

Using the Python POD API

Setup_PodDevices Class

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1 Summary

The Setup_PodDevices class is used to initialize and stream data from 8206-HR and 8401-HR Data Conditioning and Acquisition Systems as well as operate 8229 Automated Sleep Deprivation Units. The user can set up several devices and stream concurrently from one computer. Other POD devices will be supported in the future.

All of the required modules can be found here:

<https://github.com/Pinnacle-Technology-Inc/Python-POD-API/tree/integration/Code/Modules>

Example Python code can be found here:

<https://github.com/Pinnacle-Technology-Inc/Python-POD-API/tree/integration/Code/Examples>

Other documentation for Python POD API code can be found here:

<https://github.com/Pinnacle-Technology-Inc/Python-POD-API/tree/integration/Documents>

2 Class Setup

Setup_PodDevices requires Setup_8206HR, Setup_8401HR, Setup_8229, Setup_Interface, Params_Interface, and UserInput classes. You may also need to install these (<https://github.com/Pinnacle-Technology-Inc/Python-POD-API/blob/integration/Documents/PyEnvRequirements.txt>) libraries to your python environment.

First, create a new python file (*.py) or identify an existing file where you want to use an 8206-HR. To include the Setup_PodDevices class, write the following line of code to the top of your Python file:

```
from Setup_PodDevices import Setup_PodDevices
```

Next, you must create the Setup_PodDevices object and call Run() on the class instance. The initialization and usage of this class are described in Sections 3 and 4. Here is an example:

```
from Setup_PodDevices import Setup_PodDevices
go = Setup_PodDevices()
go.Run()
```

After completing the first-time setup, the program can generate some initialization variables that can be used for the Setup_PodDevices constructor. You can pass a dictionary with keys as the POD and value as a string containing the path and filename as a parameter. If you set the saveFileDict parameter, it will skip the associated initialization steps. Here is some example code:

```
from Setup_PodDevices import Setup_PodDevices
sfd = {'8229': 'C:\\Users\\tkelly\\Desktop\\TEST\\test.edf'}
go = Setup_PodDevices(saveFileDict=sfd)
```

```
go.Run()
```

You can also give the `Setup_PodDevices` constructor a dictionary containing the parameters for all POD devices. If you set the `podParametersDict`, it will also skip the associated setup steps. Here is some example code:

```
from Setup_PodDevices import Setup_PodDevices
from Setup_PodParameters import Params_8401HR
ppd = { '8206-HR' : { 1 : Params_8206HR(port='COM5 - USB EEG/EMG (COM5)',
    sampleRate=500, preamplifierGain=100, lowPass=(40, 40, 40)), 2 :
    Params_8206HR(port='COM4 - USB EEG/EMG (COM4)', sampleRate=500, `
    preamplifierGain=10, lowPass=(40, 40, 40)) } }
go = Setup_PodDevices(podParametersDict=ppd)
go.Run()
```

Also, you can set both `saveFile` and `podParametersDict` into one constructor. This will skip all the object initialization steps and go straight to the options menu. Here is some example code:

```
from Setup_PodDevices import Setup_PodDevices
from Setup_PodParameters import Params_8401HR
sfd = { '8229': 'C:\\Users\\tkelly\\Desktop\\TEST\\test.edf' }
ppd = { '8206-HR' : { 1 : Params_8206HR(port='COM5 - USB EEG/EMG (COM5)',
    sampleRate=500, preamplifierGain=100, lowPass=(40, 40, 40)), 2 :
    Params_8206HR(port='COM4 - USB EEG/EMG (COM4)', sampleRate=500, `
    preamplifierGain=10, lowPass=(40, 40, 40)) } }
go = Setup_PodDevices(saveFileDict=sfd, podParametersDict=ppd)
go.Run()
```

If you are assigning the `podParametersDict` argument in the `Setup_PodDevices()` constructor, be sure to import the relevant parameters class:

```
from Setup_PodParameters import Params_8206HR
from Setup_PodParameters import Params_8401HR
from Setup_PodParameters import Params_8229
```

3 Initialization

When creating a class instance of `Setup_PodDevices` using no constructor parameters, you will be asked several questions to initialize the program. First, you will set up the POD parameters for all devices (Section 3.1); passing a correctly formatted dictionary to the `podParametersDict` parameter in `Setup_PodDevices()` will skip this step. Next, you will set up the file to save streaming data to (Section 3.2); passing a string containing the file path and name to the `saveFile` parameter in `Setup_PodDevices()` will skip this step.

