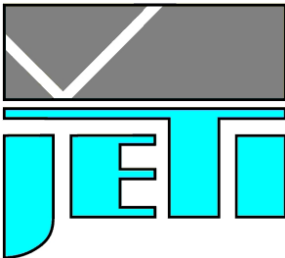


Spectroradiometer

specbos 1200

Software version: 4.x



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1. Introduction

specbos 1200 are easy to use spectroradiometer for various applications. Their miniaturized shape makes them suitable for laboratory as well as industrial use. The spectroradiometers *specbos* can measure luminance/ radiance, illuminance/ irradiance and luminous/ radiant flux. Furthermore colorimetric data (CCT, chromaticity, color 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 rooms illuminance and for the measurement of the total optical power of light sources.

The adjustment on the target in case of luminance/ radiance measurements will be proceeded with a pilot laser which is built in. The correction for irradiance measurements will be done with a cosine corrector head-piece. *Specbos 1200* detects the attached corrector automatically. Measurement of radiant flux can be done with a customer specific integrating sphere.

Acquisition and analysis of data are done by the PC software *JETI specbos radiometric*. The connection to the PC is via a USB interface.

PC requirements:

- Pentium II / AMD K6-2 400 MHz or higher, min 32 MB RAM
- graphic resolution: 800*600, 16 bit color depth recommended
- Windows 2000, XP; Excel 97 or higher (for data transfer)

The Spectroradiometer *specbos* package includes:

- Basic device *specbos 1200* with protection cap
- Cosine corrector head-piece
- Operating instructions
- Tripod
- Transport box
- CD-ROM with the calibration file, software *JETI specbos radiometric* and driver
- USB cable

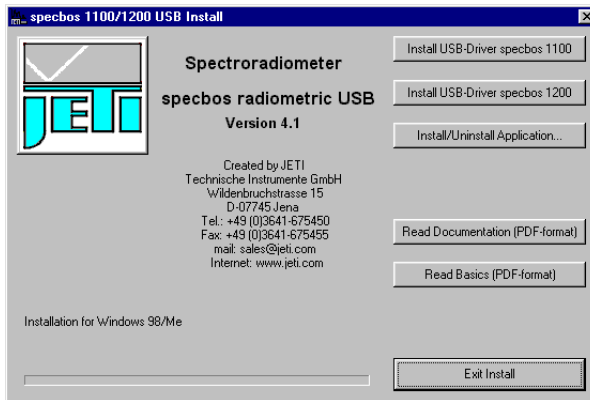
2. Installation of Software

Execute the following steps on the PC to install the software *specbos radiometric*:

- Start Windows 2000/ XP
- Insert the CD in the CD-ROM drive

Do not connect the instrument to the PC before!

- The following window appears, if the autostart function of Windows is activated. Otherwise click on install.exe in the Install folder of the CD ROM.

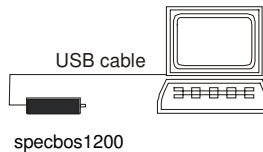


- If the correct driver wasn't installed before: install it using the **Install USB-Driver** button for the concerned instrument
- Click on the **Install/Uninstall Application** button and follow the instructions for the program installation, connect the instrument during procedure when requested (see 3.)

3. Installation of Hardware

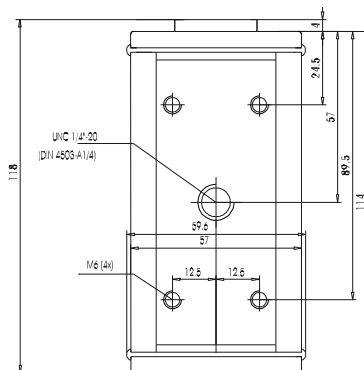
Unpack the spectroradiometer *specbos* carefully and check the delivered parts.

Connect the device to an USB interface of the PC using the enclosed USB cable as shown in the following figure.



It may be necessary to install or to update the driver for the USB instrument (see 2.).

The device can be used with the tripod or attached to a suited base with M 4 screws. The following drawings show the positions of the threads downside the devices.



Attention: Do not look inside the laser beam or direct the laser head-piece to another person!

The adjustment of *specbos1200* will be described on page 12.

The cosine corrector head-piece will be attached to the measuring head before illuminance/ irradiance measurements. It will be turned until it is correctly positioned. *specbos1200* detects the attached corrector cap automatically.

