

**SPECTRAL PRODUCTS**

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# SPM301 Operation Manual ver 1.0



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## **Warranty and Liability**

This SM product is warranted against defects in material and workmanship for a period of one year from the date of shipment. During the warranty period, Spectral Products will, without charge, repair or replace, at its discretion, the defective product or component parts.

For warranty service or repair, this product must be returned to a service facility designated by Spectral Products (SP). For products returned under warranty, the Buyer shall prepay shipping charges (including shipping charges, duties, and taxes for products returned to SP from another country), and SP will pay for shipping charges to return the product to the Buyer.

This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations, modifications or repairs, if the serial number is altered, defaced or removed, the improper or inadequate maintenance by the Buyer, Buyer-supplied software or interfacing, or improper site preparation or maintenance. No other warranty is expressed or implied. SP shall not be liable for any consequential damages, including without limitation, damages resulting from loss of use, as permitted by law.

# **Environment**

## **Operating Conditions**

*Warning! This instrument is not designed for operation in an explosive atmosphere.*

The instrument will operate correctly under the following conditions:

- Indoors or outdoors when the weather is clear and no wind.
- Ambient temperature +15 °C to +35 °C.
- Ambient relative humidity from 20% to 80%, without condensation.
- Altitude in the range from 0m to 2000m.

## **Storage Conditions**

You can store the instrument safely under the following conditions:

- Indoors.
- Ambient temperature +15 °C to +35 °C.
- Ambient relative humidity from 20% to 80%, without condensation.
- Altitude in the range from 0m to 2000m.

## **Other Environmental Conditions**

### **Chemicals**

Use, store, and dispose of chemicals that you require for your analyses in accordance with the manufacturer's recommendations and local safety regulations.

*Warning! Some chemicals used with this instrument may be hazardous or may become hazardous after completion of an analysis. The responsible body (for example, Laboratory Manager) must take the necessary precautions to ensure that the surrounding workplace and instrument operators are not exposed to hazardous levels of toxic substances (chemical or biological) as defined in the applicable Material Safety Data Sheets (MSDS) or OSHA, ACGIH, or COSHH documents.*

*Venting for fumes and disposal of waste must be in accordance with all national, state and local health and safety regulations and laws.*

## **Toxic Fumes**

If you are working with volatile solvents or toxic substances, you must provide an efficient laboratory ventilation system to remove vapors that may be produced when you are performing analyses.

## **Waste Disposal**

Waste containers may contain corrosive or organic solutions and small amounts of the substances that were analyzed. If these materials are toxic, you may have to treat the collected effluent as hazardous waste. Refer to your local safety regulations for proper disposal procedures.

## **System Description**

The SPM301 is compact NIR spectrometer operating in the 1000-3000nm range. The spectrometer features a 256 pixels PbS array detector spectrometer (SM301), a broad band tungsten-halogen light source, and a cuvette holder.

This instrument is usable in a wide range of applications requiring fast measurements.



## **Optical System**

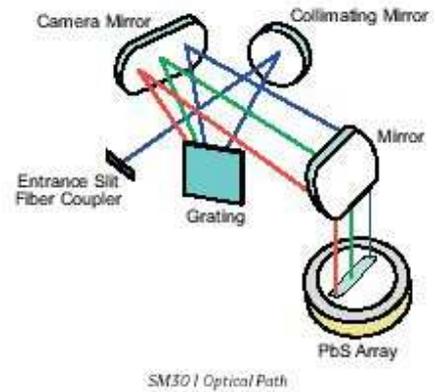
The SPM301 compact near infra-red spectrophotometer features an array detector based spectrometer system.

The optical system is depicted schematically in figure below.



