

Vernier SpectroVis Plus Spectrophotometer

(Order Code: SVIS-PL)



SpectroVis Plus is a portable, visible to near-IR spectrophotometer and fluorometer.

What is included with the SpectroVis Plus?

- One SpectroVis Plus unit
- 15 plastic cuvettes and lids
- One standard USB cable
- User's Guide (this document)

Software Requirements

Logger *Pro* 3 (version 3.8.2 or newer) software is required if you are using a computer. The LabQuest application version 1.4 or newer is required if you are using a LabQuest. Visit the downloads section of www.vernier.com to update your software.

What can SpectroVis Plus Measure?

SpectroVis Plus can measure:

- The absorbance or % transmittance of a solution
- The fluorescence of a solution excited at 405 nm or 500 nm
- The intensity of emissions from a light source (requires a SpectroVis Optical Fiber, not included, order code SVIS-FIBER) or a luminescent solution

Using SpectroVis Plus with a Computer

1. Install Logger *Pro* 3 software (version 3.8.2 or newer) on your computer before using SpectroVis Plus.
2. Connect the SpectroVis Plus to a powered USB port or a powered hub.
3. The first time you connect a SpectroVis Plus, your computer may ask you a few questions. **Note:** Do not go online for device drivers. The device drivers were installed when you installed Logger *Pro* 3.

Select the Type of Data (or Units) You Want to Measure

The default data type is absorbance. If you want to measure the absorbance of a solution, proceed directly to the Calibrate section.

If you want to measure %T, Fluorescence (excited at 405 nm or 500 nm), or Intensity, do the following:

1. Choose Change Units ► Spectrometer from the Experiment menu.
2. Select the unit or data type you wish to measure.

Calibrate (not required if measuring Intensity or Fluorescence)

1. To calibrate the SpectroVis Plus, choose Calibrate ► Spectrometer from the Experiment menu.
2. Fill a cuvette about 3/4 full with distilled water and place it in the cuvette holder.
3. Follow the instructions in the dialog box to complete the calibration, and then click .

Collect Data

There are three general modes of data collection available:

- Measurement vs. Wavelength, which produces a spectrum
- Measurement vs. Concentration for Beer's law experiments
- Measurement vs. Time for kinetics experiments.

Begin by generating a spectrum using the following instructions. Then you will be able to proceed with measuring the chosen value *versus* concentration or time.

Measurement vs. Wavelength (Generate a Spectrum)

1. Fill a cuvette about 3/4 full of the solution to be tested. Place the sample in the cuvette holder of the SpectroVis Plus.

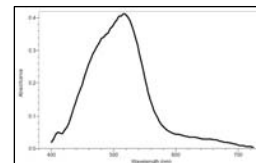



Figure 1: Typical absorbance spectrum

2. Click to generate a spectrum. Click to end data collection.

Measurement vs. Concentration (Beer's law Studies)

1. Collect a spectrum as described above.
2. Click on the Configure Spectrometer Data-Collection button, .

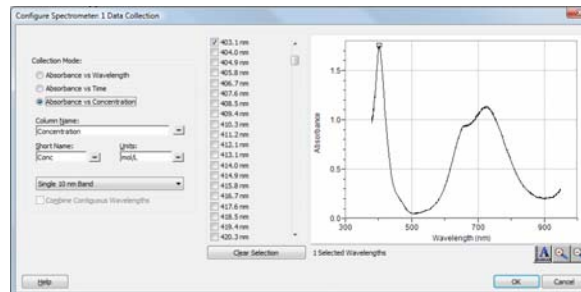


Figure 2: Configure Spectrometer Data-Collection Dialog Box

There are three regions in this box:

