Gaitup
make sense of motion

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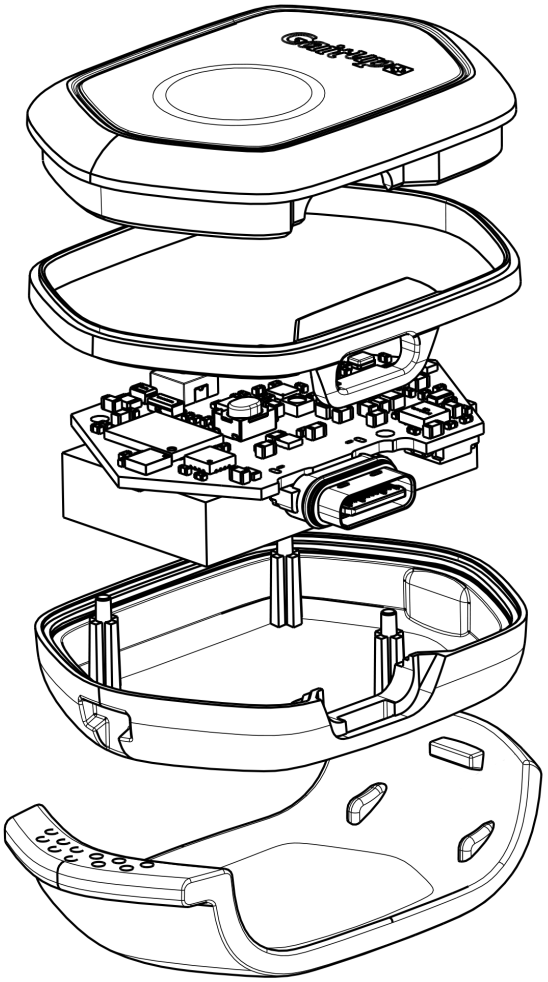
TVA CHE-145.136.760

Physilog® 6S

User manual

Thank you for purchasing Physilog 6S, the Swiss quality movement sensor. This manual introduces how to use the different features of the sensor.



Legal manufacturer:

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Website: www.mindmaze.ch

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General Contact email: contact@gaitup.com

Website: https://research.gaitup.com/

Support email: support@gaitup.com

Product:

Physilog 6S

Model:

Physilog 6S V1.1B

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1. Physilog 6S elements

2. Charging

The Physilog 6S is charged via the USB-C port. Plug the USB-C connector of the cable delivered with the Physilog 6S to the sensor. Plug the USB connector to a Computer or charger (see voltage specifications below). Physilog 6S recording must be stopped for charging. Do not charge Physilog® when room temperature is outside of range 0°C to 30°C.

Low battery level is indicated by yellow LED during measurement or if the Physilog® blinks rapidly 3 times red when starting and doesn't start the recording (see LED indications below). A battery level estimation is available via the Gait Up mobile applications. When the Physilog® is discharged, plug it for charging for at least 30 minutes before use.

It is recommended to avoid complete discharging of the Physilog 6S, therefore check that the Physilog® sensors are off when you store them. After a long period without using the Physilog®, plug it for charging for at least 30 minutes before use. If the device is not used for a time period

longer than 3 months, please make sure it is fully charged once every three months. It may happen that the LED doesn't blink white at the beginning of charging after the battery was very low, to see the charging ongoing shortly push the main button or disconnect and reconnect after some charging time.

Supply Voltage specifications

The Physilog 6S should be charged using USB at 5V, 100mA. For charging, the ambient temperature must lie between 0°C and 30°C.