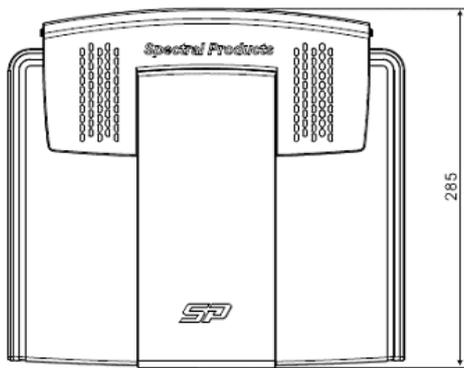
The PbS array spectrometer is based on a crossed Czerny-Turner configuration and consists of an entrance slit, a gold coated collimating mirror, a grating, a gold coated focusing mirror a gold coated bending mirror, and 256 pixels PbS array detector.

The detector array is thermoelectrically cooled ensuring long-term operating stability. A tungsten halogen lamp is used as the light source and is stable after a power-on warm up period of about ten minutes. The instrument has been uniquely designed without moving parts, providing enhanced signal/noise and sensitivity and incorporates readily available industry standard components.

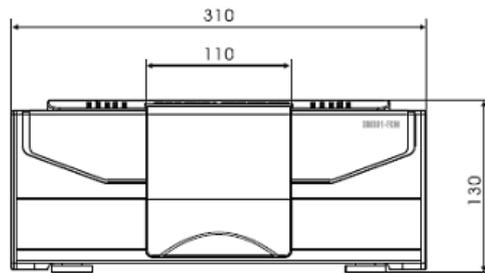


## System Overview

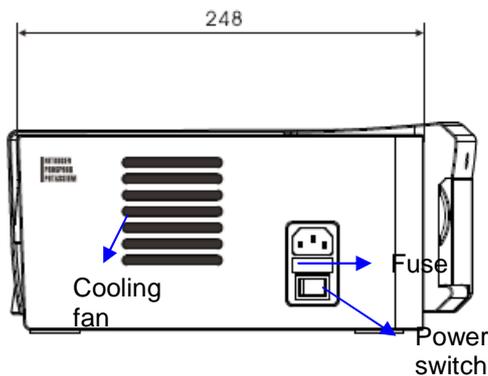
Top View



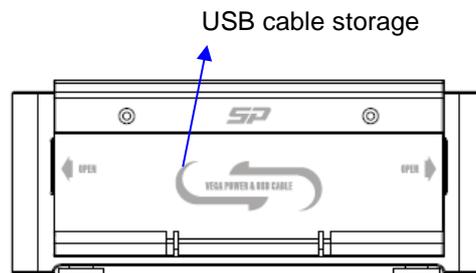
Front View



Side View



Rear View



Scale Unit: mm

# **System Specification**

## **General**

- **Dimensions:** Width: 310mm, Height: 130mm, Depth: 285mm
- **Sample compartment Dimensions:** Width: 46mm, Height: 120mm, Depth: 160mm
- **Mass:** 9Kg approx.
- **Power requirements:** 110V AC, 50/60 Hz; 400 VA
- **Ambient operating Temperature:** 15 °C to 35 °C
- **Humidity range:** 20% to 80% relative humidity w/o condensation

## **Light Source**

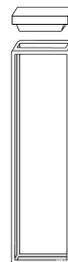
- **Lamp:** Tungsten-halogen
- **Input Power:** 12Vdc at 0.8 Amps
- **Current Regulation:** +/-0.4%
- **Mean Spherical Candlepower:** 3.3
- **Color Temperature:** 2800 °K
- **Bulb Life:** 10,000 hours average

## **Spectrometer**

- **Detector:** 256 PbS array
- **Pixel size:** 45 X 450µm
- **Peak Detectivity (D\*):**  $1 \times 10^{11} \text{ cmHz}^{0.5} \text{ W}^{-1}$
- **Linearity:** >90% over 10% to 90% of dynamic range
- **Response Uniformity:** +/-10% of array signal mean
- **Pixel Clock:** 2MHz max. for 4MHz data output
- **Integration Range:** 100µs-200ms
- **Spectral response range:** 1000 to 3000nm
- **Spectral Resolution:** ~15nm
- **Slit width:** 25µm
- **Grating:** 75 grooves per mm
- **Stray light rejection:** better than  $10^{-3}$
- **Analog to digital:** 16-bit resolution, USB standard
- **Dynamic range:** >4000:1 for single scan
- **Detector cooling:** -4°C

