Pump Probe Automatization. Owners Manual

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Contents

1 Introduction

This user manual aims to first and foremost explain how to set up an experiment with the software developed for the X-WaveS pump and probe experiment, additionally an effort was made to transfer as much of my knowledge acquired when setting up the hardware side of the experiment.

2 Theory of detection

Basic scheme for pump and probe

2.1 Lockin detection

2.2 Photodiode measurement

2.3 Measuring with an oscilloscope

3 How to configure an experiment

This section explains how to use the software to set-up an experiment as well as some quirks that the user might find useful

3.1 Downloading and Installing the software

3.2 Initialization Screen

Upon booting the software the user is welcomed with a screen prompting them to `Initialize devices`, clicking this button initializes a series of steps where the computer connects to the delay stage and lockin and configures them to an ”experiment ready” state. The user **does not** need to leave the software idle during initialization and can immediately continue setting up the experiment parameters (see section 3.3) there is only one functionality locked until initialization is established which is launching an experiment.

The steps taken by the software during initialization are logged on a secondary window, this serves the purpose of informing the user of the state that the delay stage and lockin are configured to, (more in section 3.3).

The values present on the initialization screen are only for information purposes, however there is one hack to edit them if needed which is described in section 3.6 at **Lockin not in COM5**.

3.3 Experiment Screen

At any moment throughout the process the user may change screens from Initialization screen to Experiment screen through the `File` menu on the top left. In the experiment screen the user will be able to configure how the experiment takes place by setting different parameters.

These parameters are grouped in parameters that affect the signal to noise ratio of each point captured by the software (filter roll-off, time constant) and parameters that define the delay points where each data point will be captured (abs time zero, rel time start, number of scans). Each scan is subdivided in ”legs” more commonly known as ”ranges”, these can be understood as sub-scans that the user can decide

- `experiment file name` Sets the name for the folder where data will be stored. The software prevents the user from using the same file name twice to prevent any sort of overwriting, if you really wish to

use the same file name you'll have to manually go into the output folder and delete the homonymous folder

- `filter roll-off [dB/oct]` Sets the filter slope of the Low-Pass filter at the lockin
- `time constant [s]` Sets the lockin's filter frequency/time constant
- `Number of scans` Sets the number of scans that the software will perform, each scan is subdivided in a number of "legs" or more commonly known as "ranges", these subscans are specified by the are subdivided in legs or
- `abs time zero [ps]` Specifies the delay time at which the pump and probe pulses meet, the prefix "absolute" indicates that this time is specified relative to the origin in the delay stage, that is a 0mm position in the delay stage correspond to 0ps in abs time zero [ps]
- `rel time start [ps]`
- `rel time end [ps]`
- `step [ps]`

For more information on how these values influence the measurement see section 2.

3.4 Further Manual Customization

The device states that can be configured through this software are limited to the most general use case scenario at the time of development, thus the user might feel like these options are limited, for instance the initialization step configures the lockin to measure voltage signals through input channel A but the user might someday want to measure a current signal through channel B, such a device state cannot be configured through this software, it can only be done manually in the lockin's panel, however since the software will always configure the lockin to measure a voltage signal at initialization the user has to make sure to wait until initialization is finished before manually switching the input to current measurement or else the software might overwrite it back to voltage.

If the user intends to change a parameter manually they should study the different logs on screen to identify when it's an appropriate time to manually overwrite their desired parameter. There are two different logs that the software will display: one during initialization and another while the experiment takes course, in general the software will always inform the user on what it's doing so that the user can decide when to make a manual change such that it is not later overwritten by the software.

3.5 Saved data

3.6 Errors

Delay stage with serial number ... not in device list First check whether delay stage driver is switched on, if not switch it on, connect and disconnect it's USB. If that doesn't work check whether Kinesis software is open, close it and connect and disconnect again.

Lockin not in COM5 The user has verified that the lockin **is** recognized by the PC in device manager but it is not recognized at the default port `COM5` and is instead showing at some other port like for instance `COM3`, to change the default port to the new port (*or any of the default configuration parameters*) go to the installation folder and open the following file with a text editor like VSC or Notepad++

```
"C:\...\Pump_Probe_Measurement_Automatization\Utils\default_config.json"
```

this file is a JSON (*see JSON python docs*) and it contains the default parameters to initialize the devices, editing any of the parameters from their default

`"USBPort": "COM5",`

To something else

`"USBPort": "COM3",`

Will change the default parameters. **Warning:** Changing default parameters like Acceleration and Maxvelocity can in some cases harm the delay stage, edit these parameters at your own risk.

4 Software structure