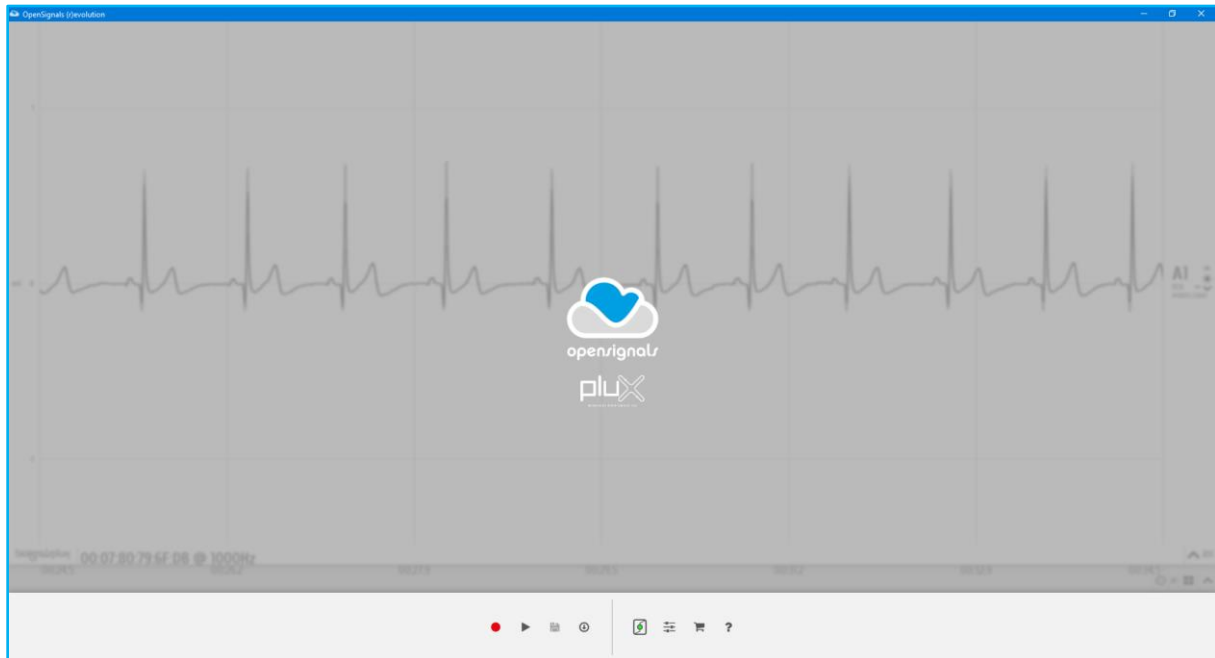




opensignals
(r)evolution

biosignal acquisition tool-kit for high-level research applications

TCP/IP Module Guide



ATTENTION

Please read this manual before
using your PLUX product(s) and
this software

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This module is part of the *OpenSignals (r)evolution* software (introduced with the release of October 2018). Reading the software's user manual is highly recommended:

[http://biosignalsplux.com/downloads/OpenSignals \(r\)evolution User Manual-print.pdf](http://biosignalsplux.com/downloads/OpenSignals_(r)evolution_User_Manual-print.pdf)

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1 Introduction

The TCP/IP (Transmission Control Protocol / Internet Protocol) module of the *OpenSignals (r)evolution* software is aimed to facilitate the support and data exchange between 3rd party and the *OpenSignals (r)evolution* software. It has been introduced with the release of October 2018.

This guide is intended to demonstrate and guide the proper configuration of the module to enable real-time signal acquisition and streaming between *OpenSignals (r)evolution* and a TCP/IP compatible 3rd party software. In this configuration, *OpenSignals (r)evolution* will act as a server while the 3rd party software will act as the client.

2 Getting Started

The information below guides you through the set up process to activate the server side in the *OpenSignals (r)evolution* software and a general approach on how to access the server.

