2 Continuous measurement

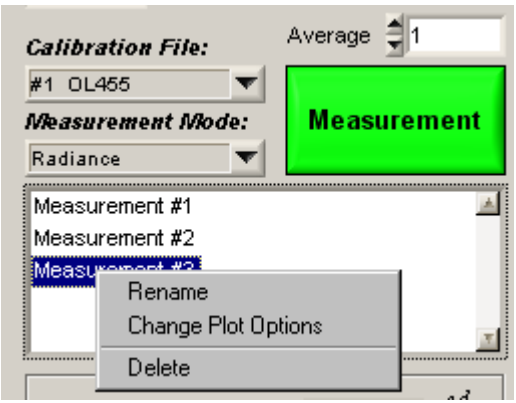
If you want to measure continuously you have two options. If you select Continuous Scan and the interval [s] the measurement procedure is like described in chapter 4.1.
If you select Hold Integration Time and Continuous Scan the measurement is without adaption. Normally the integration time at start 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).

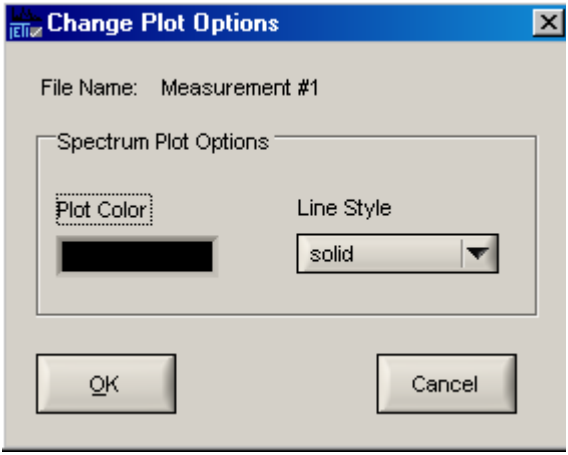
5.1.3 Change measurement name

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

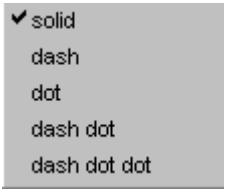


- Make a right mouse click on the desired measurement name in the legend to open a panel

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



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

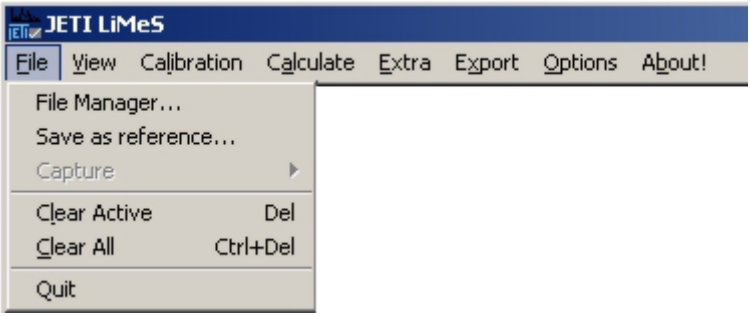


- Delete deletes the measurement
- Pressing the DEL key also deletes the actual or marked measurement

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

5.1.4 Delete Measurements

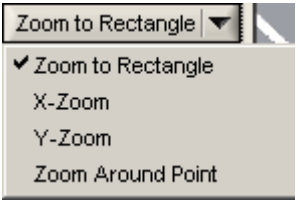
The active measurement or all measured data can be deleted under the menu point File.
A single measurement can also be deleted with the DEL key after selecting it in the legend with a left mouse click. It is also possible to delete a number of measurements using the CTRL or SHIFT keys in the usual manner.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



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

5.2. Display Settings

5.2.1 Zoom



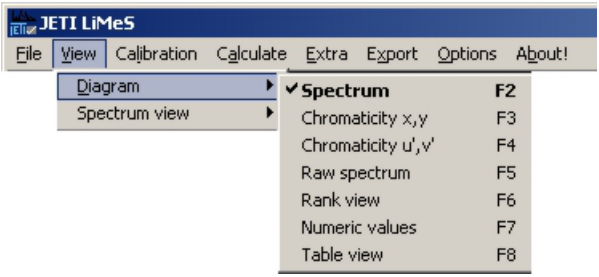
Diagrams can be zoomed with the cursor by pressing CTRL. The kind of zoom can be selected in the pop up menu left to the JETI logo. X-Zoom and Z-Zoom is only valid for the spectrum diagram.
Zoom out by pressing RESET below the Zoom pop up menu.
The start and the end of the displayed spectrum can alternatively 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.

