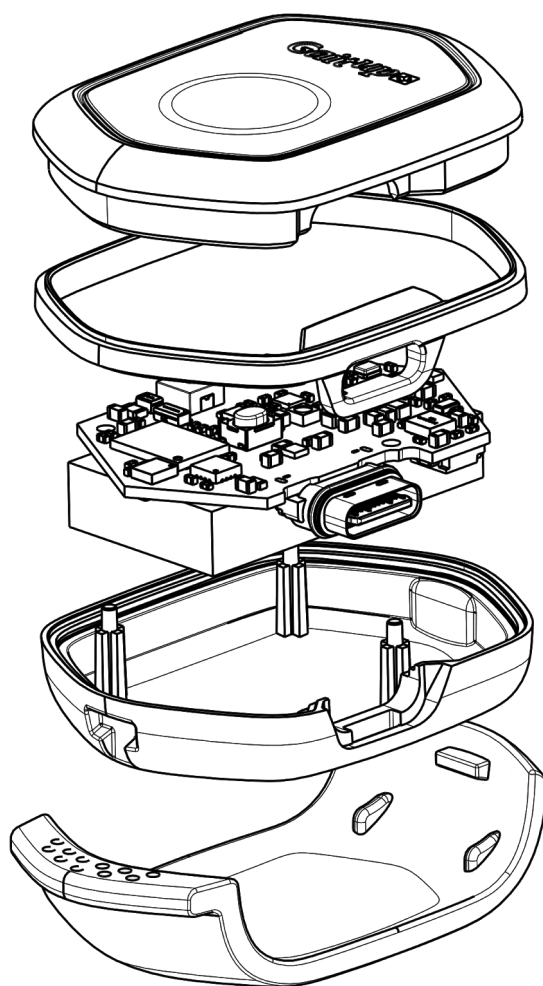


# **Physilog<sup>®</sup> 6S**

## ***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:**



Mindmaze SA  
Chemin de Roseneck, 5  
1006 Lausanne  
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mindmaze

Contact email: [info@mindmaze.com](mailto:info@mindmaze.com)

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**Commercialized by:**

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EPFL Innovation Park, Batiment C  
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**Gaitup**   
make sense of motion

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Website: <https://clinical.gaitup.com/>

Support email: [support@gaitup.com](mailto:support@gaitup.com)

**Model:**

Physilog 6S

IC ID: 26802-PHY06GAITUP

FCC ID: 2AYHH-PHY06GAITUP



CE IC FCC

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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 45°C.

Low battery level is indicated by yellow blinking 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. 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.

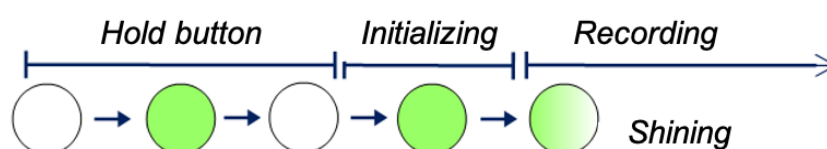
Power supply: 5V DC, 50/60Hz, 100mA

## 3. Recording with Physilog 6S

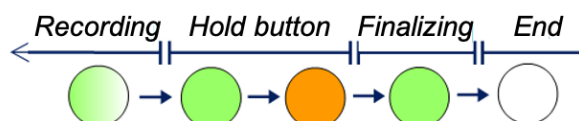
There are several ways to start and stop a measurement with the Physilog 6S:

### 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® shines 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 shine 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. Two modes are available in the application, for details refer to the user manual of the mobile application. 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.

**Troubleshoot:** If a sensor is not detected by the tablet, gently shake the sensor to enter detection mode. 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 data live via Bluetooth using the “IMU 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 1 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.

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 with Velcro patches to stick onto the Physilog® 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 hour 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:

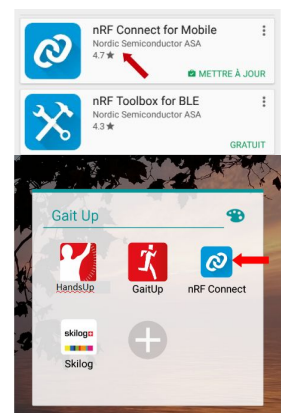
Connect the Physilog® to the Android companion application inside the “Remote control” mode. Start a short measurement from the app, you can stop the measurement as soon as the stop button is available in the user interface of the mobile application. Then disconnect the sensors or completely quit the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

