



Running Analysis Package

User manual and Outcome parameters

Thank you for purchasing our Running Analysis Package, the easy-to-use system to help select appropriate footwear, correct running technique and prevent injuries based on shoe-worn sensors. Physilog®5 sensors measure the movement in the field while a user-friendly mobile application computes relevant information and provides results with in-lab precision. This manual introduces how to use the sensors and mobile application for running analysis.

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1. Running Analysis Package elements



2. Recording with Physilog[®] 5 and the Running analysis application – Basics

Connect

Enter login information, go to Running analysis and select “New measure”. Connect the 2 Physilog[®] to the application.



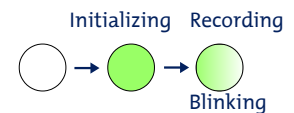
Attach



Fix the sensors on the foot /shoe using the rubber clip or foot attachment strap. The sensors can be placed in any orientation.

Start

Select options and start the recording from the application. Sensors shine green and start to blink.



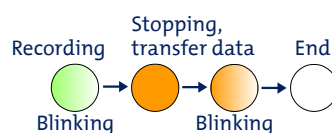
Run

Wait until the two sensors blink green and ask the subject to run for 10m or more.



Stop

Stop the recording from the application, the LED turns orange and twinkles while sending remaining data to the tablet.



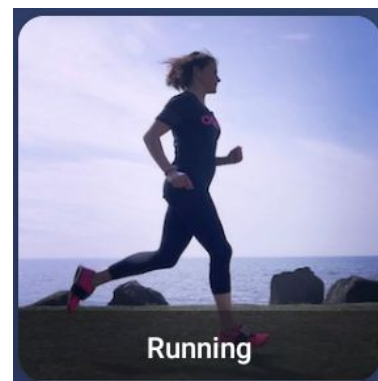
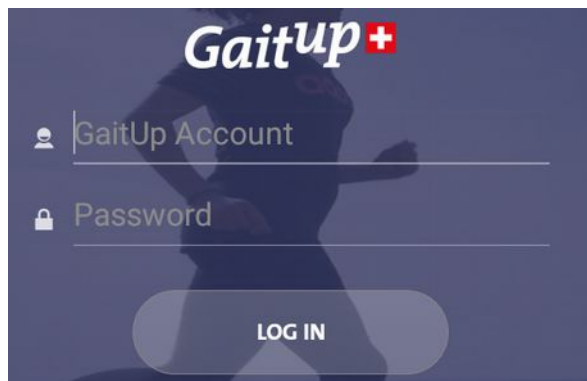
Display report

Once the files transferred to the application and from there to the server, the Running report is available.

3. Recording with Physilog[®]5 and the Running analysis application – details

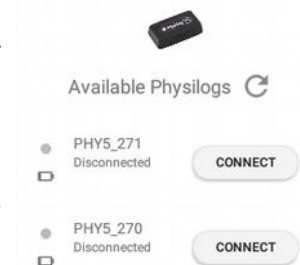
3.1 Connection to mobile application

Each time you open the application you need to connect the two Physilog[®]5 to the mobile device. Once they are connected you don't need to repeat this procedure when switching between different parts of the application.



To connect Physilog[®]5 to the application for running analysis, login with your user name (email address) and password and enter the “Running” functions of the app. Make sure that your device's Bluetooth is turned on and connected to the internet. There is no need to pair your Physilog[®] with the tablet prior to Bluetooth communication.

Click on the “Available Physilogs” refresh button below the picture of the Physilog[®]5 on the left of the screen of the application to look for available sensors. Choose two Physilog[®] from the list and click on the “Connect” button beside the sensor name. The name of the sensor contains the number which is written on the back of the Physilog[®]5.



If a sensor is not detected by the tablet, shortly press the main button of 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 Troubleshoot.

When the sensors are connected the button changes to “Disconnect” and a green dot appears besides the sensor name. You can see a battery level estimation for each sensor below the battery symbol and you can check if the sensor is measuring by displaying the raw data inside the Signals Visualizer part of the app.



For devices with small screen (such as smart phones), the sensor connection screen is available after clicking on the image of Physilog[®]5 in the top right corner of the application.

Note: In order to be able to generate the report, the tablet needs internet connection. Bluetooth 4.0 or higher is required on the mobile device to be able to communicate with Physilog®5.

3.2 Attachment

The running analysis package is delivered with 2 rubber clips as default accessory. Elastic foot straps can be bought from the web-shop (shop.gaitup.com) if needed, for example to measure barefoot running.



To insert the Physilog®5 into 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 the Physilog®. The USB entry of the Physilog® should be oriented in front of the clip opening, so that the sensor can be charged without removing the clip.



