
Operation Manual

Thorlabs SPx-USB

USB 2.0 Fiber Optical Spectrometer



2008

THORLABS

Version: 1.0
Date: 08. Feb. 2008

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We aim to develop and produce the best solution for your application in the field of optical measurement technique. To help us to come up to your expectations and develop our products permanently we need your ideas and suggestions. Therefore, please let us know about possible criticism or ideas. We and our international partners are looking forward to hearing from you.

Thorlabs GmbH

This part of the instruction manual contains information on how to use the SPLICCO measurement system.

Attention

This manual contains "WARNINGS" and "ATTENTION" label in this form, to indicate danger for persons or possible damage of equipment.

Please read these advises carefully!

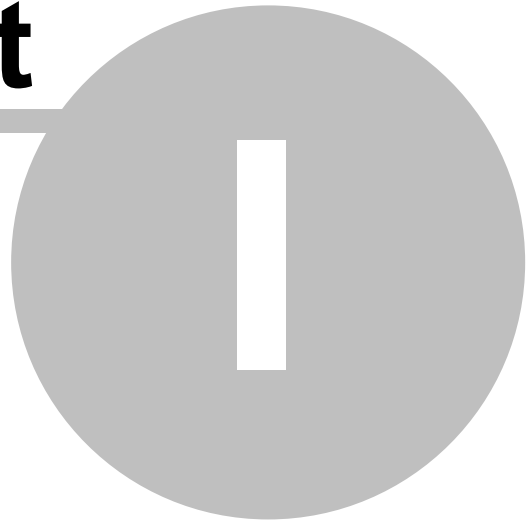
NOTE

This manual also contains "NOTES" and "HINTS" written in this form.

General Information

Splicco

Part



1 General Information

1.1 Safety

Attention

All statements regarding safety of operation and technical data in this instruction manual will only apply when the unit is operated correctly as it was designed for.

All modules must only be operated with proper shielded connection cables. Only with written consent from *Thorlabs* may changes to single components be carried out or components not supplied by *Thorlabs* be used.

This precision device is only serviceable if properly packed into the complete original packaging including the plastic foam sleeves. If necessary, ask for a replacement package.

1.2 Introduction

The SPx-USB is a family of spectrometers that is designed for general laboratory use. Integrated routines allows averaging, smoothing, peak indexing, as well as saving and recalling data sets.

The initial setup is simple to complete. Following installation of the software, the SPx- USB is ready to use. Simply plug it into a USB 2.0 port and run the application software SPLICCO. The remainder of this manual is devoted to the setup procedure and features of the fiber spectrometer. A troubleshooting section and detailed specifications of the various components are provided to further assist.

1.3 Application software SPLICCO

SPLICCO is an acronym for "spectrometer and line camera control". This software can be used for acquiring direct, transmittance and absorbance measurements in conjunction with Thorlabs line cameras and spectrometers.

After the installation the software is able to communicate with all Thorlabs LC1 line cameras and all SPx spectrometers. Additionally, there are two virtual devices: a line camera and a spectrometer, to demonstrate the functionality of SPLICCO.

1.4 Requirements

Hardware Requirements:

CPU: 1GHz or higher

RAM: 256MB

Graphic card with at least 32MB memory

Hard disc with at least 100MB free storage space
free USB2.0 port

USB cable according the USB 2.0 specification

Software compatibility:

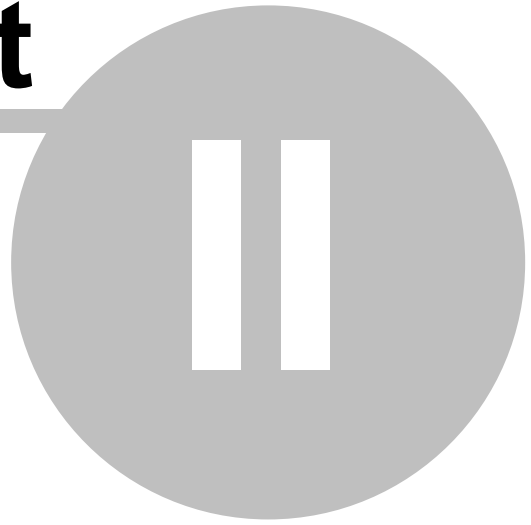
Windows 2000/XP/Vista

VISA runtime (version 4.1.0 or higher)

Installation

Splicco

Part



2 Installation

2.1 Parts List

Below is a list of all components shipped with the SPx-USB:

Qty.	Description
1	SPx-USB - USB 2.0 Fiber Optical Spectrometer
1	SPx-USB - User Manual
1	CD-ROM with SPx-USB Software SPLICCO
1	USB 2.0 A-B Cable, 2 Meters
1	Optical Fiber, SMA to SMA, 50 μ m / 0.22NA, 1 Meter

2.2 Getting started

The SPx-USB must **NOT** be connected to your PC while the software is being installed.

Once the software has been installed, connect the host connector of the USB cable to the USB 2.0 port (or USB 1.1 port) on your PC and the device connector of the USB cable to the SPx-USB and run the application program SPLICCO.

2.3 USB requirements

To achieve the maximum performance benefit from your LC1-USB, you must have a dedicated USB 2.0 port available on your PC (a built in USB 2.0 port is recommended). A USB 1.1 port may be used with a degraded level of performance.

2.4 Installing software

2.4.1 The installation menu

Before installing SPLICCO, please make sure that no Thorlabs LC1-USB or SPx-USB devices are connected. After you inserted the SPLICCO installation CD an autorun menu will appear. If autorun is disabled on your system you have to browse the installation CD and run "CD-Drive:\Autorun\Autorun.exe".

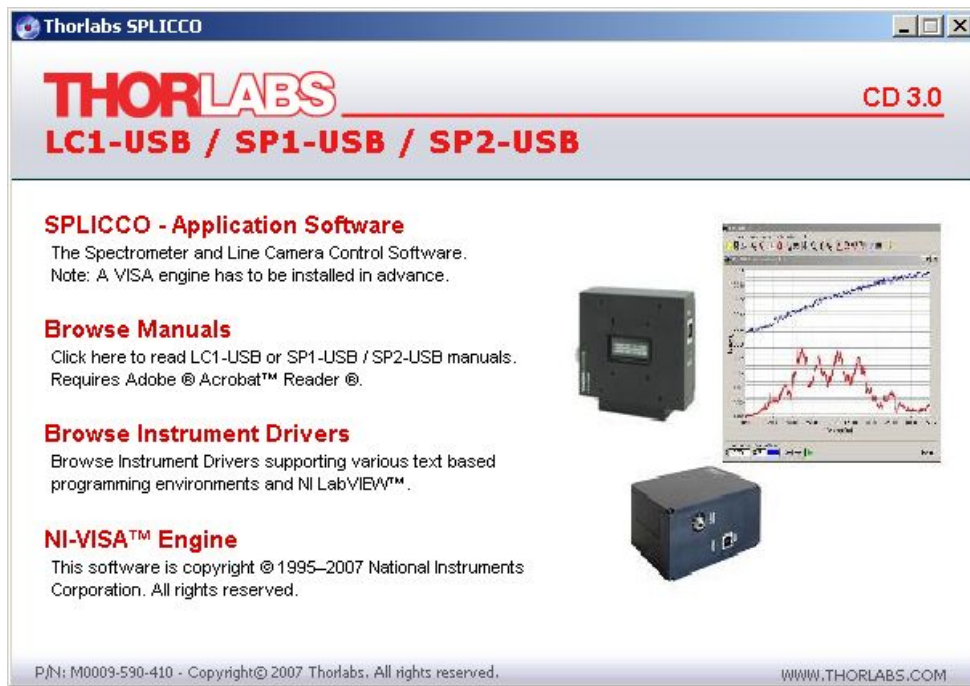


Figure 1 Autorun menu

Note: Please be aware that you need a VISA engine installed on your system to operate SPLICCO.

2.4.2 Installing VISA runtime engine

A VISA runtime 4.1.0 or higher has to be installed on your system to operate SPLICCO.

You may install the National Instruments® VISA runtime engine provided on the installation CD. You may also download the latest NI-VISA runtime engine from the National Instruments® web site (www.ni.com/visa).

In case you want to use the VISA engine provided on the installation CD select "NI-VISA™ Engine". An installation wizard will be started. If you are running Windows VISTA® you might be prompted to change to the "elevated mode". Please ask your administrator for help when you do not have administrator privileges.

Press "Next" to continue.



Figure 2 VISA installation start screen

Now you have to specify a installation path. Press "Next" to continue.

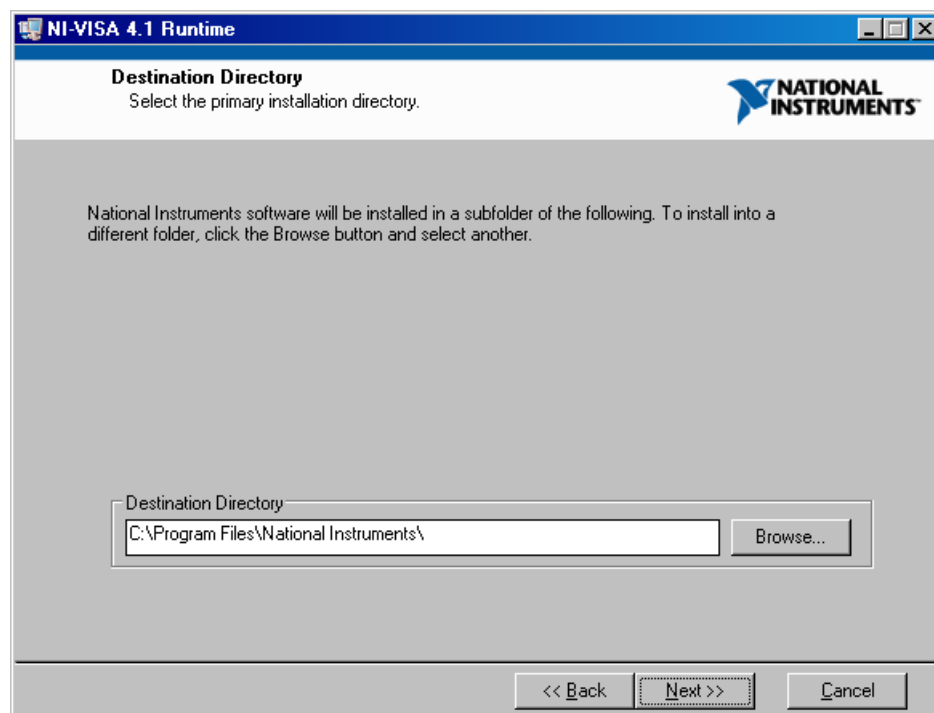


Figure 3 Selection of the installation path

Select "I accept the License Agreement(s)" if you do so and press "Next".

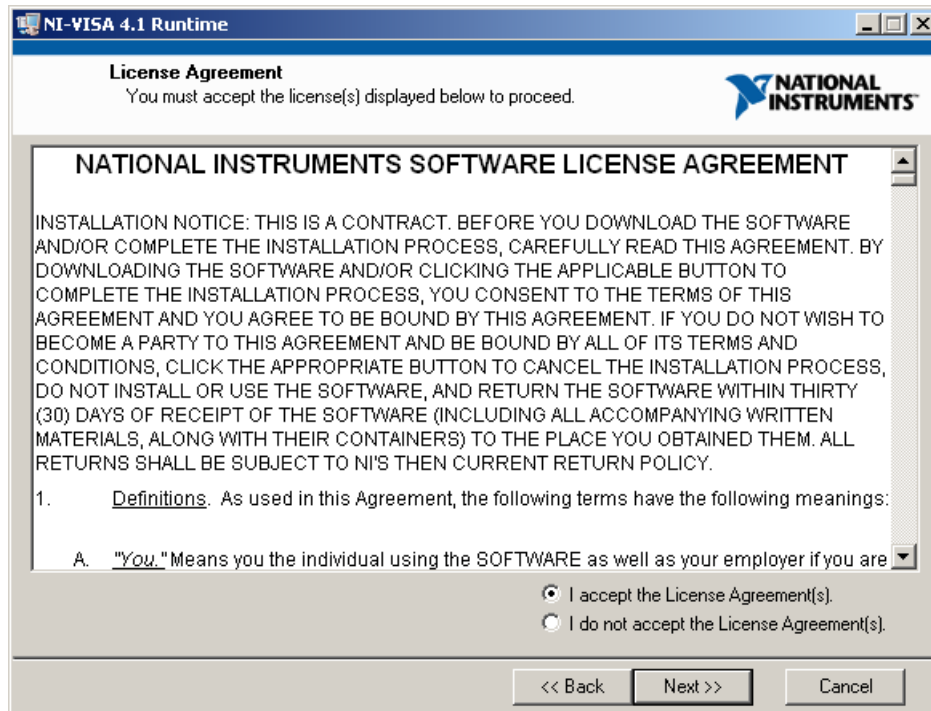


Figure 4 License agreement

In the next window you have to select the features to install. To operate SPLICCO you need at least the USB feature. Confirm with "Next" to start installation.

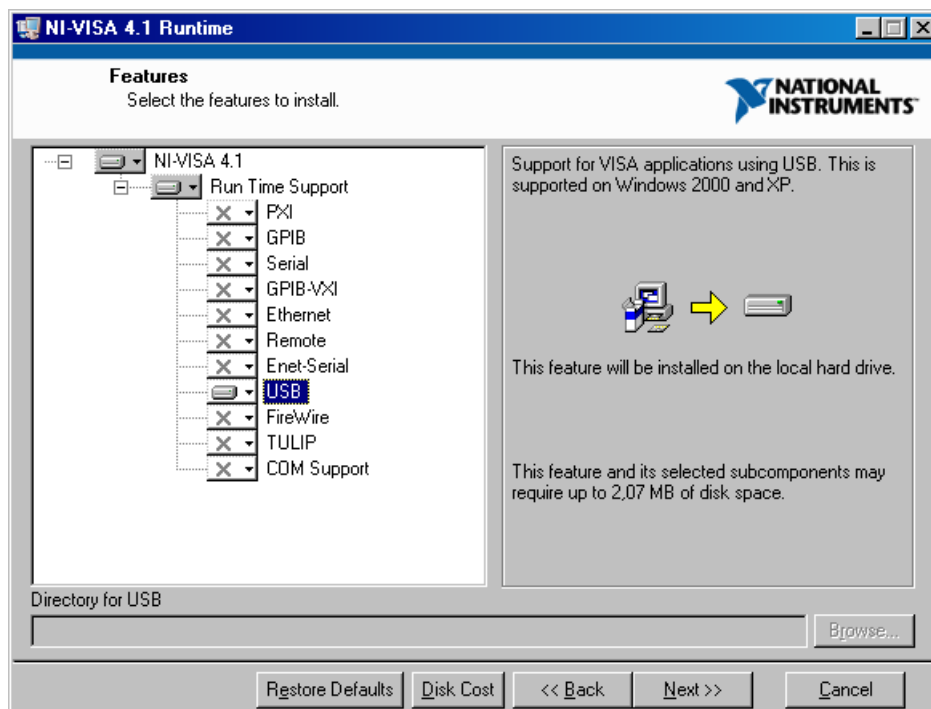


Figure 5 Selection of VISA features

After all files are copied and the installation was successful you might be prompted to reboot your machine. Click "Finish" to finalize the installation.