2.1 Configuring Acquisition Devices in OpenSignals (r)evolution

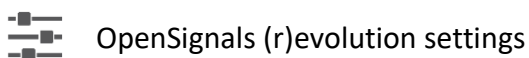
Before using any device for acquisition via the TCP/IP module it is necessary to establish a Bluetooth connection with your computer and the PLUX device(s) first and to configure the acquisition devices in the *OpenSignals (r)evolution* software.

Follow the instructions in the *OpenSignals (r)evolution* user manual to learn how to properly set up your devices for signal acquisitions (Section 2.2):

[http://biosignalsplux.com/downloads/OpenSignals_\(r\)evolution_User_Manual-print.pdf](http://biosignalsplux.com/downloads/OpenSignals_(r)evolution_User_Manual-print.pdf)

2.2 Server Side Configuration (OpenSignals (r)evolution)

Open the settings panel of the *OpenSignals (r)evolution* software by clicking on the following icon which can be found in the software's main screen.



In the settings panel, click on the *INTEGRATION* tab and select the *TCP-IP* checkbox to start the server as seen in Figure 1.

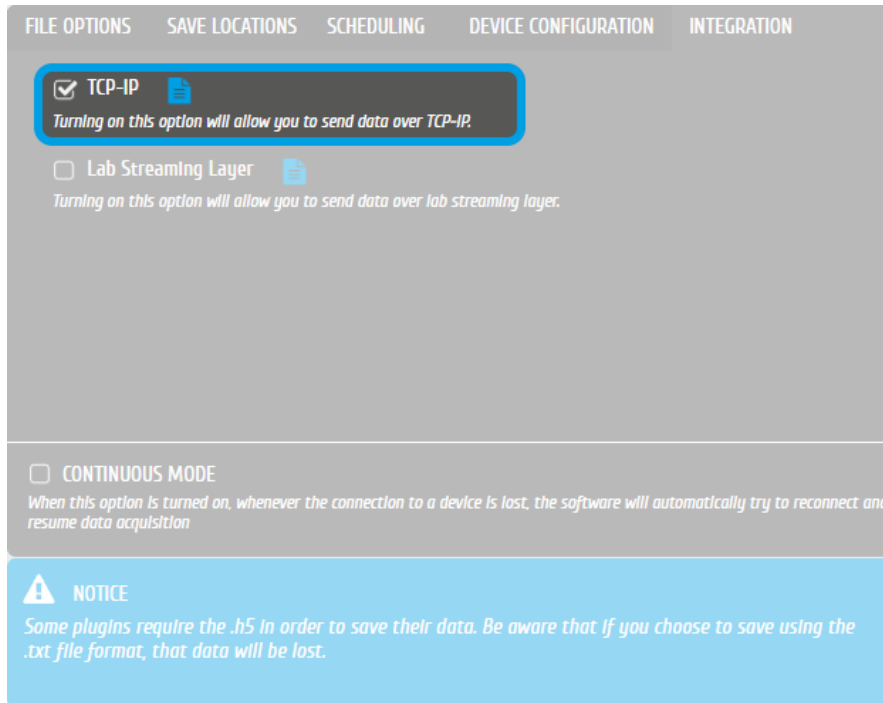


Figure 1: Settings panel with the activated TCP-IP module.

Once the *TCP-IP* checkbox has been selected, a pop-up panel will request you to select the port being used for the TCP/IP connection (default port: 5555). Enter the port of your choice and click on connect.

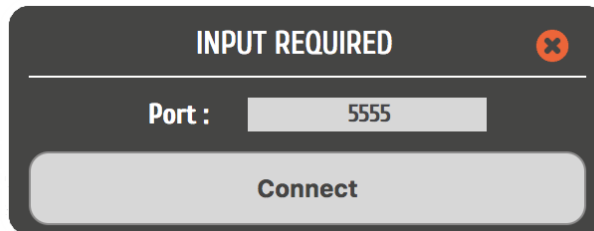


Figure 2: Configuring the preferred TCP/IP port.

Once the TCP/IP port has been chosen, the server will wait for a connection to be established (see Figure 3, you can click on OK to close the pop-up). The communication and data exchange can then be started on the client side as described in the following section.