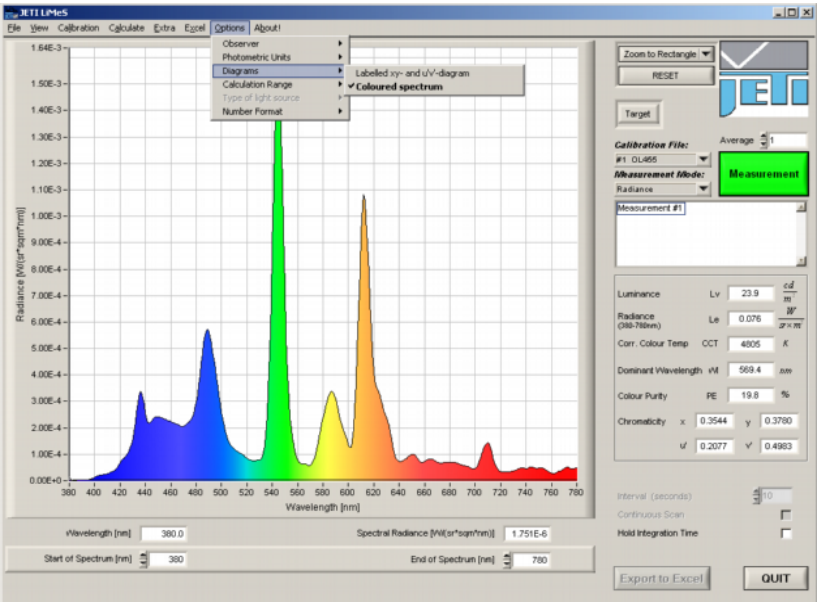
5.2.2 Diagram Options

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.



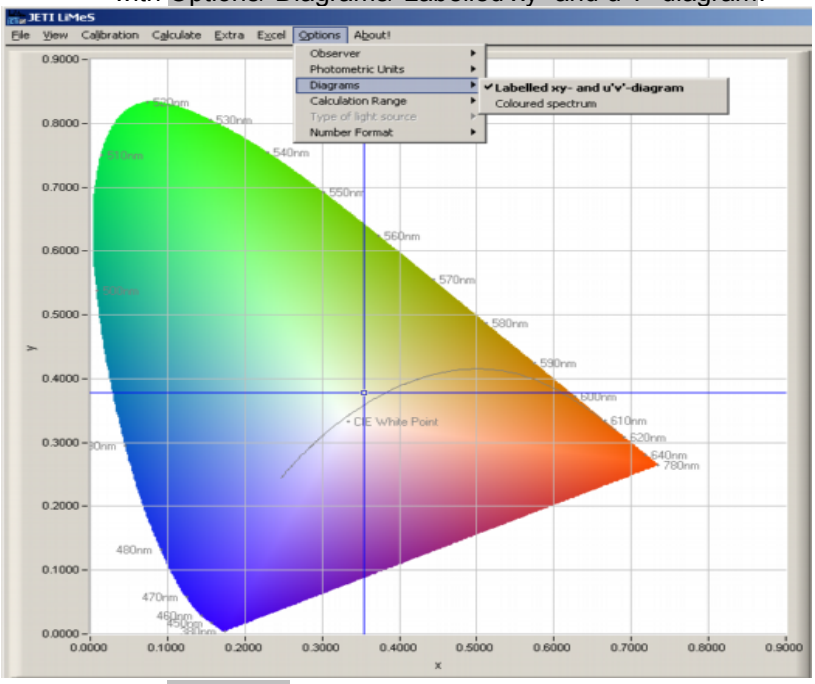
- The menu item View/ Diagram/ Raw spectrum allows to display the raw data of the spectrograph. This can be useful sometimes, e.g. if the general characteristics of the measured spectrum outside the calibrated range is of interest. The raw spectrum is the basis for all radiometric calculations.