Then fix the sensors on the feet in the shoelaces in a way that they don't move with respect to the foot / shoe. The exact orientation of the sensor is not important, the software automatically finds it.

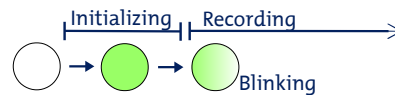
3.3 Runner and shoe database

Upon entering the Running part of the application, you can select from default or previous users. This allows to find reports for comparison more easily. Do not enter the real name of the person but enter a codified runner ID if you want to guarantee anonymity of the data on the server. You can always modify the user information after having entered and saved it by clicking on the pencil symbol below the user information on the left side of the screen.

When you have connected to two sensors, you can select or enter the shoe model the runner is wearing. Previously created models are registered and proposed. Once the shoe model entered, you can start the running measurement by clicking on “Start”.

3.4 Start the recording

To start the sensors, click on the “Start” button inside the application. The Physilog[®] LED will become green for a short moment and then start to blink green, where each blink is two short green flashes.



The best practice is to start the sensors when they are already attached to the foot just before starting the test. The recording will start when the countdown (3,2,1, Go) has arrived at “Go”. You can then instruct the subject to start running.

3.5 Running

Gait Up's Running Analysis system was made to measure short running tests in straight line and on flat ground, therefore the available free space should be at least 10m of length. You can also do the measurement outside if the local is small. When measuring several different protocols or conditions you should do a measurement for each trial, that is: start and stop the recording for each test. The subject should not go further away than 15m from the tablet, otherwise the connection between the sensor and app may get lost and the file transfer is interrupted. The tablet must have internet connection to be able to upload the files to the server at the end of the measurement.

3.6 Stop the recording

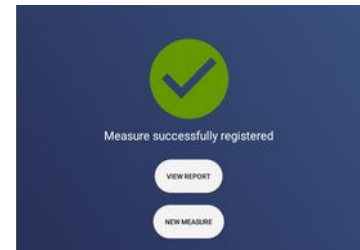
To stop the recording click on the “Stop” button in the application. The sensors blink green 3 times, then twinkle orange. The data file transfer to the application is finalized while the sensors twinkle orange. During this time do not close the application or stop the sensors via the main button. Once the entire file sent to the mobile device, the sensors stop shining and the files are uploaded to Gait Up's server where they are analysed. Shortly after you can display the running report.



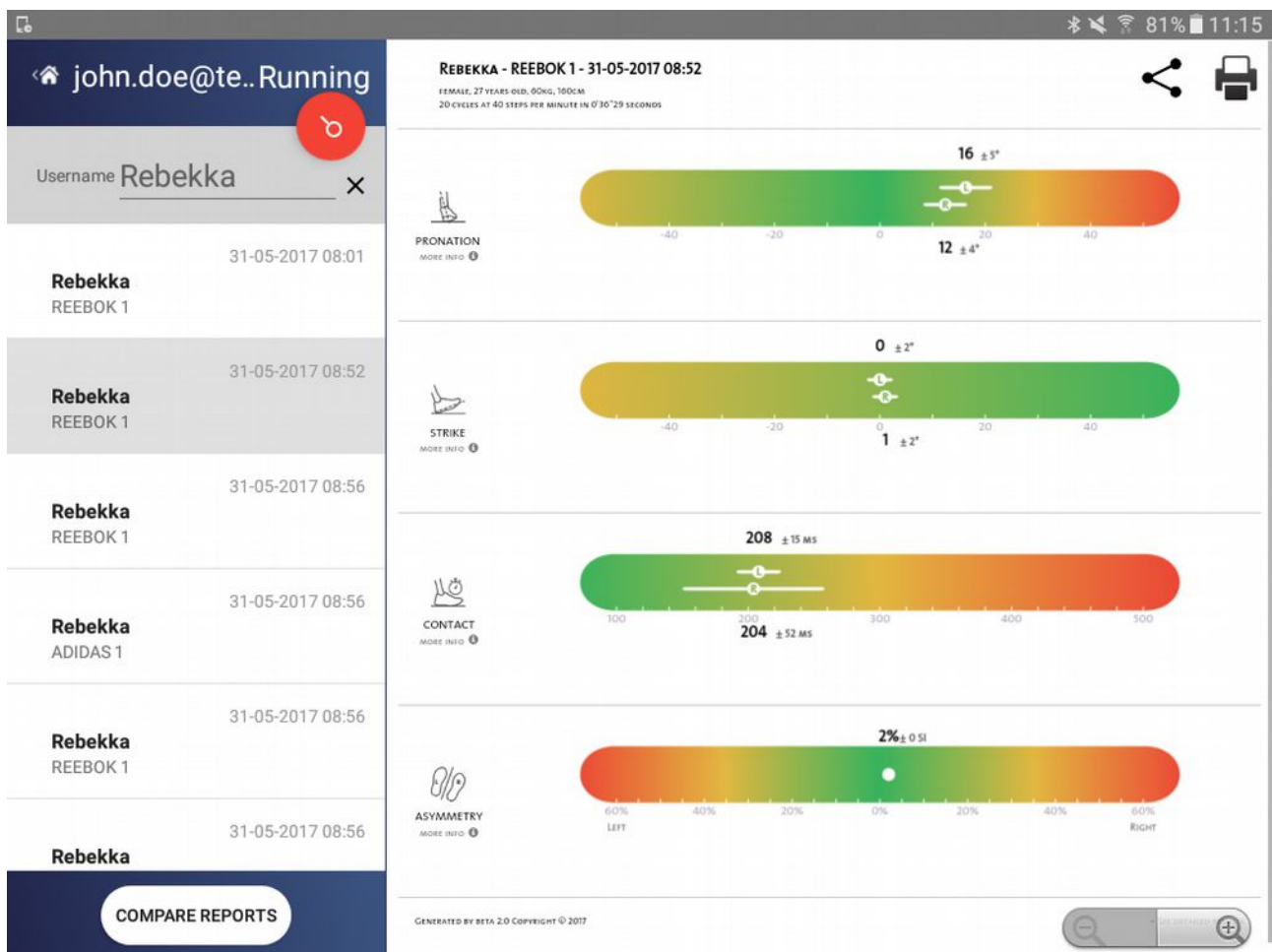
Between each start and stop of recording one file is created and stored on the tablet and on the internal memory of the Physilog[®]5. The Physilog[®] stop recording once you click on stop but stay connected to the application for quick start of the next measurement.