3.1 Setup POD Device Parameters

You will be asked which POD devices you will be using. For each supported device (8206-HR, 8401-HR, and 8229) enter 'y' for yes or 'n' for no. Next, you will be asked to input the parameters for all the devices; see Section 3.3.1 for the 8201-HR, Section 3.3.2 for the 8401-HR, and Section 3.3.3 for the 8229 setup.

After all the parameters for the POD devices are input, the program will print a table displaying the information. You will be asked if the parameters are correct. Type 'y' and Enter if the parameters are correct. This will move the program to the next step. If one or more of the parameters are incorrect, type 'n' and Enter. Then enter the device number of the POD device to be changed. You will then be asked to re-input all of the parameters of that device. The updated table will be printed to the terminal and you will be asked if it is now correct.

When the POD parameter setup is complete, the program will write the associated inputs to each of the POD devices. The connection status will be printed to the terminal.

3.1.1 8206-HR

First, you will be asked how many 8206-HR devices you will be using. Enter an integer number into the terminal and click Enter. The program will then print a header for the current device number. It will also display the available COM ports on your computer. Note that the POD devices must be plugged into the computer at this time. You will be asked to select a port from the available list. Type the integer number and click Enter.

Next, you will be asked for the sample rate in Hz for the current device. Type an integer number between 100 and 2,000 and click Enter. Then you will be asked for the preamplifier gain. Type 10 or 100 and click Enter. After that, you will be asked for the lowpass in Hz for each of the EEG channels (EEG1, EEG2, and EEG3/EMG). Enter a number between 11-500 for each channel. These steps will repeat for each 8206-HR device.

```

How many 8206-HR devices do you want to use?: 1

-- Device #1 --

Available COM Ports: COM5 - USB EEG/EMG (COM5)
Select port: COM5
Set sample rate (Hz): 500
Set preamplifier gain: 100
Set lowpass (Hz) for EEG1: 40
Set lowpass (Hz) for EEG2: 40
Set lowpass (Hz) for EEG3/EMG: 40

Parameters for all 8206-HR Devices:
+-----+-----+-----+-----+-----+-----+-----+
| Device # | Port | Sample | Preampli | EEG1 | EEG2 | EEG3/EMG |
| | | Rate (Hz) | fier | Low-pass | Low-pass | Low-pass |
| | | | Gain | (Hz) | (Hz) | (Hz) |
+-----+-----+-----+-----+-----+-----+-----+
| 1 | COM5 - | 500 | 100 | 40 | 40 | 40 |
| | USB | | | | | |
| | EEG/EMG | | | | | |
| | (COM5) | | | | | |
+-----+-----+-----+-----+-----+-----+-----+

Are the 8206-HR device parameters correct? (y/n): y

Connecting POD devices...
Successfully connected POD device #1 to COM5.

```

Figure 3.1.1. Example of the 8206-HR parameter setup for one device.

3.1.2 8401-HR

First, you will be asked how many 8206-HR devices you will be using. Enter an integer number into the terminal and click Enter. The program will then print a header for the current device number. It will also display the available COM ports on your computer. Note that the POD devices must be plugged into the computer at this time. You will be asked to select a port from the available list. Type the integer number and click Enter.

