PulseOn OHR Tracker User Instructions SP-2D-W

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1 Wrist device

1.1 Power off/on

The device is turned on by pressing the button firmly once for one second. The device will vibrate when it is ready to use.

The device can be turned off (and rebooted) by pressing the button down for 10 seconds. The display will show a power off warning at first during which you can still release the button without powering off the device.

⚠️ Holding the button down for over eight seconds will start the device in the DFU mode and the display will stay dark. In this case, the device should be turned off and back on again with a shorter press.

⚠️ For the off-hand detection to work properly, the device should **not be** worn when turning it on.

1.2 Positioning of the device

When wearing the device, position the device approximately one finger width up the arm from the wrist bone. If possible, prefer the non-dominant hand as this will increase the quality of the data.
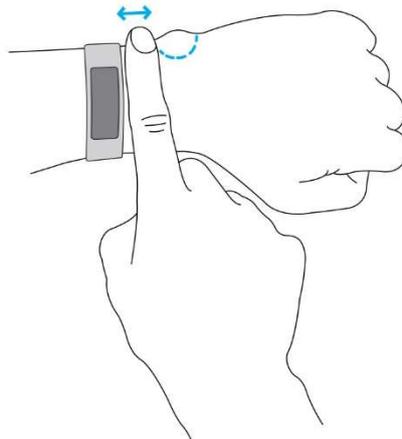
1.3 Low battery/charging

The device has a screen showing remaining battery. Currently no warning for low battery exists.

The device can be recharged using a normal USB cable. When connecting the device to a charger, it will vibrate and display a recharging screen. Removing the device from the charger will also cause the device to vibrate.

1.4 Usage modes

The device has two modes: the sampled mode and the continuous mode. During the sampled mode, the device measures the heart rate every 5 minutes or whenever the button is pressed.

In the continuous mode, PPG and acceleration is sampled constantly at 100 Hz and averaged over 4 samples. HR is estimated once per second.

The operating mode can be changed from the device by pressing the button down for one second. The device vibrates as an indicator of mode change. In addition, a small heart is shown in the display's upper-left corner while the device is in sport mode.

1.4.1 Different screens
The following is a listing of different screens and their meanings in the different modes. The screen can be cycled through by pressing the button for one second for every new screen.

1.4.1.1 Sampled mode

Steps taken since starting the device

Calories burned since starting the device

Battery level

Heart rate

Clock
Note that for the clock to show, the device must have been connected to the android app at least once for syncing.

1.4.1.2 Continuous mode

Covered distance since activating the mode

Heart rate

Time since activating the mode

Clock

1.4.1.3 Heart rate display in both modes

Device off-hand

Searching for HR

HR quality ok – displaying actual HR

1.4.1.4 Operating and warning displays

Device starting. Please wait.

Power-off warning: If button is kept pressed, device will shut down.

2   Android app

The Bluetooth LE HR and HRV data is not bound to using a specific app. Other software (for example, nRF Toolbox) can be used to receive HR and HRV information. However, all other data (steps, calories, raw data) can only be read using the specific software. In addition, to get the clock display to work, the device must be connected to the app after a reboot.

2.1   Installing the app

Save the provided apk-file to a location that you can access by phone (for example: the phone memory if you have a file browser or Dropbox). Accessing the file should prompt the user about installing an app.

⚠️   Since the app is not downloaded through the Play Store, it will require permission. Newer Android versions will bring up the settings for installing outside files, but if it this does not happen the settings can be found in Advanced **Settings** -> **Security** -> **Unknown sources**.

The app will ask for permission to access the files on the phone and to access the location. These are required for the Bluetooth connection to work.

2.2   Connecting to a device

Starting the app, it should display an empty screen with a **SCAN** button in the top right corner. Pressing **SCAN** brings up a list of devices in range. The name of the sample device is *OHR Tracker*. Distinguishing between different devices can be done based on their MAC-address that is shown under the name. The signal strength is also displayed to assist with finding the right device: a device next to the phone will usually give a strength between -35 and -55 dB while -95 dB is a very bad connection.