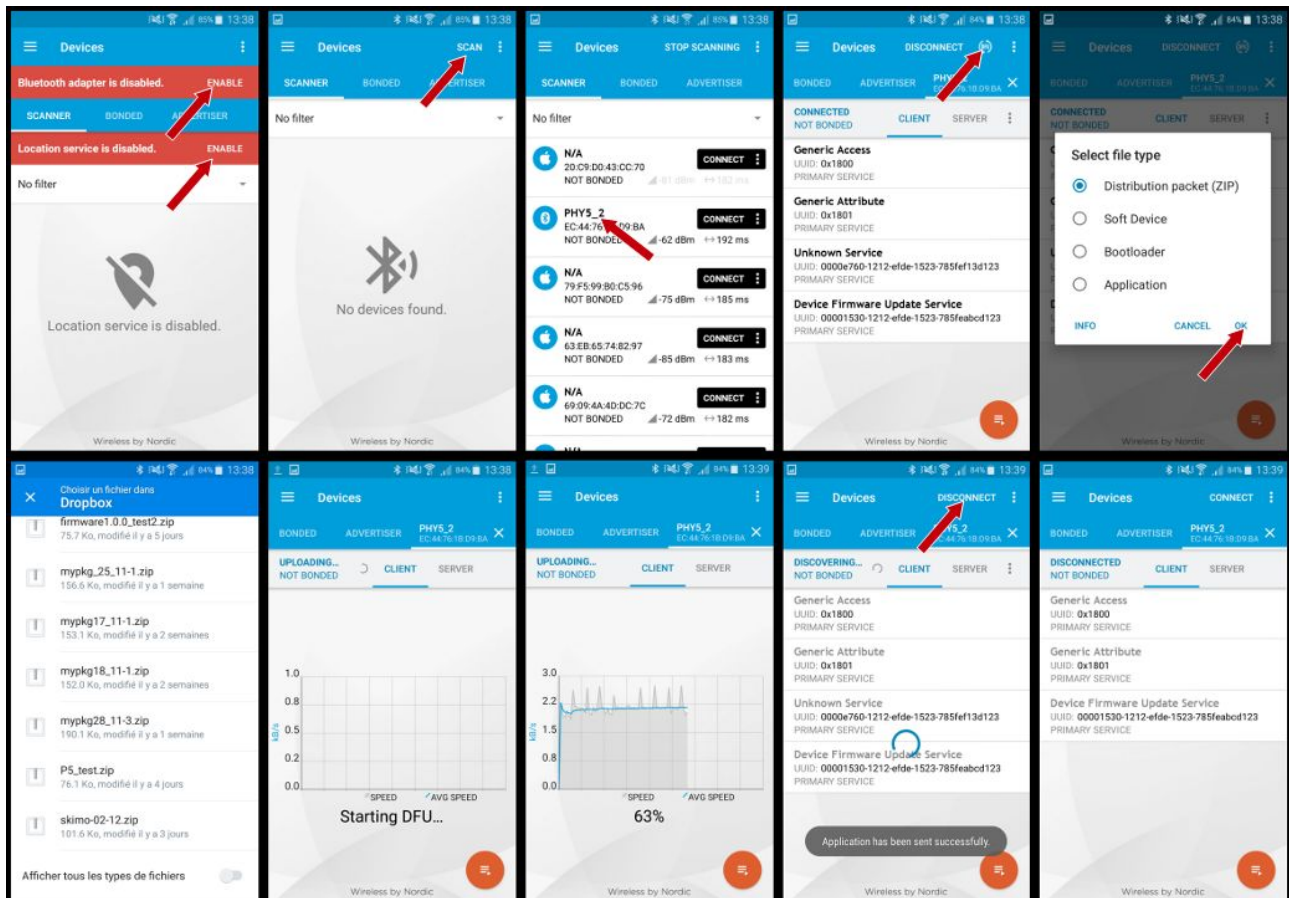
### Android

- Install the “nRF Connect for Mobile” app on the Android device
- Download the latest firmware version from the email 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 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



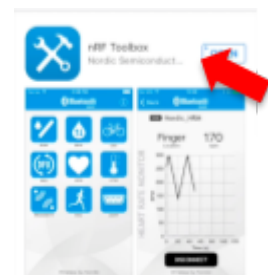


- In the top right corner of the app click on the DFU button (on the right of “Disconnect”) and select “Distribution Packet (ZIP)” from the proposed options
- Get the new firmware file from where it was downloaded
- Wait until the graph in the app has shown that 100% of the firmware was transferred, 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