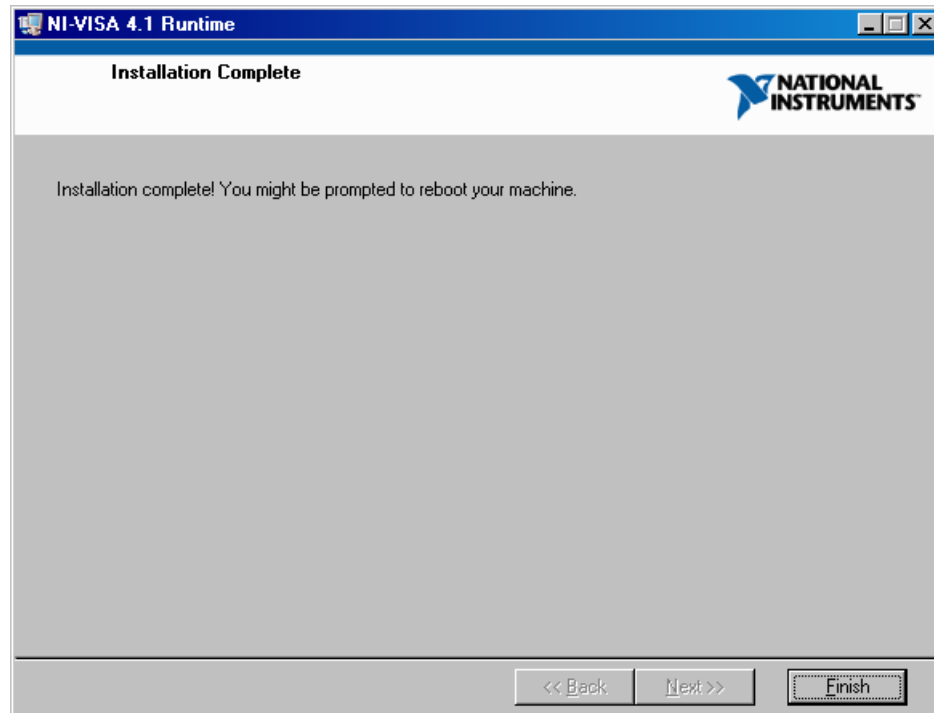


Figure 6 Finalize installation

2.4.3 Installing SPLICCO

Select "SPLICCO - Application software" from the installation menu to start the installation wizard. If you are running Windows VISTA® you might be prompted to change to the "elevated mode", as shown in figure 7. Please ask your administrator for help when you do not have administrator privileges.

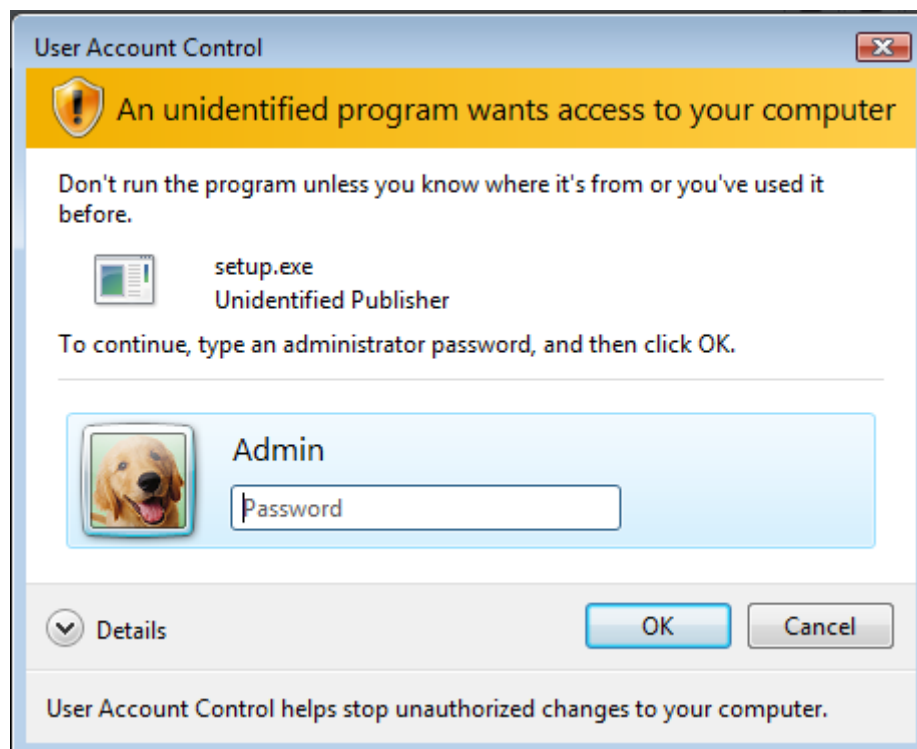


Figure 7 Request for Administrator privileges

After the SPLICCO installation wizard finished initialization, you will be prompted to specify the installation path. Confirm with "Next" when you selected the installation path of your choice.

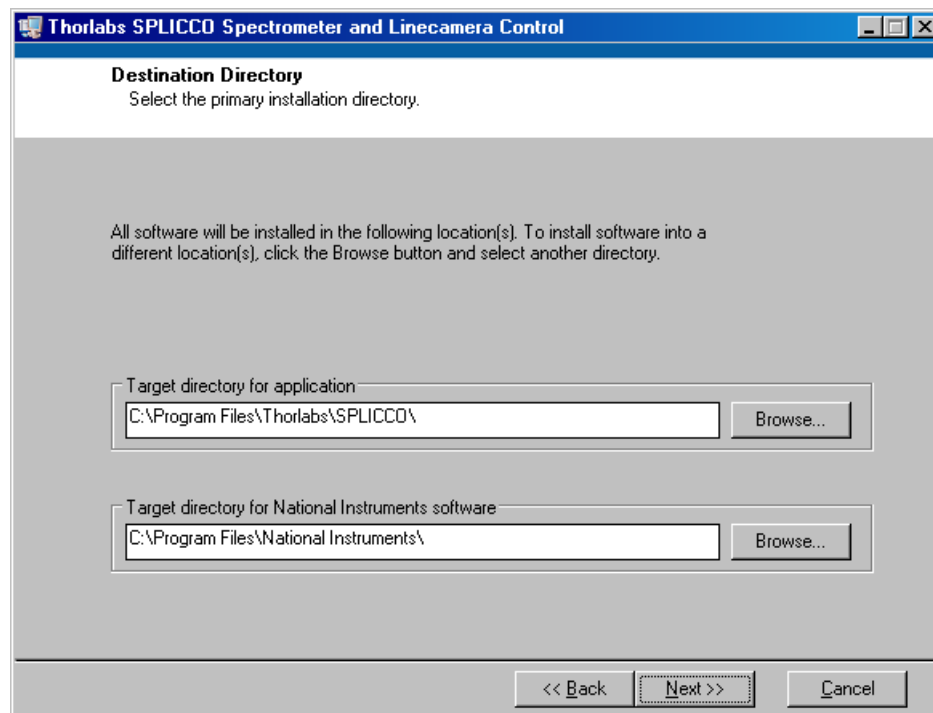


Figure 8 Selecting the installation paths

Please read the end user agreement carefully and choose "I accept the License Agreement(s)" if you do so and press "Next".

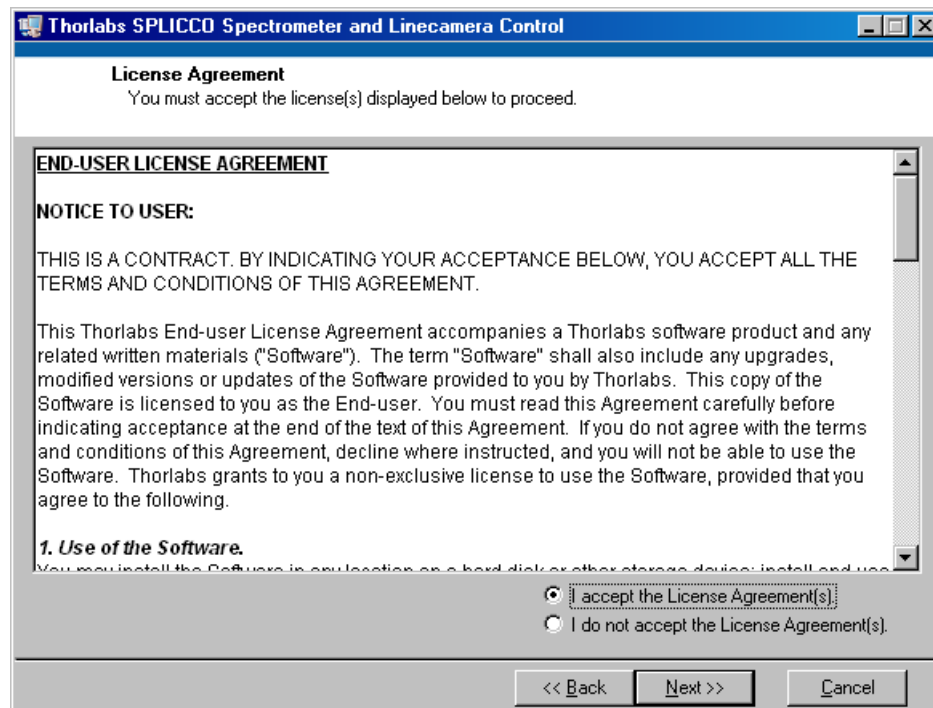


Figure 9 The end user agreement

In the following window the next installation steps are shown. Click the "Next" button to begin installation or click the "Back" button to change the installation settings.

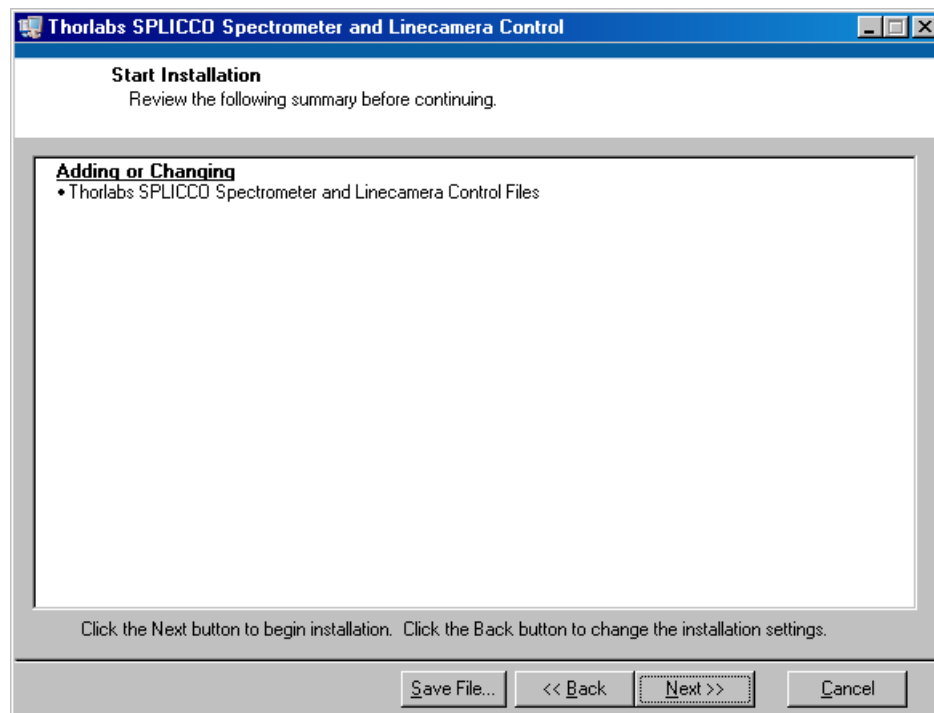


Figure 10 Installation summary

After installation was successful you will see a window containing some information about changelog and other notes. Press "Next" to finish installation.

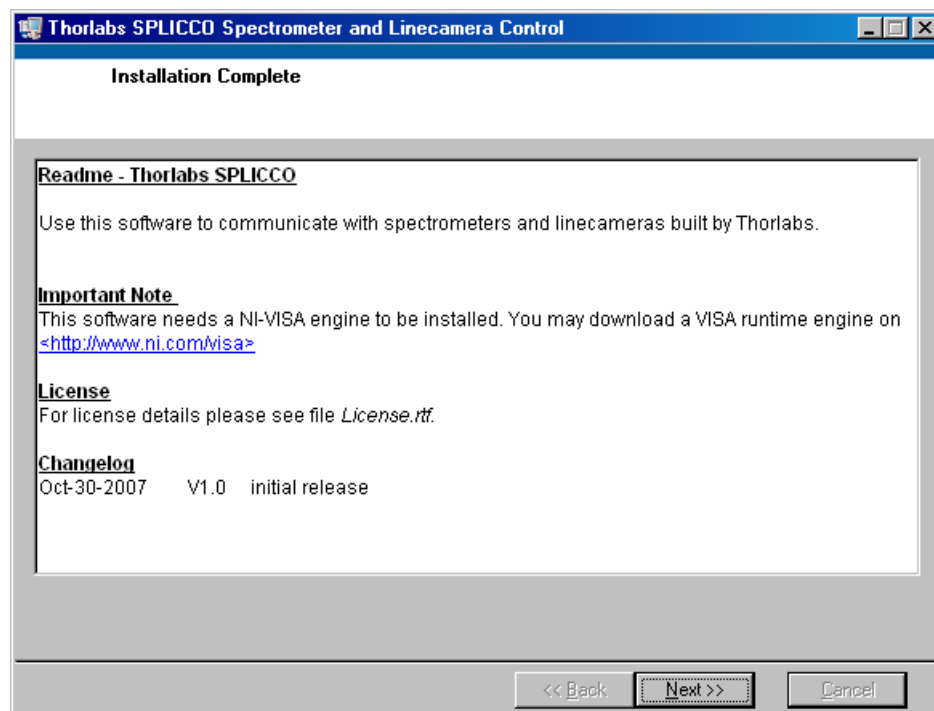


Figure 11 Additional notes

Now the device drivers will be copied into the system folders. This might take a few moments and a command prompt window will pop up. In case you are running Windows VISTA® you will be asked two times to authorize the installation of the device drivers. Choose "Install this driver software anyway" as shown in figure 12.

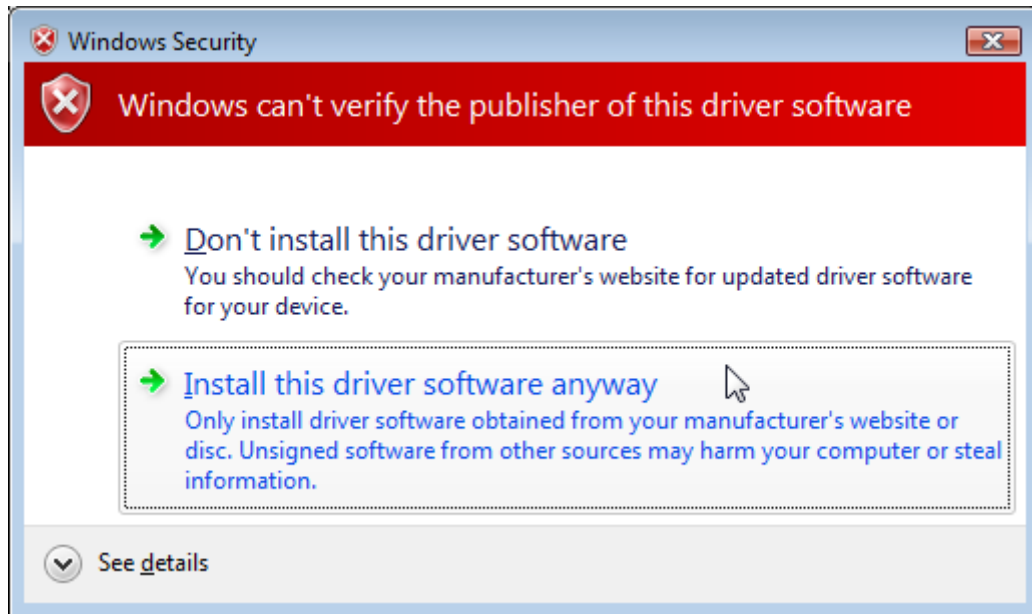


Figure 12 Install driver software

2.4.4 Driver Installation

The necessary USB drivers for the LC1-USB or SPx-USB devices are automatically copied to the system folder during the installation of SPLICCO.