## Sample holder (Cuvette)

- Material type: Optical glass
- Transmittance range: 334-2500nm
- Path length: 2mm
- External dimension: 12.5 X 3.5 X 45 mm
- Internal dimension: 10 X 2 mm (W X L)
- Nominal Vol. : 0.700ml
- No. of polished windows: 2



# **System Installation**

## **Equipment Provided**

Please check that you have been shipped a SPM301 plus the components listed below.

|   |     |
|---|-----|
| Item 1: Main SPM301 spectrophotometer,          | 1ea |
| Item 2: Software package, SM32Pro For SM301     | 1ea |
| Item 3: Cuvette holder included in the SPM301   | 1ea |
| Item 4: Optical glass cuvettes, 2mm path length | 2ea |
| Item 5: Power cable                             | 1ea |

## **Software Installation**

Before plugging the SPM301, the operating software, SM32Pro for SM301, has to be installed on your computer first. Please refer to the software manual. After installing the software properly, please connect the spectrophotometer.

## **Connecting to the line power supply**

***Warning!** To prevent potential injury to yourself and damage to the instrument, first make the electrical connections between the instruments in the system before connecting to the line power supply.*

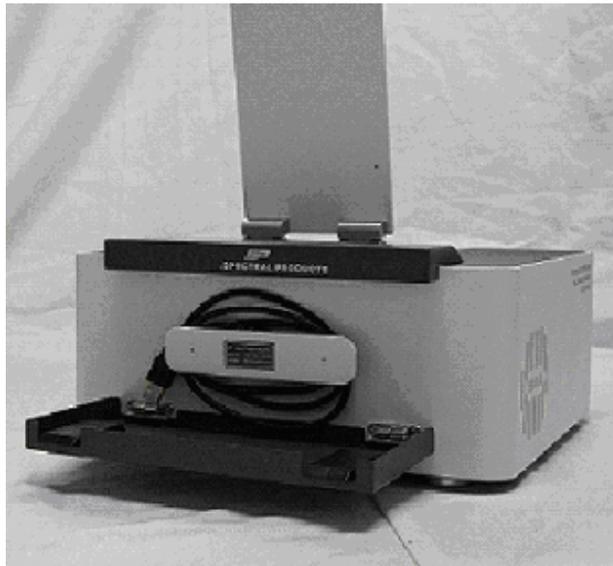
1. Make sure that the correct fuse is fitted in the holder at the side of the SPM301.
2. Make sure that the plug fitted to the line power cord provided with the spectrometer is suitable for your local electrical outlets. If it is not, remove it and fit plug conforming to the local regulations.
3. Make sure that the power switch is set to off, then connect the line cord to the electrical power supply. The power switch is located at the side of the spectrometer, right above the power cord connector.

***NOTE!:** To prevent interferences caused by earth loops when operating with ancillary instruments (for example, printers), connect all components of the system to the same phase of the electrical supply via a multisolet distributor.*

## Connecting to your computer

After checking up all the connections, connect the USB cable into your computer. Please refer to the software manual for the system driver installing process. The USB cable is located in the USB cable box on the rear side of the spectrophotometer.

**Warning!** Do not pull the USB cable too much. The other end is connected to the USB board of the spectrometer installed in the SPM301. If the cable is pulled too much, it can cause the disconnection from the electronic board.



# System Operation

## Preparation

1. Connect the USB cable to your computer. And then turn on the power switch of the SPM301. Open the software (SM32Pro for SM301) on your computer.