4. Operation of Program

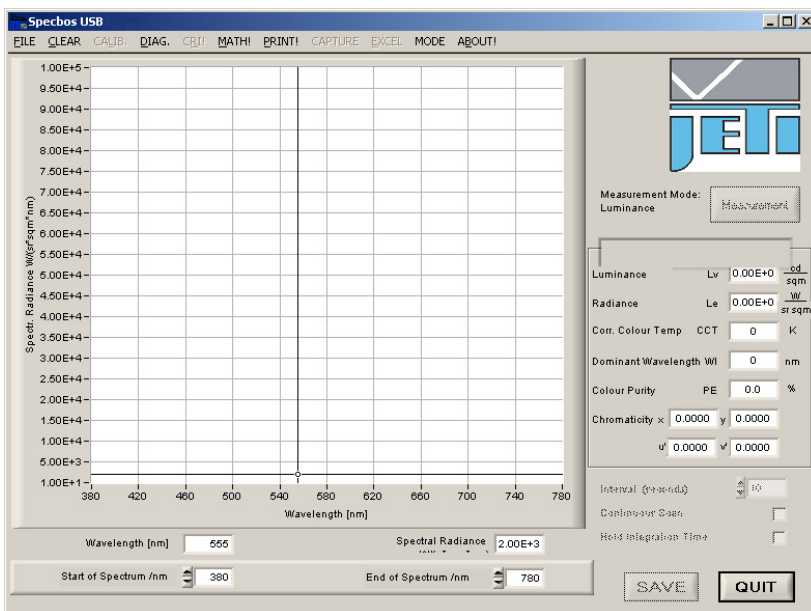
Starting the Program

- Start Windows and then activate the **Start** menu
- Select **specbos radiometric USB** under **Programs**

The software will automatically find the device after starting the program, if the spectroradiometer *specbos* is connected to the PC with USB cable.

In case of an error, this error will be displayed (see Chap. 5 Error Messages).

Main Panel



The main panel will be displayed on start-up. It consists of the following parts:

- Menu bar
- Diagram (display of measured spectrum or $xy/ u'v'$ diagram)
- Button for the triggering of measurements

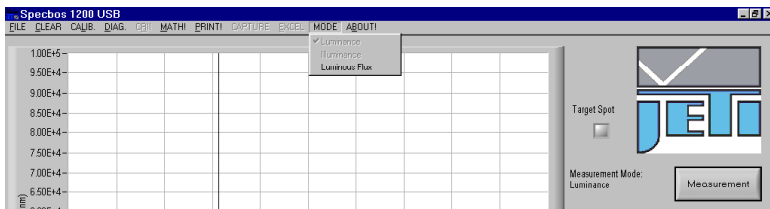
- Display of measuring results (luminance L_v and radiance L_e or illuminance E_v and irradiance E_e , or luminous flux P_v and radiant flux P_e , chromaticity x,y and u',v' , color temperature CCT, dominant wavelength Wl and color purity PE)
- Snap-to-Point cursor with display of values
- Integration time and maximum counts (switch on and off with F12)
- Start and end wavelength and zooming possibility
- Save (Excel storage) and Quit buttons

Measurement

The first step of measurement is to select between the modes luminance, illuminance and luminous flux.

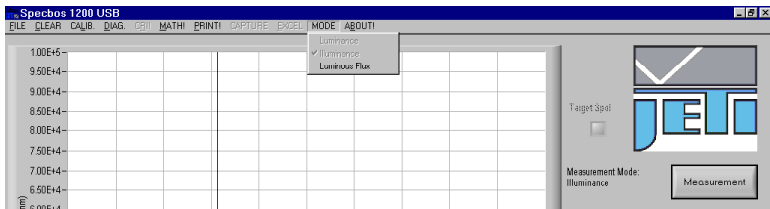
Click the button **MODE** and select the desired mode.

Screen shot *specbos 1200* luminance



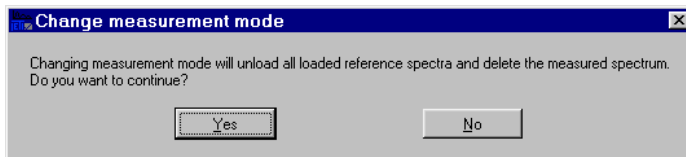
In this mode of *specbos 1200* appears a **target spot** button, which allows to switch on/off the internal pilot laser. Adjust the instrument that the laser ring is placed on the desired measuring area.

