Semiconsoft,Inc

Thin Film Measurement solution
Software, sensors, custom development and integration

PLASMA MONITOR (PT20 UVVis)

USER GUIDE

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Plasma monitor with VFT probe.

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INTRODUCTION

Plasma Monitor includes UVVis spectrometer, GPIO electronics and fiberoptics probe. Fiberoptics probe is customized to deposition chamber configuration and requirements. Plasma Monitor is intended for tracking intensity of selected plasma lines and provide an end-point detection depending on the plasma line intensity level.
Plasma monitor operation is controlled by a measurement recipe that can be created based on application requirement. Measurement recipe defines data acquisition conditions, tracking wavelengths and, optionally, control trigger conditions.
Plasma Monitor is connected to computer via USB port. It is also powered from the USB port. There is also an option to use a separate power supply – it is useful in the cases of multichannel operation or long running processes.
UVVis system measure spectrum in 200nm -1000nm range, with wavelength resolution<2nm, integration time from 10µs to 60s (typical integration time is 1ms - 100ms depending on plasma intensity).
Plasma Monitor can use from 1 to 8 spectrometer channels in one unit. This document described a single channel system operation.

OPERATION DETAILS

Plasma Monitor software has a simple and clean user interface. After software started (Fig, 1), spectrometer signal (spectrum) is continuously displayed using default integration time (typically, 20ms).

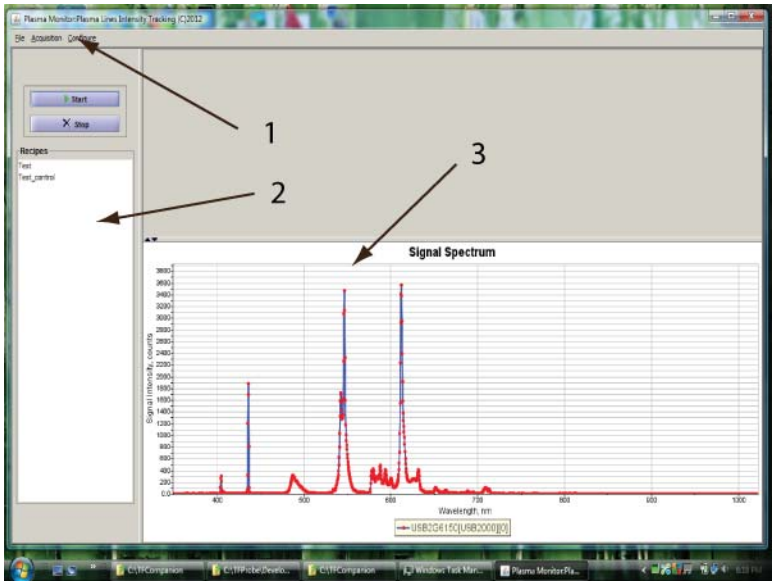

Fig. 1. Plasma Monitor main screen (after software is started)
1. Menu options
2. Measurement recipes database
3. Spectrometer signal (spectrum)

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Main menu has 3 item groups:
1. File – gives options to export the data such as spectrum, tracking chart, etc. to a file.
2. Acquisition – gives options to configure spectrometer acquisition and edit/ create measurement recipe.
3. Configure allows to configure spectrometer hardware (it is used only is special cases) and Configure/initialize GPIO/triggers