Attention: The following procedure will only be necessary for Windows XP/2000®.

Please be sure that a VISA runtime engine is installed on your system, otherwise the device cannot be installed.

Connect a device: a yellow popup in the left bottom corner appears, displaying the name of the device.



Figure 13 New device was found

On the first connection of a device the "Found New Hardware Wizard" will start to install the new device. Depending on the configuration of your system you maybe asked if you want to connect to "Windows Update to search for software" shown in figure 12. Please select "No, not this time" and click "Next" to continue.



Figure 14 The Found New Hardware Wizard

Select "Install the software automatically" and click "Next" to continue.

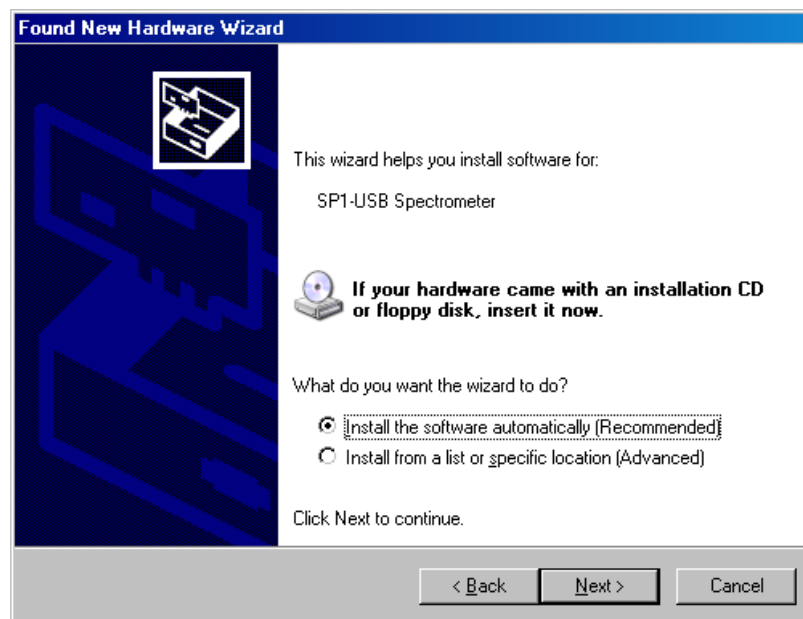


Figure 15 Choosing the installation mode

Now select the driver named "spx-usb.inf" in case you connected a SP1-USB/SP2-USB device. For a LC1-USB device select the "lc1-usb.inf" driver. Click "Next" to continue.

Attention: Do not use the "oemX.inf" drivers.

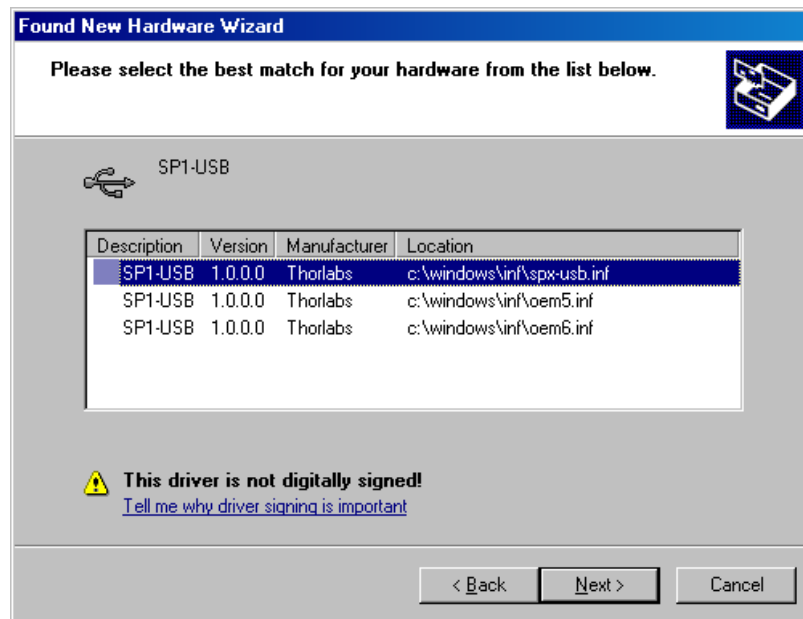


Figure 16 Selection of the correct driver

Finalize the installation by clicking "Finish". Now the device is installed and can be used by SPLICCO.

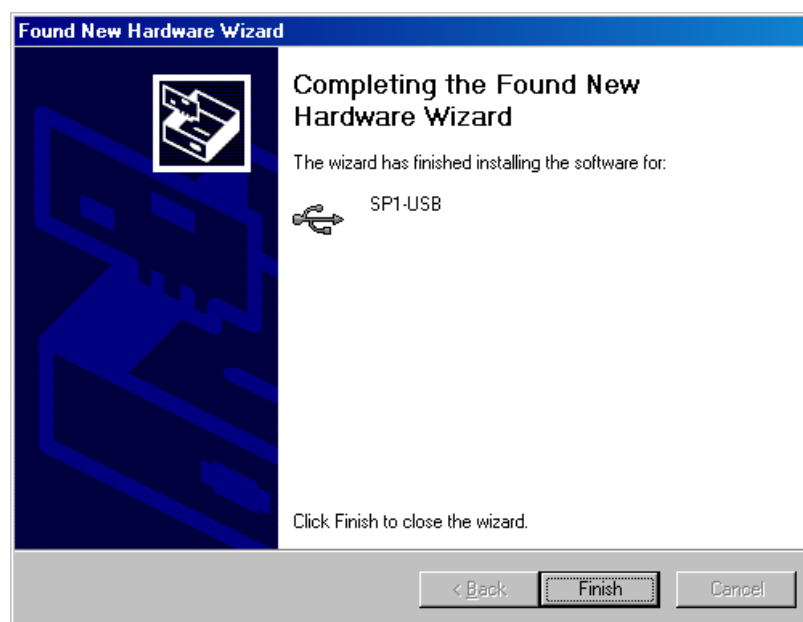
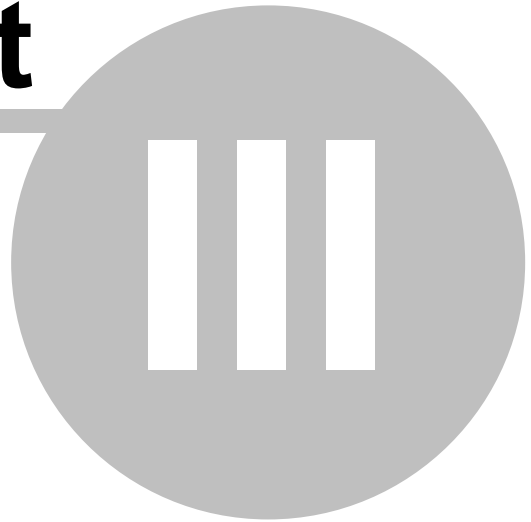


Figure 17 Finishing the New Found Hardware Wizard

Operating Instruction

Splicco

Part



3 Operating Instruction

3.1 Start the GUI

To start SPLICCO click on the desktop icon. You can also select 'Programs' via the START button in the Windows task bar and then choose 'All Programs / Thorlabs / SPLICCO / Thorlabs SPLICCO'.

3.2 Connecting a device

1. To start a measurement with a LC1-USB or SPx-USB connect it to a USB port of your PC.
2. Select 'Device / Connect...' from the menu or click on the icon 'Connect' from the tool bar. The connected devices are shown automatically in a device selection box.



Figure 18 Device menu

The following window appears and shows all connected devices and additionally two virtual devices. Now you can select a device to be used. A panel will be created according to your selection by default. If the "Create a device window automatically" option is not checked, please use the according panel icon from the main interface.

Press "Cancel" to leave this dialog and "Rescan" to scan the system again for new devices.

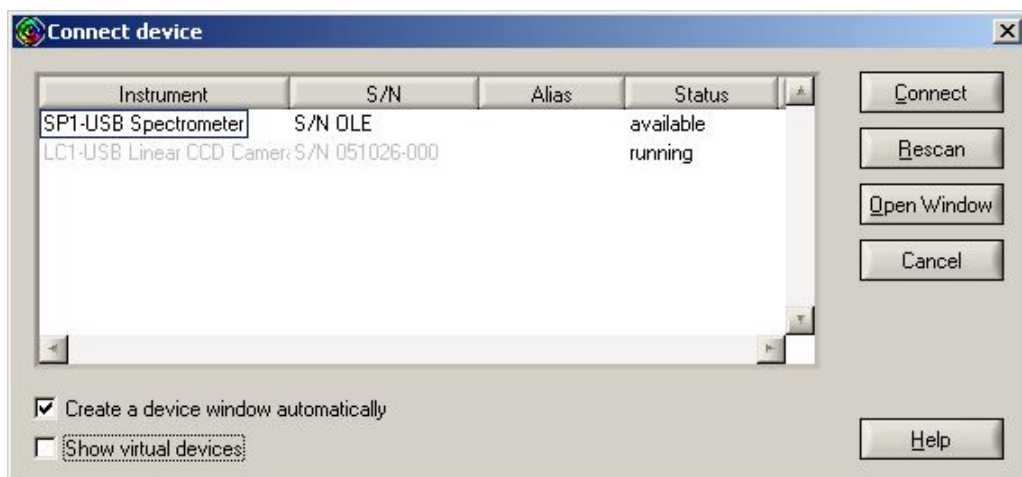


Figure 19 Device selection

Every device can only be opened once. Devices already opened by SPLICCO are marked with the "running" status and are greyed out in the device selection dialog. Devices used by another application than SPLICCO are marked with the "locked" status.

Press "Open Window" to switch to the "Open Window" dialog to connect a window to an already running device.

Furthermore, you can start a virtual line camera or spectrometer, which can simulate a spectrum. Through this feature you can familiarise yourself with SPLICCO, without the need of a light source or signal. You can select to display or hide those virtual devices with the "Show virtual devices" option. For a detailed description about the virtual devices refer to section [Virtual devices](#).

3.3 Device window

You can open up to 10 measurement windows for every device. Parameters like integration time, number of scans to be averaged and trigger control affect all of the device windows. All options, which are selected by right mouse menu affect only the active window with the exception of the option "Properties" and "Color settings".

3.4 Integration time

The integration time represents how sensitive the CCD is to incoming light. CCD pixels act like light buckets, gathering photons. The integration time display represents how many milliseconds the bucket is open. For very bright sources, low integration times are required, whereas for weak sources, longer integration times should be used. As in the light bucket analogy, CCD pixels can be overfilled. This is called saturation and will cause the output to be misleading.

SPLICCO allows setting of the devices integration time. The supported range is defined by the device itself (LC1-USB/SPx-USB 0.001 ms - 200 ms). The control to change the integration time can be found on the lower left corner of the device window. A window, which only shows a loaded reference spectrum does not offer those controls in the left bottom corner.

A change of the integration time affects all windows connected to this device, which are then updated to show the same integration time. Higher integration times results in higher peaks in the measurement data.

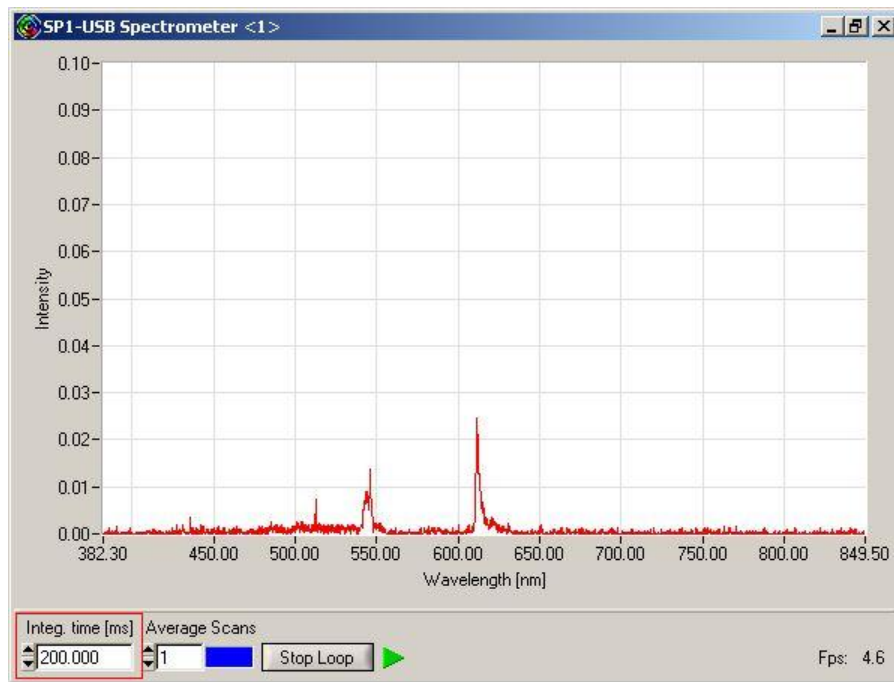


Figure 20 The integration time control

3.5 Averaging

Very noisy or weak signals can be amplified by adding several scans, which is known as averaging.

SPLICCO provides two kinds of averaging. The gliding average and the block average.

In order to change the average properties, click "Devices" in the menubar and move the cursor to the device to configurate, then choose "Properties" from the submenu.

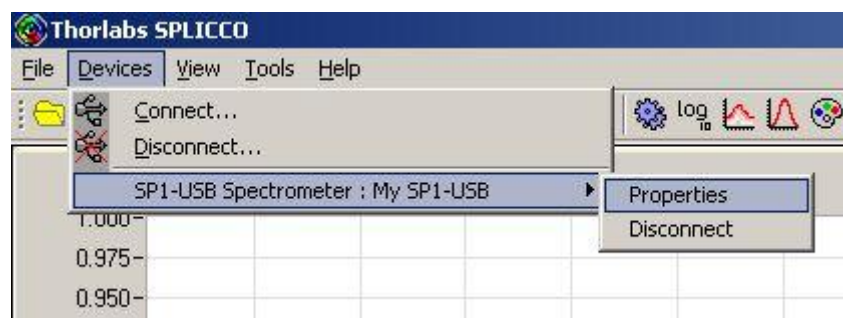


Figure 21 Device properties

Change to the "Common" tabpage and change the average method to the method you want to use.

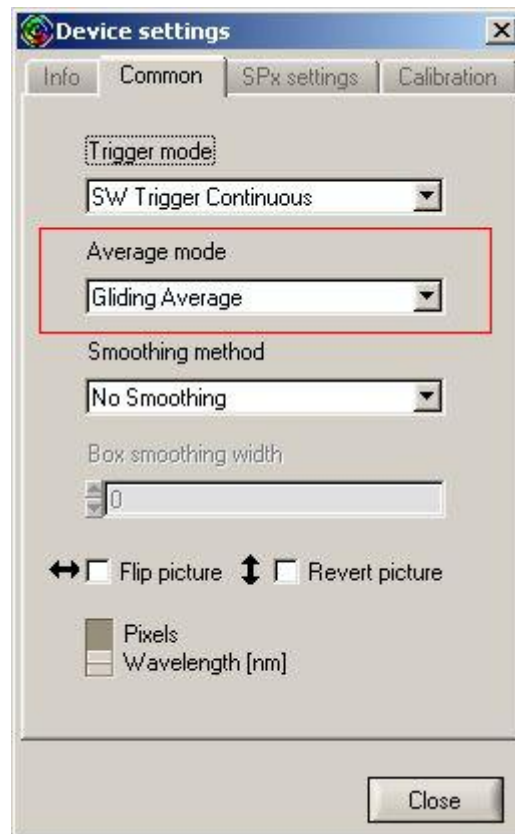


Figure 22 Setting the average mode

The control to set the number of scans to average can be found on each panel connected to this device in the left bottom corner. Right beside this control you can see a status slide, which indicates the fill level of the buffer used for averaging. In case the average method was set to "**Gliding average**" the slide will grow up to maximum and will stay there until you either change the average mode or you press "Stop Loop" and "Start Loop" again. The gliding average calculates the average from the last data sets no matter if the number of chosen data sets was reached yet. If you want to average 10 data sets, the gliding average will first calculate the average out of the first two data sets, then out of the first three sets and so on until the desired number is reached. Then the last data set will be subtracted and the newest data set will be added to calculate the average.

