GENEActiv

Instructions

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1. Getting Started

GENEActiv is a reliable body-worn accelerometer that measures and tracks everyday living in all environments. This leading, technical design offers 0.5Gb of raw data in an open format and comes as a unique, fully waterproof, value for money instrument with 2 months of battery life.

Unlike other accelerometers the GENEActiv instruments are waterproof and can be worn 24 hours a day. A near-body temperature sensor confirms wear time, and an accurate and configurable clock allows data to be matched to reported activity or other measures. The GENEActiv instruments are charged in a cradle connected to a USB power source. This cradle also allows them to communicate with the GENEActiv software, which is used to configure the instruments, and download and manage recorded data.

What the Kit includes

❶ USB cable

❷ Cradle

❸ GENEActiv instrument

❹ Interface software CD
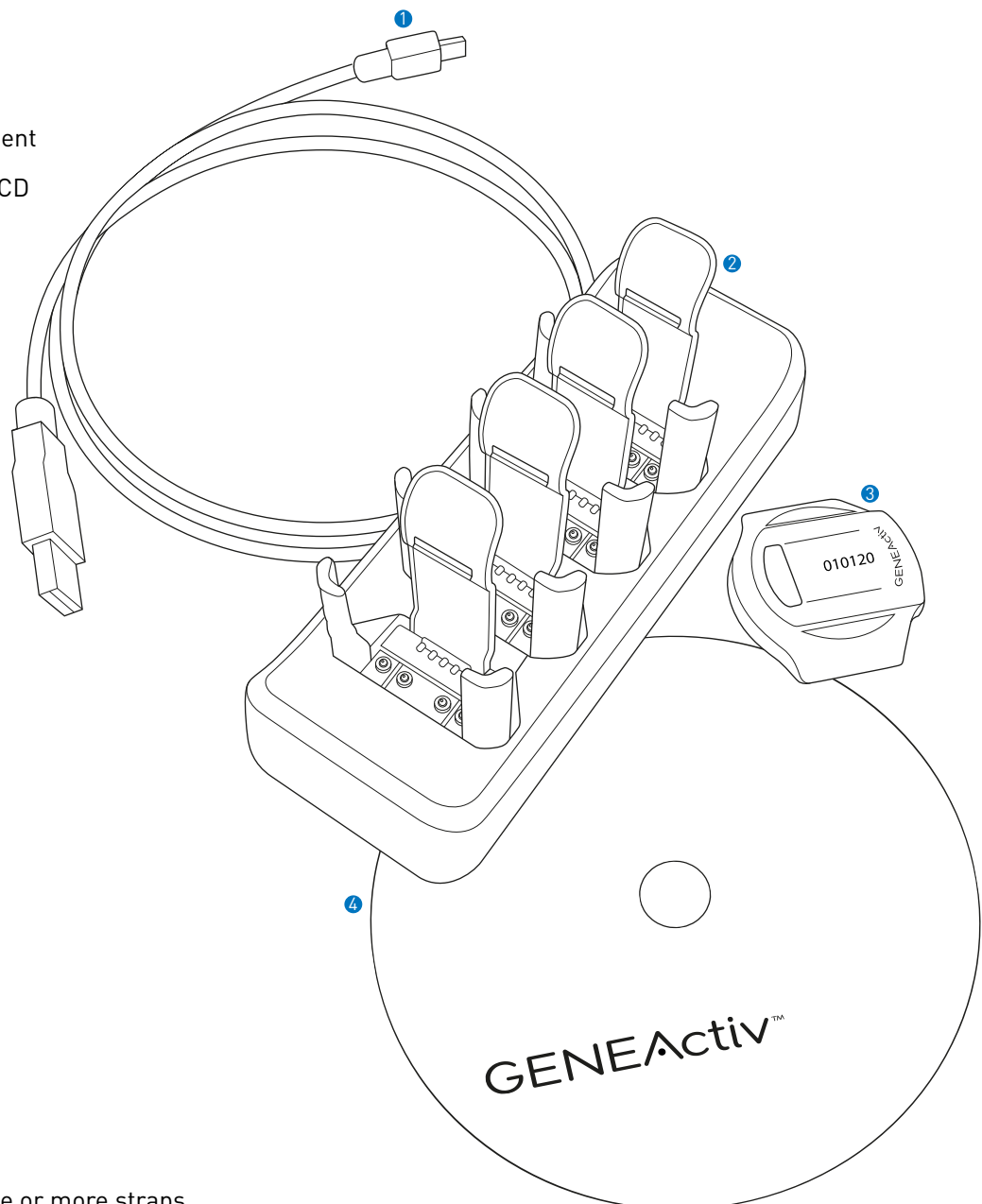
You may also have one or more straps.

System requirements:

- PC with Intel P4 Processor, 2Gb Memory

- Windows XP, Vista or 7

- .net Framework 3.5

Installation

You will need to have Administrator rights to successfully install the GENEActiv drivers and software onto your PC. If you do not have this then contact your system administrator.

1 Install CD into PC disk drive. Installing the GENEActiv software with Windows requires an additional piece of software called .net Framework 3.5. This will be automatically installed with more recent versions of Windows but if it is not shown in the list of programs, it can be installed from the supplied CDROM or downloaded from the Microsoft website. Double click on "dotnetfx35" to install from the CDROM and follow the instructions

2 Once the CDROM is in the PC, simply double click on GENEActiv software "GENEActivPCSoftwareInstaller". Install the software by following the instructions in the wizard. Click 'Allow' (if shown) on any security pop-ups so the installation can proceed

3 Connect the GENEActiv charging cradle to a USB port and plug in a single GENEActiv device as shown. Make sure that the device 'clicks' into place (if it has a strap fitted, the strap may need to go behind the mounting clip to ensure a good connection)

4 There is a different set up process dependant on which version of Windows you are using. Please follow the appropriate setup for your system (see page 6), for you to successfully install GENEActiv