3.7 Show and compare running reports

After the test and analysis of the data a running analysis report can be displayed on the tablet by clicking on “View Report”. It is also possible to initiate another measurement using the “New Measure” button.



Select the measurement you just completed from the list of available reports to display the report. The four output parameters are displayed for each side. A colour bar indicates if the result is in a good range.



It is possible to compare the results between several reports in the application. Therefore click on “Compare Reports” and select the tests which you want to compare, then click on “Generate Reports”. A comparison report is generated where you can easily see differences between tests.



You can print and share reports from the printer and share icon in the upper right corner of the report display view in the app. To print you need to have a printer connected to your mobile. You can share the report via several applications (email, gmail, dropbox etc.) depending on available services on your mobile.

Additional application features

Other functions such as visualizing the raw signals or recording files on the tablet without communication with the server are also available in the Android Application. More information and explanations about how to use these parts are available in the corresponding user manual (RTKapp_P5_user_manual.pdf).

4. Practical Considerations

4.1 Charging of Physilog®5

The Physilog®5 is charged via the microUSB port. Plug the microUSB connector of the cable delivered with the Physilog®5 to the Physilog®. Plug the USB connector to a Computer or Charger (voltage specifications: 4.2V, 100mA). Physilog®5 must be turned off for charging. Do not charge Physilog® when outside temperature is outside of range 0°C to 45°C.

Low battery level is indicated by orange blinking during measurement or if the Physilog® blinks rapidly 3 times red when starting and doesn't start the recording. When the Physilog® is discharged, plug it for charging for at least 30 minutes before use. An estimation of the battery level of the Physilog®5 can be obtained when it is connected to the application.

4.2 Physilog configuration for running measurements

The configuration of Physilog®5 can be modified using Research ToolKit software or the Android application. This allows to optimise the sensor settings for different applications. For running measurements the configuration must be set as indicated below. The correct configuration is pre-installed when you order a Running Analysis Package, so you don't need to modify the configuration of the Physilog®5.

Sensor	Sampling rate	Sensor range
Accelerometer	256Hz	+/-16 g
Gyroscope	256Hz	+/- 2000 deg/s
Barometer	off	-

4.3 Handling / Maintenance

Physilog®5 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.

- Sensors can be placed on the foot in any orientation, it will not influence running measurements.
- You need to perform running measurements with two sensors (one on each foot) when using the application.
- 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 the battery level with the App).
- 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 make 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.
- Sensors do not need yearly recalibration.
- Do not throw Physilog® sensors in the normal trash, dispose of it properly considering local laws and rules about electronic waste and batteries.
- Do not remove the “conf.bin” file from the Physilog, otherwise it will create empty files (no sensor activated). If this happens, recreate a configuration in the Research ToolKit software or contact Gait Up's customer support.
- Do not introduce pointy objects into the small hole besides the USB entry, this irreversibly damages the waterproofing of the sensor.