In case "**Block average**" was chosen, the status slide will grow to maximum and then the graph will be refreshed with the average of the accumulated scans. After this all old values will be replaced with new values and the slide will be reset.

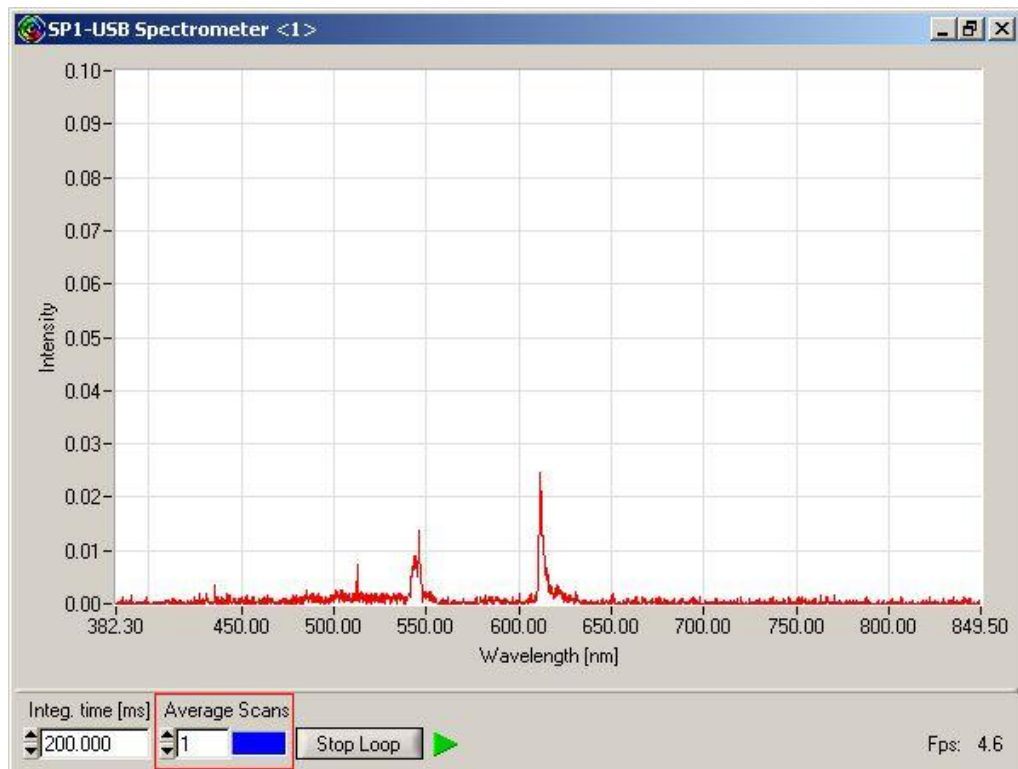


Figure 23 The average scans control

3.6 Smoothing

SPLICCO provides a method to smooth data, which is the standard method called "Moving Area Smoothing", also known as "Box Smoothing".

This kind of smoothing is like a low pass filter, suppressing the high frequency noise. Open the device properties panel. Change to the "Common" tabpage and change the smoothing method to the method of choice. In case of "Box Smoothing" you can set the smoothing box width below this control. Zero means no smoothing at all. A change will directly affect the actual graph.

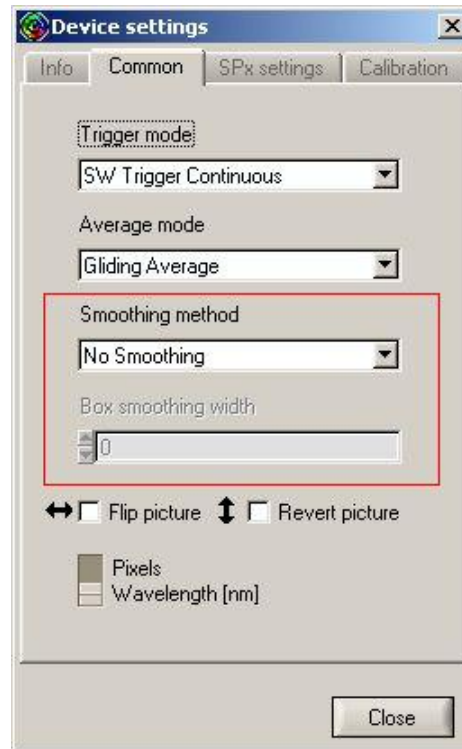


Figure 24 The smoothing controls

Smoothing Methods

Box Smoothing:

The Box Smoothing is the simplest form of smoothing. The only parameter needed is the box width, which indicates how many values are averaged. There is no weighting of those values.

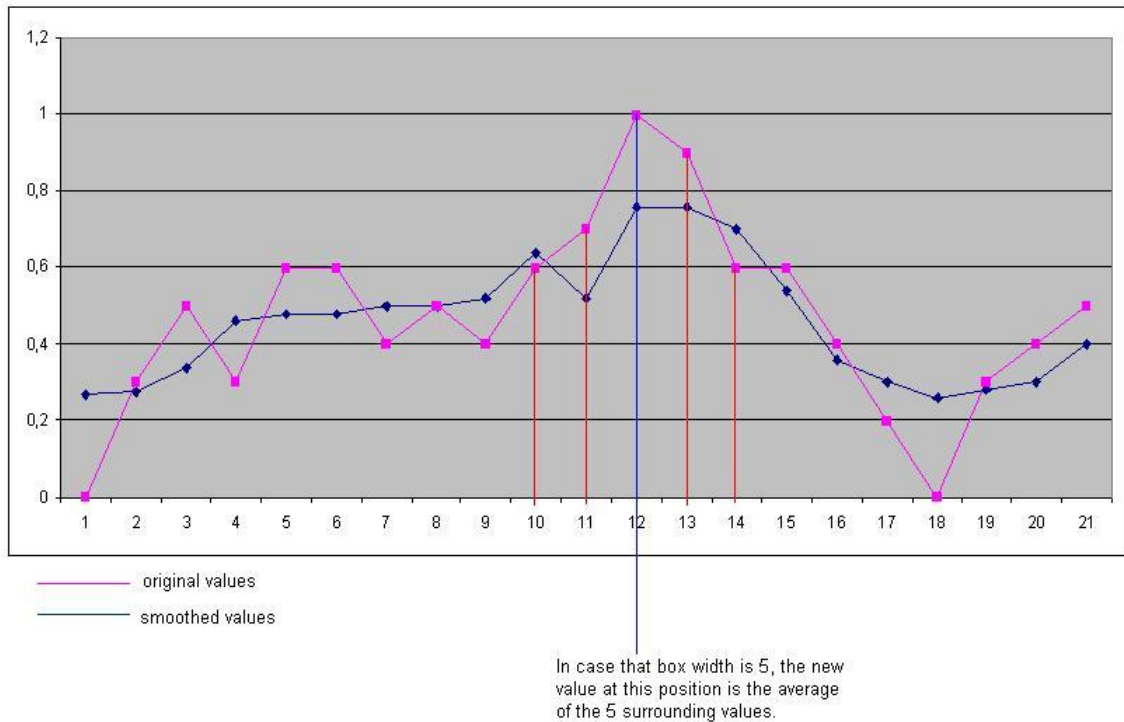


Figure 25 The box smoothing algorithm

3.7 Flip and revert picture

SPLICCO provides the possibility to flip or revert the actual measurement data displayed in a window.

Open the device properties panel, change to the "Common" tabpage and check the Flip-option and/or the Revert-option.

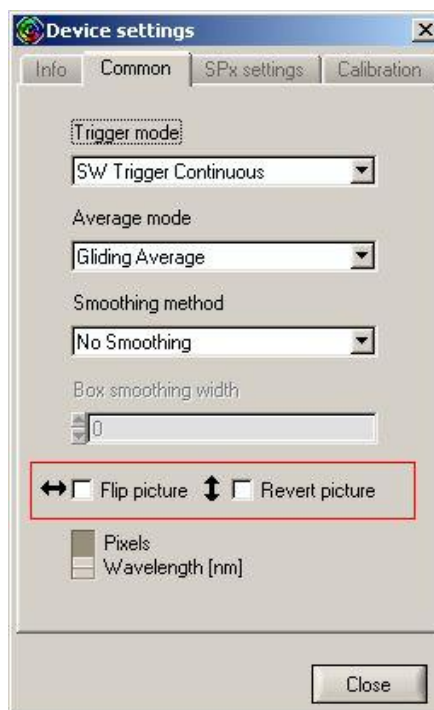


Figure 26 The flip and revert picture controls

By choosing one option all windows connected to the device will be updated.

3.8 Display mode

SPLICCO supports two display modes regarding the scaling of the x axis. Either the x axis is shown in nanometer or pixel.

Line cameras only support the display of pixels.

Spectrometers can use an internal wavelength calibration file to show the range in nanometers instead of pixels.

Open the device properties panel, change to the "Common" tabpage and flip the switch to change between the display modes.

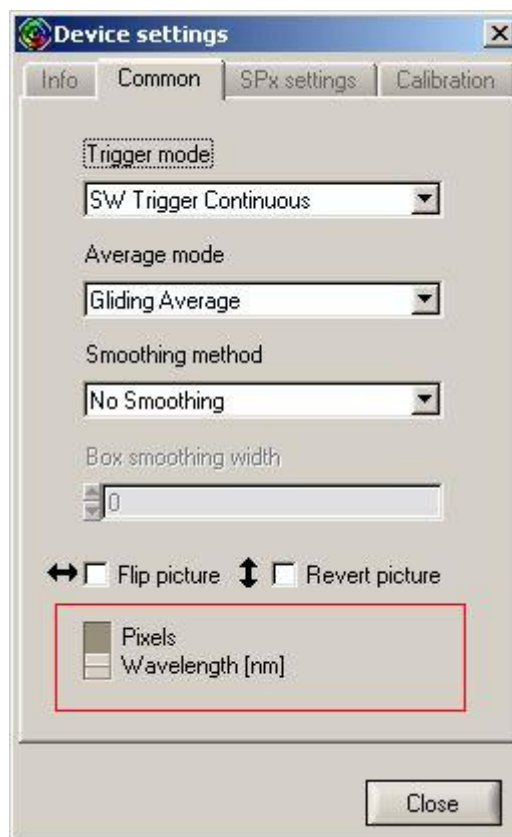


Figure 27 The display mode control

3.9 Calculations with references

SPLICCO offers the possibility to calculate the live measurement with a reference curve. This reference curve can be a sampled live curve or a curve loaded from a JCAMP-DX file as long as the ranges are compatible to each other. It is possible to calculate with a reference curve that only partly matches the range of the live measurement. In this case only the matching range is calculated and shown.

There are four modi available:

Scope: The normal view
 Relative difference: The relative changes with respect to reference or background
 Absorbance: The absorbance view
 Transmittance: The transmittance view

Scope:

The scope view is the standard view in SPLICCO. The reference curve is shown as well as the original measurement data but they are not calculated to each other in any way.

Calculations with a reference curve are not supported for line cameras.



Figure 28 Scope mode

Relative difference measurement:

The relative difference view shows the the live measurement values divided by the reference curve values. Only changes in the spectrum will be displayed. The original reference curve is still shown to allow an easy comparison.



Figure 29 Relative difference mode

Absorbance:

The absorbance view shows the light absorption by a sample. The original reference curve is still shown to allow an easy overview. The absorbance is calculated by the following equation:

$$A_{\lambda} = 2 - \log_{10} \left(\frac{O_{\lambda}}{R_{\lambda}} \right) \quad (1)$$

A_{λ} - Absorbance at a specific wavelength
 O_{λ} - Original measurement value for a specific wavelength
 R_{λ} - Reference curves value at a specific wavelength



Figure 30 Absorbance mode

Transmittance:

The transmittance view shows the light transmission by a sample in %. The original reference curve is still shown for comparison.



Figure 31 Transmittance mode

3.10 Peak finder

SPLICCO offers the possibility to find peaks in an actual measurement.

You can find the peakfinder by right clicking on the actual window and selecting "Peak finder..." or selecting 'Tools \ Peak finder' from the menu bar.

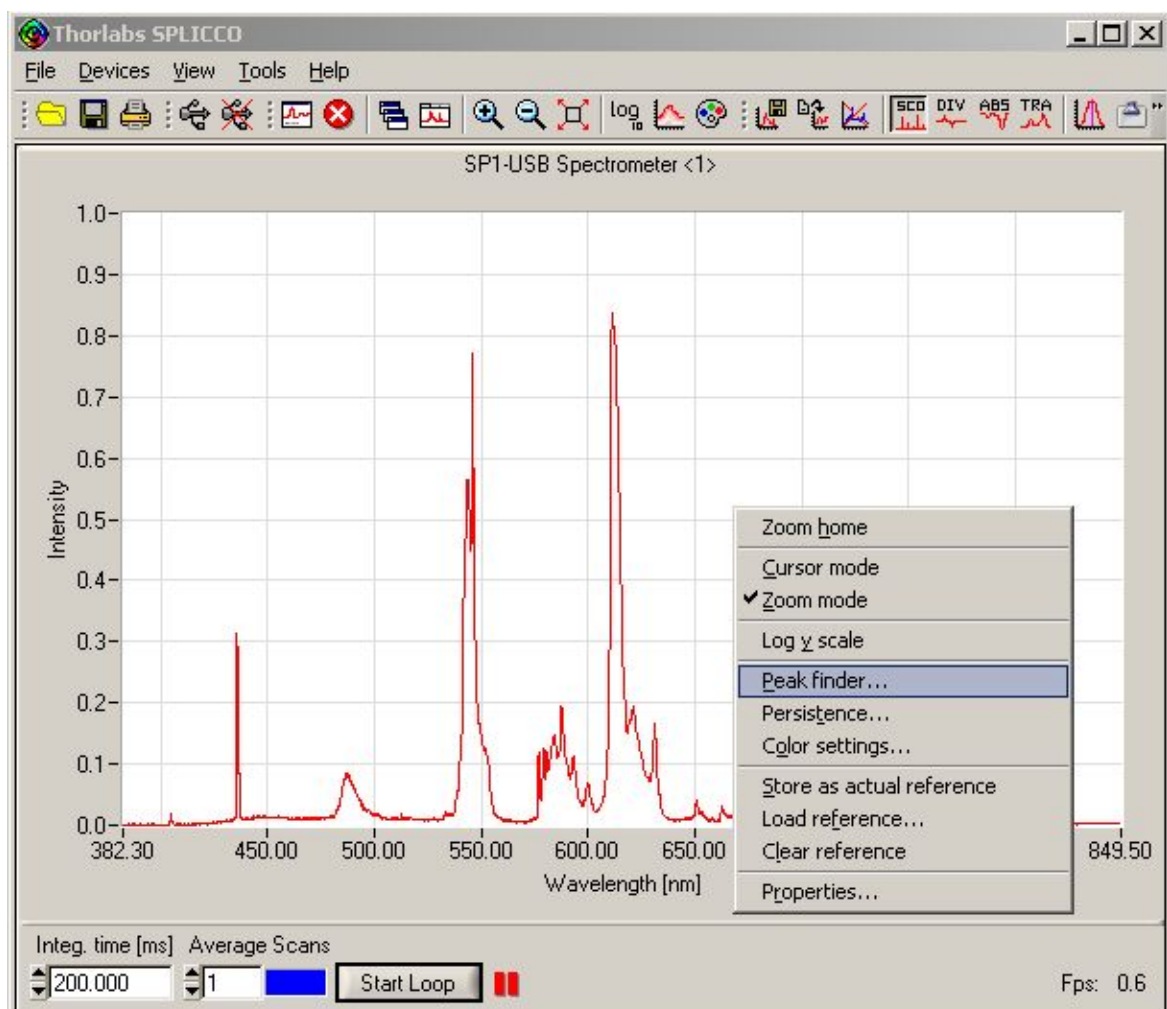


Figure 32 Right click menu

The following wizard will appear.