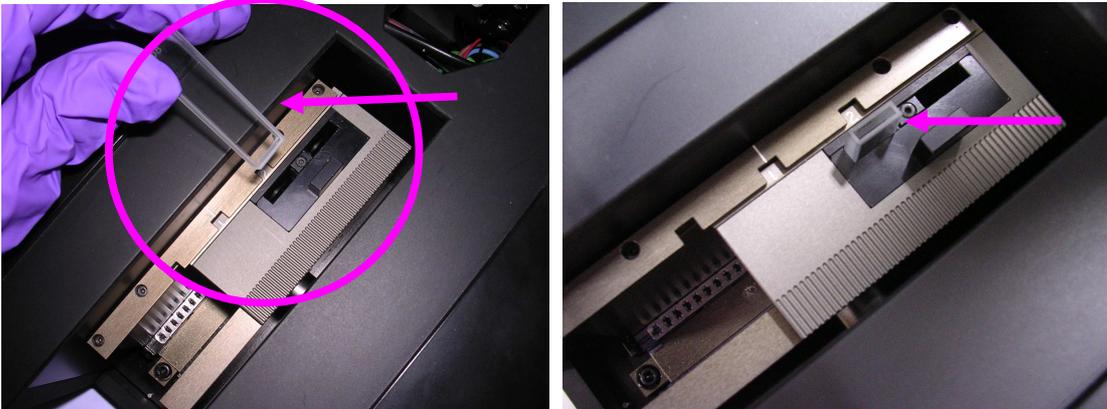


*NOTE! It is recommended to leave the system for 30 minutes to warm up the light source completely.*

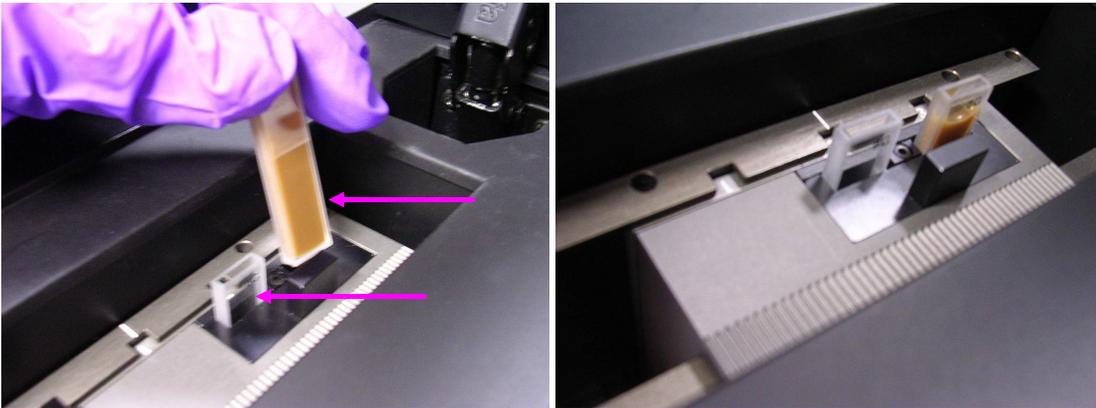
2. Open the main cover of the SPM301 to put the cuvette sample.