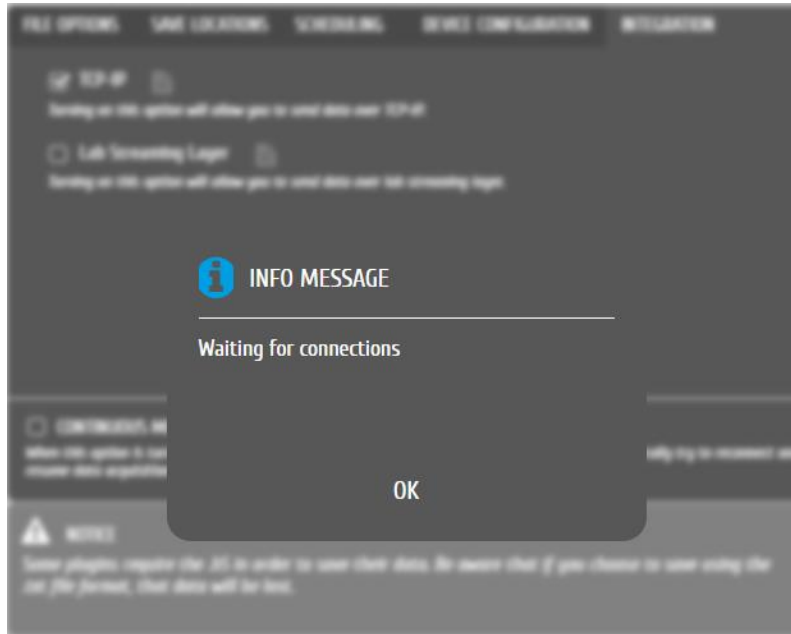


Figure 3: Activated TCP-IP module waiting for a client to connect.

NOTE

The TCP/IP module has to be reactivated as described in this section after errors occur as a proper connection has to be re-established.

2.3 Client Side Configuration (3rd Party Software)

With the server side being configured in the *OpenSignals (r)evolution* software, the client has to be configured in order to enable a data exchange between the server and client.

The 3rd party software receiving the data stream must be set up as a client and has to connect to the server using the previously selected port in *OpenSignals (r)evolution* and the IP of the machine running the server software.

To connect to the server, use the IP address of the server and the chosen port (e.g. 5555).

Alternatively, if both the server and the client are running on the same machine, use the `localhost` address and the chosen port to connect to the server.

3 Commands

This section describes the commands that the client can send to the server as well as the expected responses of the server.

The response is sent in the JSON format containing two main keys:

returnCode	Identifier of the type of response
returnData	Contains all the information of the message

The available commands, messages and response codes are presented on the following pages.

An example code showing how to configure the TCP-IP connection, send the commands and receive the return codes can be found [here](#).

3.1 List of Commands

3.1.1 devices

Returns all devices listed in the *OpenSignals (r)evolution* device manager.

Server Response Message Format

```
{
  "returnCode": 0,
  "returnData": {
    "DEVICE_ID": "MAC"
  }
}
```

Server Response Message Example

```
{
  "returnCode": 0,
  "returnData": {
    "0": "AA:BB:CC:DD:EE:FF",
    "1": "00:11:22:33:44:55",
  }
}
```

3.1.2 config, {MAC|DEVICE_ID}

Returns the configuration of the selected devices as configured in the *OpenSignals (r)evolution* device manager.

Server Response Message Format & Example

```
{
  "returnCode": 0,
  "returnData": {
    "deviceName": "aa:bb:cc:dd:ee:ff",
    "sensorChannels": ["RAW", "RAW", "RAW", "RAW", "RAW", "RAW"],
    "deviceConnect": "/dev/tty.BITalino-DevB",
    "isBLE": false,
    "digitalChannels": [0, 0],
    "resolution": 10,
    "packetLoss": 0,
    "selected": 1,
    "digitalDir": [0, 0, 1, 1],
    "activeChannels": [1, 1, 1, 1, 1, 1],
    "samplingFreq": 1000,
    "fwVersion": 1281,
    "deviceType": "bitalino_rev",
    "labelChannels": ["A1", "A2", "A3", "A4", "A5", "A6"],
    "smoothChannels": [0, 0, 0, 0, 0, 0],
    "customChannels": [
      [0.5, 1.0, "V"], [0.5, 1.0, "V"], [0.5, 1.0, "V"],
      [0.5, 1.0, "V"], [0.5, 1.0, "V"], [0.5, 1.0, "V"]],
    "hwVersion": null,
    "productID": 1538
  }
}
```