5 Allow GENEActiv devices to charge for 3 hours before using them with the software. A red light on the device will flash to show that it is charging. When it is fully charged a green light will flash and the device can be removed
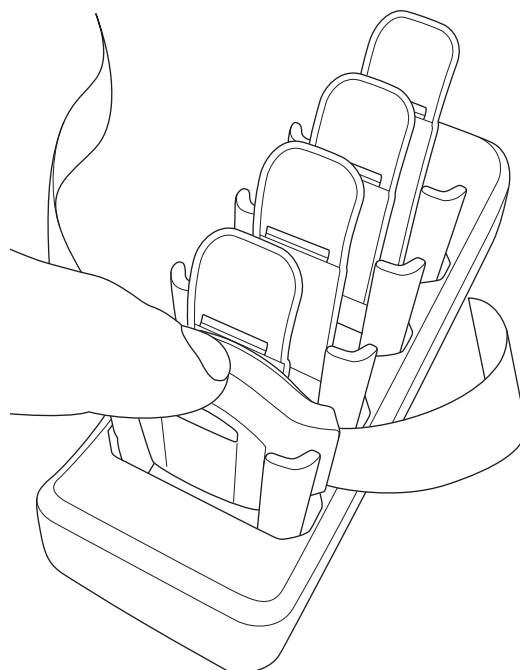
Windows 7 Loading Process

1 Windows will attempt to install automatically however due to there currently being no driver it will fail

2 To install the driver go to your 'Start Menu' and choose 'Devices and Printers'

3 Right click on a clear area of this new screen. When a pop up appears click 'Device Manager'

4 You will see 'GENEActiv' listed under 'Other Devices' on the 'Device Manager' window. Right click on 'GENEActiv' and select 'Update Driver Software' from the menu

5 From this new window select 'Browse My Computer for driver Software'

6 Click 'Browse' and select your CD/DVD drive. Make sure the 'Sub Folders' are selected and click 'Next'

7 You will get a 'Windows Security Message' at this point, select 'Install the Driver Software' for it to run. Congratulations you have now successfully installed the GENEActiv driver!

Windows XP Loading Process

1 The wizard will ask if windows can connect to 'Windows Update' to search for software. Ensure you select 'No Not at this Time' to proceed and then click 'Next'

2 You will then be asked to either select 'Install Automatically' or 'Install from List'. Please tick 'Install from List' to proceed. Then click 'Next'

3 The next page will ask if you want to 'Search Removable Media' or 'Include this location in the search' Ensure 'Search Removable Media' is ticked then click 'Next'. You will then get an installation pop up, please ignore this and click 'Continue Anyway' to let the installation run

4 Once installation is complete click 'Finish'. Congratulations you have now successfully installed the GENEActiv driver!

Windows Vista Loading Process

1 From the disk select 'GENEActiv PC Software Installer'

2 The GENEActiv set up wizard will appear click 'Next'

3 Accept the license agreement and follow instructions

4 Congratulations, you will now have the GENEActiv icon on your desktop and it is ready to use

IMPORTANT: if the PC does not automatically start the driver installation process, it will need to be initiated from the Device Manager in 'Control Panel → System → Hardware'.

Ready to record

1   Open the GENEActiv software and connect the charging cradle to a USB port. Insert a GENEActiv device into the cradle. The software will display information about the device and any data previously stored on it will be shown.

2   Click 'Config. Setup' from the left-hand menu. This page allows you to set recording options and to enter information about the trial and test subject. A few fields must be completed for the device to operate, the rest can be filled in where appropriate.

3   Select 'Measurement Frequency' (the measurement frequency selected will determine the maximum time data can be recorded for, lower frequency = longer time).

   – Select 'Measurement Period' (this can be anything between an hour and the maximum period displayed just above).

   – Select 'Local PC Time'

   – Select when you want the recording to start, 'On Button Press', 'Immediately' on 'Disconnect', or 'At Future Time'. If you select 'On Button Press', a further option, 'Allow Stop and Restart', will appear. This is useful for lab experiments but during actual user trials could lead to recording being stopped by an accidental button press. The button is hidden under the serial number and requires a firm press to avoid accidental activation.

   – Enter any further information as required (note that some fields such as Age and BMI are self-calculating).

4   To configure the GENEActiv and get it ready to record, select the serial number of the device in the Devices box in the bottom right-hand corner of the screen (the serial number is printed on the front of the device).

5   Click Erase & Configure. Pop-up windows will advise you of any problems (such as mandatory information missing or low battery charge), and warn that configuring will erase any existing data. The configuration will take about 10 seconds and a pop-up will confirm that it has been completed successfully.

6   The GENEActiv device can now be disconnected and will either start recording immediately, or wait for a button press, or wait for the selected time, depending on which option was chosen in step 3. If immediate start or timed start were chosen, the button and lights are disabled. If button press mode was selected, when the button is pressed the green light will give a long flash to show that recording has started (and if Allow Stop & Restart has been selected, pressing the button again will stop recording and the red light will give a long flash).

7   Recording will stop either after the time selected, or if the button is used to stop it, or if the device is reconnected to a USB port.
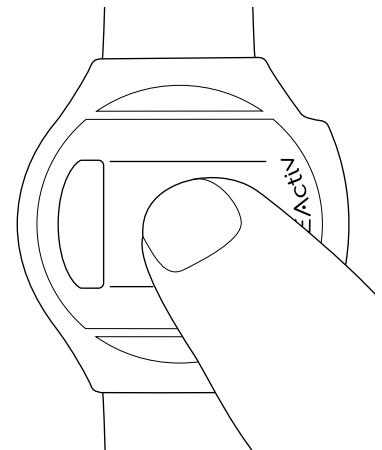
IMPORTANT : If the device is reconnected to the charge cradle, once it has started recording, it will stop recording and require reconfiguring.

Reading data

To extract data once recording is complete:

1 Open the GENEActiv software and connect the charging cradle to a USB port. Insert a GENEActiv device into the cradle. Click 'Data Extractor' from the lefthand menu. This page previews the first few minutes of recorded data and allows you to download data to a chosen file location.

2 Chose a file location and select whether to also create a .csv format file. The default data format is a compressed .bin that can be interpreted, with a suitable script, by most mathematical analysis software packages, but not Excel. A .csv format file is readable by Excel but can be unwieldy if there is a large amount of data. The Data Converter and Data Analysis tabs (selected from the left-hand menu) can convert .bin files to .csv files or to compressed .csv files that can be handled more easily. This means that .bin files can be saved and then converted to another format at a later date if required.

3 Click the 'Extract' button. The data can take up to 10 minutes to download and a pop-up will confirm completion.

Data Converter and Data Analysis

The 'Data Converter' creates .csv files, which can be used by Excel, from .bin files. Please note that older versions of Excel cannot manage very large .csv files.

The 'Data Analysis' tab has a viewer which allows data from .bin and .csv files to be previewed. There is an option to look more closely at sections of the data. The 'Epoch Converter' can be used to turn .bin and large .csv files into a smaller compressed version. It does this by creating epochs of 1, 5, 10, 15, 30, or 60 seconds – the means for each parameter and the Sum Vector Magnitude are calculated for each epoch.