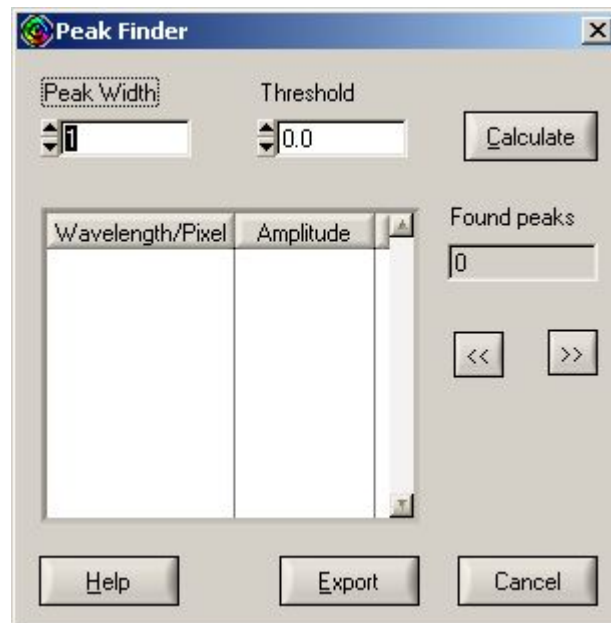


Figure 33 Peakfinder

In order to specify the relevant peaks the peak width and the peak threshold can be set. A higher threshold and a higher peak width will reduce the found peaks. By pressing the "Calculate" button the peaks specified by those two parameters are calculated and the list is filled with the found peaks. You can mark a peak in the window by a left double click on the desired peak in the list. This peak will be marked by a colored line in the graph.

The peaks can be sorted by amplitude or wavelength and can be iterated with the help of the arrow buttons ("<<" and ">>").

Only one peak can be marked at the same time, but you can export the full list into a tab separated text file with the "Export" button.

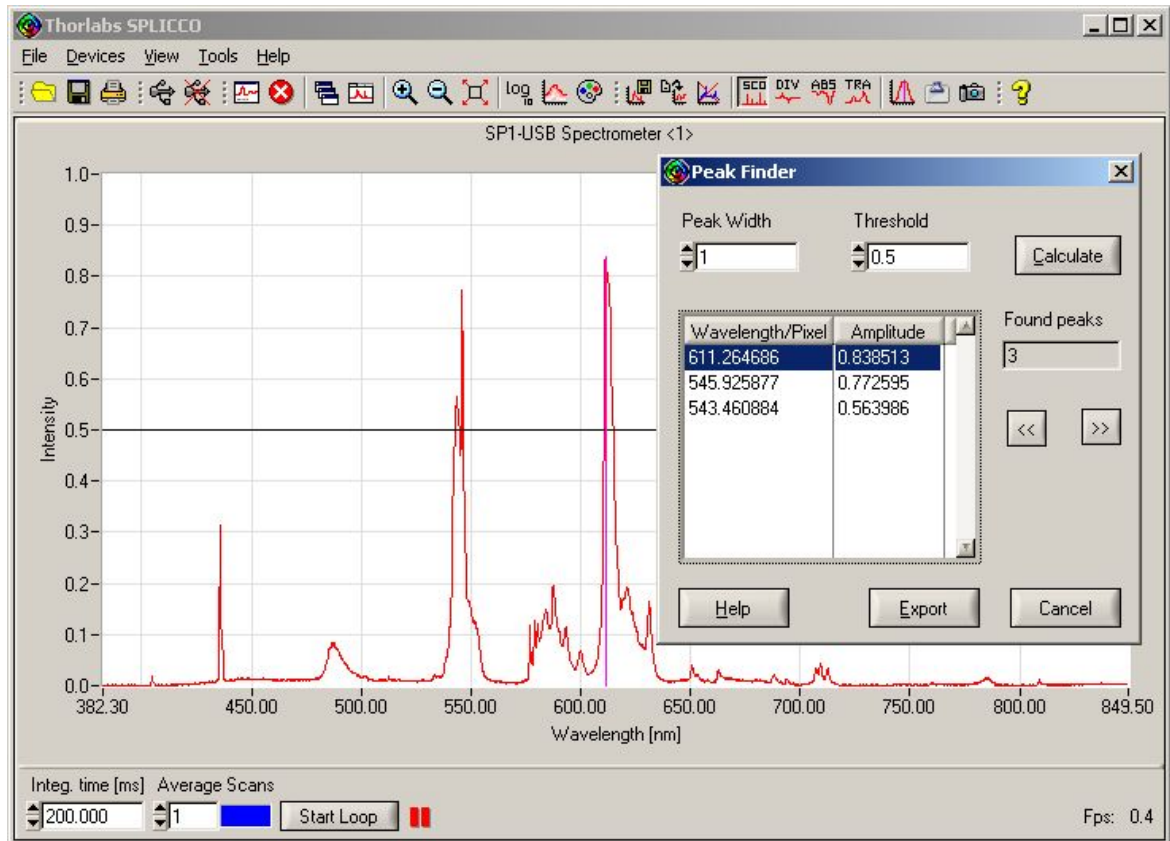


Figure 34 Using the peak finder

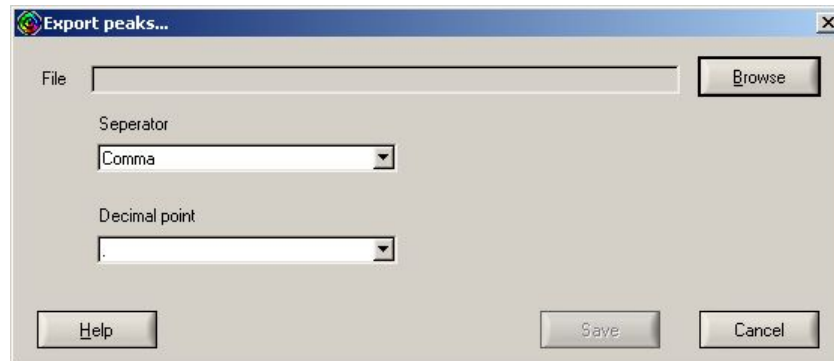


Figure 35 Export peaks dialog

3.11 Cursor control

SPLICCO provides a cursor for instantaneous readout of wavelength and amplitude. In order to use this feature, right clicj on a graph and choose "Cursor mode".

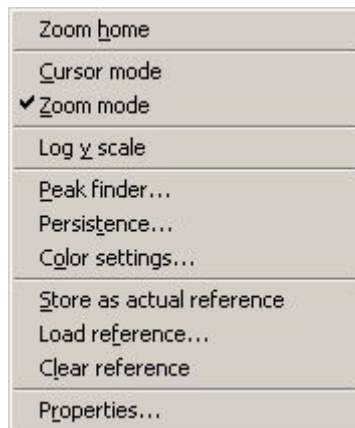


Figure 36 Right click menu

The "Cursor mode" disables the "[Zoom mode](#)" and a vertical line appears. With the first left click on the graph a small window appears right besides the mouse cursor and shows the actual x-value and y-value. The precision is always the same as the precision of the corresponding axis.

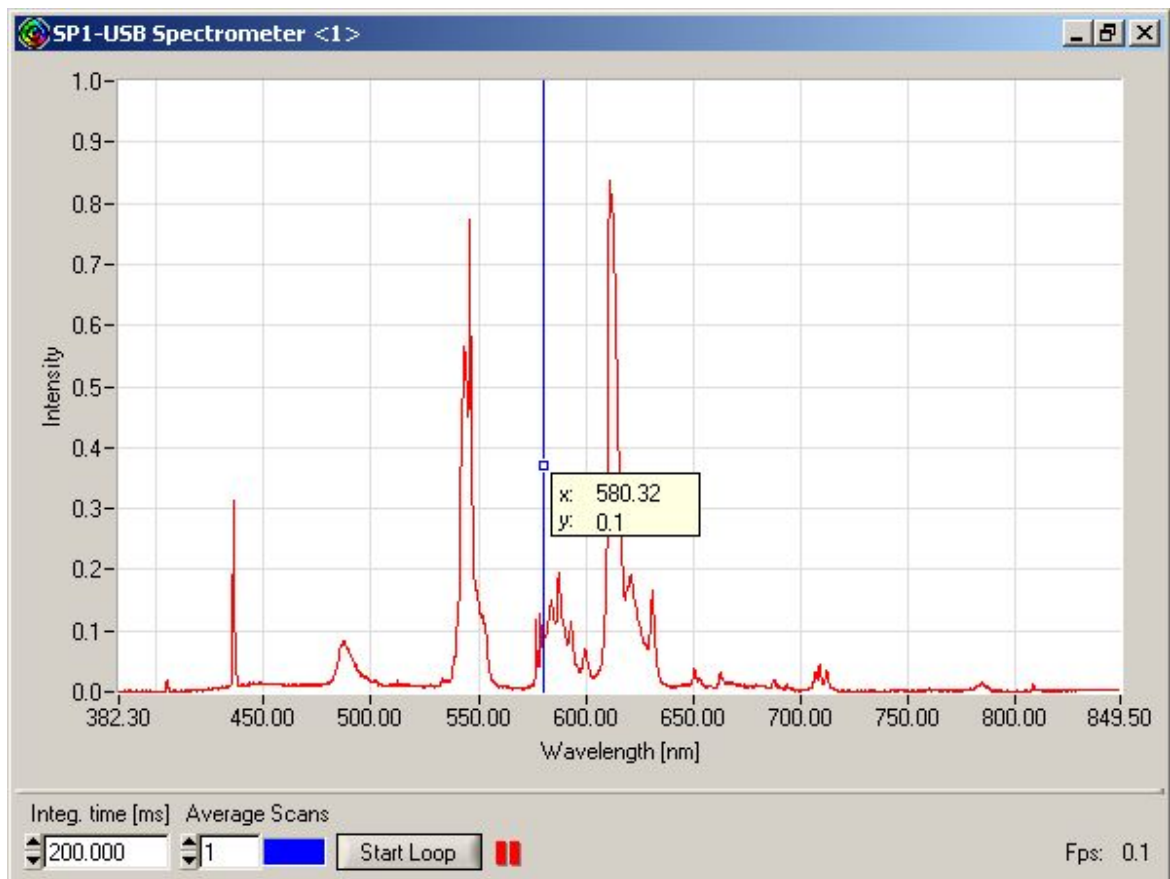


Figure 37 Device window in cursor mode

3.12 Saving data

SPLICCO can save data either in JCAMP-DX or CSV format.

JCAMP-DX:

- stores data and comments
- visit "<http://members.aol.com/rmcdjcamp/index.htm>" for more information

CSV:

- comma separated values
- later use with third party software like Microsoft Excel™ or Matlab™
- human readable

To save the measurement data to a JCAMP-DX file select 'File / Save As ...' from the menu or click the button 'Save As' from the toolbar. A file dialog window appears and you can choose the filename and directory. The file extension of this kind of file is *.jdx. Additionally you can choose the range to store and the resolution, which defines how many values are interpolated and saved to file. "High" means factor 2, "Low" means factor 0.5 and "Average" means factor 1. Text entered in the "Comments" field will be stored together with the data.

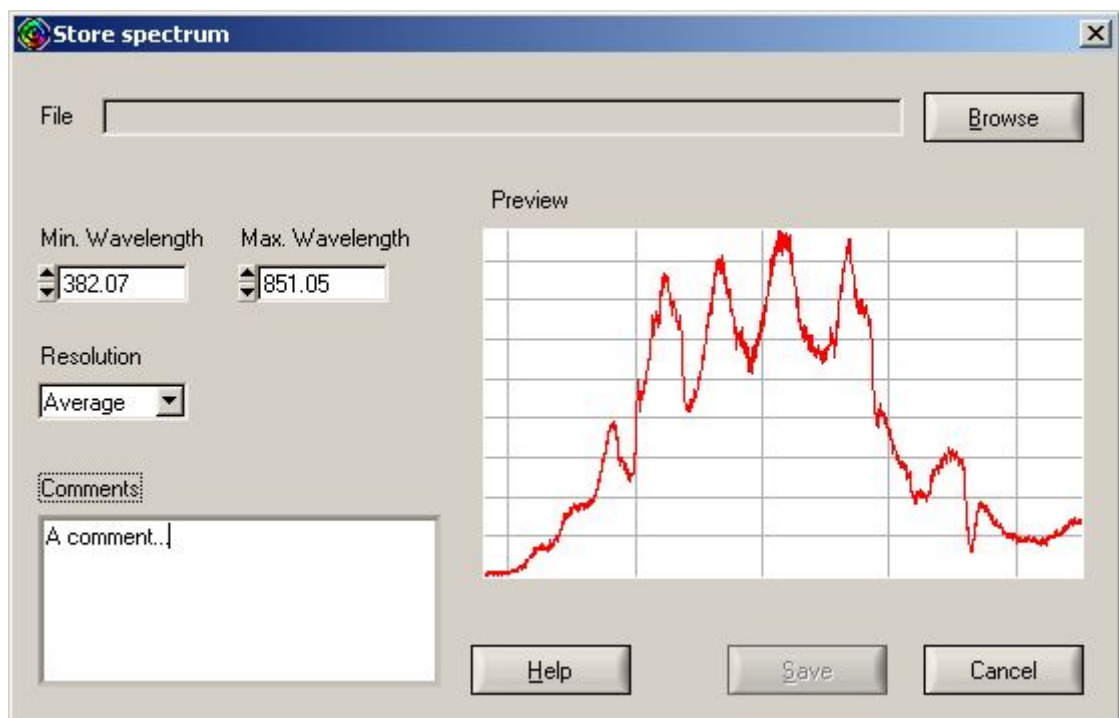


Figure 38 Save Measurement / Reference Data

Export Data

Measurement data can be exported to a *.csv file for use with e.g. Microsoft Excel™ or MathLab™.

To export the current measurement data to a *.csv file select 'File / Export CSV...' from the menu. A popup panel appears and you can choose the filename and directory, the separator character and the decimal point. Reference data can be handled in the same way.

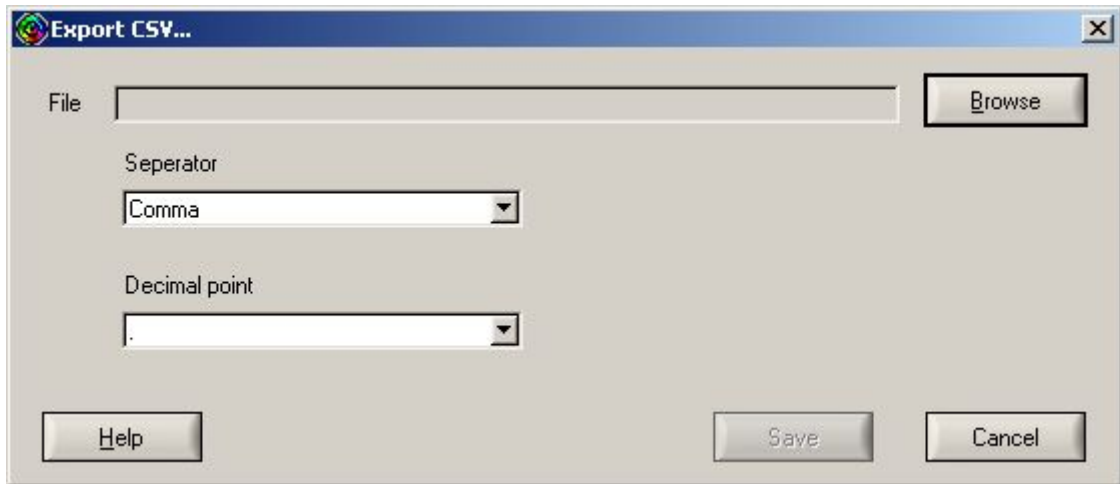


Figure 39 Export data as CSV

3.13 Loading data

You can use SPLICCO to analyze previously captured measurement scans without connecting a device. This can be done by selecting 'File / Open...' or 'File / Import' from the menu.