Attention: Do not look inside the laser beam or direct the laser to another person!

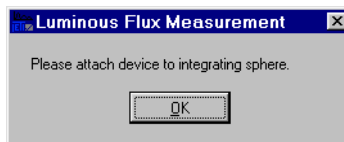
Screen shot *specbos 1200* illuminance

The cosine corrector is attached to the device.

The following window will appear if you have loaded reference spectra or measured before in another mode.



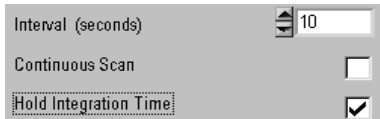
If you have selected the luminous flux mode to attach the device to the integrating sphere.



Clicking the button **MEASUREMENT** will proceed the measurement. 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 signal spectrum. In some cases more adaption steps are necessary. You will be informed about the status of the measurement (Adaption to exposure, Performing measurement) and about the remaining time. Finally the measured values will be displayed below the button. The maximum integration time is 60 s, therefore the maximum measuring time for low intensity sources is approx. 120 s (max. integration time + max. dark measuring time).

Hold Integration Time

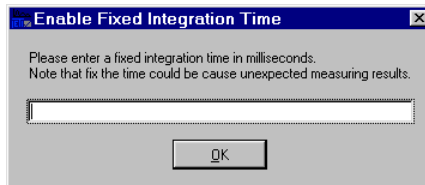
It is possible to hold an once determined integration time for further measurements. This is mainly interesting in case of measuring objects with similar intensity. Simply click the box **Hold integration time**. It will be warned if over and underexposure occurs (Couldn't hold integration time). Then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



A started measurement can be interrupted by pressing the ESC key.

Fix Integration Time

If you want to use a fixed integration time for the measurement instead of the automatic determined one press **CTRL T**. Afterwards write the time (in ms) into the appearing window.



Following measurements will use this integration time without any adaption.

Deactivate the fix integration time function by pressing **CTRL T** again.

Attention! There is no warning in case of over or under exposure.

Snap-to-Point Cursor

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

Continuous Measurement

If you want to measure continuously you have to select **Hold integration time** and **Continuous Scan** or the fixed integration time mode. Afterwards type in the desired time interval (time between end of a measurement and start of the next one, maximum 65 535 s = approx. 18 h). Then start the measurement series by clicking the Measurement button. Unselecting **Continuous Scan** stops the measuring series. A bar indicating the time remaining till the next measurement will appear on bottom of the screen.

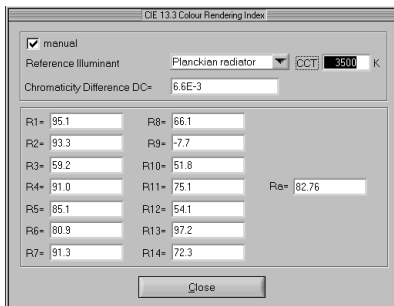
If you want to store the results start a link to Excel before beginning the measurement (see: Data transfer to MS Excel). The values will be stored in rows, maximum three tables with 768 rows are possible.

Remark: The **Save continuously** check box in the Excel box has to be selected for continuous data transfer.

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 an equal measuring frequency you have to use the Fix integration time option.

Color Rendering Index (CRI)

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



Simply click on the **CRI!** point in the menu bar after a measurement and a window which can be seen above will be opened.

The General Colour Rendering Index R_a as well as the Special Indices $R_1 \dots R_{14}$ 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 color 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.

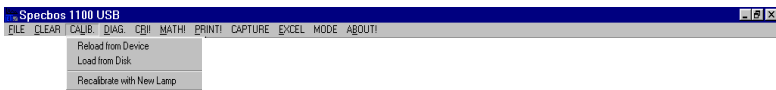
Remark: If the CCT of a light source cannot be calculated, because the chromaticity location is too far from the Planckian curvature, then the Color Rendering Index calculation is also not possible.

It is also possible to choose the reference illuminant manually by clicking the appropriate box. Then another CCT than the measured one can be used. If the manual option was chosen, successive measurements will use the selected value of CCT. If DC is greater than $5.4 \cdot 10^{-3}$ the resulting Color Rendering Indices may be expected to become less accurate.