2. About GENEActiv

Device details

PHYSICAL PARAMETERS	
Size	43mm x 40mm x 13mm
Weight	16g (without strap)
Main Housing Material	PC/ABS (medical device grade)
Light Guide Material	PC (medical device grade)
Data Contact Material	Gold-plated
Fixings	20mm heavy duty spring bar
Strap	PU resin
Battery Type	Rechargeable lithium polymer
ENVIRONMENTAL PROTECTION	
Moisture Ingress	Water-resistant to 10m (IP67 – 1m 24hrs)
Material Ingress	Dust tight (IP67)
Operating Temperature	5 to 40 deg C
Mechanical Impact	0.5m drop resistant
MEASUREMENT CAPABILITIES	
Memory	0.5Gb non-volatile
Logging Frequencies	Selectable 10-100Hz
Maximum Logging Periods	45 days @10Hz, 7 days @100Hz
INTERNAL CLOCK	
Type	Quartz Real Time Clock
Frequency	32.768kHz
Accuracy	+/- 20ppm (+/- 1.7s per day)
ACCELERATION MEASUREMENTS	
Sensor Type	MEMS
Range	+/- 8g
Resolution	12 bit (3.9 mg)
LIGHT MEASUREMENTS	
Sensor Type	Silicon photodiode
Wavelength	400 to 1100 nm
Range	0 - 3000 Lux typical
Resolution	5 Lux typical
Accuracy	+/- 10% @ 1000 Lux calibration
EVENT LOGGER	
Sensor Type	Mechanical membrane switch
TEMPERATURE MEASUREMENTS	
Sensor Type	Linear active thermister
Range	0 to 60 deg C
Resolution	0.25 deg C
Accuracy	+/- 1 deg C
Measurement frequency	Every 30s minimum
USB CONNECTION	
Device	USB 2.0 Full Speed
Charge Cradle	Format 4 unit cradle USB 2.0 High Speed
Charge Time	90% @ 2 hours, 100% @ 3 hours
Data Download Time	Maximum 15 minutes for 4 concurrent units

LED signals

LED ACTION	CONDITIONS	SIGNAL
Constant red	In plugged-in USB cradle	Communicating with software
Repeated flashing red	In plugged-in USB cradle	Charging
Repeated flashing green	In plugged-in USB cradle	Charged
Single long green flash	Not in cradle, button start mode	Recording started by button press
Single long red flash	Not in cradle, button configured as active	Recording stopped by button press
Single quick green flash	Not in cradle, not recording, following a button press	Charged
Single quick red flash	Not in cradle, not recording, following a button press	Needs charging
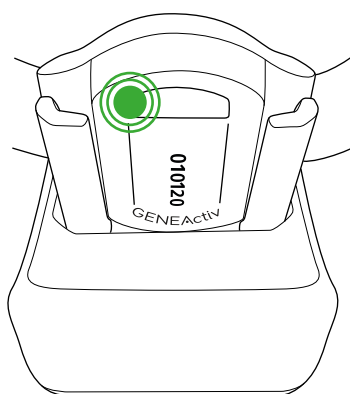
Flashing = charged
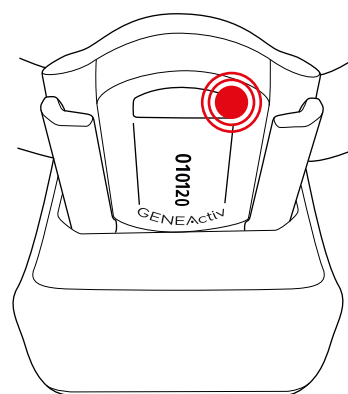
Constant = communicating

Flashing = charging
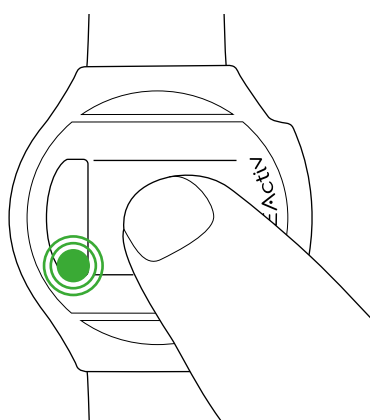
Long flash in 'Button Start' mode
= recording started

Short flash when un-configured
= battery good
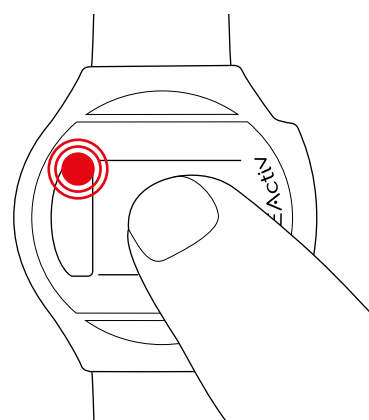
Long flash in 'Button Active' mode
= recording stopped

Short flash when un-configured
= battery needs charging

3. Charging and Storing

Charging and storing

> **IMPORTANT:** GENEActiv devices that are not in use should be charged every 3 months, and not left charging longer than necessary.

Allow the GENEActiv device(s) to charge for at least 3 hours before configuring with the software.

The light on the device will flash red while it is charging, and green once it is charged.

When not recording, the battery charge can be checked with a quick press of the button on the device.
A green flash indicates that the device is OK for storage, a red flash or no flash at all means that the device should be charged (this function is not available if a device has been configured to record).

The battery status indicator in the software user interface is for general information only. To ensure that a device is fully charged it MUST be left in the cradle until the green light is flashing.

The short flash on the button shows the storage condition of the battery. This DOES NOT indicate that the device is fully charged.