Next, you will be asked to input a mouse/rat preamplifier from a list; enter your desired option. Different preamplifiers will often have different channel names. Next, enter a sample rate between 2,000-20,000 Hz. Then you will be asked if you want to use mux mode; enter 'y' for yes or 'n' for no. Next, you will be asked to input values for each of the preamplifier channels. First, enter the preamplifier gain; typically, this is 1 for biosensors and 10 or 100 for EEG/EMG. Then select 1x or 5x gain. Then enter your high-pass filter. For AC, enter 0.5, 1, or 10 Hz. For DC, enter 0. Next enter a frequency for the low-pass filter between 21-15,000 Hz. Next, set the bias voltage, which must be between +/- 2.048 V. Lastly, choose the DC mode; this is typically VBIAS for biosensors and AGND for EEG/EMG.

```

How many 8401-HR devices do you want to use?: 1

-- Device #1 --

Available COM Ports: COM6 - High Speed 8401 (COM6)
Select port: COM6
Available preamplifiers: 8407-SE, 8407-SL, 8407-SE3, 8407-SE4, 8407-SE31M, 8407-SE-2BIO, 8407-SL-2BIO,
8406-SE31M, 8406-BIO, 8406-2BIO, 8406-EEG2BIO, 8406-SE, 8406-SL, 8406-SE3, 8406-SE4
Set mouse/rat preamplifier: 8407-SE
Set sample rate (Hz): 2000
Use mux mode? (y/n): n
Set preamplifier gain (1, 10, or 100) for...
    Bio: 1
    EEG1: 10
    EEG1: 10
    EMG: 100
    EEG2: 10
Set second stage gain (1 or 5) for...
    Bio: 1
    EEG1: 5
    EMG: 1
    EEG2: 5
Set high-pass filter (0, 0.5, 1, or 10 Hz) for...
    Bio: 0
    EEG1: 0.5
    EMG: 1
    EEG2: 10
Set low-pass filter (21-15000 Hz) for...
    Bio: 100
    EEG1: 200
    EMG: 300
    EEG2: 400
Set bias (+/- 2.048 V) for...
    Bio: 0.6
    EEG1: 0.7
    EMG: 0.8
    EEG2: 0.9
Set DC mode (VBIAS or AGND) for...
    Bio: VBIAS
    EEG1: AGND
    EMG: VBIAS
    EEG2: AGND

```

Figure 3.1.2. Example of the 8401-HR parameter setup for one device.

3.1.3 8229

First, you will be asked how many 8229 devices you will be using. Enter an integer number into the terminal and click Enter. The program will then print a header for the current device number. It will also display the available COM ports on your computer. Note that the POD devices must be plugged into the computer at this time. You will be asked to select a port from the available list. Type the integer number and click Enter.

Next, you will be asked to set the ID number for the 8229 system. Type an integer number between 0 and 999 and click enter. Then you will be asked to choose the motor direction; enter 0 for clockwise and 1 for counterclockwise. Next, set the motor speed by

entering a percent value between 0% and 100%. Next, enter 'y' to enable or 'n' to disable random reverse. If random reverse is enabled, you will be asked to set the base and variable time in seconds. The motor will reverse direction after the base time plus a random time less than or equal to the variable time. Next, you will be asked to set the system mode; set 0 for manual, 1 for PC control, and 2 for schedule. If you select manual control, you must turn the motor on and off using the touch screen on the 8229 device. If you select a schedule, the 8229 will operate the motor based on a weekly schedule. If you enter 2 for schedule, you will be asked to enter the motor on/off status for every hour of every day in a week.

```
Will you be using any 8206-HR devices? (y/n): n
Will you be using any 8401-HR devices? (y/n): n
Will you be using any 8229 devices? (y/n): y

How many 8229 devices do you want to use?: 1

-- Device #1 --

Available COM Ports: COM8 - Sleep Dep (COM8)
Select port: COM8
Set system ID: 42
Set motor direction (0 for clockwise and 1 for counterclockwise): 0
Set motor speed (0-100%): 75
Enable random reverse? (y/n): y
Set reverse base time (sec): 15
Set reverse variable time (sec): 10
Set system mode (0 = Manual, 1 = PC Control, 2 = Internal Schedule): 2
For each hour, enter 'y' or '1' if the motor should be on and 'n' or '0' if the motor
should be off.
Set set motor schedule for Sunday:
    Hour 0: 0
    Hour 1: 0
    Hour 2: 0
    Hour 3: 0
```

Figure 3.1.3. Example of the 8229 parameter setup for one device.

3.1.4 8480-SC

First, you will be asked to enter the number of 8480-SC POD devices you want to use. Enter an integer and press Enter. The program will show 'Device' with the current POD device number. Then, the program will show all the available COM ports and you will be able to select from the choice/s. Type your choice and press Enter.

Next, you will be asked to choose a channel to set the stimulus; enter 0 or 1. Then, you will be asked to enter a time period value, and a width value. Enter any valid number(only positive). Then, you will be asked to enter an integer for the repeat count of the Stimulus. Following that, you will be asked three times to enter a value (either 0 or 1) to represent the states of the filters to set up the Stimulus Config.