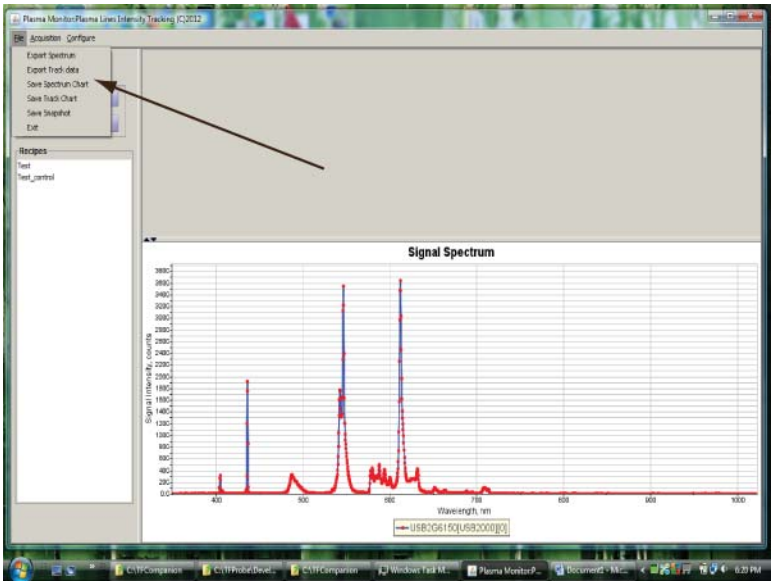

Fig. 2 File menu has 6 items:

1. **Export Spectrum** –saves current spectrum data to a text file
2. **Export Track Data** – saves data from the plasma line tracking chart to a text file
3. **Save Spectrum Chart** – saves spectrum chart to an image file.
4. **Save Track Chart -** saves tack chart to an image file
5. **Save Snapshot** – saves snapshot of the current screen to a file.

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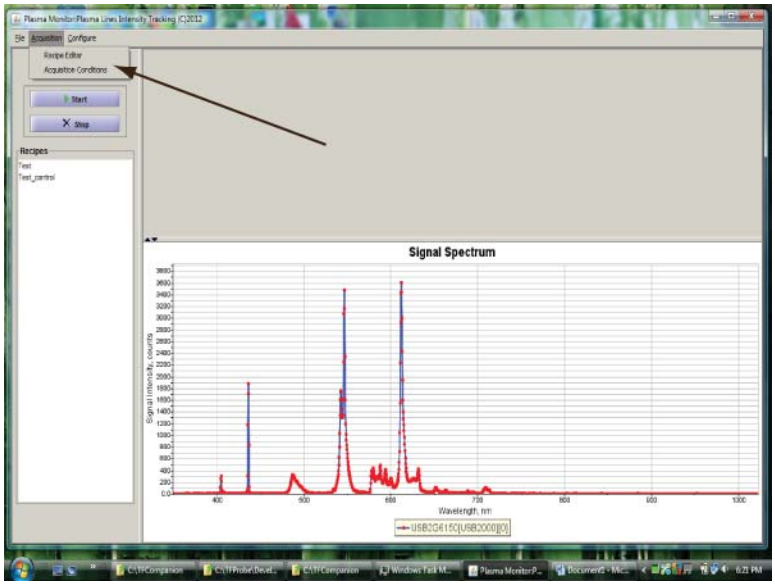

Fig. 3. Acquisition menu has 2 items:

1. **Recipe Editor-** opens Recipe dialog that allows creating end editing measurement recipes
2. **Acquisition Conditions** – open Acquisition Conditions dialog to manually setup spectrometer acquisition conditions.

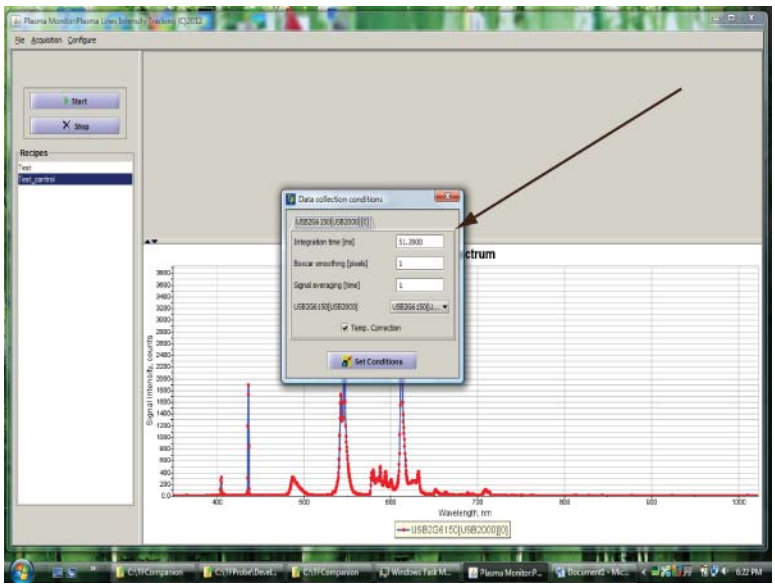

Fig. 4 Acquisition Conditions dialog.