4. Operation

Menu

Device Capabilities

Config. Setup

Data Extractor

Data Converter
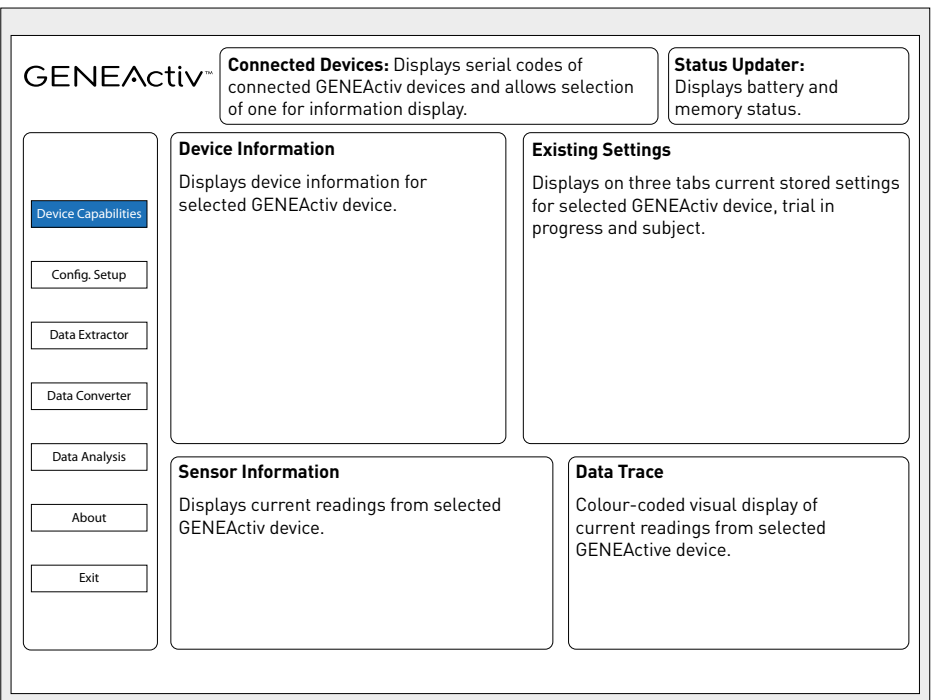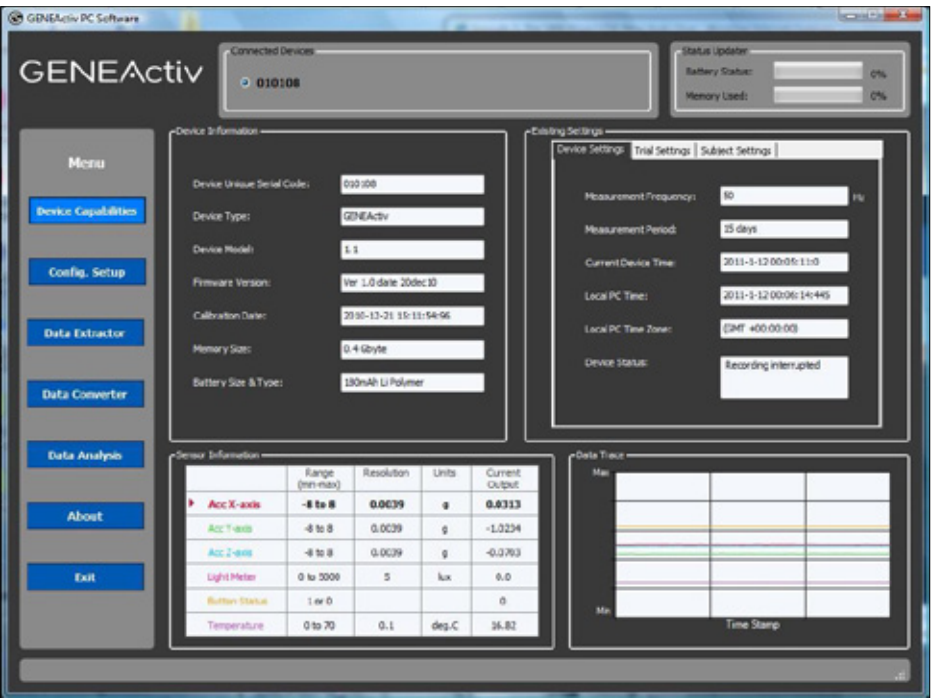
Data Analysis

About

Exit

Operation

15

Open the software and connect one or more GENEActiv devices.

Sections for viewing device settings, configuring, and downloading and viewing data are accessed by single-clicking on the menu options.

Device capabilities

This tab displays information about the device(s) connected and existing stored data.

Connected Devices: Displays serial codes of connected GENEActiv devices and allows selection of one for information display.

Status Updater: Displays battery and memory status.

Device Information

Displays device information for selected GENEActiv device.

Existing Settings

Displays on three tabs current stored settings for selected GENEActiv device, trial in progress and subject.

Sensor Information

Displays current readings from selected GENEActiv device.

Data Trace

Colour-coded visual display of current readings from selected GENEActive device.

Device Capabilities

Config. Setup

Data Extractor

Data Converter

Data Analysis

About

Exit

GENEActiv

Config. setup

This tab allows the GENEActiv device(s) to be configured and details of the trial and test subject to be stored on the device.

Device Setup

Section for inputting the device settings.

The Measurement Frequency and Measurement Period fields are mandatory.

Recording Start Mode

Allows the way recording will start to be selected.

Subject Info

Section for inputting details about the subject who will wear the device(s).

Trial Info

Section for inputting details about the study being conducted.

Devices

Allows the devices to be configured to be selected.

Device setup:

The Measurement Frequency field must be filled in. The Maximum Measurement Period will be automatically calculated. This maximum will depend on the frequency selected. A Measurement Period up to this maximum can then be set.

Choose which time setting the device should use. Initially this should be the Local PC Time (unless the PC time is known to be wrong, in which case the Manual Time setting can be used instead).

MEASUREMENT FREQUENCY (Hz)	MAX. MEASUREMENT PERIOD (DAYS)
10	45
20	30
25	28
30	21
40	18
50	15
60	12
66.7	11
75	10
85.7	9
100	7

Recording start mode:

There are three different start modes. 'On Button Press' means that recording will start after the device is removed from the charging cradle and the button on the device is pressed. In this mode the green light will flash when the button is pressed, this is useful for confirming event detection but is not recommended for trials with children. When this mode is selected, the option to 'Allow Stop & Restart' will also appear. Leaving this unselected means that once recording starts, the button becomes inactive so recording cannot be accidentally interrupted. Selecting this option allows the button to remain active and control recording stopping and starting. This is useful for laboratory testing.

'Immediately on Disconnect' starts recording as soon as the device is removed from the cradle. The LEDs are inactive in this mode and the button will not interupt recording, however button presses will be recorded as an event marker.

'At Future Time' allows the operator to choose a start time up to a week in the future. Recording will start automatically at this point. The LEDs are inactive in this mode and the button will not interupt recording, however button presses will be recorded as an event marker.

Subject info:

Once the Date of Birth is selected, the Age will be calculated automatically. Height is entered in cm and Weight in kg. Height in feet/inches, weight in stones/pounds, and BMI will then be calculated automatically.

