Physilog®5 Research ToolKit
User manual

Thank you for purchasing Physilog®5, the Swiss quality movement sensor. The Research ToolKit is the free companion software suite provided by Gait Up SA to read, program, and check Physilog®5 sensors.

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1.1. How to install Research ToolKit

Download the latest version of the Research ToolKit (RTK) for computer from the website www.gaitup.com/support (select the version corresponding to your system, Mac or Windows). Double click on the downloaded file to execute it. When the installation is finished, a desktop icon is created and the software opens. The RTK is now ready to be used on your computer.

1.2. Read & extract raw data with Research ToolKit for Mac, Windows

Data saved on the SD card inside the Physilog® can be accessed using USB data transfer. Therefore plug the USB cable to the Physilog® and a computer. The Physilog®5 connects to the computer almost instantaneously and files can be accessed. Copy-paste the files to your computer.

Warning: Do not remove the conf.bin file which contains the configuration information, otherwise the Physilog® will not record any data. If this happens, recreate a configuration using the Research ToolKit (see below). For firmware v1.1.0 and higher a default configuration is saved on the Physilog®, this default configuration will be loaded if the conf.bin file is deleted.

Open data inside Research ToolKit

To load Physilog®5 data into Research ToolKit, enter the 'Signal display' part at the top left corner. Then drag and drop the files you want to display from the folder where they are saved onto the RTK interface. To load synchronized files, drop them together.
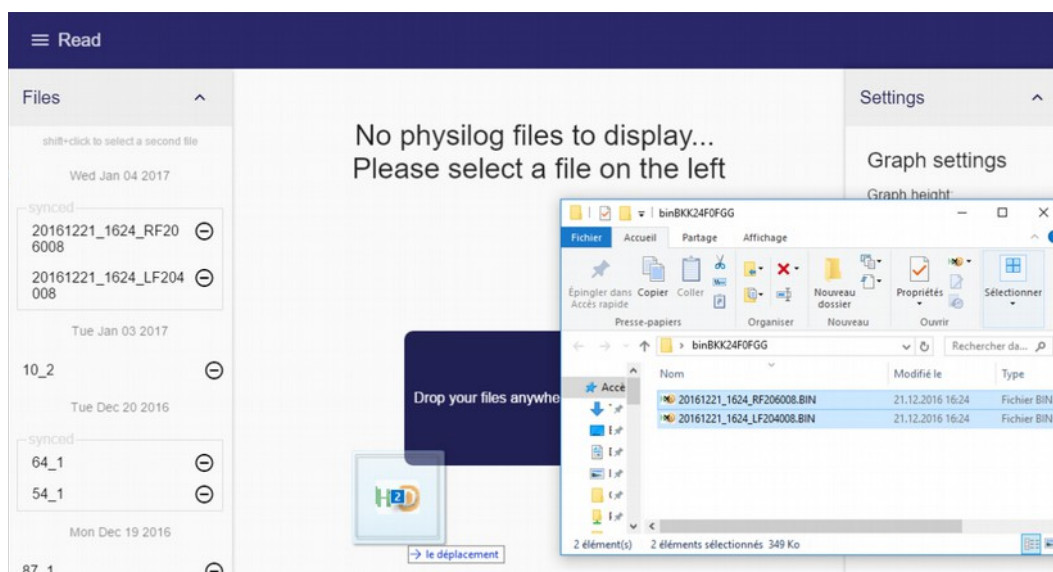

Illustration 1: Drag and drop the Physilog®5 files on the RTK Signal display interface to open the data

The information of the displayed file is shown on the right side of the window under "File info". Available information include name of the file, start and end date/time, firmware version installed when recording this file and base sampling frequency (highest frequency of activated sensors in this file).

Display options

You can display the raw signals by selecting the file in the list on the left of the window. The graph height can be adjusted in the Settings on the right. The current selection of data gives the start and end timestamps of the selected part of the signal. Further data channels can be shown by scrolling.

