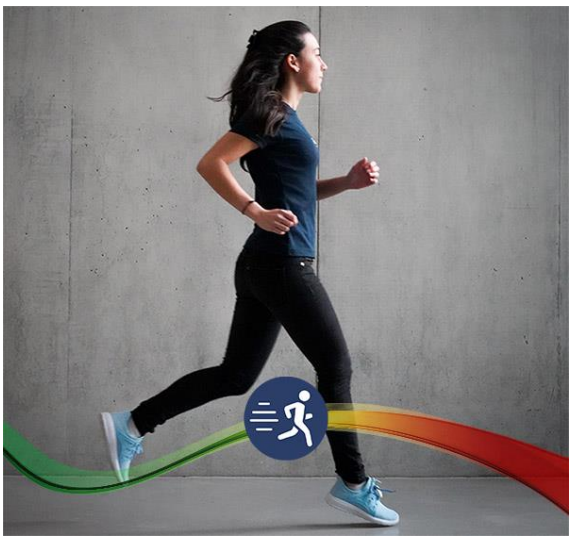
GaitUp
make sense of motion

User guide

GaitUp Lab



Thank you for purchasing the GaitUp Lab for gait and running analysis. The software allows to highlight a multitude of biomechanical parameters to observe the gait and running data with the GaitUp sensors (Physilog®5). The Physilog®5 record the raw data and the GaitUp Lab performs the analysis to get relevant and exploitable results with laboratory precision. This user guide details every step for proper use of GaitUp Lab and the Physilog®5 sensors.

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1. GaitUp Lab package content

2. Get ready with the sensors

2.1 Charging sensors

Physilog®5 are charged via micro USB. Connect the USB cable delivered with the sensors. Connect the other part to a computer or sector with an adaptor (voltage specification: 5V, 100 mA). Physilog®5 must be turned off when charging. Don't charge the Physilog®5 if the temperature is not between 0 ° and 45 °C.
Low battery level is indicated by orange blinking during measurement or by 3 rapid red blinks when you want to start a new measurement. If the Physilog®5 is completely discharged, charge at least 30 minutes before using. Battery level estimation is available when you pair the sensor to the GaitUp application (available on Apple Store and Google Play Store).

NOTE: Charging problem is indicated by a continuous red light and it could damage the sensor. In this case try to charge your sensor on another charging source.

2.2 Sensors Configuration

By default, sensors are configured for running analysis with the GaitUp Lab. If you encounter any problem during the analysis you can check the sensor configuration with the Research Toolkit (Windows version/Mac version, User guide) in the "Configuration" part. Select your sensors> "Load Config"> Change the configuration> "Send Config". For walking analysis, the same sensor configuration as for running can be used. But if you only use walking analysis, it is possible to set the sensor configuration to a lower frequency to reduce the size of the raw data files (see table below) using the Research Toolkit.

OPTIMAL RUNNING CONFIGURATION – default settings

	Sensor 1	Sensor 2
Sensors location	Left foot [LF]	Right foot [RF]
Radio Mode	Master	Slave
Radio Channel	2	2
Accelerometer [ON]	256 Hz	256 Hz
	16 g	16 g
Gyroscope [ON]	256 Hz	256 Hz
	2000 °/s	2000 °/s
Barometer	64Hz	64Hz

OPTIMAL GAIT CONFIGURATION – not suitable for running

	Sensor 1	Sensor 2
Sensors location	Left foot [LF]	Right foot [RF]
Radio Mode	Master	Slave
Radio Channel	2	2
Accelerometer [ON]	128 Hz	128 Hz
	8 g	8 g
Gyroscope [ON]	128 Hz	128 Hz
	2000 °/s	2000 °/s
Barometer	64Hz	64Hz

2.3 Time setting

By default, time is configured in the sensor. After a complete discharge, the internal time of the sensors has to be updated. To update the time, connect your sensor to your computer and add an empty text file named “time.txt” in the main folder. The file must imperatively be saved in “.txt” format. When the time is not correctly configured, your files are saved in the “NO_DATE” folder in the sensor. If the time is correctly set your files are saved in a folder with the measurement date. If you start the sensors from a companion application on the smartwatch or mobile phone, the time is automatically updated and you thus don’t need to follow the instructions hereabove.