If no device is selected, the app will connect to a device if one is clearly closer to the phone than any other. However, if multiple devices are close according to the signal strength, none will be chosen, and an error message will appear. The user can then manually connect to the right device.

2.3   Automatic firmware update

If the application detects that the device has a firmware version that is outdated, it will prompt the user for an update in the following way:
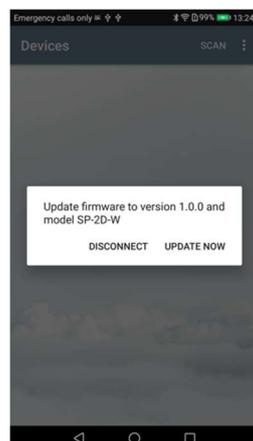
Pressing "*Update now*" will cause the OHR tracker to reset and a new version of the firmware to be installed automatically. The OHR tracker will boot automatically once the update is done.

⚠️ The app has been tested on multiple different phones and unfortunately the update is known to malfunction from time to time with certain Android phone models (such as Honor 8 lite).

⚠️ **If the update does not work, please refer to the *DFU Guide* on how to proceed with the update.** In the case of a failed update attempt, the OHR tracker is usually already in the DFU mode and does not need to be restarted before proceeding.

2.4   Using the app

After a connection is established, a screen like the following should appear:
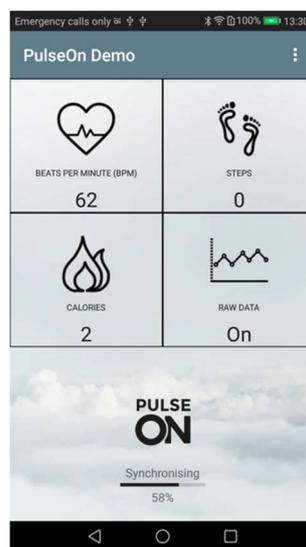
The HR, calories and steps are the same as displayed on the device display. However, there is a slight delay between updating the values.

Pressing the three dots in the upper right corner brings out an extra menu. When connected to a device, this menu has two sets of options: the operating mode and the recording mode options. In addition, there are buttons labelled *Export DB* and *Disconnect*. *Disconnect* can be used to break the Bluetooth connection between the device and the phone. *Export DB* can be used to export the stored data as csv files.
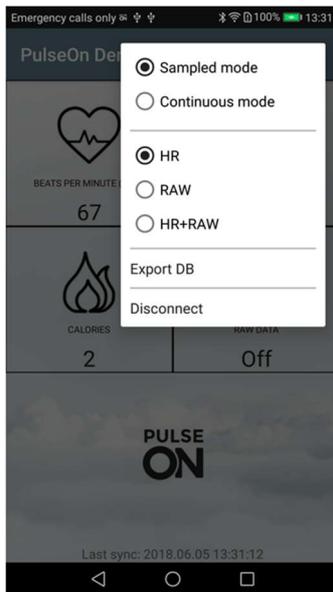
While the app should automatically reconnect to the device if a disconnection occurs (for example, the device leaves the Bluetooth range, or the device is rebooted) it is possible to end up in a situation where there is no connection. In this case, the menu will only have one button: *Connect*. This will connect to the device that the app was previously connected to. To bring up the SCAN screen again, close the program completely (usually done from the square button on the bottom of the screen) and restarting the app.

2.5   Recording raw data and streaming PPG

To record raw data, you will need to enable raw data collection. From the extra menu, press *Continuous mode* and then choose either *RAW* or *RAW+HR* depending on which data you want to store in the database. The device should vibrate to mark the switch in operating mode.

⚠️   If only *RAW* is selected, the device display and the app will not show HR, steps or burned calories.