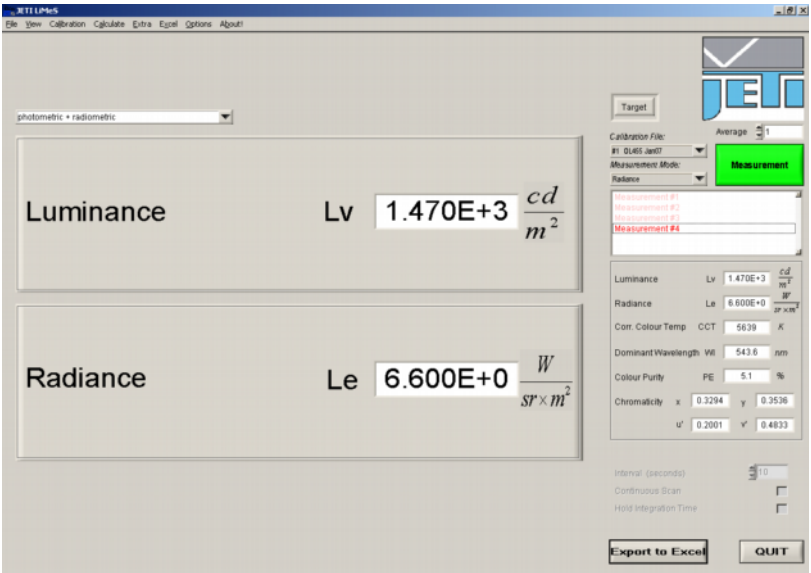
- The colour coordinate diagrams contain the Planckian curvature for orientation. The actual measuring values will be indicated in the diagrams.

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

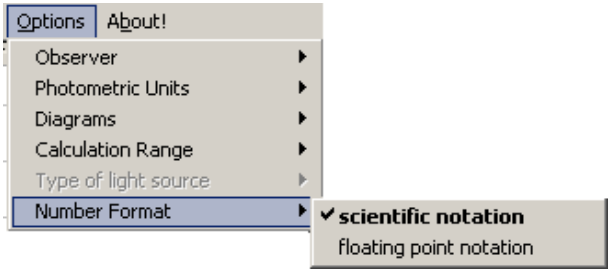
- It is possible to switch on and off the dominant wavelength scale at the curved border of both colourimetric diagrams with Options/ Diagrams/ Labelled xy- and u´v´-diagram.



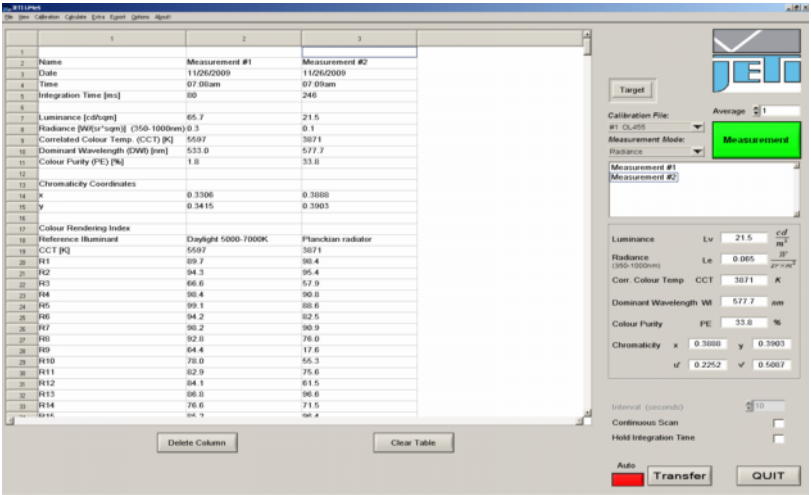
- The Rank view shows the result of the classification after defining and enabling it in the Extra/ Rank… menu point. (Chapter Fehler: Referenz nicht gefunden)
- Numeric values switches to a large display mode of selected values. The kind of data can be selected in the pop up menu above the values.



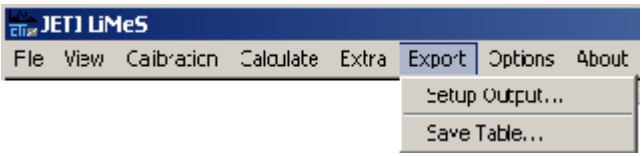
The number format for luminance/ radiance, illuminance / irradiance, luminous/ radiant flux (with specbos 13x1) and luminous/ radiant intensity (with specbos 1401) can be change between scientific and floating point notation.