Devices:

Select which device(s) are to be configured. At least one device must be selected. It might be useful to configure multiple devices together when a trial subject will wear several GENEActiv devices on different body locations.
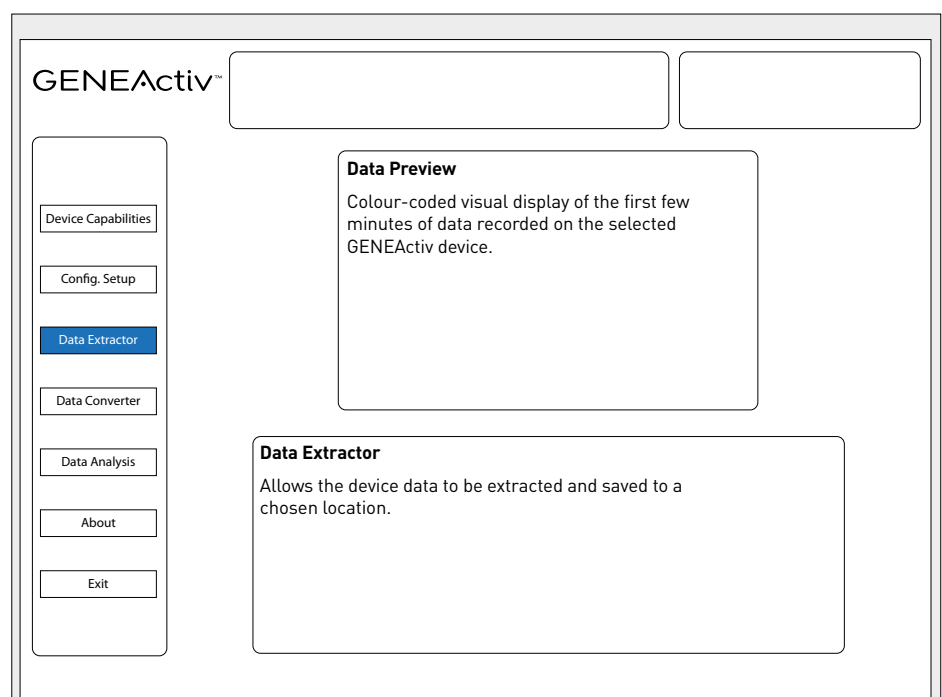
When Erase & Configure is clicked, a pop-up will appear to warn that continuing will erase all previously stored data. There will also be warning pop-ups if any mandatory information is missing, or if the battery charge is below 80%. Configuring will take about 10 seconds and a pop-up will confirm that it has been completed successfully.

Data extractor:

The default data format is a .bin file which can be interpreted by the GENEActiv software and, with a suitable script, by most mathematical analysis software packages. The tick-box determines whether a .csv file is stored as well (a .csv format file is readable by Excel but can be unwieldy if there is a large amount of data). The Data Converter and Data Analysis tabs (selected from the left hand menu) can convert .bin files to .csv files or to compressed .csv files that can be handled more easily. This means that .bin files can be saved and then converted to another format at a later date if required.

Downloading takes up to 10 minutes and successful completion will be confirmed by a pop-up.

Multiple units can be downloaded simultaneously. The total download time will remain at about 10 minutes if the cradle is connected to a high speed USB post.

Data Preview

Colour-coded visual display of the first few minutes of data recorded on the selected GENEActiv device.

Data Extractor

Allows the device data to be extracted and saved to a chosen location.

GENEActiv

Data converter

The Data Converter allows you to convert one or more .bin files into .csv files that can be read by the GENEActiv viewer and Excel.

The convertor can combine the data for up to 5 devices to have a single time stamp. The combine .bin files function is not recommended for trials of more than a couple of hours due the data processing time and file size.

Data conversions can take up to 15 minutes to complete.
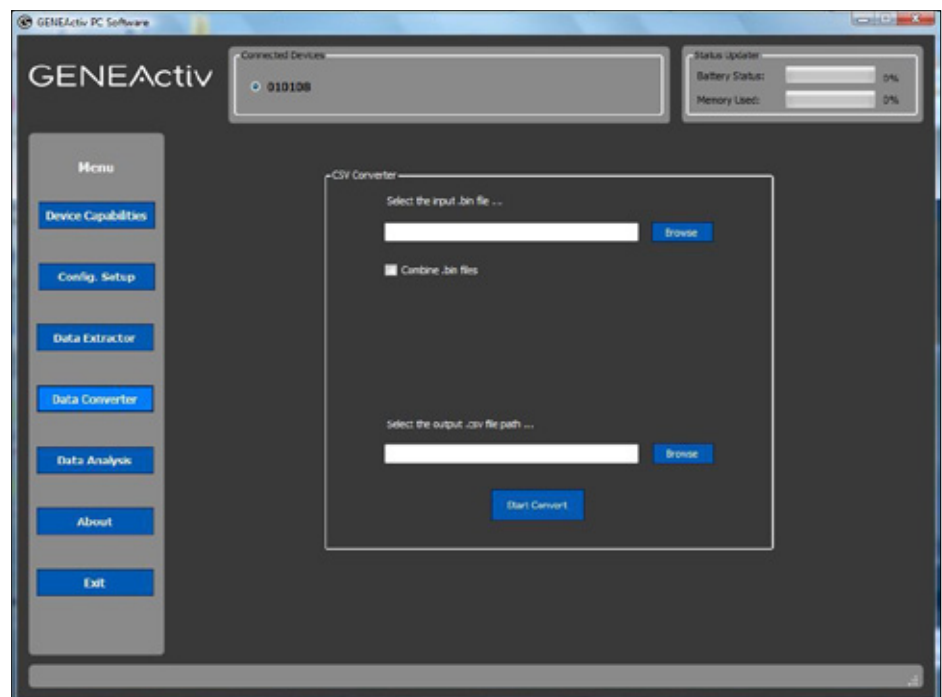
Data analysis

The Data Analysis tab allows you to view .bin and .csv files, and zoom in on a particular section. This subsection can then be saved as a raw data .csv file.

5. Getting More Help

Getting more help

For more information or assistance, please contact:

Activinsights Limited, Unit 11, Harvard Industrial Estate, Kimbolton, Cambs PE28 0NJ

Tel: 01480 862080

Email: info@geneactiv.co.uk

www.geneactiv.co.uk

A company registered in England & Wales. Registered number: 06576069

6. Regulatory Standards

Regulatory standards

GENEActiv 1.1. 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.