3.1.3 config, {MAC|DEVICE_ID}, {PARAM}, {VALUE}

Allows to set one of the parameters listed in Table 1 to modify the configuration of the selected devices in the *OpenSignals (r)evolution* software.

The server response message will be returned as in the previously listed command containing the new configurations.

Table 1: Parameters that can be set to configure the acquisitions devices form the client side.

PARAM	VALUES	
	BITalino	biosignalsplux
samplingfreq	[10, 100, 1000]	An int value between 1 and 1000
activechannels	0 or 1 ¹ with a lenght of 6 digits ² . Example: 100000 (only channel 1 becomes active)	0 or 1 ¹ with a lenght of 8 digits ^{2,3} . Example: 10000000 (only channel 1 becomes active)

¹ 0 = channel not activated for acquisition; 1 = channel activated for acquisition

² Channel numbers ordered from the most significant bit (LSB) to least significant bit (i.e. channel 1 = 10000000; channel 8 = 00000001)

³ 8 digits are also returned for 4-channel biosignalsplux devices. The code to activate all sensors of the 4-channel device is 11110000

Server Response Message Format & Example

```
{
  'returnCode': 0,
  "returnData": {
    "deviceName": "AA:BB:CC:DD:EE:FF",
    "sensorChannels": ["RAW", "RAW", "RAW", "RAW", "RAW", "RAW"],
    "deviceConnect": "/dev/tty.BITalino-DevB",
    "isBLE": false,
    "digitalChannels": [0, 0],
    "resolution": 10,
    "packetLoss": 0,
    "selected": 1,
    "digitalDir": [0, 0, 1, 1],
    "activeChannels": [1, 1, 1, 1],
    "samplingFreq": 1000,
    "fwVersion": 1281,
    "deviceType": "bitalino_rev",
    "labelChannels": ["A1", "A2", "A3", "A4", "A5", "A6"],
    "smoothChannels": [0, 0, 0, 0, 0, 0],
    "customChannels": [
      [0.5, 1.0, "V"], [0.5, 1.0, "V"], [0.5, 1.0, "V"],
      [0.5, 1.0, "V"], [0.5, 1.0, "V"], [0.5, 1.0, "V"]],
    "hwVersion": null,
    "productID": 1538
  }
}
```

3.1.4 enable, {MAC|DEVICE_ID}

Sets the selected device as acquisition device (e.g. MAC = "AA:BB:CC:DD:EE:FF").

Server Response Message Format & Example

```
{
  'returnCode':0,
  "returnData": {
    "deviceName": "AA:BB:CC:DD:EE:FF",
    "sensorChannels": ["RAW", "RAW", "RAW", "RAW", "RAW", "RAW"],
    "deviceConnect": "/dev/tty.BITalino-DevB",
    "isBLE": false,
    "digitalChannels": [0, 0],
    "resolution": 10,
    "packetLoss": 0,
    "selected": 1,
    "digitalDir": [0, 0, 1, 1],
    "activeChannels": [1, 1, 1, 1, 1, 1],
    "samplingFreq": 1000, "fwVersion": 1281,
    "deviceType": "bitalino_rev",
    "labelChannels": ["A1", "A2", "A3", "A4", "A5", "A6"],
    "smoothChannels": [0, 0, 0, 0, 0, 0],
    "customChannels": [
      [0.5, 1.0, "V"], [0.5, 1.0, "V"], [0.5, 1.0, "V"],
      [0.5, 1.0, "V"], [0.5, 1.0, "V"], [0.5, 1.0, "V"]],
    "hwVersion": null,
    "productID": 1538
  }
}
```

3.1.5 disable, {MAC|DEVICE_ID}

Disables the selected device from being an acquisition device (e.g. MAC = "AA:BB:CC:DD:EE:FF").