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.

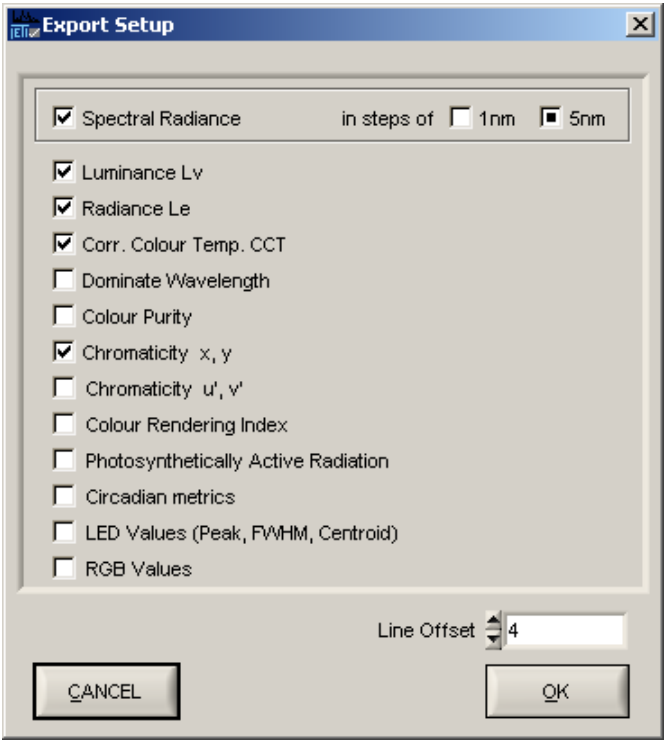


- Select Export/ Setup Output and choose the desired data to be transferred into the table.



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.

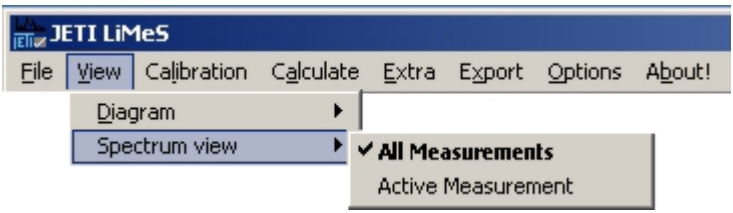
The cells of the first lines can be edited. The number of these lines has to be selected in the “Line Offset” setting.
See chapter Shortcut Keys for shortcut keys to switch between different display modi.

5.2.3 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.

5.2.4 Screen Mode

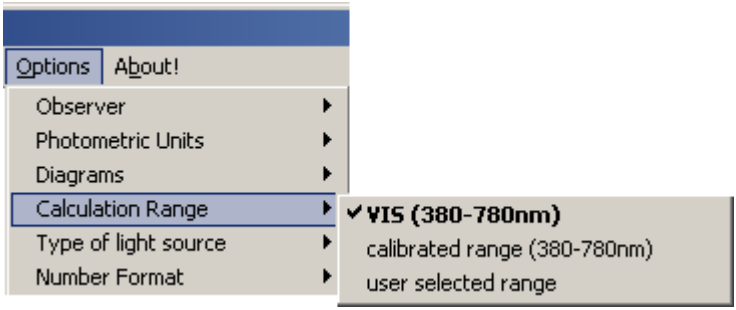
There are different spectrum display options that can be selected under the View menu:



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

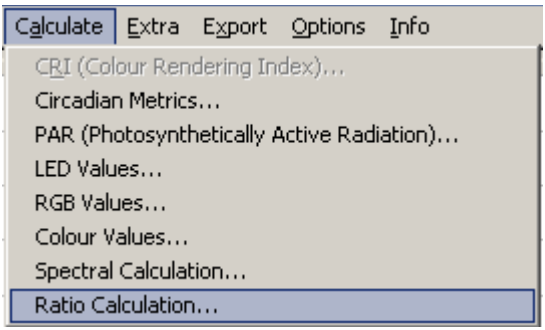
5.2.5 Calculation Range

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).