2.4 Fix the Sensors

GaitUp Lab package contains two rubber clips to fix the sensors on the shoes and elastic straps to measure barefoot gait, for example.
Insert the Physilog®5 in the rubber clip, slide the sensor into the clip on one side, then

carefully pull the rubber of the opposite side to cover the edge of Physilog®. The USB plug should match with the hole in the rubber clip so that the sensor can be charged without removing the clip. Then, strongly fix the sensor in several shoelaces to maintain it as much as possible and avoid parasitic movement. The exact orientation of the sensor is not important, the software automatically finds it. The sensor can also be attached to the outer side of the shoes.
Note that the sensor placement has an influence on running impact parameters, you should therefore always place it in the same way to be able to compare the results between different recordings.

2.5 Protocol

Gait Up LAB can be used to analyse files recorded using a wide range of protocols. There is only one requirement: each measurement must have a static period (feet flat on the ground without any movement). This period is essential for GaitUp Lab analysis to calibrate the sensor data (manually or automatically) before the analysis.

It is possible to analyse protocolled gait tests such as 10m walk test or figure-of-eight as well as walking or running on treadmill or outdoors. Running recordings should be limited to maximal 5 hours of continuous recording, whereas walking measurements should not exceed 30 minutes.

The software can analyse a single file or file pairs where the files come from a simultaneous recording with one sensor on each foot. For single file analyses not all parameters can be computed.

2.5.1 Step length protocol requirements

For gait analysis the step length, measured as the distance from one heel strike to the heel strike of the opposite foot, can only be precisely calculated if the protocol respects the following points: the feet must be aligned on the start line, so that the initial “zero” position is the same for both feet. Turns should be avoided and if not, the discard turns option should be selected.

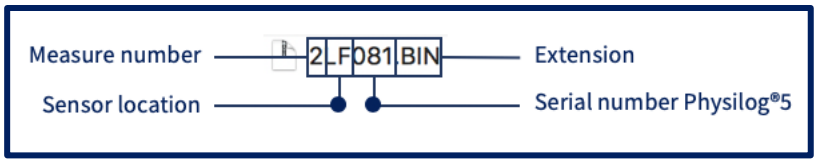
3. How to do a measurement with Physilog®5

WARNING: During automatic analysis, every step is analysed. For example, if you did a part of walking during a running measure and you include this part in the analysis the results could be biased. If the subject stopped in the middle of a walking recording, there will be a cycle with cycle duration including the stop duration.

WARNING: If the sensor is not correctly attached the data analysis could fail or be less precise than expected.

WARNING: Before starting a measurement, please carefully read part 2.

To obtain an analysable file, you have to do a measurement with Physilog®5. You can obtain this file by starting the sensors using their button or using a companion application (f.ex. on a smartwatch). For each method your measurement files (.BIN) are saved in the sensor memory (8Go). A file contains the raw sensor data. Below you can check the name description:



To start the measure directly on the Physilog®5, hold the button for 3 seconds on each sensor. Check that there is a green blinking on your two sensors after releasing the button.

WARNING: If you want a synchronization between your two sensors make sure they are blinking green at the same time. Otherwise you need to check the configuration "Radio mode" and "Radio channel" of your sensors with the Research Toolkit, tab "Configuration".

Once the Physilog®5 have started recording and are blinking green, the subject can perform the gait or running protocol.

To stop the measure hold the button for 3 seconds, the sensor shines orange, then blinks rapidly 3 times and stops. Check that the sensors stopped blinking. The file is automatically saved on the device.

The Physilog®5 sensors can be remotely controlled by a companion application installed on a smartwatch or mobile phone. For explanations regarding the companion applications, please refer to the corresponding user manual.

4. GaitUp Lab analysis

If you don't have files to analyse yet please read the part 3 of this user's guide.