This product is compliant with the Directive 2004/108/EC; the relevant Declaration of Conformity is available from ActivInsights Ltd.

This product has been tested to BS EN 61000-6-1 :2007 and BS EN 61000-6-3 :2007 (Electromagnetic compatibility (EMC), Generic standards, Immunity for residential, commercial and light-industrial environments).

In accordance with European Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE), this item must not be disposed of in the normal unsorted municipal waste stream. Instead, it is the user's responsibility to dispose of this product by returning it to a collection point designated for the recycling of electrical and electronic equipment waste or directly to ActivInsights Ltd. Separate collection of this waste helps to optimize the recovery and recycling of any reclaimable materials and also reduces the impact on human health and the environment. For more information concerning the correct disposal of this product, please contact your local authority or our issuing authority.

This product meets the minimum standards of the RoHS Directive 2002/95/EC.

The lithium polymer cell has met the acceptance criterion for the UN Recommendations on the Transport of Dangerous Goods relating to lithium batteries, reference Para 38.3 of Manual tests and Criteria document No. ST/SG/AC.10.11/Rev.4:2003.

Safe handling guidelines

- Do not use with children without supervision or further safety assesments.
- Do not disassemble the device or charger. The battery in the device is not replaceable. If the device or charger is damaged, dispose of it responsibly or return to Activinsights.
- If the device becomes warm to the touch whilst in use, remove and return to Activinsights.
- Do not wear while charging or connected to USB.
- Clean the device with a soft moistened cloth. Do not use abrasive cleaners or solvents.
- Do not subject the device to excessive force, shock or extreme temperature changes.
- Do not put the device in a microwave, oven, dishwasher, or washing machine. Do not use an external heat source such as a hair dryer or heater to dry the device.
- At the end of the product life, please return it to your issuing authority.

7. Technical Notes

Understanding .csv files

The first 100 rows of the .csv file is the header which contains all the information about the device, its firmware and the trial that recorded the information.

In both the raw data and epoch compressed files, the data starts from row 101 and is organised in the following columns:

COLUMN	RAW DATA	EPOCH COMPRESSED
A	time stamp	time stamp of epoch end
B	x axis (g)	mean x axis
C	y axis (g)	mean y axis
D	z axis (g)	mean z axis
E	light level (lux)	mean lux
F	button (1/0)	sum button
G	temperature (°C)	mean temperature
H	–	sum of vector magnitudes
I	–	x axis standard deviation
J	–	y axis standard deviation
K	–	z axis standard deviation
L	–	peak lux

In the epoch compressed .csv, the gravity-subtracted sum of vector magnitudes is calculated as follows:

$$SVM^gs = \sum \left[(x^2 + y^2 + z^2)^{1/2} - 1g \right]$$

For each measurement in the epoch the vector magnitude is created and 1g is subtracted. When the accelerometer is static and the earth's gravitation pull is the only acceleration, the result of this will be zero.

The total number of measurements in the sum is defined by multiplying the recording frequency by the epoch length. Measurements from different recording frequencies and epoch lengths can be compared with suitable scaling.

Decoding .bin files

Data packets are visualised with first bit on the left with the byte numbers labelled above the row in decimal:

Output values that require interpretation are labelled with an asterisk (*).

The .bin output file should be intuitive when opened as text:

- It has a main header (lines 1 to 59)

- Followed by 'pages' of 300 measurements (lines 60-72,73-85, etc.)

- Each page has its own sub-header (e.g. lines 61-68)

- And a data block (e.g. lines 69-72)

The time span of a page is dependant on the measurement frequency. A measurement consists of 3 axis of acceleration, a light measurement and the button status. In the page header it also records the battery voltage and temperature as well as some of the basic set-up information. The time stamp of the page corresponds to the first measurement of the page.

The first 300 measurement block of hexadecimal data starts on line 69 of the file - this is a sequential stream of 6 byte data blocks starting at the timestamp in the page header:

Repeated 300 times
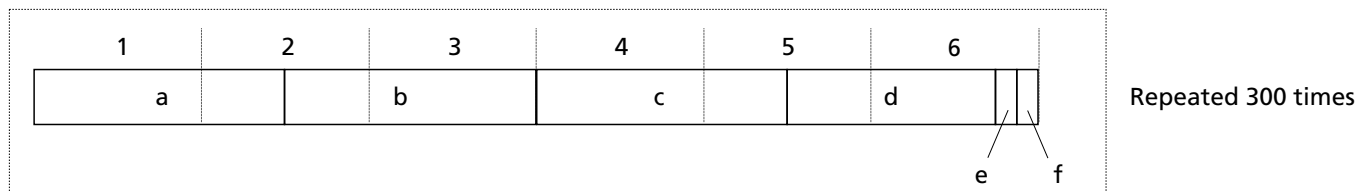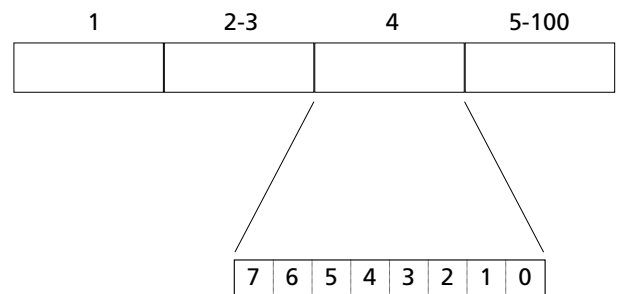
a 12 bits	accelerometer x axis (+/- 2048)*
b 12 bits	accelerometer y axis (+/- 2048)*
c 12 bits	accelerometer z axis (+/- 2048)*
d 10 bits	light meter (0-1024)*
e 1 bit	button status (1 on / 0 off)
f 1 bit	reserved (set to zero)