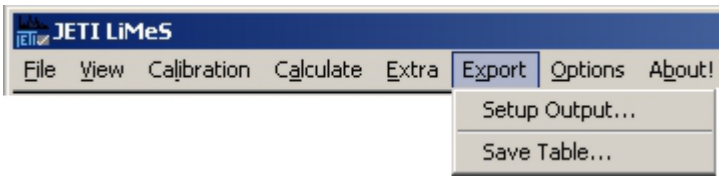
See chapter Spectra Calculations how to change the wavelength range.

5.3. Special Calculations



5.4. 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).

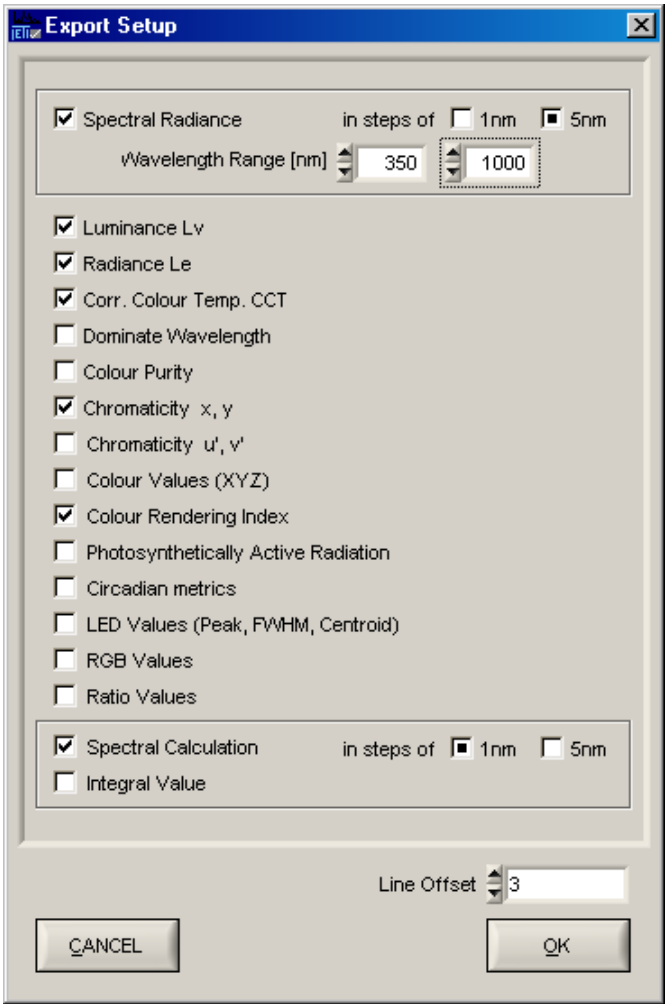


Remark: Excel installation isn't necessary.

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.

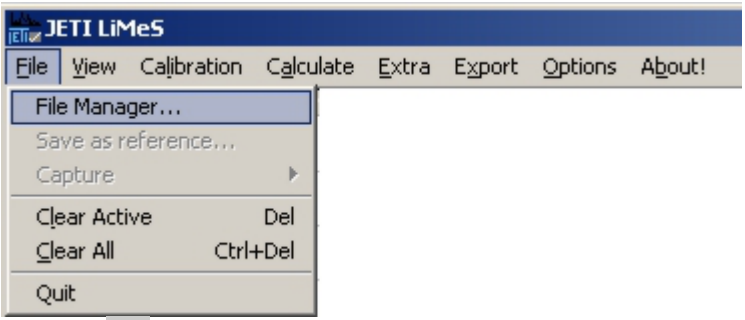


Use Export/ Save Table, select the file name, format and storage location of the file and press OK.

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.