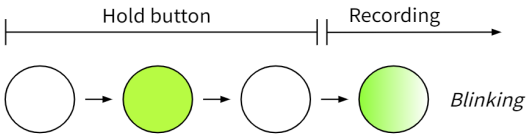
Power supply: 5V DC, 50/60Hz, 100mA

3. Recording with Physilog 6S

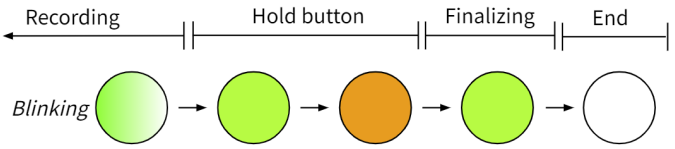
There are several ways to start and stop a measurement with the Physilog 6S:

3.1. Standalone measurement

Press on the main button (for about 2 secs, until the green light turns off) to start the measurement. During measurement, the Physilog® blinks green.



Hold the main button for 3 seconds, until the light turns orange to stop the measurement. When the measurement has been concluded, the LED shortly blinks green three times.



If several Physilog 6S sensors are configured to do so and started at the same time, they synchronize regularly during the measurement. A network includes one single master sensor and several slave sensors (from one to as many as wished). Multiple sensor networks can be created by selecting a different radio channel. The network configuration is done via the Research ToolKit Desktop software (see RTK user manual for details) and is saved in the conf.bin file on each Physilog 6S.

To perform a measurement with synchronized Physilog 6S, turn on all sensors of the network with the main button within a short interval of time (all must be started within one minute). No precise order of starting the sensors is necessary. Each sensor starts recording data from start and once it is synchronized with the master sensor it will blink green synchronously with the

master sensor. To stop the measurement, push the main button of the sensors until the LED turns orange, you can turn off the sensors in any order.

3.2. Control the Physilog from a mobile application

The Gait Up companion mobile applications allow to control the Physilog 6S sensor. There is no need to pair your Physilog® with the tablet prior to Bluetooth communication, just select the Physilog® from the list in the app. In order to be able to connect a Physilog 6S to a mobile application it needs to be visible by Bluetooth. This can be achieved by different methods which can be set in the configuration of the device, the default setting is activation of the BLE advertisement for 30 seconds by gently shaking the sensor (see the Research Toolkit user manual for details).

Physilog 6S provides several modes which can be controlled by the companion mobile application:

Raw data stream

The raw data stream mode allows to send the raw sensor data (3D acceleration, 3D angular velocity, barometric pressure and 3D magnetic field) to a mobile device via BLE in quasi real-time. The Physilog does not save any data on its internal memory in this mode. Depending on the firmware version, the sensor shines or blinks green during the raw data stream.

Remote controlled recording

The remote controlled recording allows recording data files like in standalone mode, except that the start and stop of the recording is done via a command from the mobile application instead of pressing the button on the sensor. One file per recording between a start and stop in the mobile application is created on the internal memory of each Physilog. No data is streamed to the mobile application. Depending on the firmware version, the sensor shines or blinks green during the remote controlled recording.

Remote controlled recording with File transfer

This mode adds the streaming of the recording file from the Physilog to the mobile application to the remote controlled recording. The Physilog still saves one file per recording on its internal memory, and in addition it sends this binary file to the mobile application during and at the end of the recording. Depending on the firmware version, the sensor shines or blinks green during the file transfer recording.

Troubleshoot: If a sensor is not detected by the tablet, gently shake the sensor or shortly press the button to enter detection mode (depending on the settings). If the sensor can still not be connected, check that it has enough battery and is not connected to another mobile device and if necessary ultimately do a reset of the sensor as explained in section 5.7 Troubleshoot.

Note: Bluetooth 4.0 or higher is required on the mobile device to be able to communicate with Physilog 6S.

4. Data Analysis

Physilog® always saves raw data on its internal memory, except when streaming the raw data via Bluetooth using the “Raw data stream” functionality of the app. Users have access to the raw data through companion software called Research ToolKit (RTK). The RTK is available for computers (PC and Mac). Functions to read raw data inside MATLAB® are also available. Please refer to the RTK user manual for more details.