4.1 Get the recorded file

To obtain your file follow the steps below:

—Connect your sensors Physilog®5 to your computer with the USB cable

—Select your sensors in the USB device list on your computer

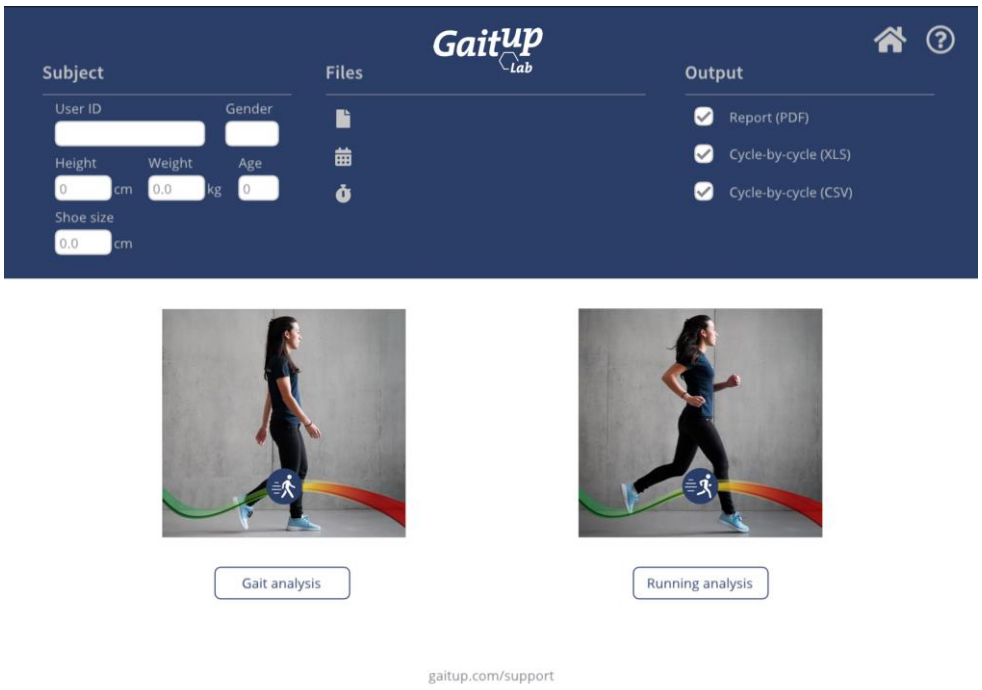
—Save your files from multiple sensors to the same folder on your computer ("1LF091.BIN" for example). If the time is correctly configured, your file is saved in a folder at the date of measurement (for example "18_10_25" for October 25th 2018. If the time is not configured, your file is saved in the "NO_DATE" folder in the order of recordings. You can also find your data by using the file creation time and the size of the files.

WARNING: You have to save the files of both feet in the same folder otherwise the analysis cannot work.

4.2 Analyse your file(s) with GaitUp Lab

4.2.1 Load your file in GaitUp Lab

The software is located in the USB key provided in the package. Open the software directly from USB key.
Once the software is running, complete all user information (name, gender, height, weight, age, shoe size). Then select Gait or Running analysis according to the type of recording you want to analyse.



Under “Output” you can choose from different result files you want to obtain (PDF, Excel file, csv file). The PDF report provides an easily-readable report including benchmark color-codes for some of the parameters and statistics for all parameters. The Excel report includes cycle-by-cycle data, allowing to dig deeper into the data behind the statistics. The csv result file is useful if you want to calculate your own statistics from the cycle-by-cycle values using a third party software.

To generate these reports, select your files (saved before on your computer in the same folder). You can drag and drop your files on the main page (both files at the same time). If you select the files with the button “Select” use “CTRL” to take the two files [LF and RF].

NOTE: You can also analyse 1 foot, however some parameters will not be calculated

