# Rm1 – Raman spectrometer



Weight:  $6 \text{ kg} (\sim 17.5 \text{ lb})$ 

Dimensions: 33cm x 30cm x 7 cm (13" x 12" x 2.5")

Detector: Toshiba TCD1304DG linear array, cooled down to

-35C

200 – 1800 cm<sup>-1</sup> (spectral resolution best 2 cm<sup>-1</sup>) 200 – 2400 cm<sup>-1</sup> (spectral resolution best 3 cm<sup>-1</sup>)

Spectral range: 200 – 3100 cm<sup>-1</sup> (spectral resolution 4 cm<sup>-1</sup>)

 $200 - 3700 \text{ cm}^{-1}$  (spectral resolution 5 cm<sup>-1</sup>)  $200 - 4510 \text{ cm}^{-1}$  (spectral resolution 6 cm<sup>-1</sup>)

Variable slit:  $0-600\mu$ Spectral resolution:  $3-11 \text{ cm}^{-1}$ 

Pixels: 3648
Signal-to-noise ratio: 300:1
A/D resolution: 16 bit

Exposure time:  $10 \mu s - 150 s$ 

CCD reading time: 10 ms

Onboard memory capacity: 128 spectra

Data transfer speed: 180 ms / 90 ms (2 points binding)

USB 2.0, HID 2.0

Computer interface: Several spectrometers can be connected to the

same computer

Operational system: Windows 98/Me/XP/Vista/Windows 7/Windows 8/

Windows 10; 32/64b

Software: application software, driver, LabView and VC,

VB, MathLab, Linux examples

Hardware: USB cable, power cable, power supply.

Laser: Wavelength 532nm regulated up to 300mW, Class

3B

Laser focusing: 10x objective lens, 6.3mm working distance

Power consumption: 50mA @ 5V from USB interface (CCD poser supply), 110 – 240 Volts (laser power supply)

Safety goggles Eagle Pair® 190-540nm & 800-

2000nm

Safety window:



Safety equipment:





Package Content

# Safety

Always use safety goggles when operate with Raman spectrometer!!!

Lid should be closed if laser is on!!!

Nobody should be in a direct view from working Raman spectrometer without safety goggles!!!

### **Application software** (included in standard configuration)

#### Connection

Connect micrometer screw to the translation stage.

Connect laser to laser power supply.

Insert key to the laser power supply.

Connect laser power supply to electrical outlet.

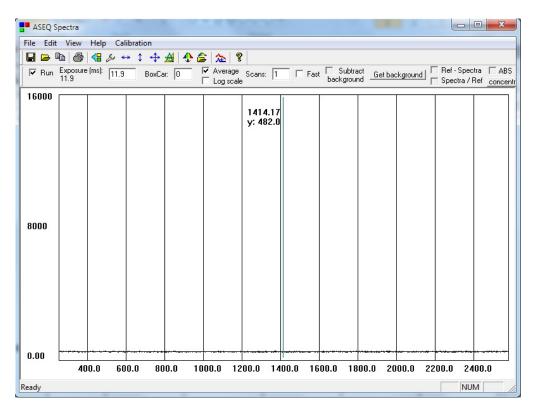
Connect USB cable from the spectrometer to computer.

Rm1 is recognized by Windows operational system as standard HID device. That is why there is no need to install any special drivers to use Rm1 spectrometer.

Operational system recognizes device after spectrometer has been connected to USB port. As usually it takes less that one minutes. In the end of this process windows shows message on the Toolbar that device is installed and ready to use.

It is possible to start "CheckTr.exe" program as soon as device is recognized by operational system.

After program is started it reads configuration information including calibration information from spectrometer FLASH memory. Typical view of the program main window:



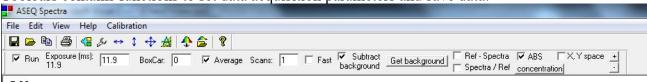
If software can not recognize connected device it shows Error message:



If so check connection and version of the USB port on your computer.

### Toolbar

Toolbars contains functions to set data acquisition parameters and save data.



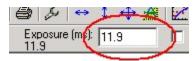
#### Start data acquisition:



To start data collection check Run:

To stop data collection uncheck it.

#### **Exposure time:**



Exposure time (in ms) is set:

#### Number of scans and averaging:

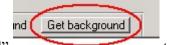


To set number of data collections (ref. Trigger options):

It is possible to plot averaged spectra to increase Signal to Noise ratio:

All spectra specified in "Scans" are plotted if this Check Button is unchecked.

#### **Background:**



Push "Get background" to acquire Background. (We recommend to use average several spectra to get Background with better Signal to Noise level).