USB data transfer

Data saved on the internal memory of the Physilog® can be accessed using USB data transfer. Therefore, plug the USB cable to the Physilog® and a computer. The Physilog 6S connects to the computer like a USB key and files can be accessed. One file for each measurement is created and files are stored in folders depending on creation date (YY_MM_DD). The file name is composed of a file number (increasing from 01 to 99), the body location (as defined in the configuration, f.ex. 'LF') and the sensor serial number unique part (4 digits). Copy-paste the files to your computer for analysis. From here you can also rename folders and files or delete the files from Physilog®'s memory.

It is recommended to copy-paste the files from the internal memory to a computer and delete the files from the sensor memory to avoid encountering memory capacity problems and to simplify file identification when performing multiple recordings.

Warning: Do not remove the conf.bin file which contains the configuration information, otherwise the Physilog® will return to a default configuration. If this happens, update the configuration using the Research ToolKit or contact Gait Up support.

5. Practical Considerations

5.1. Fixation

The Physilog 6S comes with two fixation clips as default attachment accessory, one for the belt and one for the shoe laces. Additional clips and elastic straps can be purchased from Gait Up.

5.2. How to update Date and Time of the Physilog 6S

Via computer:

- Create a new text file on the Desktop of your computer or directly on the Physilog® sensor (on Windows: right click, new>text file, on Mac: open text editor and save file as text file)
- Leave it empty and rename it to TIME (complete name with file extension: TIME.txt)
- Copy-paste the file to the Physilog® if you saved it on the Desktop

- Disconnect the Physilog® from the computer to update the time and date to the time when the file has been created

Create a new text file each time you update the date, do not just rename or modify an existing TIME.txt file (TIME.txt file previously created will update to the date it was created, so in the past). The TIME.txt file will disappear from Physilog's memory when disconnecting the Physilog® from the computer, therefore it is normal to not find it the next time you open the Physilog® on the computer.

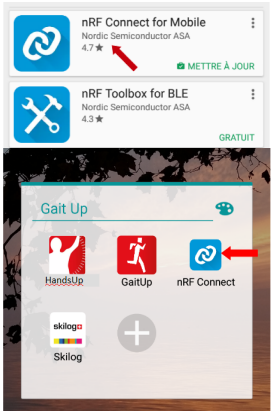
Via mobile application:

Connect the Physilog® to the Android companion application inside the “Remote control” mode. Start a short measurement from the app, you can stop the measurement as soon as the stop button is available in the user interface of the mobile application. Then disconnect the sensors or completely quit the app.