The GENEActiv device stores raw data to allow all processing to be completed off-line. Calibration data is created in production and recorded to be applied in post-processing.
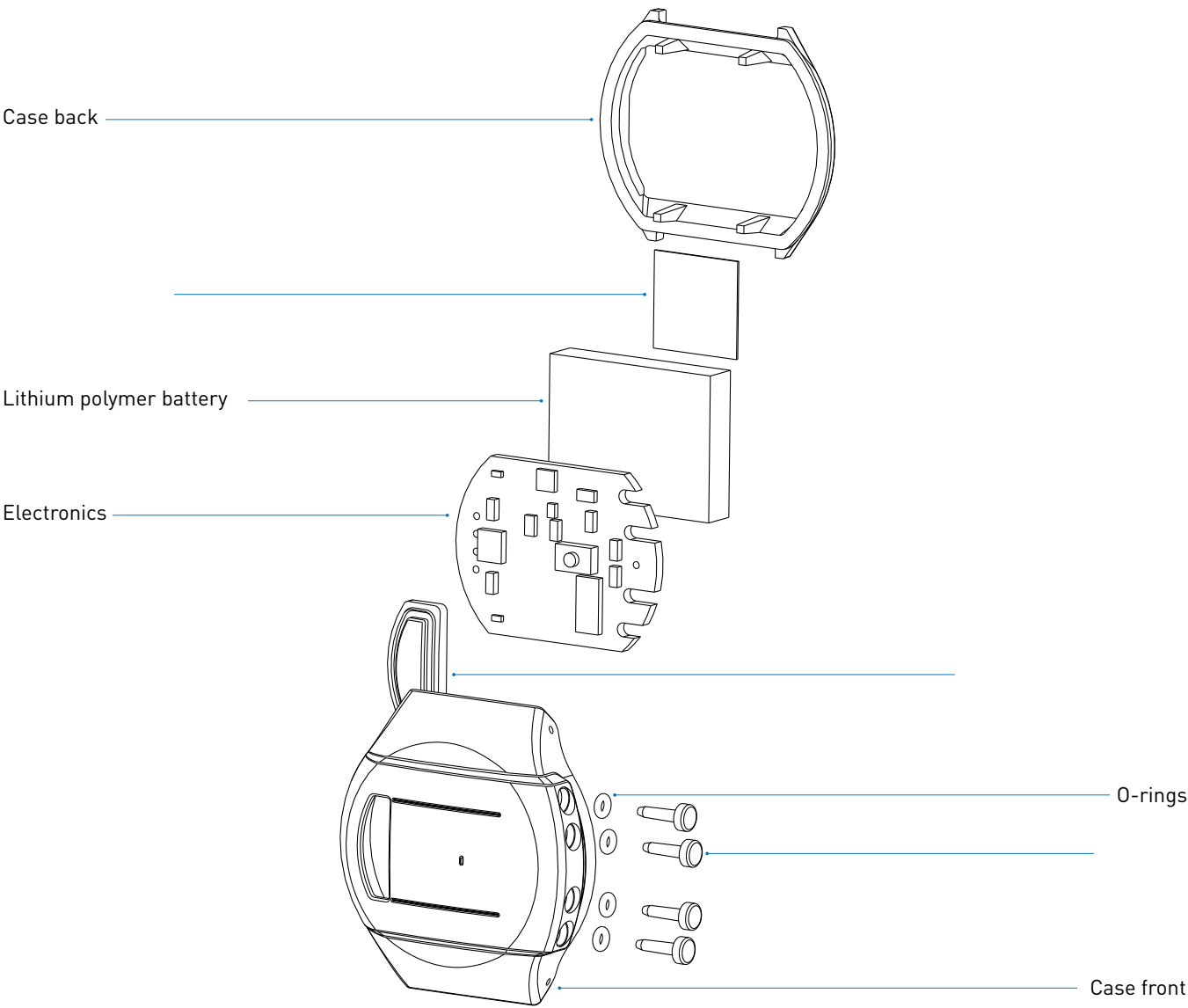
Accelerometer x, y & z axis:
calibrated measurement = (output*100 - offset) / gain   (g)

Light meter:
calibrated measurement = output * lux / volts   (lux)