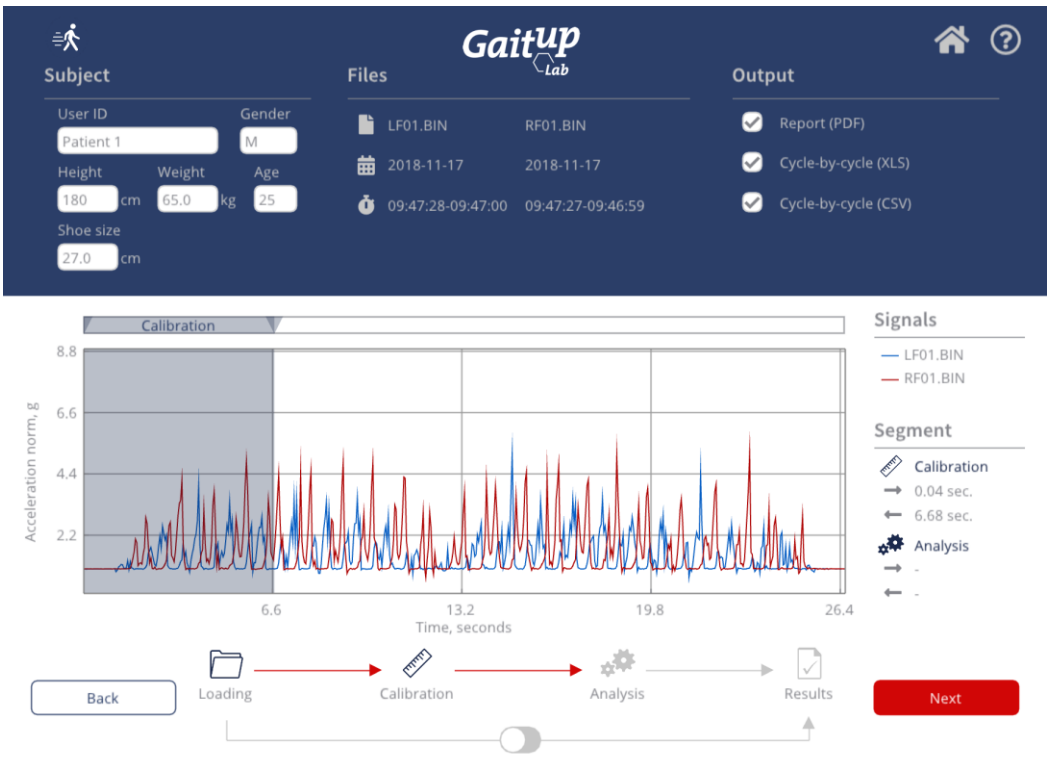
4.2.2 Select a period for the analysis

You can choose between a manual or automatic analysis. Manual analysis allows to select a specific period for calibration and analysis. Automatic analysis takes the entire signal.

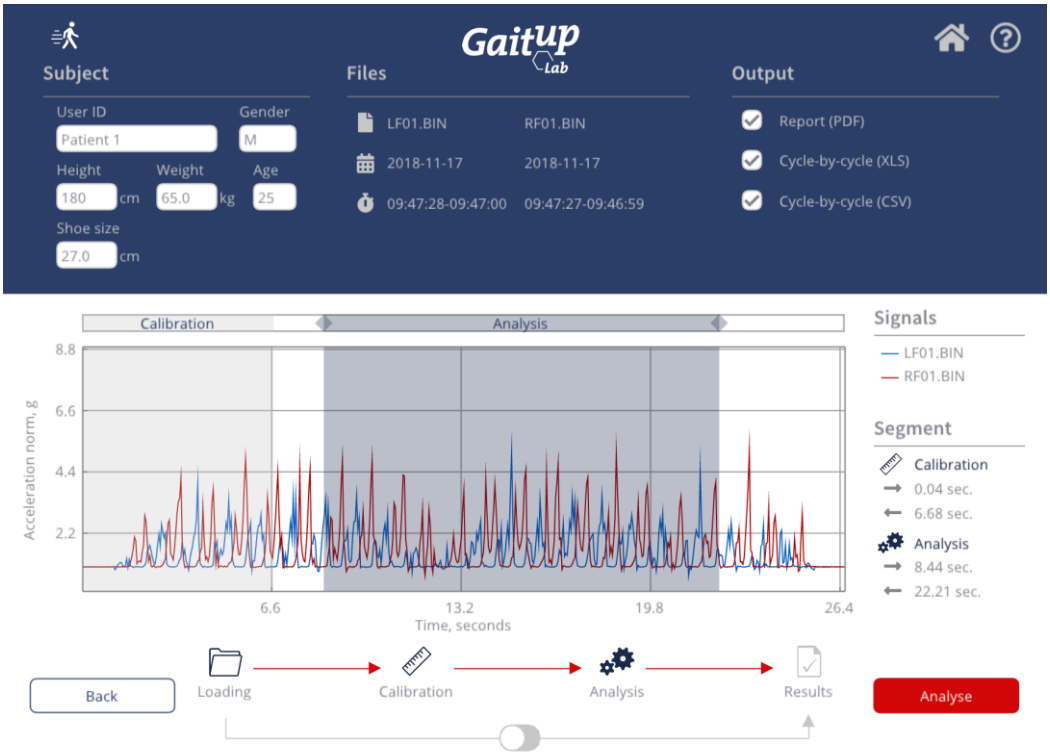
NOTE: If you choose automatic analysis, the following instructions are not necessary and you can directly click on “Analyse” to obtain your reports.