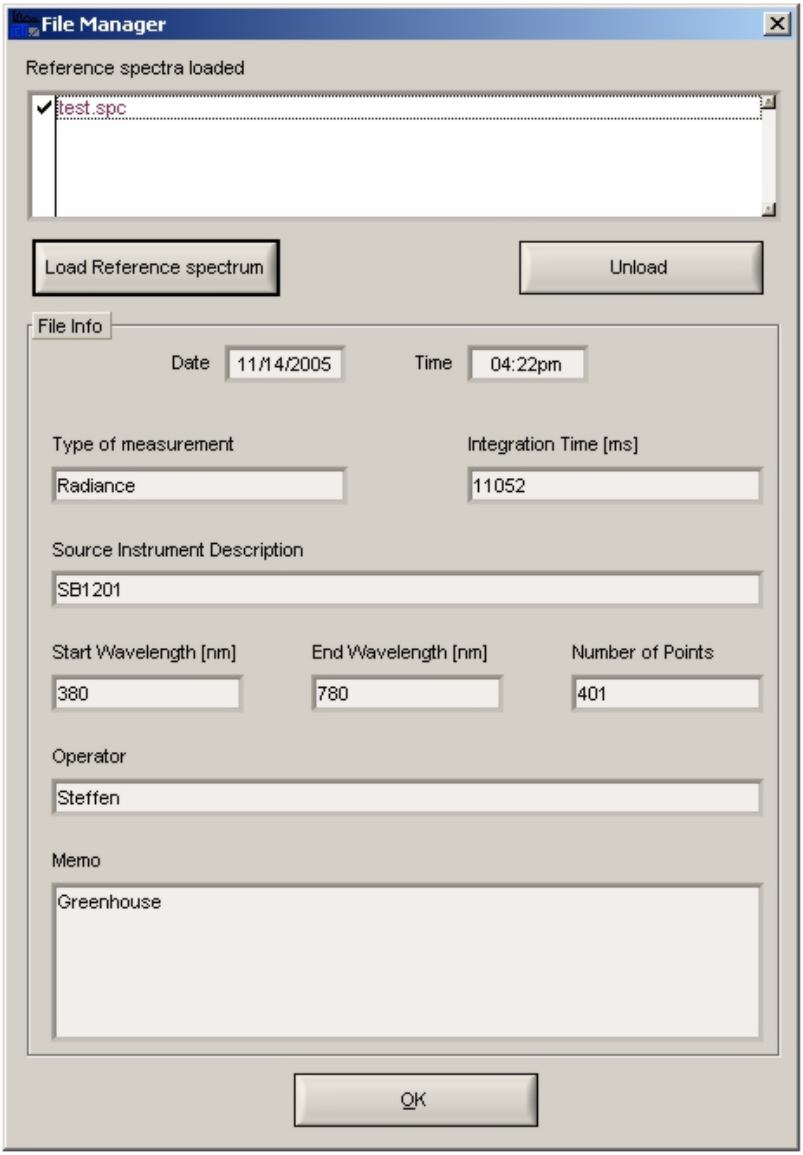
5.5. Store as Reference



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

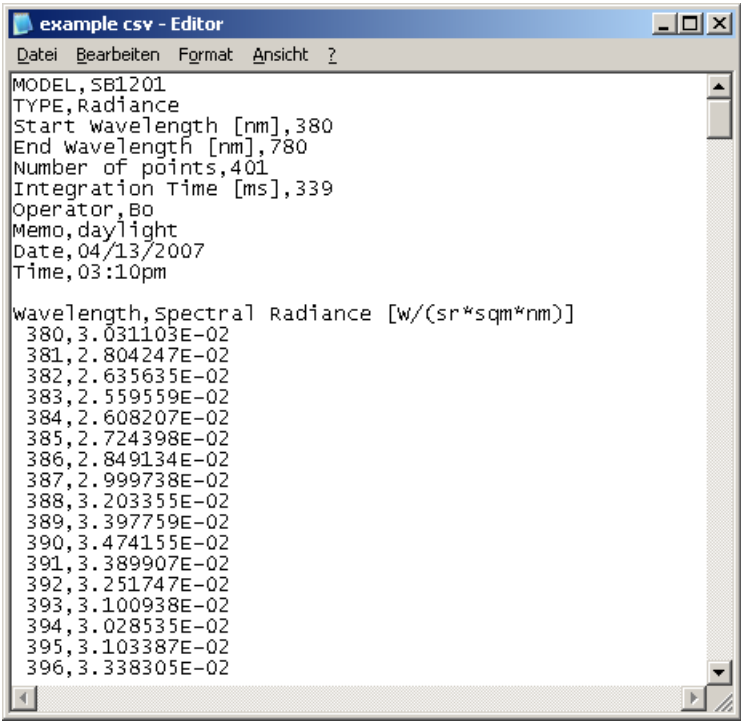
displayed below the file list. Click into the column left of the file name to mark the desired spectra.
The plot options of each reference file can be changed by double click on the file name in the list. Then close the window. Now all marked spectra are shown in the diagram. If you click on a spectrum 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.