This dialog is used to adjust spectrometer acquisition parameters manually to have a full range signal. This is mostly achieved by adjusting integration time. The optimal integration time adjust signal a full 16 bits range (65000 counts). Signal averaging allows to average several acquisition data cycles to reduce the noise. Boxcar smoothing – provides pixel to pixel smoothing but at the expense of wavelength resolution. Once optimal acquisition conditions for specific application are determined they can be set in the measurement recipe.

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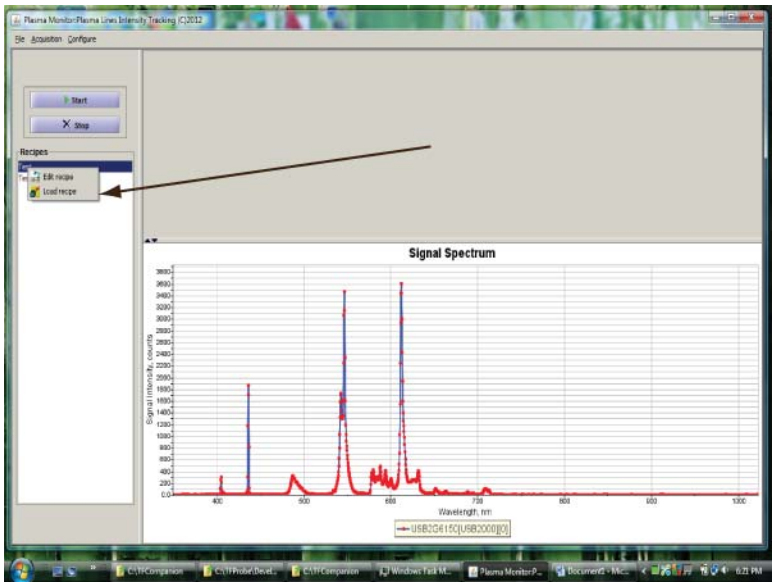

Fig. 5. Measurement recipe can be edited by using a popup menu at the recipe record. Alternatively, Acquisition/Recipe Editor from the main menu can be used.

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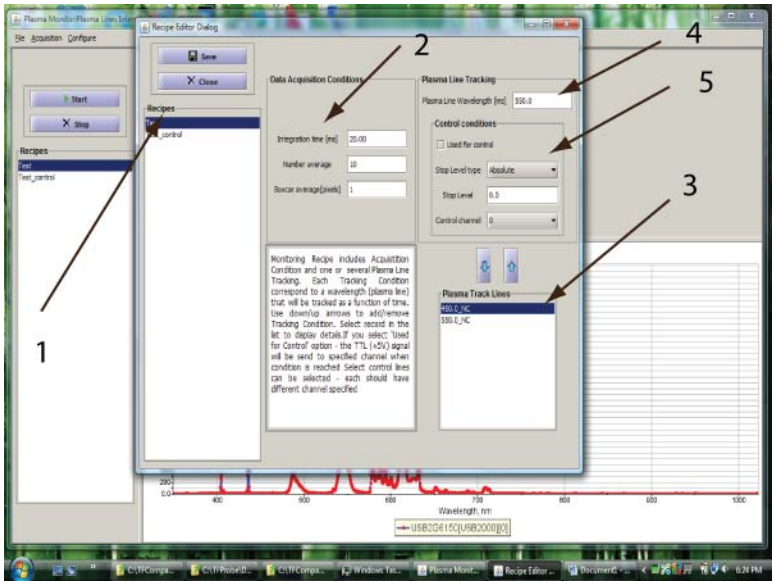
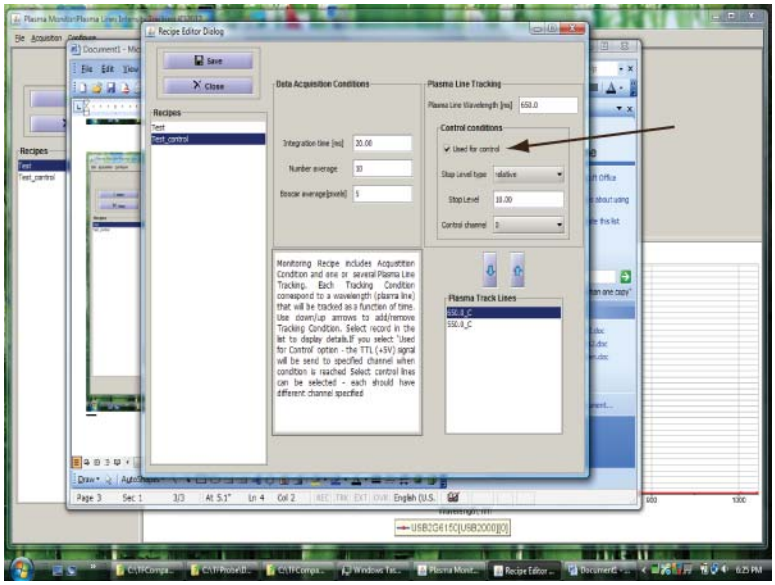