If the manual analysis has been selected please read the following instructions carefully.

For sensors calibration, move the gray window to have a part of static period (at least 2 seconds) and some running or gait cycles (see picture below). To move the window, click and drag the top bar. You can also expand the period by holding and moving the triangle on each extremity of the selection window. It is possible to zoom in on the data. Once this step finished click on “Next”.

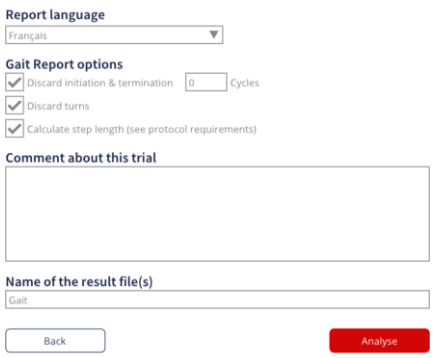


For **analysis**, move the gray window “Analysis” on the signal you want to analyse. Like for the calibration part you can move, expand and reduce the window and zoom on the data. One this step is finished click on “Analyse” to get your report.



Before generating the reports, you can add some comment on the report and rename your result files (no space or special character allowed). PDF, excel and csv will have the same name. The language for the PDF report can be selected from available translations in the list.

OPTIONS FOR GAIT REPORT



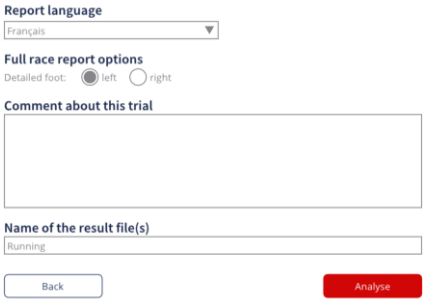
In the report options you can discard initiation and termination cycles. The same number of cycles will be removed from the results at the beginning and at the end. To obtain steady-state gait results, it is recommended to discard 2 cycles (Yuancheng J. et al. 1993).

You can also discard turns. The GaitUp Lab algorithm is able to detect turns so if you don’t want to include turning cycles you can activate this option.

Activate the step length option if it is useful for you and if the protocol requirements described above were respected.

You can add some comments which are visible on the report and you can change the name of the result files.

OPTION FOR RUNNING REPORT



To obtain the third page of the PDF report, select either left or right foot results to be displayed on the full race graphs.

You can add some comments which are visible on the report and you can change the name of the result files.

After selecting the destination folder, the software informs if the analysis was successfully done or not. In the case where you have an issue, please read the “Support” part or contact customer support contact@gaitup.com.

5. Practical considerations

5.1 How to update the software on USB key

The software on the USB key can be updated to the latest version using the “Gait Analyser Updater” which can be downloaded for free from www.gaitup.com/support. Install the updater software on your computer, start the updater software and plug your USB key with the Gait Up Lab software. By following the instructions provided by the updater software, your USB key will automatically be updated with the latest software version. The computer needs to be connected to the internet to download the new version. Free updates are included in the first year after purchase, for later updates an extension can be purchased. If the update doesn't work, please contact Gait Up's customer service.

5.2 Handling and maintenance of Physilog®5

Physilog®5 should be handled carefully. In particular, it should not receive shocks, such as fall, crushing, being hit, etc. Do not press forcefully 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 disconnect the sensor from any plug and 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 a computer or charger, you can also check the battery level with the Physilog®5 companion Android Application available on www.gaitup.com/support).