- Plug the Physilog® to the computer and update the date and time (see above)
- Install the “nRF Toolbox” on the iOS device
- Download the latest firmware version from the email 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.
- 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 (H<sub>2</sub>O<sub>2</sub>) 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 45°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 45°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 45°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 35°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) Operating frequency range: 2.402-2.480 GHz (TX & RX) Effective radiated power (max): 11.11 dBm
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	<ul style="list-style-type: none"> <li>• Input voltage: 100-240V AC, 50-60 Hz</li> <li>• Output voltage: DC 5V 3A/9V 2A/12V 1.5A</li> <li>• Efficiency: &gt;85%</li> <li>• CE-marked &amp; ROHS compliant</li> <li>• USB-A connection</li> </ul>

## 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 on the support page ([www.gaitup.com/support](http://www.gaitup.com/support)) or write an email to: [contact@gaitup.com](mailto: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

Light indicators		Acoustic indicators	
	<i>blinking</i>		<i>shining</i>
			<i>bip</i>

	<b>Blinking white</b> Physilog is charging.		<b>Shining green</b> Physilog is recording.
	<b>Shining green</b> Physilog is charged.	 	<b>Shining orange during recording</b> Physilog battery is low. <b>Blinking orange and bip after holding the button 5 sec</b> Physilog soft reset completed.
	<b>Shining red</b> Physilog error during charging.		<b>Blinking red</b> Physilog has not battery enough. Physilog cannot start recording. Physilog hardware is broken.

## 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

### IC statement

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This device complies with 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. This device complies with Industry Canada radiation exposure limits set forth for general population. This device must not be co-located or operating in conjunction with any other antenna or transmitter.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. 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. Le présent appareil est conforme aux niveaux limites d'exigences d'exposition RF pour la population globale définies par Industrie Canada. L'appareil ne doit pas être installé à proximité ou être utilisé en conjonction avec une autre antenne ou un autre émetteur.

### FCC statement

This document, which describes the instructions for use for an intentional radiator, cautions the user that changes or modifications not expressly approved by the Manufacturer could void the user's authority to operate the equipment.

[54 FR 17714, Apr. 25, 1989, as amended at 68 FR 68545, Dec. 9, 2003]

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: 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 instruction, 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 interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution: the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### 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

#### Europe

Maximum RF Output power (11.11 (13mW) peak EIRP at Cmid, Tmax) of the equipment is under 20mW, and then test result is compliant without additional measurement. So, EN 62311 (2008) "low power / inherent compliance decision" is applied

#### FCC

This device complies with FCC radiation exposure limits set forth for general population. This device must not be co-located or operating in conjunction with any other antenna or transmitter.

#### IC - Canada (EN)

This device complies with ISED radiation exposure limits set forth for general population. This device must not be co-located or operating in conjunction with any other antenna or transmitter.

## IC - Canada (FR)

Le présent appareil est conforme aux niveaux limites d'exigences d'exposition RF aux personnes définies par ISDE. L'appareil ne doit pas être installé à proximité ou être utilisé en conjonction avec une autre antenne ou un autre émetteur.

**Note:** The separation distance between the user and/or bystander and the antenna and/or radiating element of the device is of at least 20mm.

## 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](mailto:contact@gaitup.com)

web: [www.gaitup.com](http://www.gaitup.com)

Version	Changes	Responsible	Date
0.0.1	Send to external Lab for electrical safety testing	Rebekka Anker	6 oct. 2020
0.0.2	Update cleaning instructions	Rebekka Anker	8 oct. 2020
0.0.3	Add RF exposure limit text		
0.0.4	Replace to official name Physilog 6S	Rebekka Anker	20 nov. 2020
0.0.5	Add FCC and IC statement, add RF exposure Add information from labeling requirements Update cleaning instructions	Rebekka Anker	27 nov. 2020
0.0.6	Add IMDA labelling requirements	Ainara Bujanda	1 dec. 2020
0.0.7	ISED labelling requirements added	Ainara Bujanda	09 DEC 2020
1.0.0	Addition of FCC license ID, charger specifications addition and correction of errors. Removal of IC compliance for PHY 6S V1.0	Ainara Bujanda	08 JAN 2021
1.1.0	Addition of IC compliance for PHY 6S V1.1	Ainara Bujanda	13 JAN 2021
1.2.0	Change the separation distance between the radiation element and the human body to 20 mm Change order of FCC & IC statements according to suggestion from LCIE	Ainara Bujanda	26 JAN 2021