To zoom on the data, either use the time-bar below the signal or select a part of the signal by selecting with a left mouse click. The displayed portion of the signal is at the same time the part of the signal that is exported.
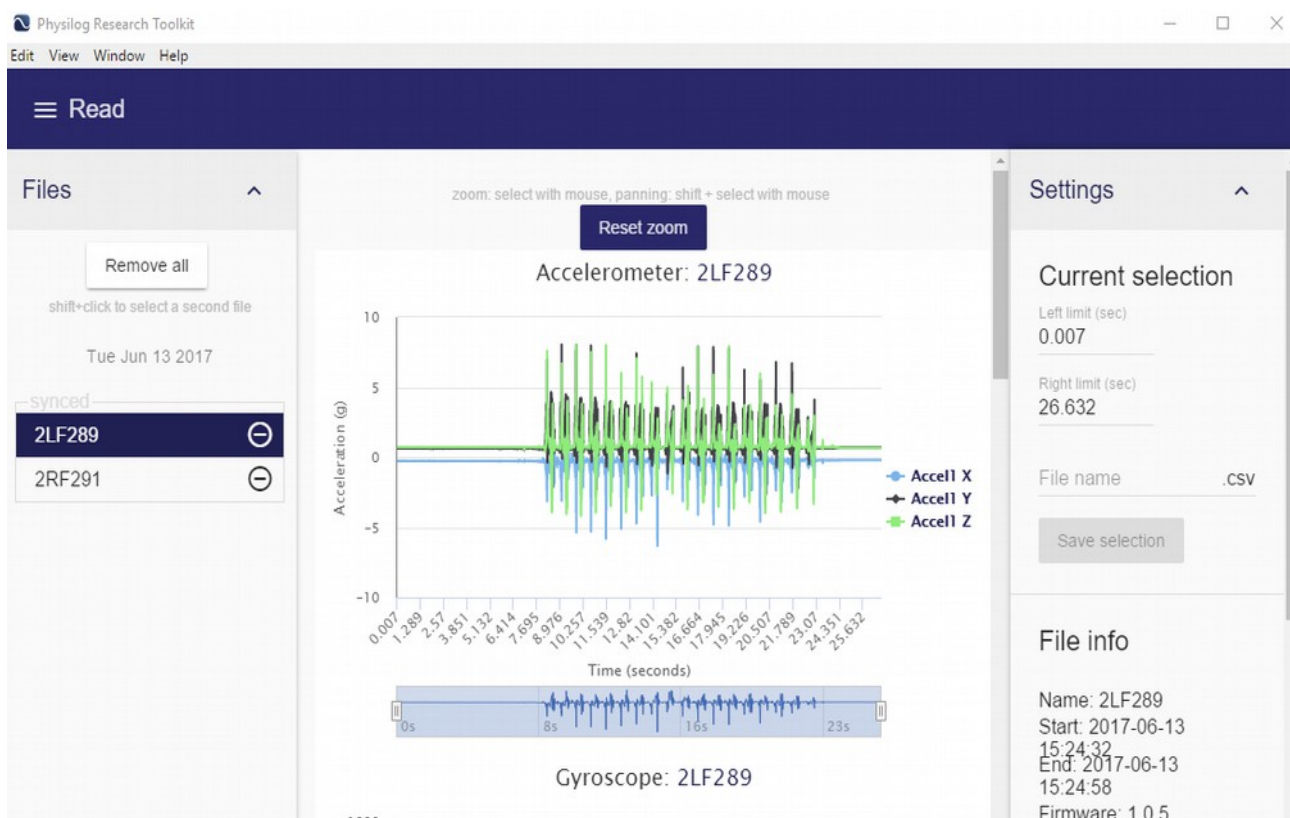

Illustration 2: Display of the raw data of Physilog®5

Exporting Physilog®5 data

You have the possibility to export Physilog®5 data to csv for further use by your own programs. Therefore indicate the name of the exported file. Only the displayed part of the file is exported.