Fig.6. Measurement Recipe dialog.

1. List of available measurement recipes. Double click on the record load recipe data for editing /review
2. Data acquisition conditions (same condition applied to all lines)
3. A List of lines/wavelengths added to the recipe. Clicking on line record displays details. Line can be a "control line" or a "no-control line". Control line activates a trigger at a specified level (will be discussed in more details). "No control" line only tracks intensity. Lines of both types can mixed in the same recipe.
4. Wavelength of the tracking line
5. Defines "control" or "no control" line. Picture shows a "no control" line



Fig, 7 Measurement recipe with "control line" displayed

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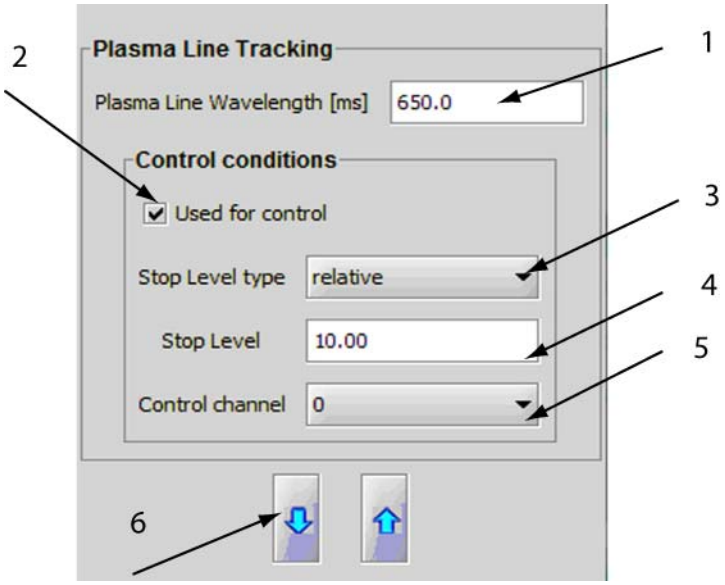
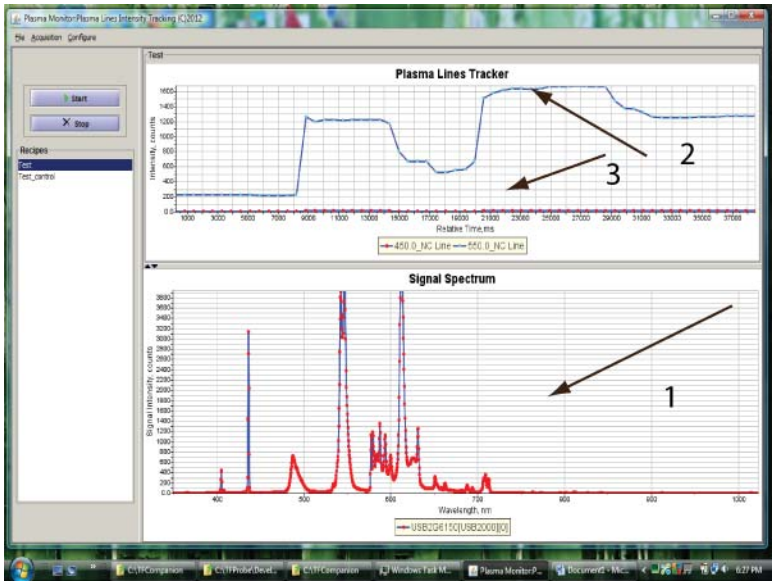