It is possible to subtract acquired background:

#### **Settings:**

Push "Settings" sure Ims: To set exposure parameters and trigger mode. It calls dialog window "Exposure Settings":

Exposure Settings	×
Exposure time (ms)	
12.5	Average
number of scans	
1 F	Fast
number of blank scans between real scans	☐ Trigger ☐ keep Trigger
Tstart pixel Tend pixel 333 3685	Show Report
OK	Cancel

It duplicates controls described previously: "Exposure time", "Number of scans" (the save as "Scans"), "Fast". It has control Box to specify "number of blank scans between real scans" (see Trigger options). Combination of Check Buttons "Trigger" and "Keep trigger" sets one of three trigger options. It sets first trigger regime (no trigger) if both Check buttons are uncheck. If "Trigger" is checked and "keep Trigger" is unchecked it selects second trigger mode. If both Boxes are checked it selects third trigger mode.

#### Choose between spectrometers connected to computer:



Button "Choose spectrometer" 11 c allows choosing between connected spectrometers

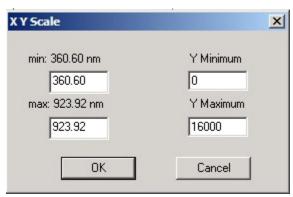
#### **Scaling:**

Button "x autoscale" sets horizontal wavelength scale to its maximum values

Button "y autoscale" sets vertical intensity scale to the minimum and maximum of current acquired data.

Button "x and y autoscale" is a combination of previous two.

Button "scale" calls dialog window to set vertical and horizontal scale:

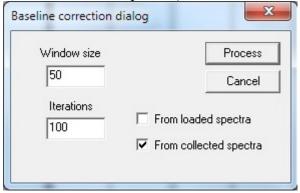


(Note: Picture is representative. Minimum and maximum wavelengths presented here can be different for each device)

The same dialog windows can be called by double clicking on the vertical or horizontal scale of the main window.

#### **Baseline correction:**

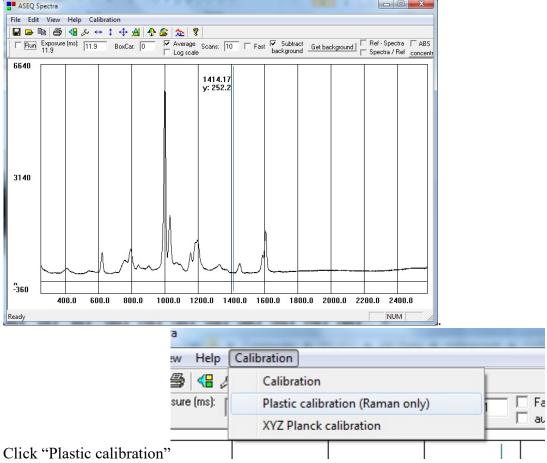
Use "baseline correction" button to remove baseline from collected spectra. It offers baseline corrected options ("Windows size", "Iterations"):



Click "Process". Program makes correction and plots results.

#### Calibration:

It is recommended to use our built-in automatic calibration procedure. Place polystyrene sample (included with Raman spectrometer) in the sample translation stage. Optimize Raman signal (Example):



Software calculates new wavelength vs. CCD elements calibration.

(Note: Picture is representative. Spectra can be different depending on spectral range of the Raman system.)

WARNING!!! Old calibration is lost as soon as new calibration are written in to FLASH memory. Do not use calibration procedure if Raman signal from calibration plastic sample (polystyrene) is not strong enough (S/N>200).

It is recommended to save original calibration information to file as a backup.

If plastic calibration is not done correctly software can freeze during starting procedure. It is necessary to make following steps:

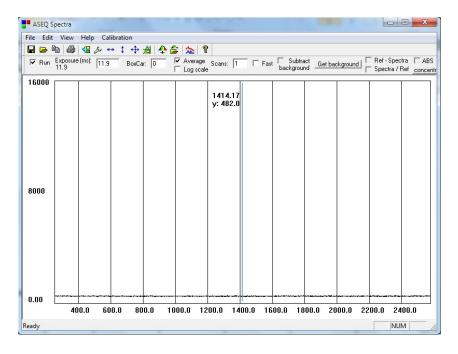
- 1. unplug spectrometer from PC.
- 2. un software
- 3. click OK on message "device is no found"
- 4. connect spectrometer to PC
- 5. load original calibration from file
- 6. save calibration to flash memory of the spectrometer (wait 10 seconds)
- 7. restart software

## Measurements

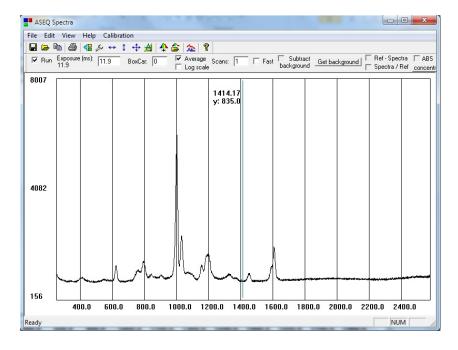
- 1. Connect Raman spectrometer to USB port of the computer
- 2. Connect 12V power supply (included with spectrometer) to the connector on Raman box to start TE cooling module. Wait ~15 minutes to let CCD cool down to -35C.
- 3. Be sure laser is off
- 4. Wear safety goggles
- Open lid and place sample in front of the objective lens (objective working distance 6.30 mm).