3. Place the reference (empty) cuvette in the “REF” slot.



4. Place the sample cuvette in the “MEA” slot.



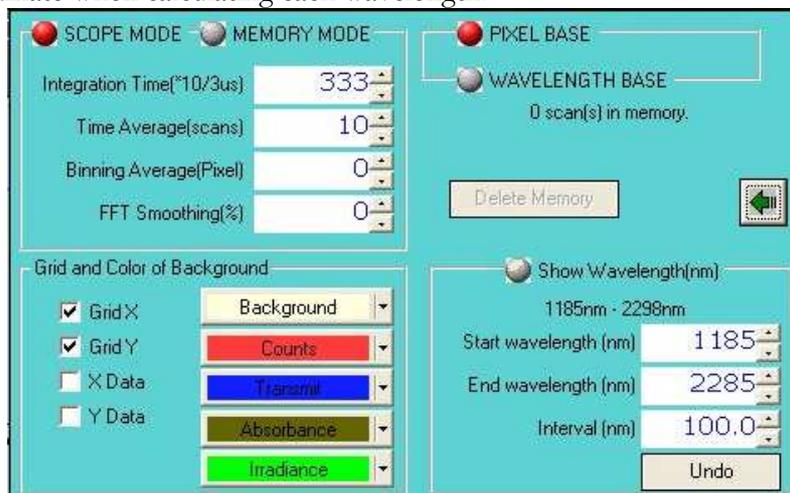
5. Move the cuvette holder to the dark position to block the light and execute the detector balancing and the dark scan on the software.



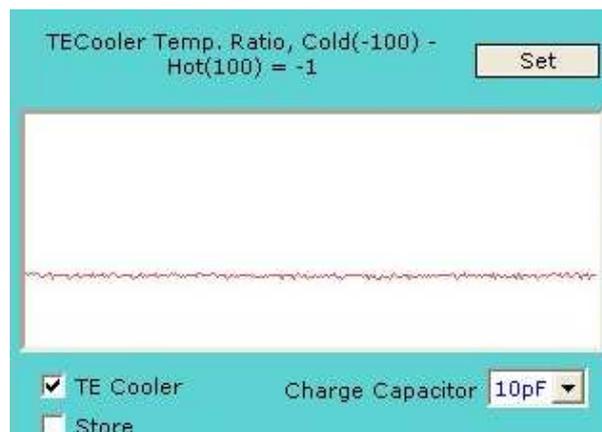
## Measurement with Software

The SPM301 is ready to measure the data. Before carrying out the measurement on the software, the initialization has to be done first, which is the detector “balancing”. Please refer to the software manual for the details.

1. **Configuration.** On the SM Setup Dialog box, you can set up the spectrometer condition. The integration time needs to be adjusted depending on the signal level with the reference cuvette. You can select the pixel base to see the data on the 256 pixels x-coordinate or the wavelength base to use your own wavelength range. The wavelength base mode will use some interpolation from the actual 256 pixel based a-coordinate when calculating each wavelength.

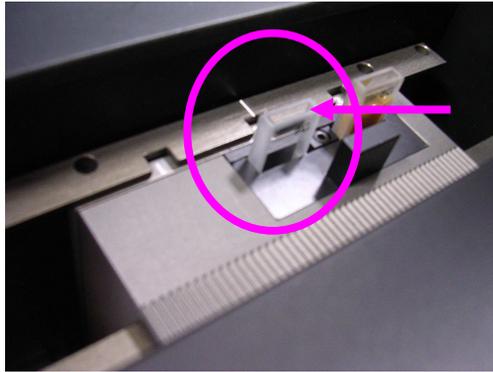


2. **Balancing.** Under the dark condition (#5 step at the “preparation process described above), run the “Balance” to balance each detector pixel under the dark condition.

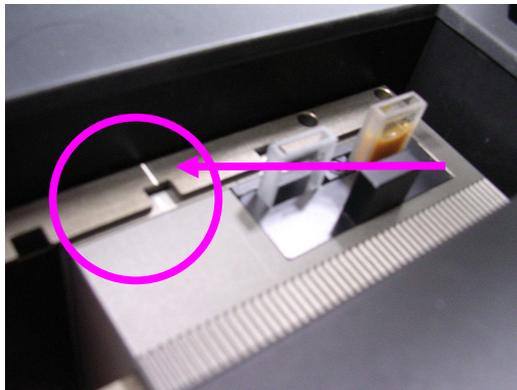
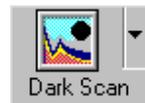


**NOTE!** It has to be done under the “dark” condition. And whenever you change the integration time, this balancing has to be run again.