Calibration

The spectroradiometer *specbos* will be delivered calibrated. The calibration data are stored inside the device. Furthermore the intensity calibration file can be found on the disk. The calibration file contains the spectral sensitivity data of the instrument from 380 ... 780 nm in steps of 5 nm, separated for radiance, irradiance (and radiant flux) mode.

The following figure shows the possibilities for the calibration management under the menu point **CALIB**:



Reload from device:

The reloading can be done in case of any problems with the automatic upload of the calibration data during program start.

Load from disk:

The calibration data can be loaded from disk. The file has the extension *.cal*.

Attention! The loaded files will not be written into the instrument!

Recalibrate with New Lamp:

It is necessary to have a calibration lamp and to know the spectral radiance of this lamp, the spectral irradiance in the plane of the diffuser of the instrument and/ or the spectral radiant flux in the adapted integrating sphere.

All lamp files have to list the spectral values (step width: 5 nm, range: 380 to 780 nm, unit: **mW/(sr·m²·nm)** for luminance mode, **mW/(m²·nm)** for illuminance mode and **mW/nm** for luminous flux mode) in **decimal or scientific** format:

```
29.54361
34.167968
39.105913
44.745458
50.61276
56.902684
64.150922
71.967095
..
```

There have to be 81 values in each file. The file extensions have to be *.Imp*.

After choosing of **Recalibrate with New Lamp** you have to select between radiance, irradiance and radiant flux calibration. Be sure that the diffusor cap is removed in case of radiance and attached in case of irradiance calibration (*specbos 1100*) and the instrument is attached to the integrating sphere for radiant flux calibration! Afterwards load the appropriate lamp file.

Remark: All three calibrations can be done independently.

Afterwards 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, which is password protected. Ask your supplier for details. Then you can repeat the same procedure for the other mode.

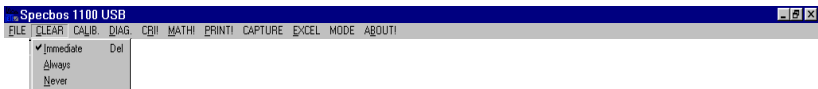
The new calibration data for all three modes are stored in a file with the extension *.cal* on disk as well as directly inside the instrument. If you start the program again, this new calibration file will be used automatically. If you want to use another file, proceed the step **Load from Disk**.

If the calibration ends with an error message („data file corrupted“) calibrate again.

Set Up

Screen Update Mode

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



IMMEDIATE

The acquired spectra will be deleted at once (**actuation of the DEL key also deletes the current spectrum display!**) Afterwards the software switches to the **NEVER** mode.

ALWAYS

The acquired spectra will be deleted before every measurement. Only the most recent acquisition will be displayed.

NEVER The measured spectra will not be deleted. Further measuring curves are displayed one on top of the other (default setting).

Zooming of wavelength

The start and the end of the displayed spectrum can 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 input using the keyboard number pad. The maximum interval is between 380 nm and 780 nm. For measurements always the full spectral range of the device is used.

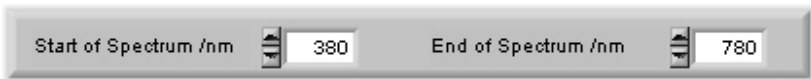


Diagram Options



Selecting **DIAG** in the menu bar opens a window, where the display of the spectral radiance/ irradiance/ radiant flux or the xy and u'v' diagrams can be chosen.

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

The following zooming options are possible in both diagrams:

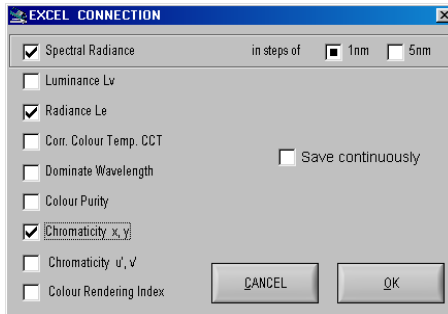
- Zoom in: **CTRL + left mouse key** (the position of the cursor will be the new center)
- Zoom out: **CTRL + right mouse key** (the position of the cursor will be the new center)
- Shift diagram: **CTRL + Shift + left mouse key** – now move the diagram with the mouse
- Back: **CTRL + Space** (one step back)
Home (back to starting diagram)

Print Screen

The print of the actual screen on a connected printer is possible by **PRINT!**. If no printer is connected the action is ignored without an error message.