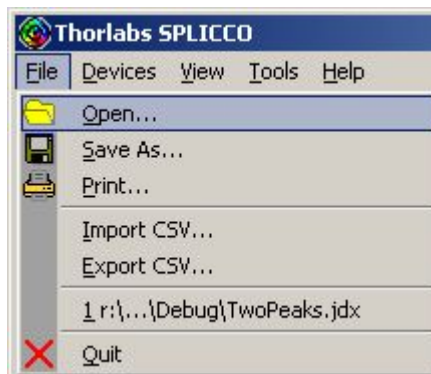


Figure 40 File dialog

SPLICCO can load most JCAMP-DX files with file extension *.jdx either as a reference to use with the live measurement data or in an individual window to show formerly saved data.

You can open a reference in its own window by selecting 'File / Open ...' from the menu or click the button 'Open...' from the toolbar. A file dialog panel appears and you can select a *.jdx file.

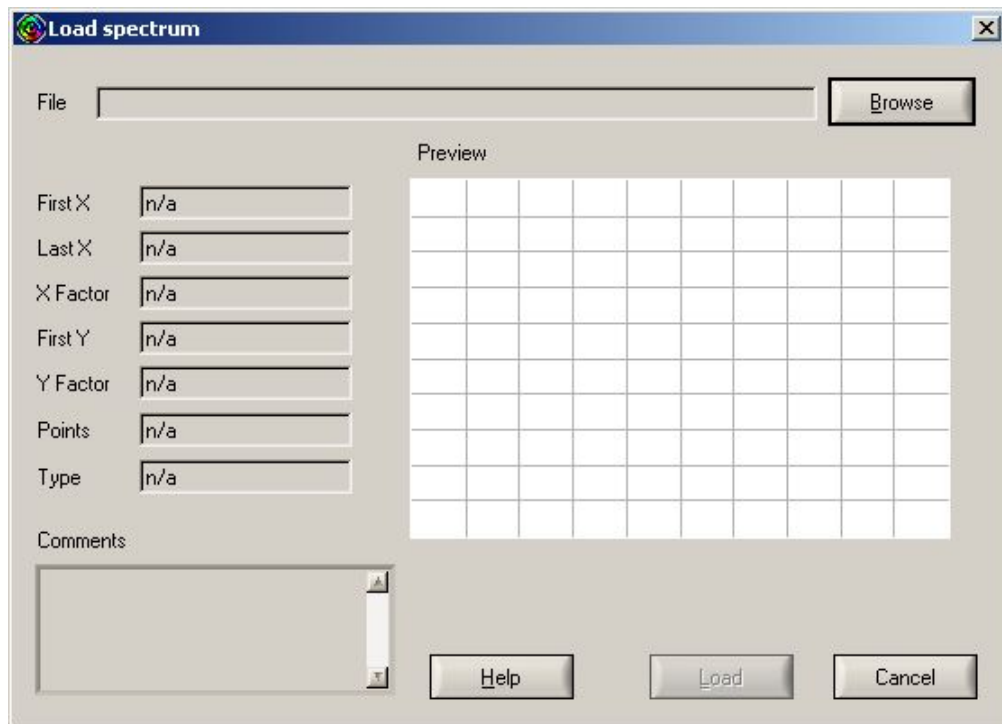


Figure 41 Load reference file

A file selected from the file dialog is shown in the preview window. Eventually saved comments are shown in the "Comments" field.

In case you want to use a stored measurement curve in JCAMP-DX format as a reference curve you have to right click on an active window and select "Load reference...". The following window appears in which you can see the actual unzoomed live measurement. By selecting a file via the "Browse" button a preliminary reference curve is drawn into the preview screen. You can set the scale maximum and a scale offset to maximize readability. This scaling influences the reference curve and future calculations.

By pressing "Load" the reference curve is copied into the actual window and can be used for future calculations.

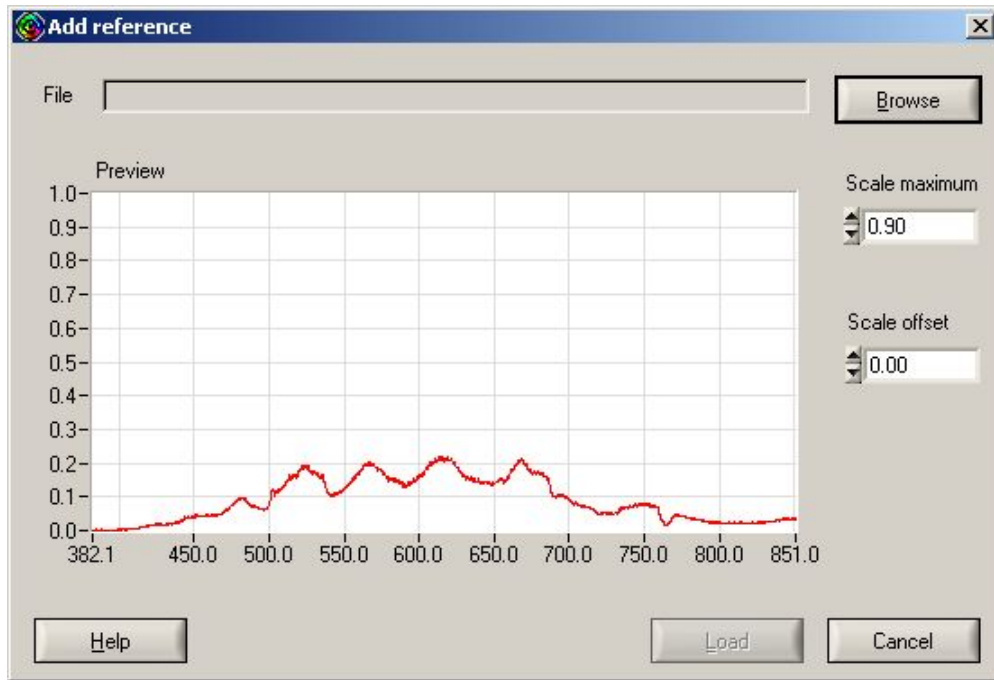


Figure 42 Add reference

To import measurement data from a *.csv file select 'File / Import CSV...' from the menu. Please specify the character separating the x & y columns and choose which character marks the decimal position in the appearing window.

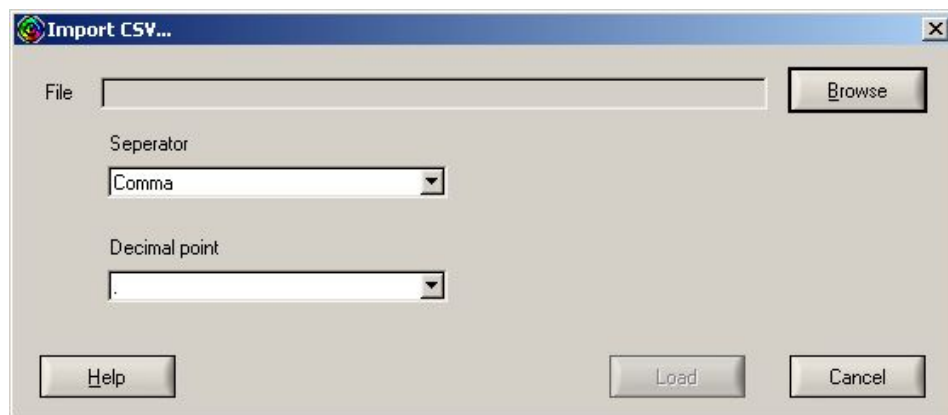


Figure 43 Import a CSV file

3.14 Zooming and panning

SPLICCO offers several possibilities to zoom/expand areas of interest.

In case the window is in "Zoom mode", you can box-in a region by pressing and holding the left mouse button.

By pressing the "Zoom in" (🔍) and the "Zoom out" (🔍) button in the toolbar you can step in or step out on the actual windows graph. Use the "Zoom home" (🏠) button in the toolbar to zoom to the original size. You can also zoom home by a right click on the graph and selecting "Zoom home" in the appearing menu.

The third option to zoom is the use of the editable graph axis. On each axis you can double click the minimum or maximum value for editing. The axis is rescaled

after confirming the changes.

Another way to zoom is holding the CTRL key on the keyboard and left clicking on the graph to zoom in and right clicking to zoom out.

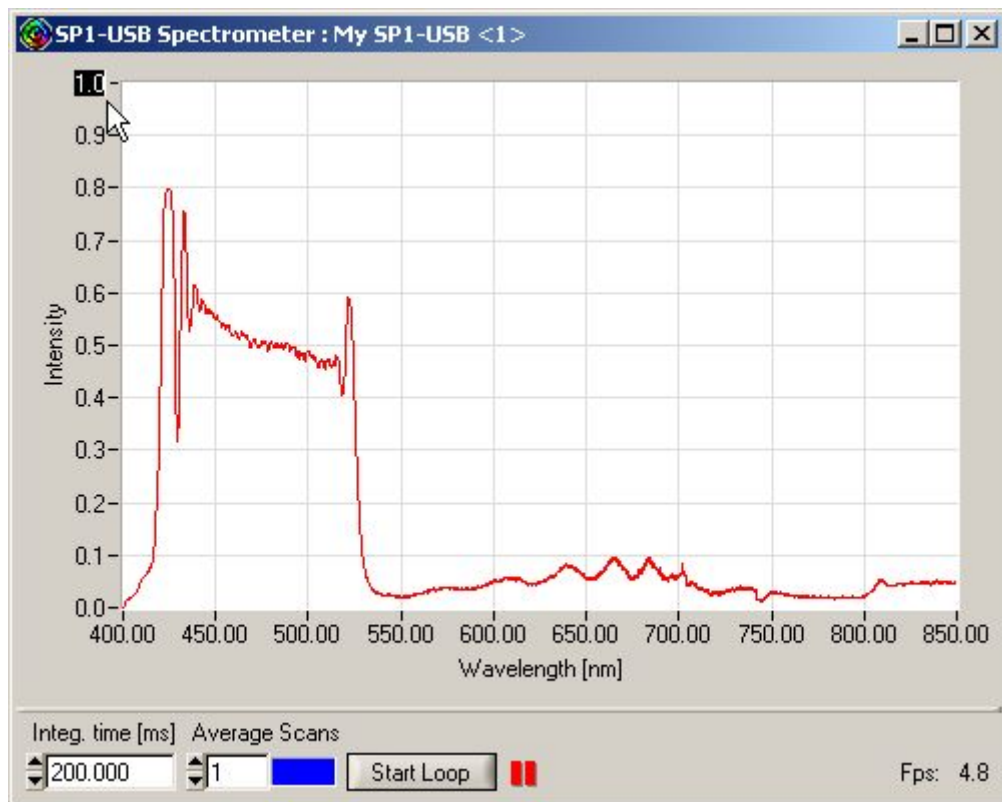


Figure 44 Editable axis

Press and hold the CTRL and SHIFT key on the keyboard to use the mouse to pan the actual graph.

Note: The zoom is limited to 1% of the original size of each axis. Furthermore you cannot zoom out more than the original size.

3.15 Program navigation

SPLICCO can be operated by using the menu or the toolbar.

Menu

SPLICCO has several menu items.

File menu

The 'File' menu contains all functions for saving, loading and exporting measurement data.

You can save the current measurement data in a *.jdx file. This kind of file can be loaded into the application. You can also save and load reference data directly.

Devices menu

In the 'Devices' menu you find all functions regarding your actual connected devices. You can connect / disconnect devices as well as setting device properties.

View menu

The 'View' menu contains all functions to configure the display windows. All active windows are listed here. Windows can be opened/closed/zoomed or you can switch between the released and tabbed view.

Tools menu





























All functions to calculate with reference curves like transmittance can be found here. Furthermore there are tools like taking snapshots from the actual window or copying the actual measurement to clipboard.

Help menu

You will find the online help in this menu. Furthermore, there is a link to the Thorlabs web page to check for the latest drivers or software version. You can check the current version by selecting 'About...'.

Tool Bar

The toolbar offers quick access to important functions.

-  Opens an existing file (*.jdx)
-  Saves the current measurement in a file (*.jdx)
-  Prints the current window with user's comment and timestamp
-  Connect a device
-  Disconnect a device
-  Creates and connects a new window to a device
-  Closes the actual window
-  Switches to released view
-  Switches to tabbed view
-  Zooms in by factor 2
-  Zooms out by factor 2
-  Zooms home
-  Opens the devices properties panel with the common settings like smoothing
-  Switches between logarithmic and normal y scale
-  Opens a dialog to configurate persistence
-  Opens a dialog to configurate gaussian transformation
-  Opens a dialog to configurate colors
-  Stores the actual measurement plot as reference plot
-  Loads a reference plot out of a JCAMP-DX file
-  Deletes the actual windows reference curve
-  Switches to scope view
-  Switches to division view
-  Switches to absorbance view
-  Switches to transmittance view
-  Opens the peak finder dialog for the actual window
-  Copies actual measurement to clipboard
-  Makes a snapshot from the actual window
-  Opens the windows help for SPLICCO

3.16 Color setup

The colors of the graph and its curves can be set by selecting 'View / Color settings...' from the main menu or by right clicking on a window and selecting "Color settings". The following dialog appears and you can set the colors to the desired value. Furthermore you can select to hide the grid or not. If you click on the button 'Reset' the factory default will be restored. Click on 'Save' to confirm the setting.

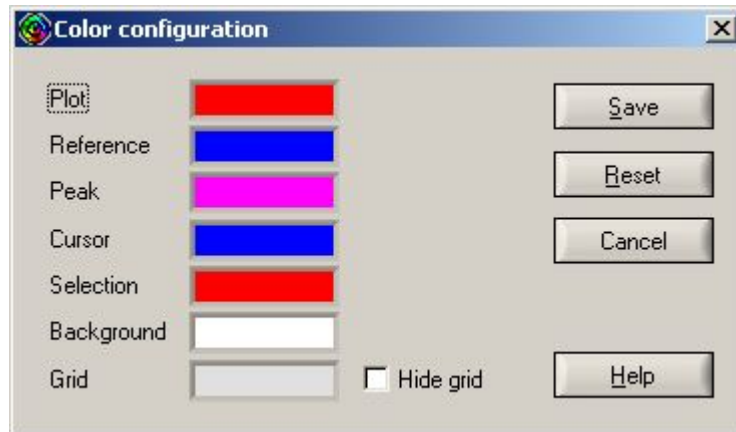


Figure 45 Color setup

3.17 Trigger mode

SPLICCO is able to generate internal trigger signals (SW) or use external trigger signals to take readings at defined time intervals.

You can set the trigger mode in the devices properties.