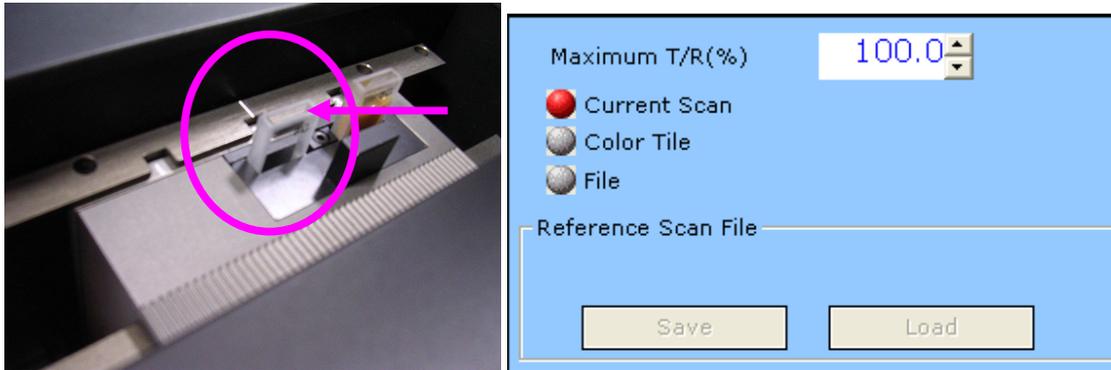
3. **Signal Saturation Checkup.** Move the cuvette holder to the “REF” position and check up the signal level. No signal has to be saturated in the full range. If the signal is saturated at any wavelength, you need to adjust the integration time and run the balance in the “dark condition” again (step #2 above) until all signals are under saturation.



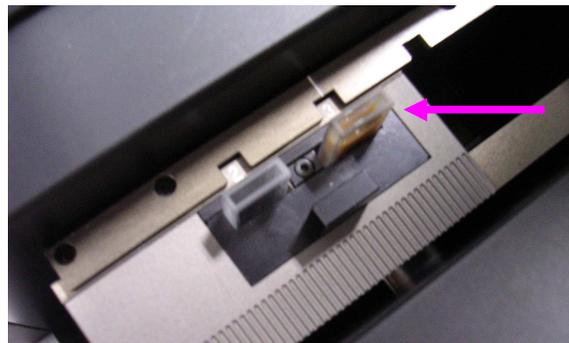
4. **Dark Scan.** After confirming that all the signals are under saturation, move the cuvette holder to go back to the “dark condition” again. On the software, click the “Dark Scan” toolbar button to run the dark scan. This is to set the 0% transmittance.



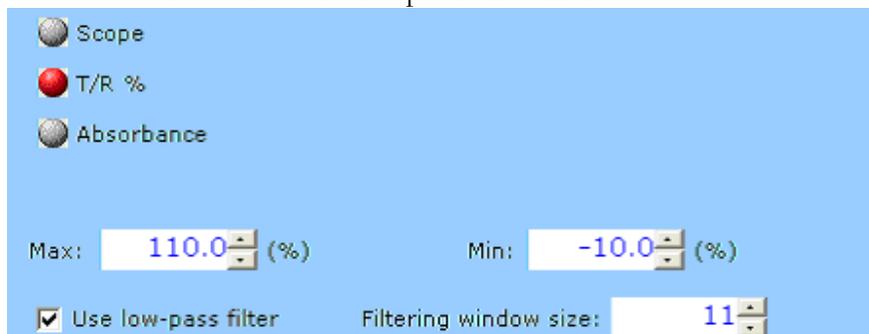
5. **Reference Scan.** Move the cuvette holder to the “REF” position where the reference cuvette is located and click the “Ref Scan” toolbar button on the software. This is to set the “100%” transmittance. If you have any reference sample that you know its transmittance, you can set this reference transmittance on the reference scan dialog box.