Data Transfer to MS EXCEL

- Select the desired measuring mode (luminance/ illuminance/ luminous flux)
- Select the sub menu item **START EXCEL** in menu **EXCEL**
- After a successful start of MS EXCEL the dialogue box **EXCEL CONNECTION** appears. Here the data to be exported have to be selected.



Remark: The boxes Spectral Radiance/ Spectral Irradiance/ Spectral Radiant Flux, Luminance/ Illuminance/ Luminous Flux and Radiance/ Irradiance/ Radiant Flux appear in dependence from the previously selected mode. Select the desired step width (1 or 5 nm), if these data shall be transferred.

- In case of selection of spectral radiance/ irradiance the user has to click on the desired wavelength step width for the transfer (1 or 5 nm). The **Save continuously** option offers the possibility to save all further measurements automatically.
- After activation of the **OK** button a window appears, which confirms the activation of the link to Excel.
- Clicking the OK button will close the window. The **SAVE-**Button is now activated and can be used to store the actual

and any further measured spectrum. The name/ a description of the actual measured data set can be filled in into the appearing window, it will be used as column header in the EXCEL-spreadsheet. Furthermore it is possible to store loaded reference and calculated spectra. Click on the desired spectrum and afterwards on the **SAVE**-Button.

Remark: If you change the measuring mode (luminance/ illuminance/ luminous flux) when an Excel sheet is opened, you are asked to close this sheet.

The connection to MS EXCEL will be finished and the data will be stored (*.XLS) by selection of the sub menu item **END EXCEL** in menu **EXCEL**.

Important: It is necessary to end the link to MS EXCEL in this manner by **END EXCEL** and not from MS EXCEL by a closing operation.

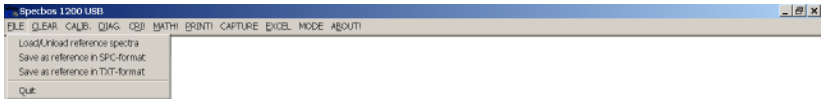
Data Transfer to a Text File (CAPTURE)

- Select the sub menu item **START CAPTURE** in the menu **CAPTURE**
- Type in a file name for the measurement series, the extension is *.dat*.
- After activation of the **OK** button the calculated values of the actual and all following measurements are written into this file according to the following scheme (on the next page):

No.	Luminance [cd/sqm]	Radiance [W/(sr*sqm)]	x	y	u'	v'	CCT [Kelvin]	PE %	D. Wavelength [nm]
1	2.895e+04	2.067e+02	0.4780	0.4155	0.2720	0.5319	2505	68	585
2	2.904e+04	2.073e+02	0.4779	0.4155	0.2719	0.5319	2506	68	585
3	2.904e+04	2.073e+02	0.4779	0.4155	0.2719	0.5319	2506	68	585
4	2.905e+04	2.074e+02	0.4778	0.4154	0.2719	0.5319	2507	68	585
5	2.906e+04	2.074e+02	0.4778	0.4154	0.2719	0.5319	2507	68	585
6	6.347e+01	2.590e-01	0.3060	0.3227	0.1955	0.4639	6938	10	486
7	6.907e+01	2.833e-01	0.3079	0.3249	0.1960	0.4654	6803	9	487
8	3.496e+01	1.506e-01	0.3225	0.3436	0.1991	0.4774	5944	3	505

- Capturing will be finished by selecting **End Capture**.

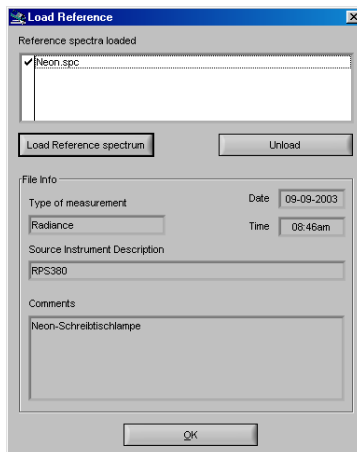
Reference Spectrum Management



The point **File** in the menu bar allows to store measured spectra as a reference for further measurements. There can be used two formats – text file (file extension `.txt`) or the Galactic SPC file format (GRAMS compatible, file extension `.spc`).