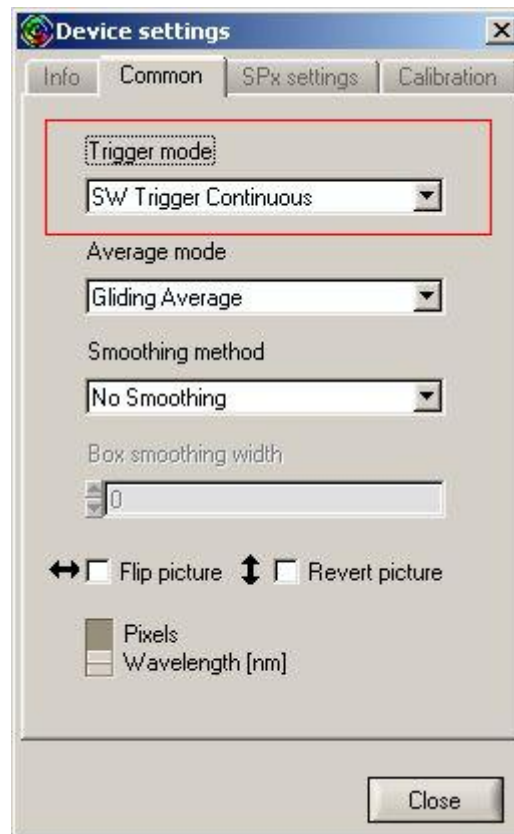


Figure 46 Device trigger properties

Depending on the device the control offers up to five trigger modi. Each device can handle SW Trigger Continuous, Single shot and the idle mode. According to the trigger mode the status symbol and the trigger button in the left bottom corner of each device windows changes. The trigger buttons labels shows the possible option, e.g. "Stop Loop" or "Arm Trigger".

Software trigger

SW Trigger Continuous:

The default trigger mode. The software triggers as fast as possible for maximal data refresh rate.

Figure 47 shows the status symbol and the trigger button.



Figure 47 Running data loop

By pressing the "Stop Loop" button the data readout is stopped and the symbol changes to:

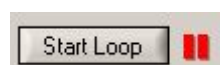


Figure 48 Stopped data loop

SW Trigger Singleshot:

In this mode for each click on the trigger button a data set is read out and shown. The status symbol and the trigger button will appear as shown in figure 49.



Figure 49 Software single shot mode

Hardware Trigger

All LC1-USB line cameras and SPx-USB spectrometers are equipped with a hardware trigger input. This input will be enabled by selecting either the "Ext. Trigger Continuous" mode or the "Ext. Trigger Singleshot" mode.

Ext. Trigger Continuous:

This mode is similar to the "SW Trigger Continuous" mode, except that the data readout is triggered by an external signal. After each data readout the external trigger will be armed again.

The status symbol and the trigger button will look the same way as in the software continuous mode.

Ext. Trigger Singleshot:

You have to press the trigger button to arm the external trigger before you can readout data. While the software is waiting for an external trigger signal the status symbol changes from figure 50 to figure 51.



Figure 50 Arming the external trigger



Figure 51 Waiting for external trigger

Idle:

This mode causes the device to be idle. In this mode the device does not take any measurements.

3.18 Wavelength calibration

The SPx-USB family of Spectrometer devices are delivered with calibration data preprogrammed on the device corresponding to the spectrometer optics mounted on the device. This data cannot be erased. Every time a SPx-USB instrument is opened with SPLICCO the calibration data will be uploaded automatically and

used to format each plot.

You have the possibility to use your own calibration data for setting the wavelength scale of the spectrometer. The calibration dialog can be reached via the device properties dialog in the tabpage "Calibration". Here you can start the calibration by pressing "Calibration" button or switch between the factory or the user calibration data set. SPLICCO will notify you if "User calibration data set" is selected but not present.

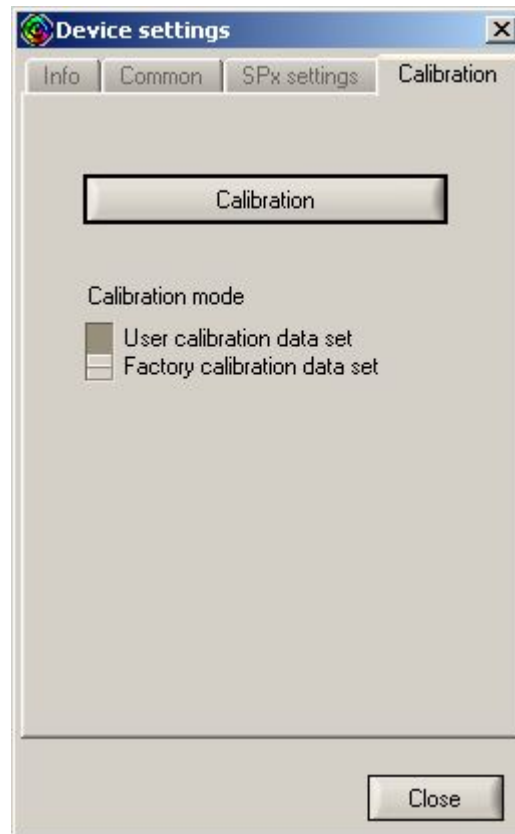


Figure 52 Calibration tabpage

The wavelength calibration window is divided into two parts. The actual measurement is shown on the left side. You can zoom into the graph by holding the CTRL key and boxing-in a region of interest or pressing the "Auto Zoom In" button. It is always possible to zoom to the original window by pressing the "Zoom home" button or to refresh the graph by pressing the "Refresh" button. The blue cursor in the graph always snaps to a data point so that you can mark a peak graphically. The graphically marked point is shown in the "Edit Calibration Points" box.

A minimum of four and a maximum of ten calibration points are required for a valid calibration. If you calibrated the instrument beforehand the "Calibration points" list on the right side of the window is filled with the former calibration points.

You can edit a calibration point by selecting it in the "Calibration Points" list. The point can be edited with the controls in the "Edit Calibration Points" box. Press "Accept" to make the changes valid. To add a new point press "Add" and a new point will be added to list and can be edited. To delete a selected point press "Remove" and the point will be removed from list.

Press "Save" to save the user calibration. SPLICCO will notify you in case the new calibration would lead to negative or other non valid wavelengths.

Note: SPLICCO uses a polynomial fitting routine to create the pixel-wavelength correlation array. Make sure that the calibration points are distributed over the whole pixel range.

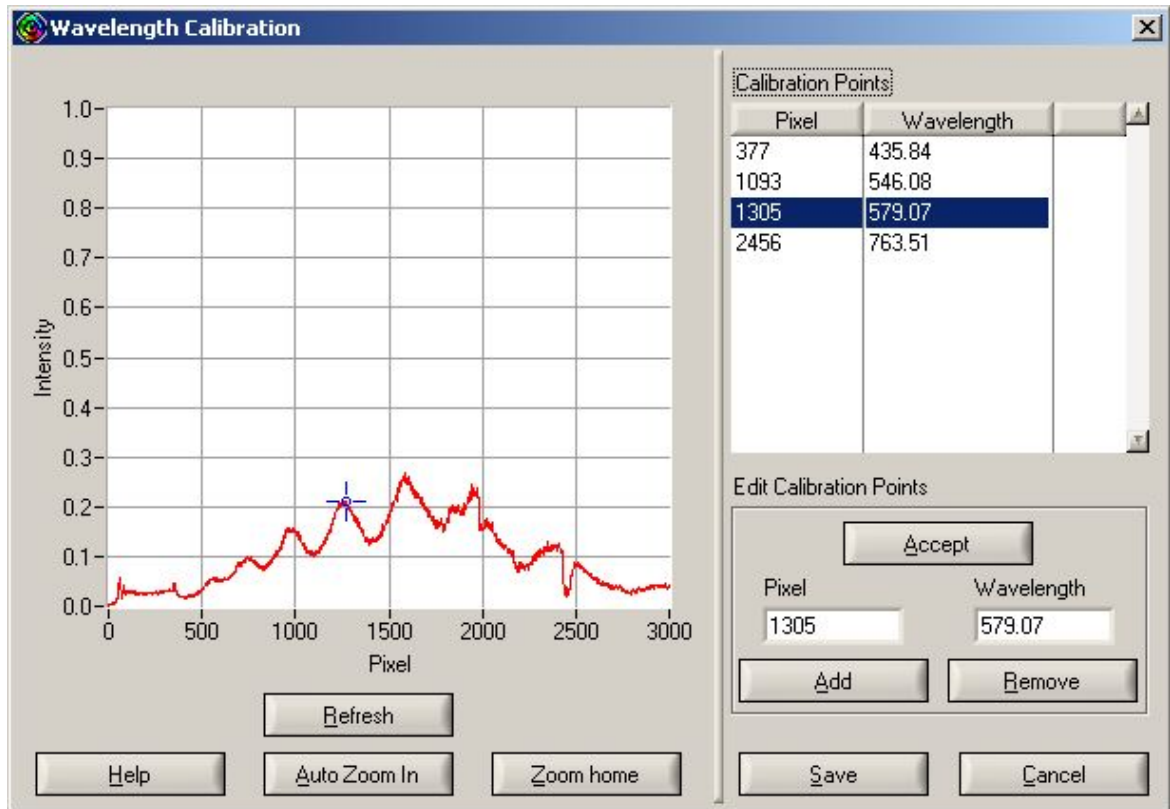


Figure 53 Wavelength calibration window

3.19 Persistence

SPLICCO offers the possibility to change the persistence attributes for each panel. You can reach the menu either by right clicking on a window and choosing "Persistence..." from the appearing menu or selecting 'View / Persistence' from the main menu.

The persistence dialog offers two sliders for duration and intensity of the persistence feature. After you have chosen the parameters, press "Apply" to make the changes valid. Press "Done" to leave the dialog.

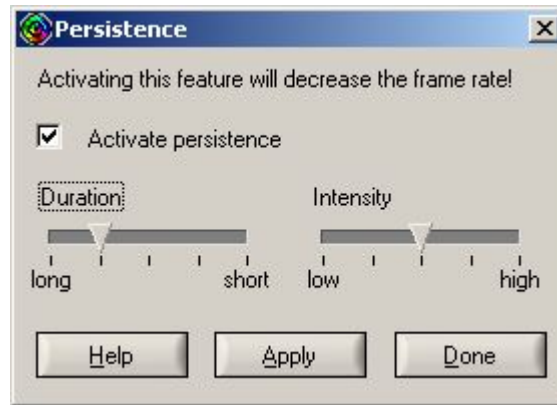


Figure 54 Persistence settings

3.20 Gaussian Transformation

SPLICCO is able to display the measurement data as the best-fit Gaussian distribution. You can reach the menu either by right clicking on a window and choosing "Gauss Transformation..." from the appearing menu or selecting 'View / Gauss Transformation' from the main menu.

The appearing dialog offers two sliders for sensitivity and significance, which influences the Gaussian fit.

After you have chosen the parameters, press "Apply" to make the changes valid. Press "Done" to leave the dialog.



Figure 55 Gauss-Transformation settings

Virtual devices

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IV

4 Virtual devices

4.1 What are virtual devices?

SPLICCO offers a special feature named "Virtual devices" which allows to demonstrate the various application features without having a real device connected to the PC.

Those virtual devices can simulate line cameras or spectrometers. The properties of virtual devices can be set and will be stored in a XML file.

Available parameters:

- device type
- number of pixels
- minimum and maximum wavelength
- manufacturers and instruments name
- serial and revision number
- alias
- lock status

4.2 Configuration of virtual devices

Virtual devices offers some options to manipulate the simulated data.

The settings can be changed in the device properties in the "Virtual settings" tab shown in figure 56. Virtual settings are only available in connection with virtual devices.

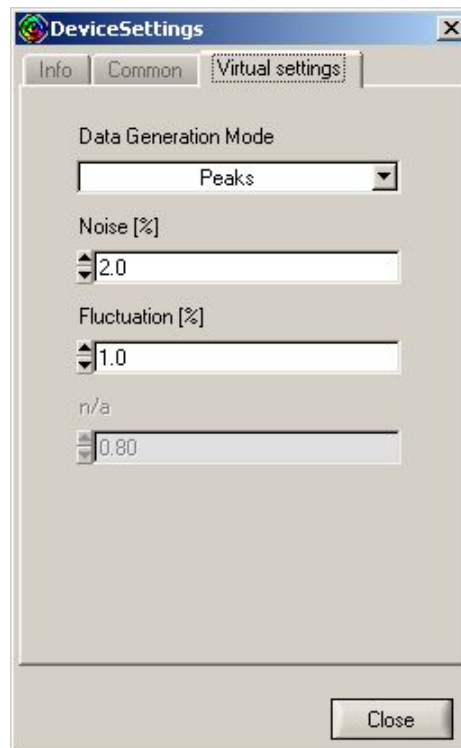


Figure 56 Virtual device settings

Virtual spectrometer:

If the virtual device simulates a spectrometer the "Data generation mode" only offers the mode "Peaks". Each time you select this mode new peaks will be generated. With the help of the control "Noise" the noise level in % can be changed as well as the fluctuation.

Virtual line camera:

If the virtual device simulates a line camera, the "Data generation mode" offers the modi "Line" and "Curve". The noise level and the fluctuation can be set and the baseline of the measurement and the amplitude of the curve can be changed.

4.3 The virtual devices description file

All virtual devices used by SPLICCO are described by a XML file, which can be modified with a simple text editor. This description file can be found in the installation folder of SPLICCO and is named "CameraDescription.xml".

HINT: Make a backup of this file before you modify the original to restore it if needed.

Please close SPLICCO before you edit this file. The changes will become active after SPLICCO is started again.

Each virtual device has the following parameters:

Table 1 Virtual device parameters

DEVICETYPE	The device type. 0 for a spectrometer, 1 for a virtual line camera.
NUM_PIXELS	The number of pixels. $1 < \text{NUM_PIXELS} < 10000$
WAVELENGTH_MIN	The minimum wavelength, minimal value should be 0.
WAVELENGTH_MAX	The maximum wavelength, maximal value should be 10000.
MANUFACTURER	The manufacturers name.
INSTRUMENT	The instruments name.
SERIALNUMBER	The virtual devices serial number.
REVISION	The virtual devices revision number.
ALIAS	The virtual devices alias.
LOCKSTATUS	The virtual devices lock status. 0 means unlocked, 1 means locked. The device can only be opened if the lockstatus is 0.

To create a new virtual device for SPLICCO, you have to open the file "CameraDescription.xml" in the installation folder. A new entry should be

formatted in the same way as the original virtual devices.

Important: Please make sure that serial numbers are unique.

Example:

```
<SPLICCO>
  <CAMERA_1>
    <DEVICETYPE>1</DEVICETYPE>
    <NUM_PIXELS>3000</NUM_PIXELS>
    <WAVELENGTH_MIN>300</WAVELENGTH_MIN>
    <WAVELENGTH_MAX>800</WAVELENGTH_MAX>
    <MANUFACTURER>Thorlabs</MANUFACTURER>
    <INSTRUMENT>Virtual Linecamera</INSTRUMENT>
    <SERIALNUMBER>S/N L1N3-0001-CAM</SERIALNUMBER>
    <REVISION>1.00</REVISION>
    <ALIAS>LC1</ALIAS>
    <LOCKSTATUS>0</LOCKSTATUS>
  </CAMERA_1>
</SPLICCO>
```

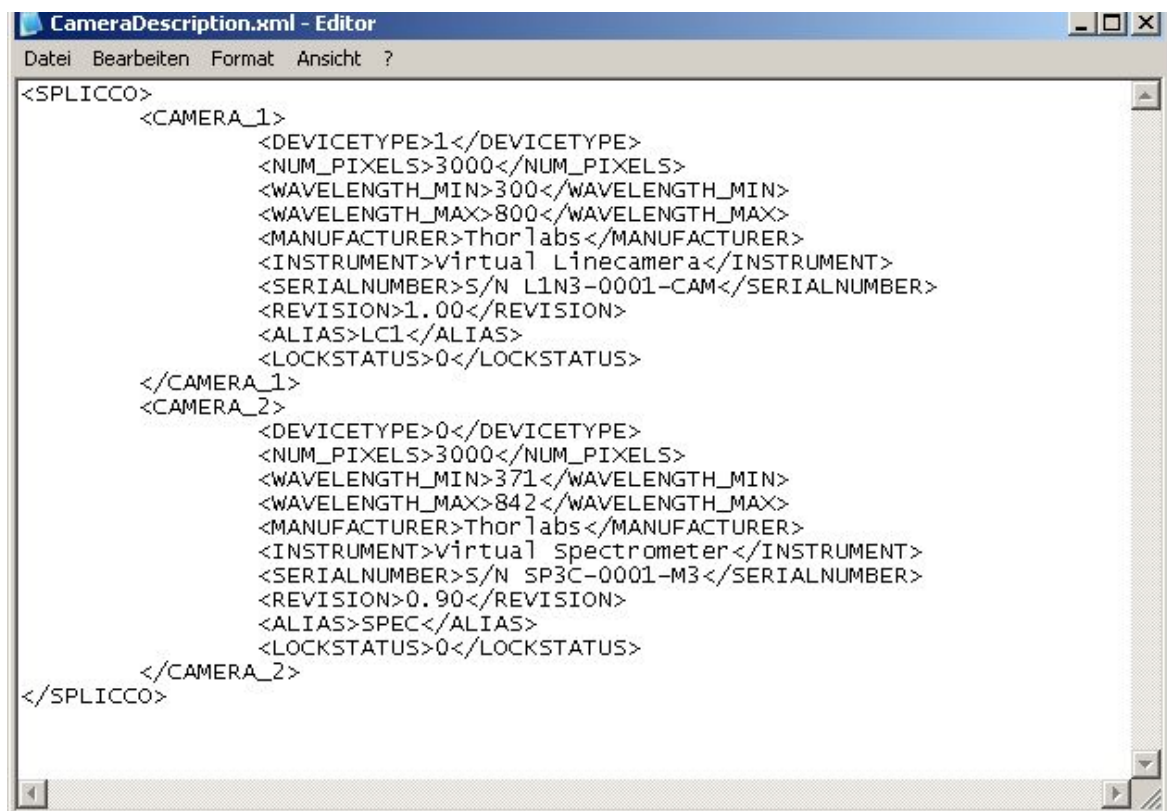


Figure 57 Virtual device description file

Service and maintenance

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Part



V

5 Service and maintenance

5.1 Troubleshooting

SPLICCO cannot find any devices but the virtual devices :

- Check if VISA runtime 4.1.0 or higher is installed.
- Make sure that the connected device is made by Thorlabs.
- Try to connect the device to another USB slot.