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. Gait Up declines any responsibility due to charger usage.
- Supply voltage should be as follows: DC, 4.2V. Current consumption is 100mA. 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® 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, 4.2V. 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

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, 4.2V. La consommation de courant est de 100mA. Tout circuits connectés à Physilog®5 doivent être «très basse tension de protection» et «source à tension limité» comme décrit dans les normes suivantes: IEC60950-1:2005+/A1:2010 et EN60950-1:2006+/A11:2009+/A1:2010+/A12:2011

4.4 Troubleshoot

Soft reset

The soft reset is the first manipulation which can be done if the Physilog® 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® serial number and describe the problem in as much detail as possible.

LED indications

Situation	Description	Meaning
Connected via USB	Green continuous	Fully charged
	Orange blinking	Charging
	Multicolor blinking	Data transfer
	Red continuous	Error 1
During standalone measurement	Green blinking	Measuring
	Green continuous	Waiting for synchronization
	Orange blinking	Low battery
During measurement started from application	Green blinking (2 flashes per blink)	Measuring and sending data to application
	Orange blinking (2 flashes per blink)	Measuring, connection to application to send data lost
	Green/orange blinking (1 green, 1 orange flash per blink)	Measuring and sending data to application with low battery
Error indications	2 rapid red blinks, pause – repeated 3 times in total	Error 2
	3 rapid red blinks, pause – repeated 3 times in total	Error 3
	4 rapid red blinks, pause – repeated 3 times in total	Error 4
	5 rapid red blinks, pause – repeated 3 times in total	Error 5
	6 rapid red blinks, pause – repeated 3 times in total	Error 6

Troubleshoot for error indications

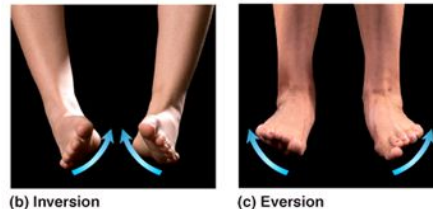
Error Type*	Troubleshoot
Error 1	Disconnect and replug the Physilog®
Error 2	Contact Gait Up
Error 3	Charge the Physilog®
Error 4	Contact Gait Up
Error 5	Contact Gait Up
Error 6	Empty the memory card

*see LED indication above

5. Running Parameter Overview



Pronation angle is the sideways inclination of the foot when it hits the ground. It indicates if the runner's foot touches the ground in an eversion or inversion position. Negative values are associated with eversion, positive with inversion.



Strike angle indicates the forward inclination of the foot when it hits the ground. Footstrike types include forefoot, midfoot and rearfoot/heel strike types; these are characterized by initial contact of the ball of the foot, ball and heel of the foot simultaneously and heel of the foot respectively. The associated angle is negative for heel strike, around zero for midfoot and positive for forefoot strike.



Contact time measures the average time (in milliseconds) of ground foot contact. It decreases with increasing speed and is generally higher for rear foot strike runners than mid and forefoot runners.

Subjects	Speed	Contact time	Study reference
Usain Bolt	40 km/h	83±2ms (100m sprint)	
Female Amateur Athletes (n=30)	21 km/h	140±11ms for sprinters 160±13ms for long-distance runners	Cunninghal 2013
Half-marathon participants (n=283)	18 km/h	183±16ms for mid/front strike runners 200±21.3ms for rear strike runners	Hasegawa 2007
Female Amateur Athletes (n=30)	15 km/h	180±16ms for sprinters 250±20ms for long-distance runners	Cunninghal 2013
Trail Ultra-Marathon runners (n=18)	10 km/h	249±16ms at start of race 252±17ms after 3h of running	Morin 2011
Novice runners (n=210)	9 km/h	236±26ms	Bredeweg 2013



Asymmetry is the ratio of contact times between sides. Perfect symmetry is given by a 0% value, values on the left side of the zero appear when left contact time is higher than for the right side and vice-versa.

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.

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.

7. Certification claims for physilog®5 sensors

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'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 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.

(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 Gait Up, we welcome your feedback and questions.

Please contact us at:

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web: www.gaitup.com

Document Version	Changes	Responsible	Date
0.0.9	Pre-release to public	Rebekka Anker	31 May 2017
1.0.0	Initial release to public - added certification statements - corrected to “running” where wrong	Rebekka Anker	04 July 2017
1.0.1	New pictures, adaptations for new application version (v1.1.2)	Rebekka Anker	17.10.2017