- 6. Close lid.
- 7. Adjust slit width to desirable opening to get desirable spectral resolution (Remember the narrower slit the higher spectral resolution but lower signal).
- 8. Start "CheckTr.exe" program:

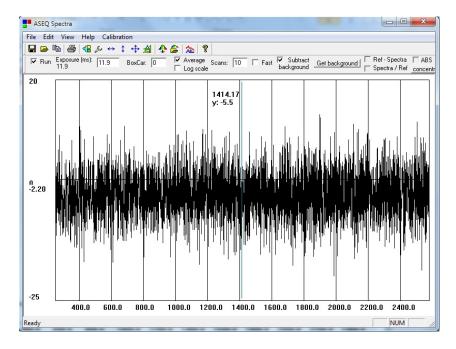


- 9. Adjust laser energy by turning adjustable knob on laser power supply
- 10. Turn laser ON
- 11. Set slit width to maximum (with top rotating knob in slit can be adjusted in the ranges 25-100um. Top knob can be removed to get full adjustable range (0-600μm)
- 12. Adjust micrometer screw on translation stage with sample to get maximum signal

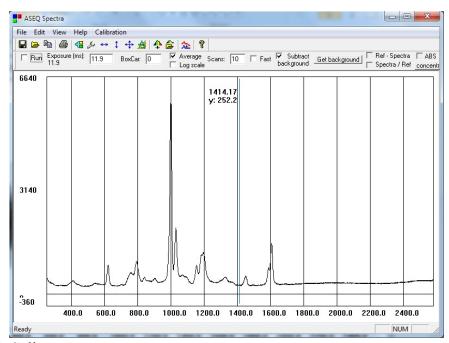


- 13. Optimize "Exposure time" for best signal/noise ratio (S/N). It is recommended to use "Scans" equal to 10 to get better S/N ratio.
- 14. Turn laser off

#### 15. Collect background and subtract background. Click "Y autoscale"

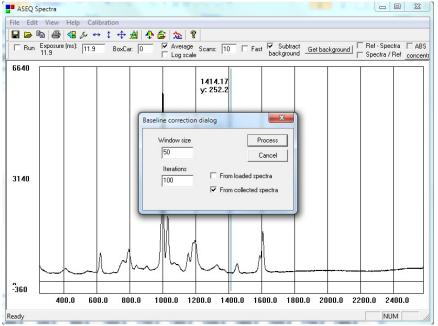


#### 16. Turn laser ON

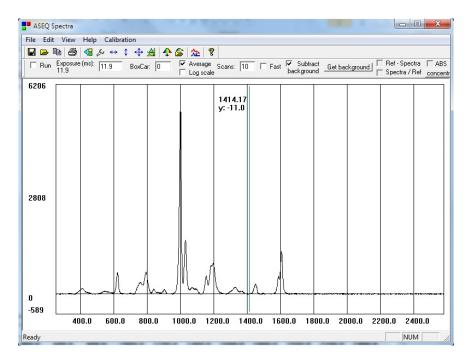


17. Collect spectra.

Stop spectra acquisition and click "baseline correction"



Adjust baseline correction parameters ("Windows size" and "Iterations"). Click "Process".



- 18. Save spectra and turn laser off.
- 19. Remove sample from the spectrometer
- 20. It is recommended to unplug 12V power supply if you do not use Raman spectrometer

#### Extra band-pass filter:

Fluorescence from some samples can be strong and located in longer wavelengths that Raman signal. It is possible to use extra band-pass filter located in front of the HR1-T spectrometer to cult unnecessary dominating signal.

# **Optimization procedure**

Spectrometer has to be optimized time-to-time and after moving.

#### **Optimization procedure:**

- 1. Use all safety precautions
- 2. Place laser power supply near main spectrometer body:
- 3. Place sample inside spectrometer turn laser, start "CheckTr.exe" program
- 4. Optimize micrometer screw for the best signal
- 5. Turn laser off.
- 6. Remove cover to get access to the back mirror adjustable screw:



- 7. Turn Laser on
- 8. Adjust both screws on the back mirror holder for the best Raman signal.
- 9. Repeat optimization procedure reducing slit width.
- 10. Turn laser off
- 11. Put cover back