Fig. 8 Control line panel details

1. Plasma line Wavelength in nm. By default wavelength resolution is <2nm
2. Control line box is checked – this line can activate trigger when conditions (defined below) are met
3. Stop level/ end point can be defines as "relative" i.e. % of the starting value or "absolute" i.e. intensity in ADC counts
4. Stop level/ end point intensity value
5. GPIO channel/port where trigger will be generated
6. Arrow used to add line to a recipe.

After recipe is created/edited it needs to be saved in the database. After closing of the Recipe Editor dialog, program returns to the main menu. To load the recipe, click on the recipe record in the main screen.
Once recipe is loaded,measurement can be started at any time by pressing "Start" button.



Fig, 9 Main screen showing line tracking.

1. Current measured spectrum

2,3 – track chart of two selected lines/wavelengths

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TRIGGER DETAILS.

Plasma Monitor provides 5 TTL triggers that can be activated by software for end point detection. Triggers have two states: on/high (+5V), off/low (0V).
If the trigger is specified in the control recipe, it will go high (+5V) when the target condition is reached. The trigger will stay in the high state indefinitely (until either USB cable is disconnected or the state is changed manually (Fig. 11))

NOTE. GPIO driver creates a virtual serial port. It has to be initialized before the use using Trigger control dialog (Fig. 11)

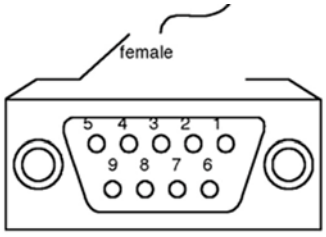

Fig. 10. GPIO Trigger-out port (located on the backpanel of the unit)
Pins 1 -5 correspond to channels 0 - 4 (as defined in the recipe)
Pin6 - ground.

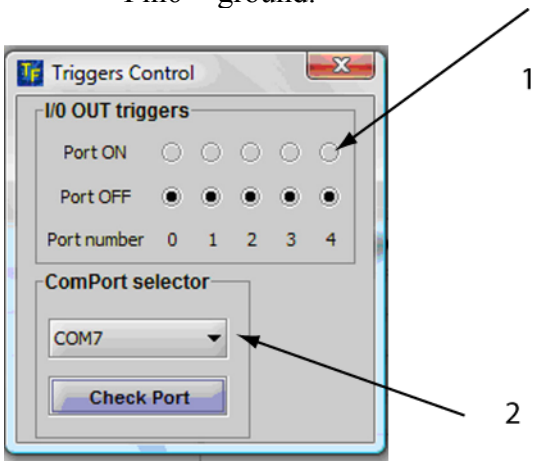

Fig. 11 Trigger control (Configure/Configure GPIO from the main menu)
To activate communication port, select the COM port (virtual port created by the driver) and click Check Port button.(2)
After port is initialized, the state of the GPIO channels can be changed (1).

GPIO channels can also be independently accessed and controlled using terminal emulation program like HyperTerminal.
Commands: gpio set 0 - sets channel 0 (pin 1) to high (+5V),
gpio clear 0 - sets channel 0 (pin 1) to low (0V)

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