1.3. Program Physilog®5's sensors configuration

To access and change the configuration of the Physilog®5 sensors, open the 'Configuration' part of the Research ToolKit at the top left corner. For changing configuration of the Physilog®5 the sensor should be connected to your computer.

Create a new configuration and save configurations to the computer

By clicking on the 'New config' button you can start a new Physilog®5 configuration from scratch. You can load an existing configuration from your computer by dropping a configuration on the interface. Once a configuration is created, you can save it to your computer by clicking on 'Save config'.

Load current configuration and update the Physilog's configuration

When one or several Physilog®5 are connected to the computer via USB, they appear in the list at the top of the window. You can retrieve the current Physilog®'s configuration by selecting it from the list and clicking on 'Load from device'. You can then modify it and re-apply it to the Physilog® by clicking on 'Send to Device' button. You should always retrieve the current config of the Physilog® for each Physilog® before modifying it. This allows to keep the correct calibration values.
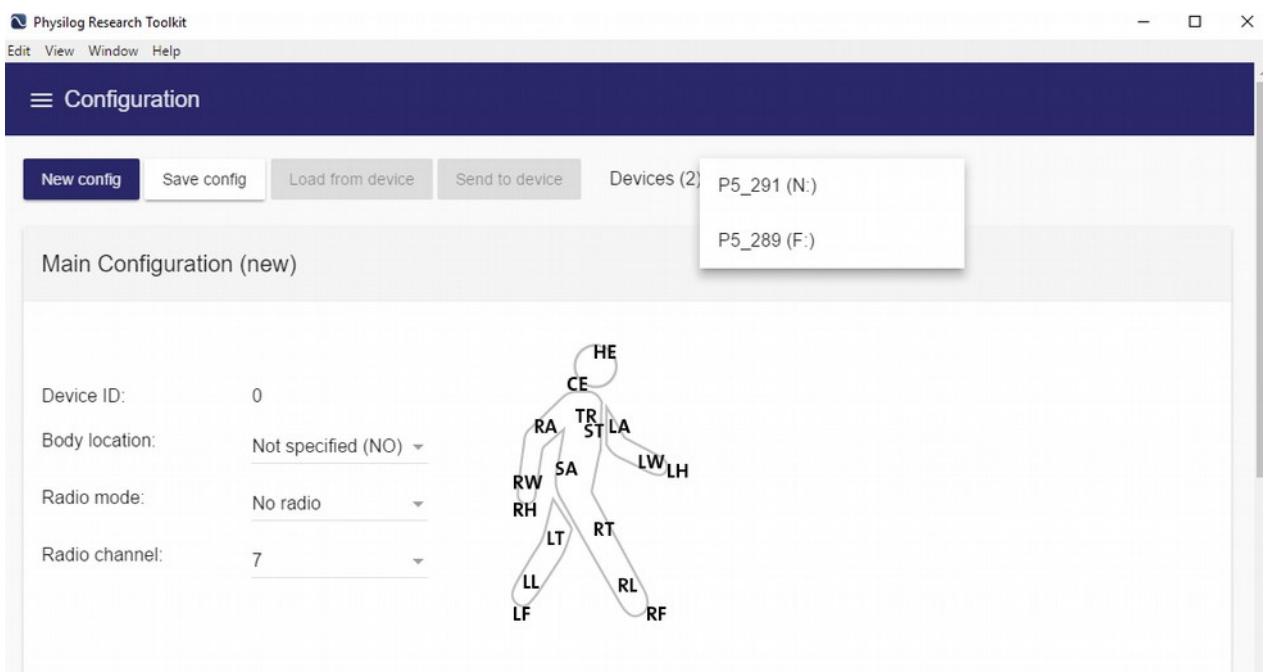

Illustration 3: RTK sensor list and Main Configuration

Contents of the configuration

The Physilog® main configuration contains the serial number of the device (Device Id), the Body location (f.ex. Left foot (LF)) and the Radio mode and channel. These settings allow to create a network of sensors, where one master sensor and several slave sensors (from one to as many as wished) create a network. Multiple sensor networks can be created by selecting different radio channels. The "No radio" mode can be used when measuring with single Physilog® which do not need to synchronize with any other units. Sensor battery life decreases significantly when using slave mode when the sensor is not part of a network (see Battery autonomy estimations in P5_Instructions_for_Use.pdf).