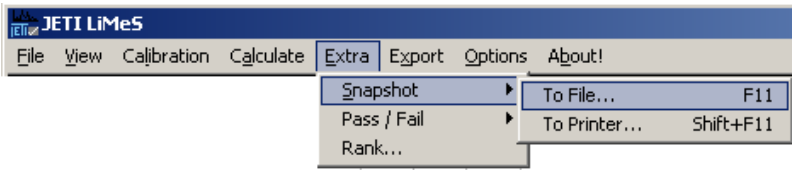



```
MODEL,SB1201
TYPE,Radiance
Start Wavelength [nm],380
End Wavelength [nm],780
Number of points,401
Integration Time [ms],339
Operator,Bo
Memo,daylight
Date,04/13/2007
Time,03:10pm

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
```

5.6. 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.

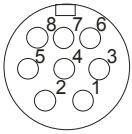
6. Shortcut Keys

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)

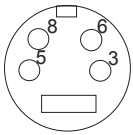
7. Trigger Functions

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.

8. 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 *12*) 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

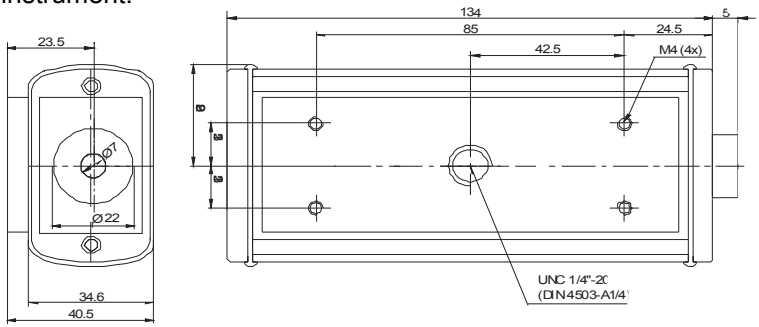
9. Technical Data

Applications	Measurement of diffuse light sources, screens etc., of room illuminance and of lamps
Spectral range	380 ... 780 nm
Spectral resolution (Rayleigh)	5 nm (specbos 1x01)
Wavelength accuracy	± 0.5 nm
Digital spectral resolution	2 nm (specbos 1x01)
Digital electronic resolution	16 bit A/D (15 bit used, 14 bit displayed)
Measuring values	Spectral radiance/ spectral irradiance (radiant flux with specbos 1301/ 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 Color Temperature Dominant wavelength, color purity Color Rendering Index Circadian metrics Photosynthetically Active Radiation
Measuring range luminance	2 ... 70 000 cd/m^2
Measuring range illuminance	20 … 50 000 lx
Measuring range luminous intensity	
specbos 1401	cond. A 100 mcd … 300 cd
	cond. B 30 mcd … 100 cd
Measuring range luminous flux	
specbos 1301	50 mm sphere 30 mlm … 250 lm 150 mm sphere 100 mlm … 800 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 % (@ illum. A)
Reproducibility of photometric value	
	± 2 %
Color chromaticity accuracy	± 0.002 x, y (@ illum. A)

Color reproducibility	± 0.0005 x, y
CCT reproducibility	± 20 K (@ illum. A)
Integration time range	5 ms ... 60 s
Dispersive element	Diffraction grating
Light receiving element	256 pixel (128 pixel specbos1x01 M) photodiode 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)
Weight	300 g (basic unit)
Pilot laser	Laser class 1, λ= 645 … 660nm (classific. accord. to EN60825-1/Oct. 2003)

Mechanical Fixing

specbos 1201 can be used with the tripod or attached to a suited base with M 4 screws. The following drawing shows the positions of the threads downside the devices and some general dimensions of the instrument.



Attach *specbos 1301* with the delivered UNC screw to the integrating sphere. The UNC screw is fixed on the angle of the integrating sphere.
Attach *specbos 1401* with the delivered UNC screw to the tube. The UNC screw is fixed in the base plate of the tube. Insert the tube extension if you want to measure in CIE standard condition A mode.

10. 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

11. Certificate of Warranty

Certificate of Warranty for

Model: Spectroradiometer

Type: specbos 1201
specbos 1301
specbos 1401

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.

12. 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

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