To stream the PPG, click the "Raw Data" screen (that should now say "On") to bring up the PPG demonstration screen. It shows the past few seconds of the PPG raw data and the HR and steps values in addition.
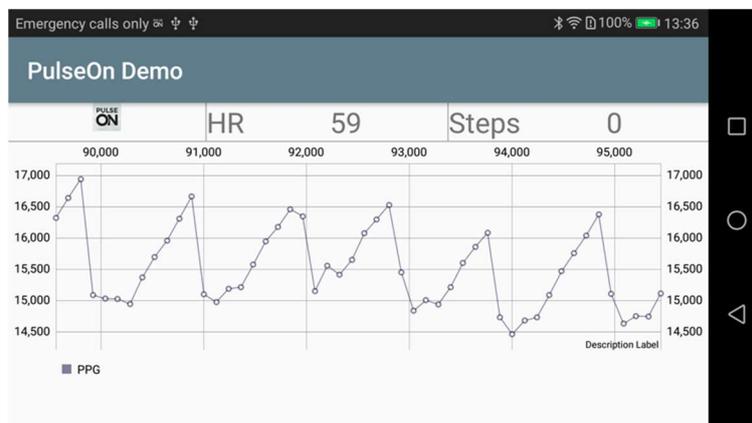
When demonstrating the PPG, please remember that all movement and changes in the ambient light will drastically affect the graph. When demonstrating the PPG, the hand with the device should remain still and in a constant lighting.

⚠️ When the PPG display is open, no data will be written into the phone's database. While this will not cause data loss, in a longer run it will slow down data transfer. To prevent this, please exit the PPG screen once done demonstrating it.

To stop collecting raw data, select the *HR* from the upper right-hand menu of the app.

3   Data transfer and storing

When the app and the device have a connection, all data written into the device memory will be transferred in compressed packets to the phone. <u>This transfer only happens for full files</u>. The progress of transferring the files is indicated by the progress bar in the app.

⚠️   If the device memory has a lot of stored data, the transfer might take quite long. In the case where the Bluetooth connection has been broken for a long time, please leave the app on and give the files time to transfer when connecting.

Any collected data will be written into an sqlite database that is stored in the phone under the directory */sdcard/PulseOnOHR/*. The database file is always named *pulseon_ohr.sqlite.* This database includes three different tables: *RawData*, *ContinuousData and AdlData*. Please see chapter 4 for clarification on the different tables and the values written into them.

⚠️   In certain phone models and Android OS versions the application might not be able to write into the database if another app accessing the SD-card is open in the background. Please close all file explorers etc while using the PulseOn recorder app.

⚠️   The database is being written whenever there is a connection and transferrable data. When collecting raw data, please be careful not to enable raw data recording while not measuring. This will result in collecting unwanted data.

⚠️   In *sampled mode*, the *ContinuousData* is written only when it changes from its previous values. If only recording *HR* data in *sampled mode*, the value might not change often and thus the transferrable packets will fill slower. In this case, a file might take up to hours to fill up before it is shown in the phone's database.

To reset the database, the sqlite-file (or even the whole containing folder) can be deleted from the phone memory. If no such file or folder exist, the app will create them by itself. It is advised to also delete the database after updating the app to a newer version.

3.1   Exporting the database as a CSV-file

In the app, the upper-right menu has an option labelled *Export DB*. This creates a separate CSV-file from each table in the sqlite database into */sdcard/PulseOnOHR/csvexport/* subfolder. The files will be named as YYYYMMDD_time-raw/cont/adl.csv.
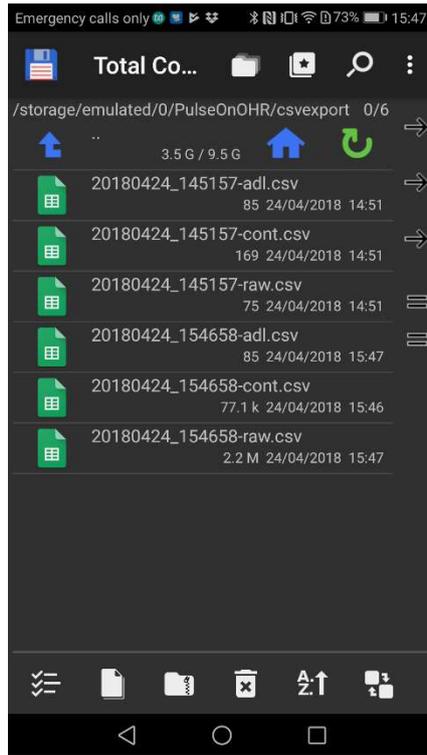
⚠️ *Export DB* exports the whole current database and does not affect it any way. In most cases, the user might want to delete the database after exporting to avoid having the same data in multiple exports.