Next, you will be asked to enter the preamp value; enter an integer from 0-1023. You will then be asked to enter an integer (0-600) to set Led-Current (Hz) for Channel 0 and Channel 1. After that, you will be asked whether you want the TTL Pull Ups enabled (0 for disabled, non-zero for enabled). Following that, you will be asked to set the estimCurrent for Channel 0 and Channel 1. Enter a value between 0-100. Next, you will be asked three times to choose values of either 0 or 1, representing individual filters to set up Sync Config. Next, you will be asked to select a channel (0 or 1) to set up TTL. Then, you will be asked three times to choose values of either 0 or 1, which represents the state of the filters for TTL Config Setup. At last, you will be asked to enter a debounce value in ms. Enter any valid positive number.

```
Will you be using any 8206-HR devices? (y/n): n
Will you be using any 8401-HR devices? (y/n): n
Will you be using any 8229 devices? (y/n): n
Will you be using any 8480-SC devices? (y/n): y

How many 8480-SC devices do you want to use?: 1

-- Device #1 --

Available COM Ports: COM4 - 8480 Optogenetics Interface Module (COM4), COM1 - Communications Port (COM1)
Select port: COM4
Choose channel (0 or 1) for Stimulus: 1
Enter a stimulus period value (ms): 1500
Enter a stimulus width value (ms): 1500
Enter a value for the stimulus repeat count: 5
Enter a value (0 for Electrical stimulus, 1 for Optical Stimulus): 1
Enter a value (0 for Monophasic, 1 for Biphasic): 0
Enter a value (0 for standard, 1 for simultaneous): 0

Set preamp (0-1023): 1

Set ledCurrent (Hz) for CH0 (0-600): 22
Set ledCurrent (Hz) for CH1 (0-600): 23

Are the pullups enabled on the TTL lines? (0 for disabled, non-zero for enabled): 1

Set estimCurrent for Channel0 (0-100): 22
Set estimCurrent for Channel1 (0-100): 23
Enter a value (0 for LOW sync line, 1 for HIGH sync line): 0
Enter a value for Sync Idle (0 to idle the opposite of active state, 1 to sync to idle tristate): 1
Enter a value for Signal/Trigger (0 for sync to show stimulus is in progress, 1 to have sync as input triggers): 0

Choose channel (0 or 1) for TTL Setup: 0
Enter a value (0 for rising edge triggering, 1 for falling edge): 0
Enter a value for stimulus triggering (0 for TTL event, 1 for TTL inputs as triggers): 1
Enter a value for TTL Input/Sync (0 for normal TTL operation as input, 1 for TTL pin operate as sync output): 0
Enter a debounce value (ms): 25
```

Figure 3.1.4. Example of the 8480-SC parameter setup for one device

3.2 Setup Save File

You can set a unique path and filename for each POD device type you are using. First, the program will ask for a directory path to create a save file for streaming data. Copy the path into the terminal and click Enter. If you want to save the file in the local directory, simply type the filename with the extension (i.e *.txt) now. If a filename was not included in the file path, the program will ask you for a filename. Type the name of the save file and click Enter. If no

extension is given, the program will default to *.txt. Note that the POD device number will be appended to the end of the filename, as each device will save streaming data to its own file. Different POD devices accept different file extensions. The 8206-HR and 8401-HR accept *.txt, *.csv, or *.edf. The 8229 accepts only *.txt and *.csv.

```
Where would you like to save streaming data to?
Path: C:\Users\tkelly\Desktop\TEST
File name: test.csv
```

Figure 3.2. Example of save file setup.

4 Options

After the initial setup is complete, you will be presented with several different options (see Figure 4). To select an option, type the number into the terminal and click enter. Before you quit the program, run option 8 to save the current class configuration.

```
Options:
1. Start streaming.
2. Show current settings.
3. Edit save file path.
4. Edit POD device parameters.
5. Remove POD device.
6. Connect a new POD device.
7. Reconnect current POD devices.
8. Generate initialization code.
9. Quit.

What would you like to do?: 
```

Figure 4. Options menu in the terminal.

4.1 Start Streaming

Option “1. Start streaming.” will concurrently read data from all connected POD devices. Streaming begins immediately after selecting this option. To stop streaming data, click enter when in the terminal. Then, the data from each POD device will be saved to its own file. The device number will be appended to the end of the filename provided during setup. Lastly, the terminal will print the execution time of the total operation.

```
Press Enter to stop streaming:
Finishing up...
Save complete!

Execution time: 20 sec
```

Figure 4.1. Example of option “1: Start streaming.”

Running option #1 a second time will overwrite the previous save. If you want to save the data to a new file, run option #3.

The computer will only stream data if all POD devices are properly connected to the computer. If there is a connection issue, check that all devices are plugged into the computer in the proper ports and attempt to reconnect by choosing option #6. If this does not fix the issue, there may be an issue with the device setup. Edit the devices as needed using option #3.