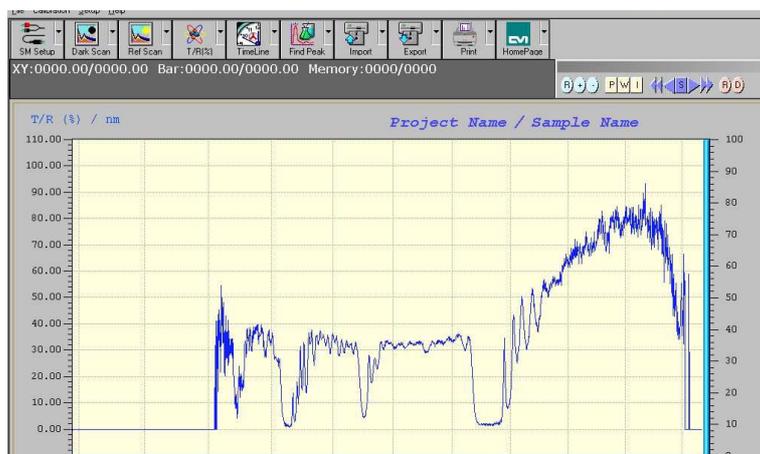


6. **Sample Measurement.** Move the cuvette holder to the “MEA” position where the sample cuvette is located and click the “Scope” toolbar button on the software to change to “T/R(%)” mode.



You can adjust the Max and Min Transmittance percents on the display dialog box. Also if the signal is too noisy, you can use the low-pass filter that will reduce the noise level but also can distort the spectrum somehow.

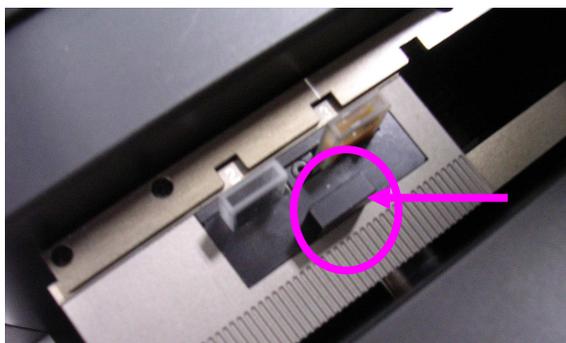




In the Transmittance (%) mode, you will be able to see the transmittance spectral data of your sample.

**NOTE!** The SM301 doesn't have a linear variable filter on the detector to block the 2<sup>nd</sup> or higher diffraction orders. So the spectrum above 2000nm will have some 2<sup>nd</sup> or higher orders of 1000nm and above. The PbS detector protection window is silicon so it doesn't transmit below 1000nm. When interpreting the data, the effect of the 2<sup>nd</sup> or higher diffraction orders above 2000nm will have to be considered.

7. **Repeat Measurement.** For measuring other sample, just simply replace the cuvette in the "MEA" position. If it is needed, you can take out the sub-cuvette holder by pulling out the black small grip.



**NOTE!** After a few minutes later from the balancing, the signal may get noisy. In this case, simply run the "balancing" again in the "dark condition" (ref, step #2 Balancing above).

8. **Close.** When you finished all measurements, close the software first and then turn off the spectrophotometer power switch. You can unplug the USB cable or leave it plugged on your computer. Without the power switch on, the computer won't recognize the SPM301.

# **Technical Support**

If you have any issue on the system, need any technical support for the maintenance, or need any help for running the system, please contact SP.

Toll Free: (877) 928-5834  
Tel: (860) 928-5834  
Fax: (860) 928-2676  
Website: <http://www.spectralproducts.com>  
Email: [support@spectralproducts.com](mailto:support@spectralproducts.com)

To help us serve you most efficiently, please collect some information for us before you call:

1. A detailed description of your problem
2. The specific error or error message you received
3. Your system information;
  - a. Software version
  - b. Version of Windows (98, ME, 2000, NT, XP, etc.)
  - c. Unit Serial Number

Our technical staff can be most effective if you are sitting at the computer while consulting technical support.