The CSV files include the headers and all the data from the database and each field is separated by a comma. For more information regarding the different columns, see chapter 4.

	A	B	C	D	E	F	G	H	I	J	K	L
1	timestam	running_cou	ppg1	ppg2	ppg3	ppg4	acc1	acc2	acc3	rssi		
2	1694993	24045	-9433252	-131068	-16385	4095	32261	-12106	11295	-57		
3	1695033	15824	-9435244	-3906	-16385	4095	20221	29018	-18273	-57		
4	1695073	39753	-7338345	166037	-16385	4095	-12423	10025	18046	-57		
5	1695113	39754	-7336988	248021	-16385	4095	-11911	12457	22366	-57		
6	1695153	39755	-7338982	15219	-16385	4095	20768	12459	-29868	-57		
7	1695193	39756	-6830278	424971	-16385	4095	-12121	-19925	2900	-57		
8	1695233	39757	-6830278	424971	-16385	4095	21926	-15586	2900	-57		
9	1695273	39758	-6830278	424971	-16385	4095	25960	-15586	2900	-57		
10	1695313	39759	-6830278	424971	-16385	4095	-25762	-15586	2900	-57		
11	1695353	39760	-6830278	424971	-16385	4095	7006	-15586	2900	-57		
12	1695393	39761	-6830278	424971	-16385	4095	7132	-15586	2900	-57		
13	66511753	56208	-6830278	424971	-16385	4095	7132	-15586	2900	-57		
14	-1,5E+09	39313	-6830278	424971	-16385	4095	7132	-15586	2900	-57		
15	-1,5E+09	47510	-6830278	424971	-16385	4095	7132	-15586	2900	-57		
16	-1,5E+09	61974	-6830278	424971	-16385	4095	7132	-15586	2900	-57		
17	-1,5E+09	54419	-6830278	424971	-16385	4095	7132	-15586	2900	-57		
18	-1,5E+09	21779	-7067368	32925580	-16385	4095	28122	-20837	2900	-57		
19	-1,5E+09	58867	10490997	-1,8E+07	-16385	4095	22879	-4149	2900	-57		
20	-1,5E+09	9748	26727845	-2,6E+07	-16385	4095	6799	-4149	2900	-57		
21	-1,5E+09	38180	-3,3E+07	-2,6E+07	-16385	4095	6799	-4149	2900	-57		
22	-1,5E+09	58599	-3,3E+07	-2,6E+07	-16385	4095	-899	-4149	2900	-57		
23	-1,5E+09	58603	16777577	-3,2E+07	-16385	4095	-897	-4149	2900	-57		
24	-1,5E+09	39409	8618345	30066099	-16385	4095	32255	-4149	2900	-57		
25	-1,5E+09	39933	-2,5E+07	30572467	-16385	4095	-30081	-4149	2900	-57		
26	-1,5E+09	39934	-2,8E+07	30572467	-16385	4095	-28610	-4149	2900	-57		
27	-1,5E+09	39935	-1,2E+07	30572467	-16385	4095	-28610	-4149	2900	-57		
28	-1,5E+09	39919	-2E+07	30572467	-16385	4095	-20682	88	26428	-57		

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4   Data column explanations