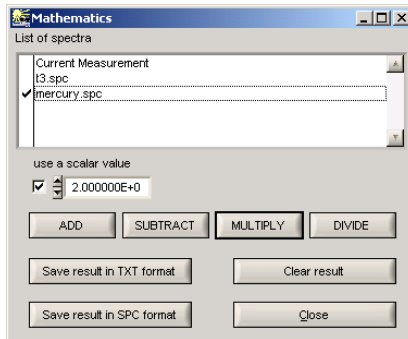
A spectrum can be stored by clicking **File/ Save as reference in SPC-format** or **File/ Save as reference in TXT-format**. First type in the name of the file. Afterwards user comments can be written into the following window.

If a reference spectrum stored earlier shall be displayed, click **File/ Load/Unload reference spectra** (see below). Up to five reference 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. 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.



Mathematical Operations

The menu point **MATH!** in the main menu allows to proceed the mathematical operations +, -, x and ÷ with the actual measured spectrum as well as with stored references. Furthermore it is possible to use a scalar factor for the operations with one spectrum.



The **MATH!** Window shows a list with the actual spectrum (current measurement) and all selected reference spectra. Click on two desired spectra and on the button for the mathematical operation. If a scalar operand is used, only one spectrum and the scalar value have to be marked. In case of subtraction and division the order of operands has to be selected. Afterwards the calculated spectrum is shown in the diagram area.

The result can be stored by clicking **Save result in TXT format** or **Save result in SPC format**. After closing the **MATH!** window the calculated spectrum will be displayed. If it is clicked on the calculated spectrum the measuring values will be updated. This is only done if the calculation from the spectrum is reasonable. The calculated spectrum can be deleted by pressing the **Clear result** button in the **MATH!** window.

Finishing the Program

The program can be finished by selecting the **Quit** Button or by typing **Alt-Q** on the keyboard. The finally used measuring mode (luminance, illuminance or luminous flux) will be stored and used for next start of program.

5. Maintenance and Error Messages

The instrument needs no permanent care, if you use it carefully. It is recommended to recalibrate it every year. Ask your dealer or the producer (see 8. chapter) for details.

Error message	Reason	Removal
No specbos 1200 USB 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.	Temporarily: Use the file from disk. Afterwards contact your supplier.
Could not write calibration data!		Repeat calibration process.
Calibration file empty.	No valid calibration file loaded.	Load the right calibration file with Calib./ Load from disk
Could not read lamp file, process denied!	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

6. Technical Data

Applications	Measurement of diffuse light sources, screens etc., of room illuminance and of lamps
Spectral range	380 ... 780 nm
Spectral resolution (Rayleigh)	9 nm
Wavelength accuracy	$\pm 0,5$ nm
Digital spectral resolution	4.1 nm
Digital electronic resolution	14 bit A/D
Viewing angle	1,5 °
Measuring distance/ diameter	20 cm - \varnothing 5 mm; 100 cm - \varnothing 26 mm
Measuring values	Spectral radiance/ irradiance/ (radiant flux only with Integrating sphere) Integral luminance/ integral radiance/ integral illuminance/ integral irradiance/ (integral luminous flux/ integral radiant flux) Chromaticity x,y; u',v' Correlated Color Temperature Dominant wavelength, color purity Color Rendering Index
Measuring range luminance	2 ... $7 \cdot 10^4$ cd/m ²
Measuring range illuminance	20 ... 50 000 lx
Measuring range luminous flux	depending from sphere
Luminance accuracy	± 5 % (@ illum. A)
Luminance reproducibility	± 2 %
Color chromaticity accuracy	± 0.002 x, y (@ illum. A)
Color reproducibility	± 0.0005 x, y
CCT reproducibility	± 20 K (@ illum. A)
Illuminance accuracy	± 5 % (@ illum. A)
Luminous flux accuracy	depending from integrating sphere
Integration time range	5 ms ... 60 s

Dispersive element	Diffraction grating
Light receiving element	128 pixel photodiode array
Operating cond.	Temperature 10 ... 40 °C
Humidity	< 85 % relative humidity at 35 °C
Power supply	USB version: Hub powered
PC interface	USB1.1 fullspeed (12Mbit/sec)
Dimensions	150 mm x 58 mm x 34 mm
Weight	300 g
Pilot laser	Laser class 3R P_0 < 5mW λ 650 ... 670nm

7. CE Declaration

The devices agree with the regulations of the instruction 89/336/EEC for electromagnetic compatibility and the low voltage instruction 73/23/EEC for product security.

EN 55011

EN 60555-2

EN 61010-1

8. Service

In case of any questions or technical problems please contact:

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