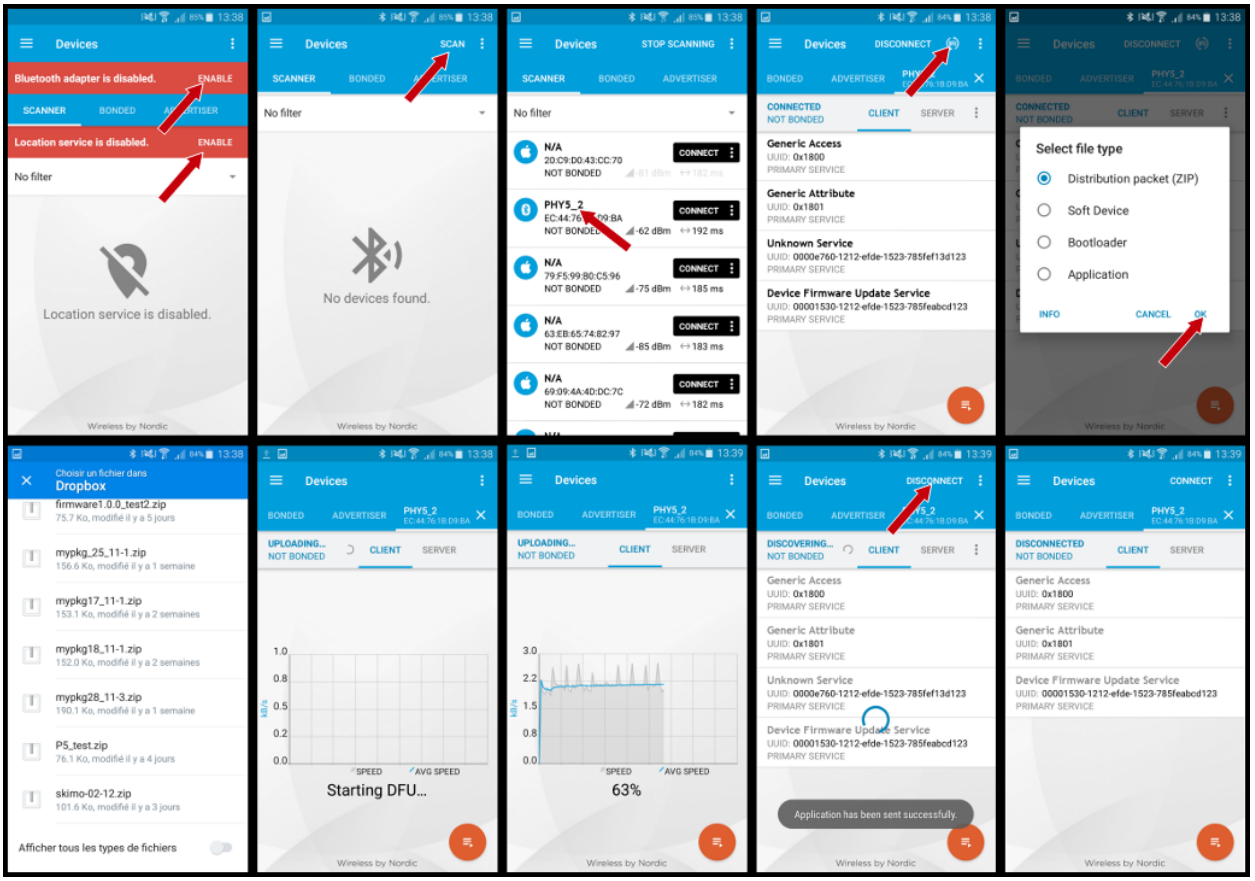
5.3. How to update firmware of Physilog 6S with nRF Connect

The firmware is updated via Bluetooth. Therefore, install the nRF application on a mobile or tablet (Android or iOS) and follow the steps below. It may be necessary to install a file manager application in addition to the nRF app to be able to select the firmware file from a chosen location of file storage on your device.

Android



- Install the “nRF Connect for Mobile” app on the Android device
- Download the latest firmware version to the Android device
- Open the nRF Connect app and enable all necessary permissions (Bluetooth and Position, see pictures below)
- Go to Scanner tab and scan for surrounding Physilog (gently shake the Physilog 6S or briefly press the main button to enter detection mode)
- Select connect of one Physilog 6S sensor in the list
- Plug the selected Physilog to a power source to be sure to have enough battery to perform the update
- In the top right corner of the app click on the DFU button (on the right of “Disconnect”) and select “Distribution Packet (ZIP)” from the proposed options
- Get the new firmware file from where it was downloaded
- Wait until the graph in the app has shown that 100% of the firmware was transferred, this may take some minutes
- Disconnect the Physilog® by clicking on “Disconnect” and close the tab of the Physilog 6S
- Plug the Physilog® to the computer and update the date and time (see above)



iOS

- Install the “nRF Toolbox” on the iOS device
- Download the latest firmware version to the iOS device
- Add the downloaded firmware to nRF Toolbox by connecting the iOS device to the computer:
- Open iTunes and select your phone
- Select the “Apps” tab on the left and scroll down
- Under “File Sharing” select the nRF Toolbox app and add the Firmware file to the Documents list
- Click on “Done” and disconnect phone from computer
- Open the nRF Connect app on the iOS device and enable Bluetooth
- Open DFU option of the app

- Click on “Select File” and go to the tab “user files” where you find the firmware added to the app earlier
- Gently shake the Physilog 6S to enter detection mode
- Click on “Select device” button and look for surrounding Physilog
- Select connect of one Physilog 6S sensors in the list
- Plug the selected Physilog to a power source to be sure to have enough battery to perform the update
- Click on “Upload” and wait until the percentage has arrived at 100%, this may take some minutes
- Plug the Physilog® to the computer and update the date and time (see above)

5.4. Tips for best practices

Physilog 6S should be handled carefully. In particular, it should not receive shocks, such as fall, crushing, being hit etc. Do not press too hard on the on/off button, this can damage the button.