4.1   ContinuousData table

Column	Explanation
timestamp	milliseconds from 01.01.1970 (Unix epoch in milliseconds)
running_counter	a running 16-bit number to check no data is missing
activity_class	0 – rest 1 – other 2 – walking 3 – running 4 – biking 5 – other rhythmic 6 – sleep: other 7 – sleep: light 8 – sleep: deep
sleep_class	not in use
workout_class	0 – no workout 1 – workout ongoing
speed	current speed
walk_steps	cumulative walking steps since turning on the device
run_steps	cumulative running steps since turning on the device
bike_steps	cumulative biking steps since turning on the device
walk_distance	cumulative distance walked since turning on the device in meters
run_distance	cumulative distance run since turning on the device in meters
calories	number of calories burned since turning on the device
hr	current heart rate
hr_qi	the quality index of the heart rate measurement
rssi	signal strength during the transfer of the file containing this line
savetime	time according to the phone when the file was transferred

4.2 RawData table

Column	Explanation
timestamp	milliseconds from 01.01.1970 (Unix epoch in milliseconds)
running_counter	a running 16-bit number to check no data is missing
ppg1	Green PPG signal
ppg2	Ambient for green PPG signal
ppg3	not in use
ppg4	not in use
acc1	acceleration in one dimensions
acc2	acceleration in one dimensions
acc3	acceleration in one dimensions
rssi	signal strength during the transfer of the file containing this line
savetime	time according to the phone when the file was transferred

4.3 ADL table

Column	Explanation
timestamp	milliseconds from 01.01.1970 (Unix epoch in milliseconds)
running_counter	a running 16-bit number to check no data is missing
IBI	interbeat interval
IBI_QI	quality index of the IBI
sqeclass	0 – reliable 1 – unreliable
rhythm_class	proprietary information
arrhythmia_state	proprietary information
rssi	signal strength during the transfer of the file containing this line
savetime	time according to the phone when the file was transferred

4.4   Notifications table

Notification table meant for debugging and internal testing.

Column	Explanation
timestamp	milliseconds from 01.01.1970 (Unix epoch in milliseconds)
running_counter	a running 16-bit number to check if no data is missing
event_id	event identifier
value	event value
rssi	signal strength during the transfer of the file containing this line
savetime	time according to the phone when the file was transferred

4.5   AdlStatistics table

This table exists but is set to be empty.

Column	Explanation
timestamp	milliseconds from 01.01.1970 (Unix epoch in milliseconds)
running_counter	a running 16-bit number to check if no data is missing
classified	proprietary information
undetermined	proprietary information
periodic	proprietary information
rssi	signal strength during the transfer of the file containing this line
savetime	time according to the phone when the file was transferred

5   Regulatory information

5.1   Trademark holder

PulseOn Oy
Tekniikantie 12
02150
Espoo, Finland

support@pulseon.com

5.2   CE regulatory information

PulseOn declares under its sole responsibility that the product is in conformity with the provisions of
Directive 1999/5/EC of the European Parliament http://PulseOn.com/declaration_of_conformity/

5.3   Operating parameters

Operating frequency: 2400 – 2483.5 MHz
Operating temperature: 5 – 45 °C

5.4   Safety Statements

CAUTION

RISK OF EXPLOSION IF BATTERY IS REPLACED BY AN INCORRECT TYPE. DISPOSE OF USED BATTERIES
ACCORDING TO THE INSTRUCTIONS.

No user replaceable parts inside, refer servicing to manufacturer specified agency or qualified
service personnel.

Only use accessories/battery specified by the manufacturer.

Do not expose to excessive heat sources, sunshine, fire or the like.

Disposal: All electrical and electronic products including batteries should be disposed of separately
from the municipal waste stream via designated collection facilities appointed by the government or
the local authorities.

5.5   FCC statement

FCC ID: O4GPU426
Model: SP-2D-W

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.

The grantee is not responsible for any changes or modifications not expressly approved by the party responsible for compliance. Such modifications could void the user's authority to operate the equipment.

The RF Exposure Compliance distance is 5 millimeters.

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 instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

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

—Consult the dealer or an experienced radio/TV technician for help.