Server Response Message Format & Example

```
{
  'returnCode':0,
  "returnData": {
    "deviceName": "AA:BB:CC:DD:EE:FF",
    "sensorChannels": ["RAW", "RAW", "RAW", "RAW", "RAW", "RAW"],
    "deviceConnect": "/dev/tty.BITalino-DevB",
    "isBLE": false,
    "digitalChannels": [0, 0],
    "resolution": 10,
    "packetLoss": 0,
    "selected": 0,
    "digitalDir": [0, 0, 1, 1],
    "activeChannels": [1, 1, 1, 1, 1, 1],
    "samplingFreq": 1000, "fwVersion": 1281,
    "deviceType": "bitalino_rev",
    "labelChannels": ["A1", "A2", "A3", "A4", "A5", "A6"],
    "smoothChannels": [0, 0, 0, 0, 0, 0],
    "customChannels": [
      [0.5, 1.0, "V"], [0.5, 1.0, "V"], [0.5, 1.0, "V"],
      [0.5, 1.0, "V"], [0.5, 1.0, "V"], [0.5, 1.0, "V"]],
    "hwVersion": null,
    "productID": 1538
  }
}
```

3.1.6 start

Starts an acquisition and return the configurations of the devices selected for acquisition (same JSON response as in the previous commands).

3.1.7 stop

Stops a running acquisition and returns a success message.

Server Response Message Example

```
{
  "returnCode": 0,
  "returnData": "Acquisition Stopped"
}
```

3.1.8 set_digital_output, {MAC|DEVICE_ID}, {DIGITAL_OUTPUT_CHANNEL}, {STATE}

Allows to enable or disable the selected digital output channel from the selected device. The parameter DIGITAL_OUTPUT_CHANNEL corresponds to the number of the digital output channel (1 for biosignalplux; 1 or 2 for BITalino (r)evolution). The STATE parameter corresponds to the state to which the digital output channel is set, and can either be 0 (disable) or 1 (enable).

3.2 List of Codes

As previously stated, *OpenSignals (r)evolution* sends a **returnCode** with every server response message. The following table lists all the available **returnCodes** and the respective type.

Table 2: List of OpenSignals (r)evolution (server side) response messages.

Type	Return
SUCCESS	{'returnCode':0, "returnData": {returnData} }
COMMAND	{'returnCode':1, "returnData": "Unknown Command"}
DEVICE	{'returnCode':2, "returnData": "Unknown Device"}
PARAM	{'returnCode':3, "returnData": "Unknown Param"}
VALUE	{'returnCode':4, "returnData": "Unknown Value"}
SAMPLING FREQ	{'returnCode':5, "returnData": "Sampling frequency should be: {possible values}"}
NO DEVICE	{'returnCode':6, "returnData": "No device selected for acquisition"}
NO ACQUISITION	{'returnCode':7, "returnData": "No acquisition started"}

4 Regulatory & Legal Information

4.1 Disclaimer

All mentioned *OpenSignals (r)evolution*, *biosignalsplux* and *BITalino* products in this manual are intended for use in life science education and research applications only; they are not medical devices, nor medical software solutions, nor are they intended for medical diagnosis, cure, mitigation, treatment or prevention of disease and is provided to you “as is”.

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4.2 Certification

OpenSignals (r)evolution and any PLUX device connected to this software do not have a medical device certification and are, therefore, not a medical device.

PLUX research products are intended for use in life science education and research applications with humans and not intended for diagnostics, cure, mitigation, treatment or prevention of disease.

4.3 Contact & Support

Contact us if you're experiencing any problems that cannot be solved with the information given in the *biosignalsplux* or *OpenSignals (r)evolution* manual. We'll get back to you as soon as possible to find the best solution for your problem.

Please send us an e-mail with precise information about the error occurrence, device configuration, and, if possible, screenshots of the problem to support@plux.info.