Warning: Do not use or charge the Physilog® if the sensor or its case is damaged. Contact Gait Up about what further action is needed when the case is damaged. In case the battery is damaged, immediately move the device away from flammable materials and contact Gait Up's customer support.

- To benefit from the maximal battery life, fully charge Physilog® sensors before doing measurements (LED shines green when connected to computer or charger, you can also check with the App).
- Copy trial recordings to your computer: Physilog® is not the best place to keep important data.
- Physilog 6S can be used outside when the temperature is not exceeding 30 °C. Do not use Physilog 6S to measure water-sport activities without additional waterproofing.
- Do not introduce pointy objects into the small hole on the bottom of the sensor, this irreversibly damages the waterproofing of the sensor.
- Accelerometer and Gyroscope sensors are calibrated by Gait Up prior to delivery. Magnetometer data is not calibrated.
- Sensors do not need systematic yearly recalibration. Depending on the use, regular recalibration can be recommendable for: offset and gain dependent measures such as sensor orientation calculation.
- Make sure to know which Physilog® file corresponds to which trial for your analysis – First digits of file name are automatically incremented for each day of measurement (exceeding 99 resets the increment back to 1). It is recommended to delete old files from the sensor memory. Note that date of file generation (recorded between one start and stop of the

Physilog®) is visible in the XLS or CSV file and the Matlab structure “header”. If you wish to adapt internal date and time of the Physilog®, read the section above.

- Do not remove the “conf.bin” file from the Physilog, otherwise it will return to a default configuration. If this happens, update your configuration in the Research ToolKit software or contact Gait Up's customer support.

5.5. Maintenance and Disposal

Cleaning: Before you clean the device make sure it is turned off and disconnect all cables. Use water and soap, saline solution or 3% Hydrogen peroxide (H2O2) solution to clean the Physilog 6S sensor device and its fixation clip accessories. Do not use a cleaning spray, but carefully wipe all parts using a humid wipe.

Storage: Store in a cool (0°C – 30°C) and dry place. The provided box is the perfect place for your sensor. Keep away from direct sunlight.

Do not throw Physilog® sensors in the normal trash, dispose of it properly considering local laws and rules about electronic waste and batteries. Contact Gait Up's customer support for more information about elimination of Physilog®.

Safety information

- Physilog 6S includes a lithium battery. This battery may only be charged over a limited temperature range. Never attempt to dock or charge your Physilog® 6S when the temperature is outside of the range of 0 to 30°C.
- Physilog 6S should be charged through USB connection with a computer. An external charger may be used; note that no charger is provided by Gait Up. Gait Up declines any responsibility due to charger usage.
- Supply voltage should be as follows: DC, 5V. Current consumption is 100mA. All external circuits connected to the Physilog 6S should be «Safety Extra Low Voltage» and «limited Power Sources» circuits as described in the following standard:IEC62368-1:2014+/A11:2017

Warnhinweise:

- Physilog 6S enthält eine Lithium Batterie. Die Batterie soll nur in einer definierten Temperaturspanne aufgeladen werden. Versuchen Sie nie Ihren Physilog® 6S an den Computer anzuschliessen oder aufzuladen, wenn die Aussentemperatur nicht zwischen 0°C und 30°C ist.
- Sensoren sollen durch eine USB Verbindung mit einem Computer aufgeladen werden. Ein externes Ladegerät kann benutzt werden; Gait Up empfiehlt und liefert aber kein externes Ladegerät. Gait Up übernimmt keine Haftung falls ein Ladegerät gebraucht wird.
- Die erlaubte Netzspannung ist: DC, 5V. Stromaufnahme beträgt 100mA. Alle an den Physilog 6S angeschlossenen externe Stromkreise sollen die «Sicherheitskleinspannung" und "mit begrenzter Leistung" Regeln erfüllen, die im folgenden Standard beschrieben sind: IEC 62368-1:2014+/A11:2017

Informations relatives à la sécurité:

- Physilog 6S contient une batterie au lithium. La batterie ne doit être chargée que si la température extérieure est dans les limites définies. N'essayez jamais de connecter ou charger votre Physilog® 6S si la température ambiante est en dehors des limites de 0 à 30°C.
- Physilog 6S doit être chargé par une connexion USB avec un ordinateur. Un chargeur externe peut être utilisé; mais Gait Up ne livre et ne recommande pas de chargeur. Gait Up refuse toute responsabilité liée à l'utilisation d'un chargeur externe.
- La tension de réseau devrait être: DC, 5V. La consommation de courant est de 100mA. Tout circuits connectés à Physilog 6S doivent être «très basse tension de protection» et «source à tension limité» comme décrit dans les normes suivantes: IEC 62368-1:2014+/A11:2017

6. Sensor specifications

Physical properties	
Dimensions	42,2 x 31,6 x 15 mm
Weight	15 gr
IP Rating	Waterproof IP64
Operating Temperature	From 0° to 30°C
Fixation Accessories	Application dependant, Belt clip and shoe lace clip included Straps available by Gait Up (sold separately)
USB-C interface	USB-C, High-speed USB 2.0
Communication	Bluetooth Low Energy (BLE) and Rf proprietary protocol for intrasensor communication Operating frequency range: 2.402-2.480 GHz (TX & RX)
Internal Memory	450MB
Battery	Lithium Ion Polymer Accumulators 3.7V 240mAh Battery life: up to 20h continuous use (depends on sampling frequency) Number of recharging cycles > 500 cycles
Electronics specifications	
Microcontroller	Nordic Semiconductors ARM® Cortex® M4 with floating-point for on-board processing
Inertial Sensors	3D Accelerometer up to ±16g 3D Gyroscope up to ±2000°/s Sampling frequency up to 512Hz
Magnetic field sensor	3D magnetic field sensor up to ±50mT Sampling frequency up to 256Hz
Ambient Sensor	Barometric altitude from 260 to 1260 hPa Temperature sensor accuracy of ±1.5°C Sampling frequency up to 64Hz
Compatible charger minimum specifications	
Minimum specifications	• Input voltage: 100-240V AC • Output voltage: DC 5V 3A • Efficiency: >85% • CE-marked & ROHS compliant • USB-A connection