- Copy trial recordings to your computer: Physilog® is not the best place to keep and save important data. GaitUp cannot be held responsible if data stored on the sensor are lost.
- Physilog®5 can be used outside. Do not use Physilog®5 to measure water-sport activities without additional waterproofing.
- Storage: Store in a cool (0 °C—30 °C) and dry place. The provided box is the perfect place for your sensor.
- Cleaning: Sensors can be cleaned gently using alcohol wipes. Before you clean the device makes sure it is turned off and disconnect all cables. Alcohol used in excess may damage the sensor's waterproofing. Make sure to use wipes and not put liquid alcohol directly on the sensor. Do not clean the USB entry with alcohol.
- Each sensor is individually calibrated by Gait Up and they do not need yearly recalibration for gait measurements.
- Do not throw Physilog® sensors in the normal trash, dispose of it properly considering local laws and rules about electronic waste and batteries.
- Make sure to know which Physilog® file corresponds to which trial for your analysis—First digits of file name are automatically increased (exceeding 999 and new date resets the increment back to 1). Note that date of the 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 corresponding section of the user manual of Physilog®5.
- Do not remove the "conf.bin" file from the Physilog, otherwise it will return to a default configuration based on original configuration.
- Do not introduce pointy objects into the small hole besides the USB entry, this irreversibly damages the waterproofing of the sensor.

Informations relatives à la sécurité :

- Physilog®5 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®5 si la température ambiante est en dehors des limites de 0 à 45 ° C.
- Physilog®5 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 100 mA. Tout circuit connecté à Physilog®5 doivent être « très basse tension de protection » et « source à tension limitée » comme décrite dans les normes suivantes : IEC60950-1:2005+/A1:2010 et EN60950-1:2006+/A11:2009+/A1:2010+/A12:2011

Safety information :

- Physilog®5 includes a lithium battery. This battery may only be charged over a limited temperature range. Never attempt to dock or charge your Physilog® when the temperature is outside of the range of 0 to 45 °C.
- Physilog®5 should be charged through USB connection with a computer. An external charger may be used; note that no charger is provided by Gait Up. GaitUp declines any responsibility due to charger usage.
- Supply voltage should be as follows: DC, 5V. Current consumption is 100 mA. All external circuits connected to the Physilog®5 should be "Safety Extra Low Voltage" and "limited Power Sources" circuits as described in the following standards: IEC60950-1:2005+/A1:2010 & EN60950-1:2006+/A11:2009+/A1:2010+/A12:2011

Warnhinweise:

- Physilog®5 enthält eine Lithium Batterie. Die Batterie soll nur in einer definierten Temperaturspanne aufgeladen werden. Versuchen Sie nie Ihren Physilog®5 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®5 angeschlossenen externe Stromkreise sollen die «Sicherheitskleinspannung" und "mit begrenzter Leistung" Regeln erfüllen, die in den folgenden Normen beschrieben sind: IEC60950-1:2005+/A1:2010 und EN60950-1:2006+/A11:2009+/A1:2010+/A12:2011

5.3 Support

LED indications

Situation	Description	Meaning
Connected via USB	Green continuous	Fully charged
	Orange blinking	Charging
	Orange blinking	Data transfer
	Red continuous	Error 1
During measure	Green blinking (2 flashes per blink)	Measuring
	Green blinking (2 flashes per blink)	Waiting for synchronization
	Green/Orange blinking (1 green, 1 orange flash per blink)	Low battery
Error	2 rapid red blinks	Error 2
	3 rapid red blinks	Error 3
	4 rapid red blinks	Error 4
	5 rapid red blinks	Error 5
	6 rapid red blinks	Error 6

Error type

Error type*	How to solve the issue
Error 1	Disconnect and replug the Physilog®5
Error 2	Contact GaitUp
Error 3	Charge the Physilog®5
Error4	Contact GaitUp
Error 5	Contact GaitUp
Error 6	Empty the memory card

*see LED indication above

Soft reset of Physilog®5

The soft reset is the first manipulation which can be done if the Physilog®5 is not working properly. To do a soft reset, hold the main button for 15 seconds. The LED shines orange and then stops. If the problem persists, fill out the contact form on the support page (www.gaitup.com/support) or write an email to contact@gaitup.com. Please indicate Physilog®5 serial number and describe the problem in as much detail as possible.

6. 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.

GaitUp 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.

Warranty and Support conditions may change without prior notice. Please refer to the Sales terms and conditions on Gait Up's website.

7. Certification claims for Physilog®5 sensors

IC Statement

Under Industry Canadian 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 operations 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.

FCC Statement

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 operations.
(a) (5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

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.

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.

Contact information

At GaitUp, we welcome your feedback and questions
Please contact us at:

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web: www.gaitup.com

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1.0.0	Initial version	Jules Gellaerts and Rebekka Anker	04 May 2020