4.2 Show current settings

Selecting option “2. Show current settings” will print out a table describing the setup parameters for all POD devices and the file name and path that streaming data will be saved to.

Parameters for all 8206-HR Devices:

Device #	Port	Sample Rate (Hz)	Preamplifier Gain	EEG1 Low-pass (Hz)	EEG2 Low-pass (Hz)	EEG3/EMG Low-pass (Hz)
1	COM5 - USB EEG/EMG (COM5)	500	100	40	40	40

Streaming data will be saved to C:\Users\tkelly\Desktop\TEST\test.edf

Figure 4.2.1. Example of option “2. Show current settings” for one 8206-HR device.

Parameters for all 8401-HR Devices:

Device #	Port	Preamplifier Device	Sample Rate (Hz)	Mux Mode	Preamplifier Gain	Second Stage Gain	High-pass (Hz)	Low-pass (Hz)	Bias (V)	DC Mode
1	COM6 - High Speed 8401 (COM6)	8407-SE	2000	False	Bio: None EEG1: 10 EMG: 100 EEG2: 10	Bio: 1 EEG1: 5 EMG: 1 EEG2: 5	Bio: None EEG1: 0.5 EMG: 1.0 EEG2: 10.0	Bio: 100 EEG1: 200 EMG: 300 EEG2: 400	Bio: 0.6 EEG1: 0.6 EMG: 0.6 EEG2: 0.6	Bio: VBIAS EEG1: AGND EMG: AGND EEG2: AGND

Streaming data will be saved to C:\Users\tkelly\Desktop\TEST\test.csv

Figure 4.2.2. Example of option “2. Show current settings” for one 8401-HR device.

Figure 4.2.3. Example of option “2. Show current settings” for one 8229 device.

```
Parameters for all 8480-SC Devices:
```

Device #	Port	Stimulus	Preamp	Led Current	TTL Pullups	Estim Current	Sync Config	TTL Setup
1	COM4 - 8480 Optogenetics Interface Module (COM4)	Channel: 1 Period: 1500.0 Width: 1500.0 Repeat: 5 Config: 1	1	Channel 1: 22 Channel 2: 23	1	Channel 1: 22 Channel 2: 23	2	Channel: 0 Config Flag: 2 Debounce: 25

Streaming data for 8480-SC will be saved to C:\Users\skondi\Desktop\test\test.txt

4.3 Edit save file path

4.4 Edit POD device parameters

4.5 Remove POD device

Option “5. Remove a POD device.” will allow you to remove one POD device, if there are more than one POD devices of a given type (i.e. 8206-HR or 8401-HR). The parameters table will be displayed. Next, you will be asked to input the device number of the POD device you want to remove.

4.6 Connect a new POD device

Option “6. Connect a new POD device.” will allow the user to connect one new POD device. The device number will be generated and displayed. Then you will be asked to input the device's setup parameters. Then, the updated parameters table will be shown and you will be asked if everything is correct.

4.7 Reconnect current POD devices

Selecting option “7. Reconnect current POD devices.” will attempt to reconnect all the 8206-HR devices. This is done by testing the cable connection to the device and then writing the setup parameters. The connection status, as success or failed, will be printed to the terminal. If the connection fails, check that all devices are plugged into their corresponding COM ports and attempt to reconnect.

4.8 Generate initialization code

Option “8. Generate initialization code.” will print out the code needed to setup and run the Setup_PodDevices class with the current setup parameters. The save file and POD device parameters, which are passed as parameters to the Setup_PodDevices constructor.

```
saveFile = r'C:\Users\tkelly\Desktop\TEST\test.csv'
podParametersDict = { '8206-HR' : { 1 : Params_8206HR(port='COM5 - USB EEG/EMG (COM5)', sampleRate=500, preamplifierGain=100, lowPass=(40, 40, 40)), 2 : Params_8206HR(port='COM4 - USB EEG/EMG (COM4)', sampleRate=500, preamplifierGain=10, lowPass=(40, 40, 40)) } }
go = Setup_PodDevices(saveFile, podParametersDict)
go.Run()
```

Figure 4.8. Example of option “6. Reconnect current POD devices.”

4.9 Quit

Selection option “9. Quit.” will exit the Setup_PodDevices program. If you want to save the current setup configuration, run option #8 before quitting.