Measurement is running but the diagram is not updated with new measurement values :

- Look if the device is set to idle mode.
- Maybe you pressed the "Stop" button.

After opening an exported *.csv file with Microsoft Excel, a large number of incorrect numbers are displayed at the Excel sheet :

- The decimal separator in your Microsoft Excel may be set to ',' instead to '.'. The *.csv files generated by this program requires that Excel interprets '.' as the decimal separator.

"New Found Hardware Wizard" finishes with the error "the wizard cannot find the necessary software":

- This error occurs when the installer cannot find SPLICCO installed on your system.
- Install SPLICCO.
- Be sure that your device is configured as a VISA device. In case you used the "spectra" software before you can use the "USB PID changer tool" delivered with "spectra" to change the used drivers.
- Check if VISA runtime 4.1.0 or higher is installed on your system.

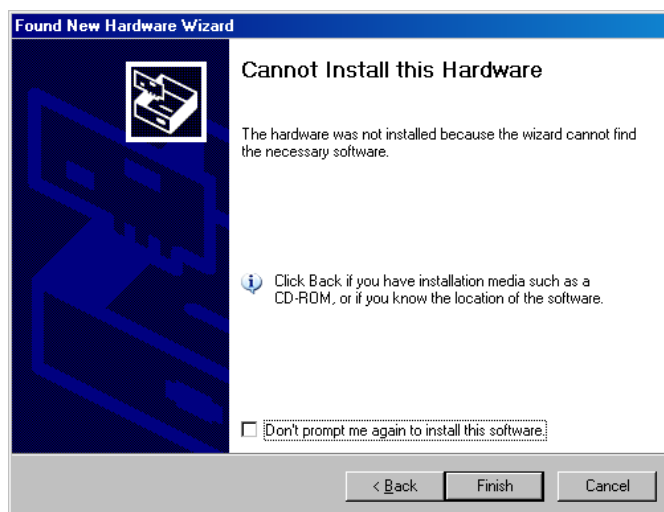


Figure 58 Error message in case SPLICCO was not installed

"New Found Hardware Wizard" finishes with the error "Cannot install this hardware":

- This error occurs when the installer cannot find VISA runtime 4.1.0 or higher installed on your system.
- Install VISA runtime.

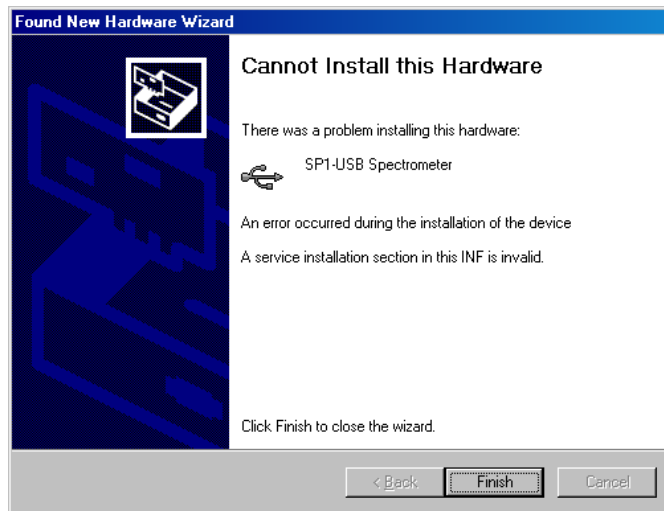


Figure 59 Error message in case VISA runtime was not found

Specifications

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VI

6 Specifications

Optical Head:

Spectral Range: SP1-USB \Rightarrow 400 to 800 nm
SP2-USB \Rightarrow 500 to 1000 nm

CCD Integration Time: 1 μ s to 200 ms

CCD Sensitivity: 300 V / (lx \cdot s)

CCD Pixel Size: 7 μ m x 200 μ m (7 μ m pitch)

Dimensions (L x W x H): 4.4 x 3.6 x 2.0 Inches

Weight: 0.70 kg

Cables:

USB 2.0 Cable 1.80 m. length

6.1 Dimensions

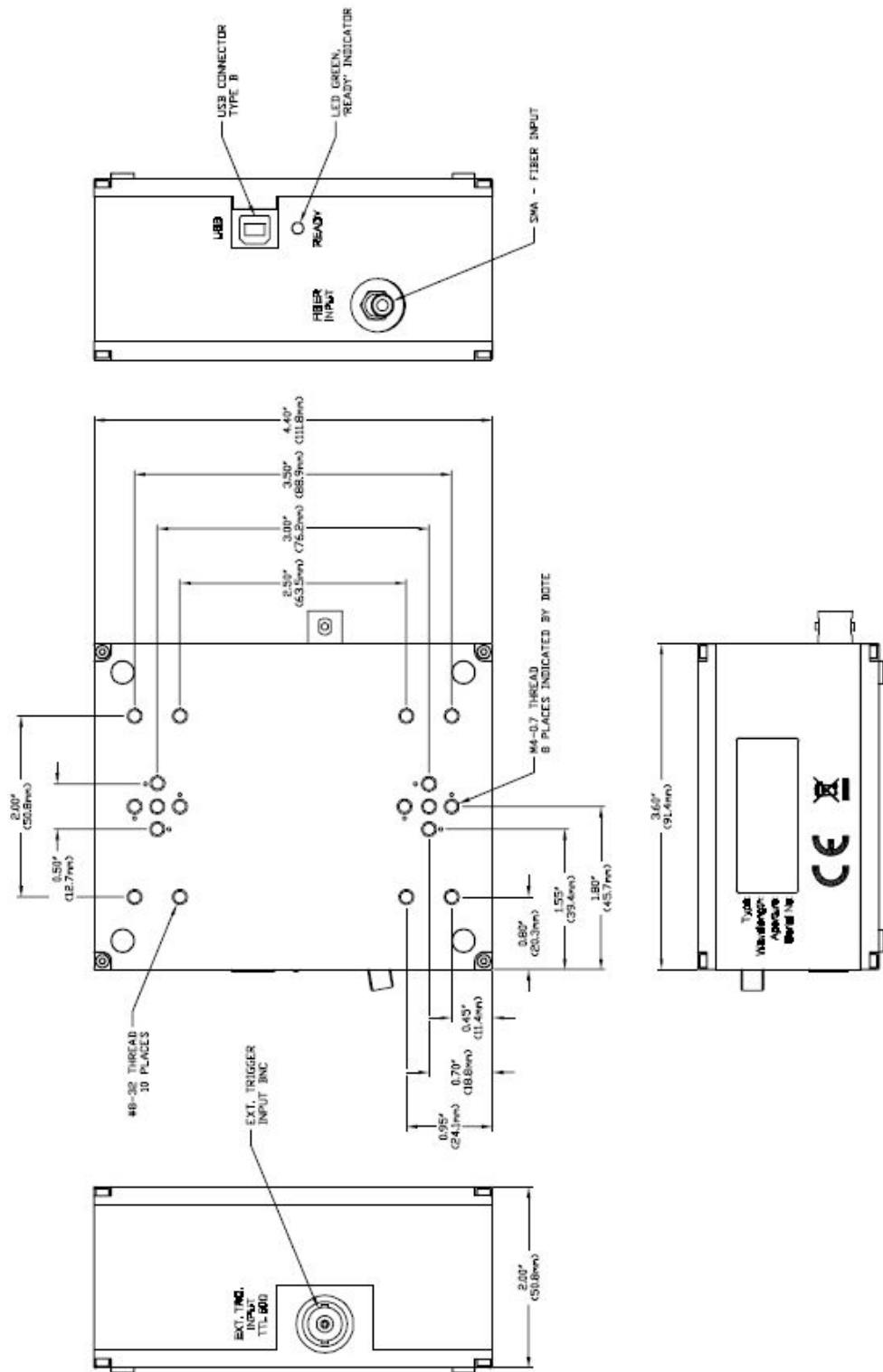


Figure 60 SPx-USB dimensions

Certifications and compliances

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VII

7 Certifications and compliances

Table 2 Certifications and compliances

Category	Standards or description
EC Declaration of Conformity - EMC	Meets intent of Directive 2004/108/EC ¹ for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:
EN 61326	EMC requirements for Class A electrical equipment for measurement, control and laboratory use, including Class A Radiated and Conducted Emissions ^{2,3,4} and Immunity.
IEC 61000-4-2	Electrostatic Discharge Immunity (Performance criterion C)
IEC 61000-4-3	Radiated RF Electromagnetic Field Immunity (Performance criterion B)
IEC 61000-4-4	Electrical Fast Transient / Burst immunity (Performance criterion C)
IEC 61000-4-11	Voltage Dips and Interruptions Immunity (Performance criterion C)
FCC EMC Compliance	Emissions comply with the Class A Limits of FCC Code of Federal Regulations 47, Part 15, Subpart B ^{2,3,4} .
EC Declaration of Conformity - Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive 2006/95/EC ⁵
EN 61010-1:2001	Safety requirements for electrical equipment for measurement, control and laboratory use.
UL 61010-1 2 nd ed.	Safety requirements for electrical equipment for measurement, control and laboratory use.
CAN/CSA C22.2 No. 61010-1-04	Safety requirements for electrical equipment for measurement, control and laboratory use.
IEC 61010-1:2001	Safety requirements for electrical equipment for measurement, control and laboratory use.
Equipment Type	Test and measuring
Safety Class	Class I equipment (as defined in IEC 60950-1:2001)

¹ Replaces 89/336/EEC

² Compliance demonstrated using high-quality shielded interface cables.

³ Emissions, which exceed the levels required by these standards, may occur when this equipment is connected to a test object.

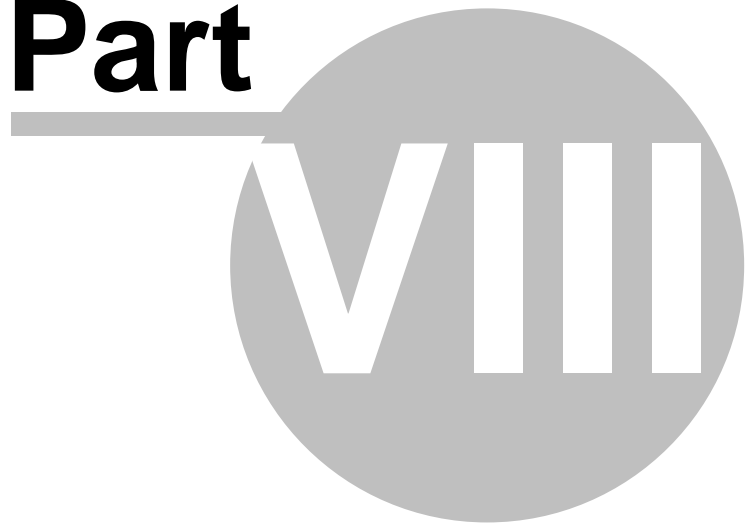
⁴ Minimum Immunity Test requirement.

⁵ Replaces 73/23/EEC, amended by 93/68/EEC.

Appendix

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Part



8 Appendix

8.1 Warranty

Thorlabs warrants the hardware and software determined by *Thorlabs* for this unit to operate fault-free provided that they are handled according to the requirements of *Thorlabs*. However, *Thorlabs* does not warrant a faulty free and uninterrupted operation of the software or connected devices for special applications nor this instruction manual to be error free. *Thorlabs* is not liable for consequential damages.

Restriction of warranty

The warranty mentioned above does not cover errors and defects being the result of improper treatment, software or interface not supplied by *Thorlabs*, modification, misuse or operation outside the defined ambient conditions stated by *Thorlabs* or unauthorized maintenance.

Further claims will not be consented to and will not be acknowledged. *Thorlabs* does explicitly not warrant the usability or the economical use for certain cases of application.

Thorlabs reserves the right to change this instruction manual or the technical data of the described unit at any time.

8.2 WEEE

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community (EC) and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return "end-of-life" units without incurring disposal charges.

This offer is valid for Thorlabs electrical and electronic equipment

- sold after August 13, 2005
- marked correspondingly with the crossed out "wheelie bin" logo (see fig. 61)
- sold to a company or institute within the EC
- currently owned by a company or institute within the EC
- still complete, not disassembled and not contaminated

As the WEEE Directive applies to self-contained operational electrical and electronic products, this "end-of-life" take back service does not refer to other Thorlabs products, such as

- pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- components
- mechanics and optics
- left over parts of units disassembled by the user (PCBs, housings etc.)

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

8.2.1 Waste treatment on your own responsibility

If you do not return an "end-of-life" unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

8.2.2 Ecological background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS Directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE Directive is to enforce the recycling of WEEE. A controlled recycling of end-of-life products will thereby avoid negative impacts on the environment.



Figure 61 Crossed out "Wheelie Bin" symbol

8.3 Listings

8.3.1 List of acronyms

The following acronyms and abbreviations are used in this manual:

CCD	<u>C</u> harge- <u>c</u> oupled <u>D</u> evice
CSV	<u>C</u> omma <u>S</u> eparated <u>V</u> alues
GUI	<u>G</u> raphical <u>U</u> ser <u>I</u> nterface
OEM	<u>O</u> rginal <u>E</u> quipment <u>M</u> anufacturer
PCB	<u>P</u> rinted <u>C</u> ircuit <u>B</u> oard
RoHS	<u>R</u> estriction of the use of certain <u>h</u> azardous <u>s</u> ubstances in electrical and electronic equipment
SPLICCO	<u>S</u> pectrometer and <u>L</u> ine <u>c</u> amera <u>C</u> ontrol
SW	<u>S</u> oftware
USB	<u>U</u> niversal <u>S</u> erial <u>B</u> us
WEEE	<u>W</u> aste <u>E</u> lectrical and <u>E</u> lectronic <u>E</u> quipment Directive
XML	<u>E</u> xtensible <u>M</u> arkup <u>L</u> anguage

8.3.2 List of tables

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8.3.4 Addresses

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.



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