3D orientation

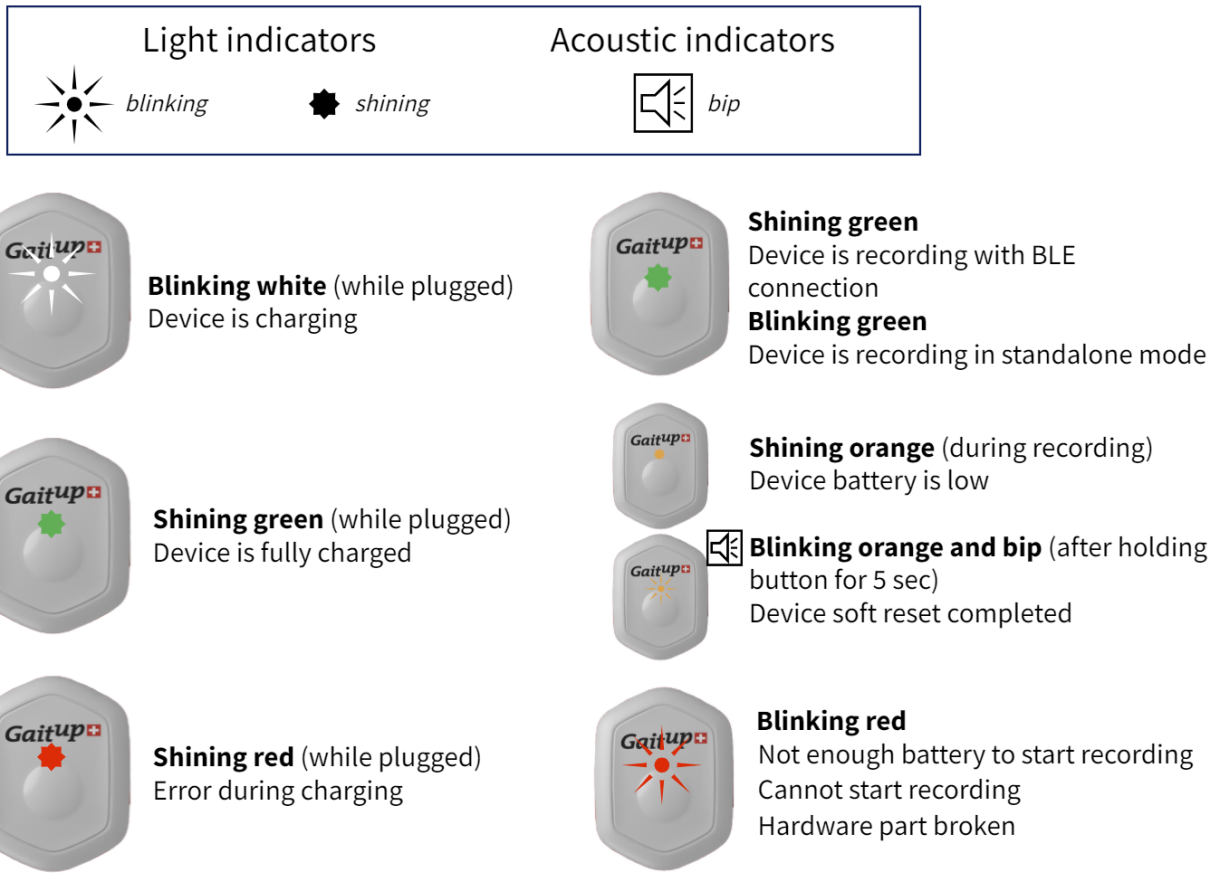
3D orientation of the sensor is calculated on-board during the measurement when in streaming mode. The Matlab function to read the .BIN file has the option to output the quaternions and Euler angles.

7. Troubleshoot

Reset

The reset is the manipulation which can be done if the Physilog® is not working properly. To do a reset, hold the main button for 5 seconds. The LED blinks red/orange and then stops. If the problem persists, fill out the contact form at the bottom of the support page (www.gaitup.com/support) or write an email to: contact@gaitup.com. Please indicate Physilog® serial number and describe the problem in as much detail as possible (number of red blinks, last manipulation, firmware version etc.).

LED indications



8. Limited Warranty & Support Policy

Warranty:

Gait Up offers 12 months parts and labour on Physilog® starting from the date of delivery. If within one year from the date of delivery to the customer the equipment does not comply with the foregoing Limited warranty, Gait Up will at Gait Up's option, repair, replace or refund the purchase price of the defective equipment free of charge to the customer. Customers requesting repair, replacement or refund are required to ship, the Physilog® to Gait Up. As a condition of this warranty, customers must contact Gait Up's customer service for instructions on and approval of shipment prior to returning any defective Physilog®. The warranty shall not apply to any product or component thereof which has been repaired or altered by anyone other than Gait Up in any manner so as, in Gait Up's judgement, to affect its service ability, or any product been subject to alteration, accident, misuse, abuse, neglect or abnormal wear. Gait up warrants solely to the original purchaser (customer). Only the terms expressed in this warranty shall apply and no distributor, corporation or individual is authorized to amend, modify or extend this warranty in any way.