GENEActiv

Construction

Case back

Lithium polymer battery
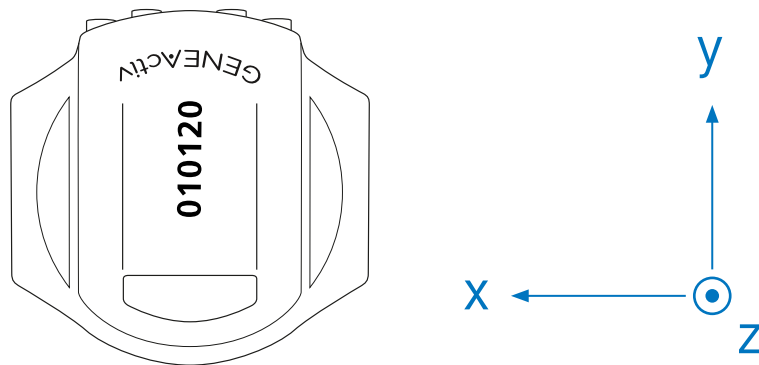
Electronics

O-rings

Case front

Sensor axes & body positions

The device should be fitted to the wrist in the most intuitive manner – with the serial number in the correct orientation to be read by the wearer and with the 'crown' to the right – like a watch.
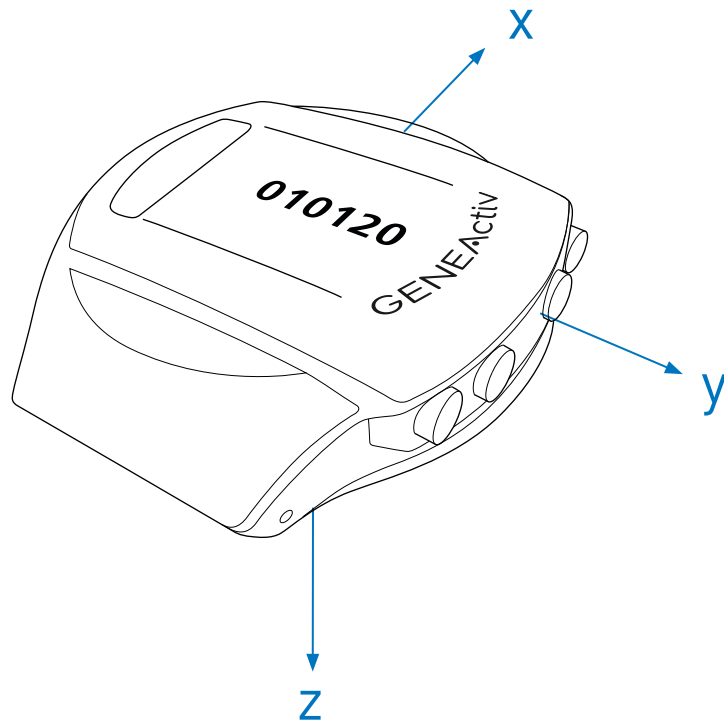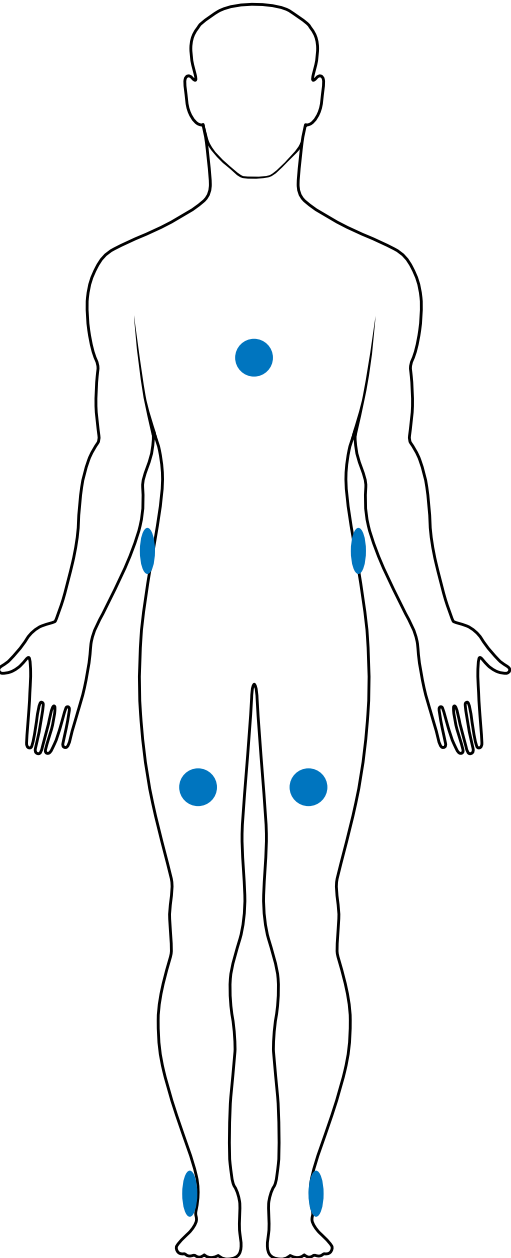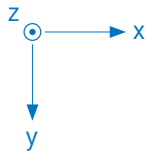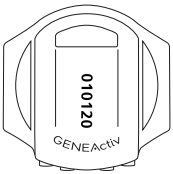
On the right hand, with the arm relaxed to the side, the device will appear to the observer:
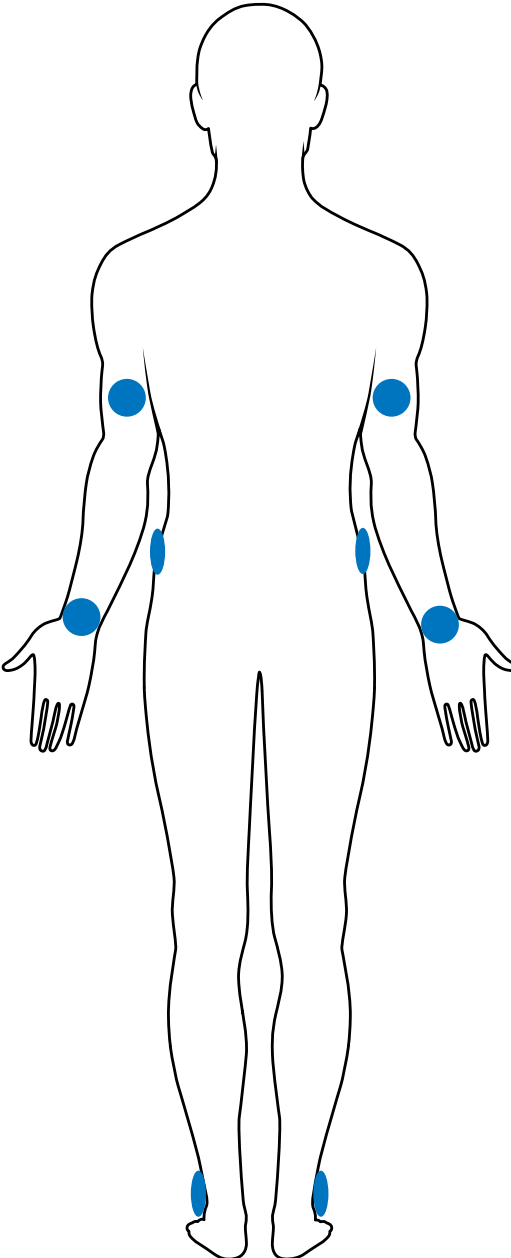
On the left hand, with the arm relaxed to the side, the device will appear to the observer:
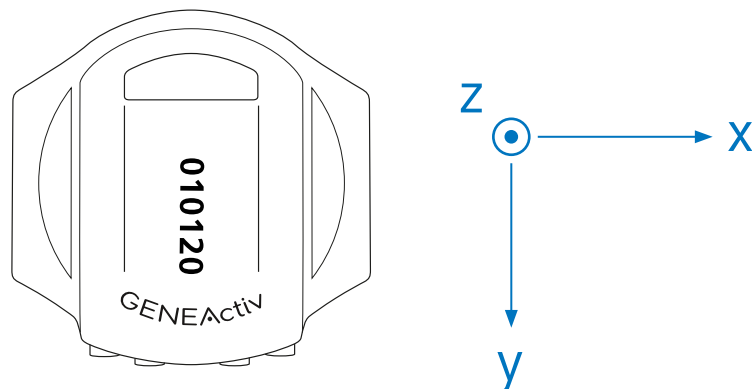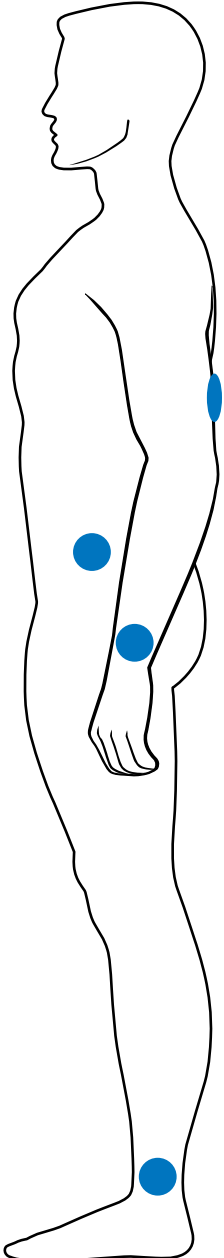
In all other body positions the device should be fitted with gold contact pins towards the ground:

z

x

y

010120

GENEActiv

Front

Back

Side