- **Collection Mode:** The three options for data collection are offered. If the measurement (Absorbance in this example) *vs.* Time or *vs.* Concentration is selected, a wavelength or wavelengths will need to be chosen.
 - **Graph:** The graph displays a full-spectrum analysis of the sample in the cuvette holder. By default, the wavelength with the maximum measured value will be selected. You may wish to select a different wavelength. See Step 3 for details.
 - **List of wavelength options:** This column lists all the available wavelengths. It becomes active when either the Concentration or Time modes are selected.
3. Select Absorbance (or %T or Fluor.) *vs.* Concentration as the data-collection mode. The wavelength with the maximum value from the spectrum (λ max) will be automatically selected. There are three options when choosing a wavelength (or wavelengths) for subsequent measurements:
 - **Option One:** The default option is to use a single 10 nm band. This measures the average absorbance from ~5 nm on either side of the chosen wavelength. You can change the center wavelength value by clicking on the graph or by choosing a wavelength from the list.
 - **Option Two:** If you wish to use the λ max chosen by *Logger Pro*, but you want the absorbance to be measured only at that one wavelength, change “Single 10 nm Band” to “Individual Wavelengths.” You may then select up to ten wavelengths to measure at the same time.
 - **Option Three:** If you wish to measure an average over a range of contiguous wavelengths of your choice, change “Single 10 nm Band” to “Individual Wavelengths.” Click CLEAR SELECTION. Check the box next to “Combine Contiguous Wavelengths.” Click boxes in the list or drag your cursor on the graph to select up to ten contiguous wavelengths.
 4. Click to continue.
 5. Place your first sample in the cuvette slot of the SpectroVis Plus. Click and then click . Enter the concentration of the sample and click .
 6. Place your second sample in the cuvette slot. After the readings stabilize, click . Enter the concentration of the second sample and click .
 7. Repeat Step 6 for the remaining samples. When finished, click to end the data collection.

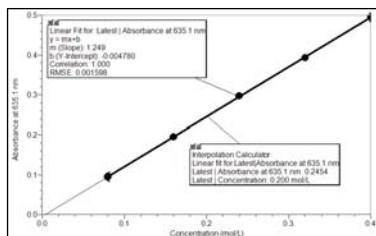


Figure 3: Typical Beer's law analysis of an unknown sample

8. Click linear fit, , to see the best fit line equation for the standard solutions.

9. If doing Beer's law to determine the concentration of an unknown, place the unknown sample in the cuvette holder. Choose Interpolation Calculator from the Analyze menu. A helper box will appear, displaying the absorbance and concentration of the unknown. Click .

Measurement vs. Time (Kinetics)

1. Collect a spectrum as described above.
2. Click the Configure Spectrometer Data Collection button,
3. Select Absorbance (or %T or Fluor.) *vs.* Time as the data collection mode. The wavelength with the maximum value from the spectrum (λ max) will be automatically selected. You may wish to select a different wavelength. See Step 3 in the previous section for instructions. Click to continue.
4. The default is set to collect data for 200 seconds. If you wish to change the data-collection parameters for your experiment, choose Data Collection from the Experiment menu and make the necessary changes. Click . **Note:** If data are being collected more slowly than you wish, you may need to reduce the Samples to Average value in the Spectrometer Dialog Box. See “Changing the Settings in *Logger Pro 3*” section below.
5. Mix the reactants, then transfer ~2 mL of the reaction mixture to a cuvette. Place the cuvette in the cuvette slot of SpectroVis Plus.
6. Click to begin data collection. You may click to end the data collection early.
7. Click Curve Fit, to calculate a function for your data.

Measure Intensity of Light Emissions

1. Insert the SpectroVis Optical Fiber into the SpectroVis Plus, lining up the white triangles. Or, if measuring the luminescence of a solution, insert the cuvette.
2. If you have not already done so, choose Change Units ▶ Spectrometer ▶ Intensity from the Experiment menu. SpectroVis Plus measures intensity in relative units scaled from 0 to 1.
3. Aim the tip of the optical fiber cable at a light source. **Note:** If you are conducting a flame test, place the tip of the optical fiber no closer than 4–5 cm from the flame.
4. Click to generate a spectrum. Click to end data collection.

If the spectrum maxes out (flat and wide peaks), increase the distance between the light source and the tip of the optical fiber cable. You could also reduce the Sample Time and/or reduce the Samples to Average, found in the Spectrometer Dialog Box.