Each of the sensors inside the Physilog® can be activated and inactivated using the 'Sensor configuration' settings. To turn a sensor on/off, click on the switch button on the left of the sensor name. The sampling rate of each activated sensors can be selected from the list. For the accelerometer and the gyroscope, the range of the sensor can in addition be selected and calibration values inserted.

Illustration 4: Sensor configuration possibilities: You can activate/inactivate each sensor and set the sampling frequency. For accelerometer and gyroscope you can in addition set the maximal range and the calibration values

2. Read raw data using Matlab® ToolKit

To read signals directly in MATLAB®, download the functions provided on the website www.gaitup.com/support (under Matlab ToolKit), unzip the folder and save the functions to your preferred location on the computer. Open your MATLAB® program and go to the folder where you saved the functions or add them to the MATLAB® path.

rawP5reader

Launch the *rawP5reader* function to read Physilog®5 raw data:

[sensorData, header] = rawP5reader();

This will open a window where you can select the files that you want to read. You can select one or several files at the same time.

For batch processing the function also allows file names (inclusive path to folder) as input arguments. Use a 'cell' variable to read several files together in batch processing:

[sensorData, header] = rawP5reader({'filename1.BIN', 'filename2.BIN', ...});

The first output of the function, called 'sensorData' in the example above contains the raw data with associated timestamps and essential information such as sensor type (accelerometer, gyroscope or barometer) and sampling frequency. The 'header' structure contains more details about the file such as start and end date or firmware version.

For **firmware v1.0.4** and earlier data of several files read together is not post-synchronized in this function. The slave sensor timestamps already start at the timestamp of the master of when it got synchronized with the master.

For **firmware v1.1.0** and higher the start of the data is synchronized, the master sensor serves as reference. If slaves sensors were started before the master sensor their timestamps before synchronization happened will be negative. No raw data is removed due to synchronization, it only adjusts the timestamps of slave sensors such that they correspond to the master timestamps. Therefore it is important to always use timestamp information in combination with raw data or to cut the data after reading with rawP5reader if only working with the data.

plot_p5_data

The *plot_p5_data* can be used to display data from Physilog®5 in MATLAB®. It creates a plot with a sub-graph for each sensor of the Physilog® (accelerometer, gyroscope, barometer, temperature) and a one plot for each sensor showing all the files together when several files

are read. The function is freely accessible and modifiable and is thought to serve as an example for inexperienced users. To run the function:

plot_p5_data(sensorData);

where sensorData is the output of rawP5reader function (from reading of one or several files).

3D Orientation

3D orientation of the sensor is calculated on-board during the measurement when in streaming mode (sensor started through "Signals Visualizer"). A 3D model of the Physilog®5 which indicates its orientation can be displayed for illustration purposes. The Matlab function to read the .BIN file has the option to output the quaternions and Euler angles.

3. Practical considerations

- Copy trial recordings to your computer: Physilog® is not the best place to keep and save important data.
- Check the support website (www.gaitup.com/support) from time to time to download the latest version of the Research ToolKit

Contact information

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1.2.0	Initial release to public	Rebekka Anker	4 January 2017
1.3.0	Restructured chapters Changes related to RTK v1.3.3 update: - Add of file information - Network configuration Changes related to firmware v1.1.0: - synchronisation in rawP5reader	Rebekka Anker	15 June 2017