Gait Up shall have no liability for any consequential, incidental or special damages by reason of any act or omission or arising out of or in connection with the equipment or its rental, delivery, installation, maintenance, operation, performance or use, including without limitation any loss of use, lost revenue, lost profits or a cost associated with downtime. The obligations contained in this paragraph continue beyond the term of this limited warranty.

Physilog® and Gait Analysis Software are not considered as proper Medical Devices, since they do not support directly diagnosis, but they provide data which have to be analysed and approved by medical doctors for them to make their diagnosis. Reclamations regarding medical devices will not be considered.

Support Policy:

Support does not include:

- support for 3rd party hardware, software, mailing lists or web content
- writing or debugging customer applications and deployments
- detailed explanations of the engineering principles behind our software and hardware
- support for systemic problems beyond the scope of the actual Physilog® and existing systems software (IT issues, computer operation)
- support for customers whose conduct fails to meet professional standards

Occasionally we engage in more interactive support or consulting. Interactive support is a customer courtesy and is provided at Gait Up's discretion. It does not invalidate the support policy described above. There is no guarantee of performance, timeliness, or establishment of a

continuous support relationship. Consulting is subject to acceptance of a formal statement of work.

9. Product compliance

IMDA Singapore statement

Physilog 6S complies with the standards and specifications published by IMDA, is compatible with the public telecommunication networks in Singapore, and does not cause radio frequency interference to other authorised radio-communication networks.

RF Exposure information

This device has been tested for compliance with FCC RF exposure limits in a portable configuration. This device must not be used with any other antenna or transmitter that has not been approved to operate in conjunction with this device.

Interference statement

The sensor uses the following band frequency 2.402MHz - 2.480MHz.

FCC information

FCC information can be found on the Physilog sensor. The FCC identifier is 2AYHH-PHY06SGAITUP.

Class B Warnings

Class B

The FCC Wants You to Know

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the

following measures:

a) Reorient or relocate the receiving antenna.

b) Increase the separation between the equipment and receiver.

c) Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.

d) Consult the dealer or an experienced radio/TV technician.

In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception.

FCC Warning (Modification statement)

MindMaze SA has not approved any changes or modifications to this device by the user. Any changes or modifications could void the user's authority to operate the equipment.

ISED Information

ISED information can be found on the Physilog sensor. The IC is 26802-PHY06SGAITUP

CAN ICES-003 (B)

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de classe B est conforme à la norme canadienne ICES-003.

ISED Warning (Modification statement)

MindMaze SA n'approuve aucune modification apportée à l'appareil par l'utilisateur, quelle qu'en soit la nature. Tout changement ou modification peuvent annuler le droit d'utilisation de l'appareil par l'utilisateur.

FCC and ISED Regulatory notices

Interference statement

This device complies with Part 15 of the FCC Rules and Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Wireless notice

This device complies with FCC/ISED radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS-102 of the ISED radio frequency (RF) Exposure rules. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Le présent appareil est conforme à l'exposition aux radiations FCC / ISED définies pour un environnement non contrôlé et répond aux directives d'exposition de la fréquence de la FCC radiofréquence (RF) et RSS-102 de la fréquence radio (RF) ISED règles d'exposition. L'émetteur ne doit pas être colocalisé ni fonctionner conjointement avec une autre antenne ou un autre émetteur.

Contact information

At Gait Up, we welcome your feedback and questions.
Please contact us at:

EPFL Innov' Park - C
CH-1015 Lausanne
tel: +41 21 633 7527
mail: contact@gaitup.com
web: www.gaitup.com

Version	Changes	Responsible	Date
0.0.1	New document - User Manual for Physilog 6S V1.1B	Gellaerts Jules	06 December 2021
0.0.2	RF changes -following 360 compliance comments Add interference statement	Gellaerts Jules	08 December 2021