Changing the Settings in Logger Pro 3

Spectrometer Dialog Box

The Spectrometer dialog box lists all of the settings for the device. To display this box choose Set Up Sensors ► Show All Interfaces from the Experiment menu.

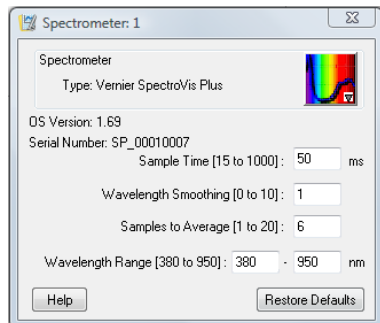


Figure 4: Spectrometer Dialog Box

There are four parameters that can be adjusted in the dialog box.

- Sample Time: similar to the shutter speed of a camera. Logger Pro automatically selects the proper sample time during calibration. **Note:** For emission and fluorescence studies, you may want to reduce the sample time.
- Wavelength Smoothing: the number of adjacent readings on either side of a given value that is used to calculate an average value.
- Samples to Average: the number of readings taken at a given wavelength to calculate an average reading.
- Wavelength Range: the range is determined by the type of spectrometer in use, but can be changed to select a narrower range.

Using SpectroVis Plus with a LabQuest

1. Confirm that your LabQuest App is version 1.4 or newer.
2. Use the USB cable to connect the SpectroVis Plus to LabQuest.

Select the Type of Data (or Units) You Want to Measure

The default data type is absorbance. If you want to measure the absorbance of a solution, proceed directly to the Calibrate section.

If you want to measure %T, Fluorescence (excited at 405 nm or 500 nm), or Intensity, do the following:

1. Choose Change Units ► USB: Spectrometer from the Sensors menu.
2. Select the unit or data type you wish to measure.

Calibrate (not required if measuring Intensity or Fluorescence)

1. Fill a cuvette about 3/4 full with distilled water and place it in the cuvette holder. Align the cuvette so a clear side of the cuvette is facing the light source.

2. Choose Calibrate ► USB:Spectrometer from the Sensors menu. When warm-up is complete, select Finish Calibration. After the message “Calibration Completed” appears, tap OK.

Collect Data

There are three general modes of data collection available for measuring absorbance, %T, and fluorescence:

- Measurement vs. Wavelength, which produces a spectrum
- Measurement vs. Concentration for Beer’s law experiments
- Measurement vs. Time for kinetics experiments.

Begin by generating a spectrum using the instructions in the following section. Then proceed with measuring the chosen value *versus* concentration or time.

Measurement vs. Wavelength (Generate a Spectrum)

1. Fill a cuvette about 3/4 full of the solution to be tested. Place the sample in the cuvette slot of the SpectroVis Plus.
2. Start the data collection to generate a spectrum. Tap the red Stop button to stop.

Measurement vs. Concentration (Beer’s law Studies)

1. Collect a spectrum as described above. LabQuest App will automatically identify the wavelength of maximum measured value (λ_{max}). If you wish to select a different wavelength, tap on the graph or use the arrow keys on the keypad to identify the wavelength of choice. Another way to change the wavelength is to navigate to the meter screen, tap on the meter itself, and select Change Wavelength. Enter the wavelength of your choice and select OK. If the wavelength you entered is not measured by the SpectroVis Plus unit, LabQuest will automatically choose the wavelength closest to your choice. By checking the box labeled “Report average of wavelength band,” the values from ~5 nm on either side of the chosen wavelength are averaged, often giving superior results.
2. Tap the Meter tab. On the Meter screen, tap Mode.
3. Change the mode to Events with Entry. Enter the Name (e.g., **Concentration**) and the Units (e.g., **mol/L**). Select OK.
4. A message will appear warning you to either save or discard the full spectrum run. Make your choice and proceed with data collection.
5. Place your first solution in the cuvette slot. Start the data collection. After the absorbance reading stabilizes, tap Keep. Enter the concentration of the solution and select OK.
6. Place your second solution in the cuvette slot. After the absorbance readings stabilize, tap Keep. Enter the concentration of the second sample and select OK.
7. Repeat Step 5 for the remaining standard samples. When finished, tap the red Stop button to end the data collection.
8. To calculate a best fit line equation for your standards, choose Curve Fit from the Analyze menu. Select Linear for the Fit Equation, and then select OK. The graph screen will appear again with the linear regression equation displayed.

9. If doing Beer's law to determine the unknown concentration of a solution, place a cuvette containing an unknown in the cuvette slot. Tap the Meter tab and write down the displayed absorbance value. Tap the Graph tab and trace the linear regression equation to determine the concentration of the unknown.

Measurement vs. Time (Kinetics)

1. Collect a spectrum as described above. The wavelength with the maximum value from the spectrum (λ max) is automatically selected. If you wish to choose a different wavelength, follow the directions in Step 1 of the previous section.
3. Tap the Meter tab. On the Meter screen, tap Mode. Change the data-collection mode to Time Based.
4. You can change the rate, interval, and/or length of time of data collection, if desired. **Note:** If data are being collected more slowly than you wish, you may need to reduce the Samples to Average value in the Spectrometer Dialog Box.
5. Select OK when you are ready to proceed. A message will appear warning you to either save or discard the full spectrum run. Make your choice and proceed with the data collection.
6. Mix the reactants, then transfer ~2 mL of the reaction mixture to a cuvette. Place the cuvette in the SpectroVis Plus. Start the data collection. You may tap the red Stop button to end the data collection early.
7. To calculate a function for your data, choose Curve Fit from the Analyze menu. Select the Fit Equation, and then select OK. The graph screen will appear again.

Measure Intensity of Light Emissions

1. Insert the SpectroVis Optical Fiber into the SpectroVis Plus cuvette holder, lining up the white triangles. Or, if measuring the luminescence of a solution, insert the cuvette.
2. If you have not already done so, choose Change Units ► USB:Spectrometer ► Intensity from the Sensors menu. SpectroVis Plus measures intensity in relative units scaled from 0 to 1.
4. Aim the tip of the optical fiber cable at a light source. **Note:** If you are conducting a flame test, place the tip of the optical fiber no closer than 4–5 cm from the flame.
5. Start data collection to generate a spectrum. Tap the red Stop button to stop.

If the spectrum maxes out (flat and wide peaks), increase the distance between the light source and the tip of the optical fiber cable. You could also reduce the Sample Time and/or reduce the Samples to Average in the data collection dialog. To do this, return to the Meter tab and choose Data Collection from the Sensors menu.

Changing the Settings in LabQuest App Spectrometer Settings Screen

The Spectrometer settings screen lists all of the settings for the device. To display this screen, navigate to the Meter screen and choose Data Collection... from the Sensors menu. **Note:** The mode must be set to Full Spectrum to access the settings.

There are four parameters that can be adjusted in this dialog box.

- Sample Time: similar to the shutter speed of a camera. LabQuest App automatically selects the proper sample time during calibration. **Note:** For emission and fluorescence studies, you may want to reduce the sample time.
- Wavelength Smoothing: the number of adjacent readings on either side of a given value that is used to calculate an average value.
- Samples to Average: the number of readings taken at a given wavelength to calculate an average reading.
- Wavelength Range: the range is determined by the type of spectrometer in use, but can be changed to select a narrower range.

Specifications

Light Sources: Incandescent white bulb, approximately 8000 hour lifetime, LED-based, approximately 100,000 hour lifetime

Wavelength Range: 380 nm–950 nm

Reported Wavelength Interval: 1 nm

Optical Resolution: 2.5 nm

Warranty

Vernier warrants this product to be free from defects in materials and workmanship for a period of one year from the date of shipment to the customer. This warranty does not cover damage to the product caused by abuse or improper use. The bulb is also covered by a one-year warranty from the date of shipment to the customer.



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Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



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