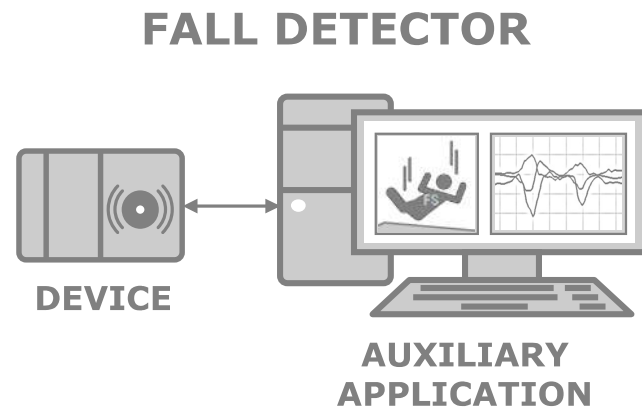# A. User Manual

A.1. Features

Detector

- human fall detection,
- automatic alarm handler,
- motion parameter recording,
- streamlined user interface,
- fits in the pocket,
- almost a week without charging (4800 mAh).

Auxiliary Application

- motion parameter analysis,
- browsing and storing recordings,
- sensor's configuration wizard,
- modern user interface,
- export to CSV/JSON,
- export graphs' screenshot.

A.2. How to use

A.2.1. Detector

Preparation

You will need a prototype, 4 AA batteries, mini-USB cable and screwdriver. Carefully open the case (top and bottom are interconnected using a cable), insert batteries into a holder. Make sure the supply cable remained connected, jumper JP6 is on and JP5 is at E5V state. Assemble the detector into a primary form. Locate a user button, supply switch, led and mini-USB connector. The device can work in both fall detection and data acquisition mode.

Fall detection

1. Switch power.

2. Wait two seconds.

3. Notice long sound and led state changing.

Now the device is able to detect a fall. Let's assume a potential fall has been detected.

4. Hear slow ticking.

It is a message that device detect a potential fall. Only now you have an opportunity to stop the alarm (then the device will go back to the fall detection). However, let's assume a user button has not been pressed for 5 seconds (it could cancel the alarm).

5. Hear faster ticking.

This signal indicates that an alarm occured. The only way to disable it is to reset the power supply of the device. The waveform which called the event has already been saved on SD card. In order to examine the signal accurately switch the device into the following mode (after reset).

Data acquisition

1. Press and hold user button.

2. While pressing a button, turn on the device by switching its supply.

3. Wait two seconds.

4. Release user button.

5. Notice short sound and led state changing.

The device has just started acquisition. Led state changing indicates full data overwriting (device is able to record last few seconds up to stop).

6. Save a recording using short user button click.

Led should change its state again.

7. Notice short sound[1] and led switch.

The device got back to recording. Let's assume you want to transfer all data to the Auxiliary Application.

8. Press and hold user button.

9. Notice long sound and led state changing.

The device is in command processing state now. You can control it using the dedicated application.
Warning*: resetting the device will make the operating mode going back to fall detection.*

A.2.2. Auxiliary application

Preparation

Install LabVIEW Run-Time Engine if you have not done it yet.

Open the application. It is able to work in two modes: measurement analysis and sensor configuration. The mode can be changed using F6 hotkey (its status is visible on a bottom-right side of the screen). Locate two graphs, recordings list, buttons for taking screenshot, removing selected packet and moving it on the list. Find menu options, working mode status and available shortcuts. Make sure the device is in the command processing state. It should establish a connection automatically.

Measurement analysis

1. Connect device to the PC using mini-USB cable.

If the device lacks of new recordings, it will be disconnected, however you can continue working on application. Let's assume new recordings are available to download.

2. Observe a prompt about some recordings available.

You have an opportunity to append or replace the list by them. Cancelling causes disconnection.

3. Append or replace packets.

4. Notice a download progress window.

After complete download the device is be disconnected. When an error occurs, transfer is aborted, however downloaded packets are available.

5. Select interesting record.

You can change its comment (double-click), remove or move on the list, export as CSV, JSON or screenshot (PNG). If you want to save current list status, you can do that (CTRL+S). Loading it from a file is also possible both by appending or replacing data. Display type allows to select between displaying normal values and peak-to-peak amplitudes assuming 50 ms time window.

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[1]when the recording is very short, the sound is not audible.

Sensor configuration

1. Press F6 in order to change the working mode to this one (*CONF*).

2. Connect the device to the PC using mini-USB cable.

3. Notice the information that device configuration has been received with success.

You now are able to configure basic parameters of sensor measurement like accelerometer full-scale range and acquisition frequency.

4. Click *Configure* button.

The device returns a prompt after it finishes the operation with success. If it fails, you will need to reopen the wizard to benefit from its features.

5. Close wizard.

Now the application changes its state to the measurement analysis.

A.3. Troubleshooting

The device cannot be turned on. Inside, a big led is blinking and fading out after switch a power supply.

Batteries are discharged. Replace them and try again.

Led is blinking and buzzer is ticking fast.

An error occurred during accessing hardware. Make sure a micro-SD card and sensor are inserted. Try to reset the device. If it does not help, the hardware is probably damaged.

Is it possible to get measurement data from micro-SD card directly?

Yes, however recordings are stored in a specific text format. You will need to parse them afterwards to make a profit on data.

Is it possible to change sensor configuration file saved on SD card manually?

Yes, however you must be careful. If you write other values than those available in sensor configuration wizard, the content will be neglected and the device will go back to its default configuration.

Is it possible to record always 10 s of measurement independently from frequency?

It is not possible because of limited resources of the MCU.

How many measurements could be stored on 4 GB micro-SD card?

About 150 000 theoretically. However transferring so many packets to the Auxiliary Application will occupy several days and could crash the application. It is strongly recommended not to transfer more than 1000 packets.

Can I run the Auxiliary Application without LabVIEW Run-Time Engine 2016?

Util now, it is impossible, however the author is considering independent application release.

A.4. License

Some third-party items have been used during development and documentation processes (and possess own licenses).

Item	Provider(s)	License	Link
cJSON	DaveGamble	*MIT*	https://github.com/DaveGamble/cJSON/blob/master/LICENSE
C library	ARM Ltd.	*Apache 2.0*	https://os.mbed.com/handbook/Apache-Licence
Diagrams, sketches	JGraph Ltd.	*draw.io EULA*	https://about.draw.io/terms-conditions/eula-draw-io-plugins
Icon	Freepik	*Flaticon Basic*	https://file000.flaticon.com/downloads/license/license.pdf
JSON	JSON.org	*The JSON License*	https://www.json.org/license.html
JSON LabVIEW	Powell, J. et al.	*BSD*	https://lavag.org/files/file/216-json-labview/
LabVIEW	National Instruments	*VLP*	http://www.ni.com/legal/license/
LaTeX	LaTeX project	*LPPL*	https://www.latex-project.org/lppl.txt
mbed	ARM Ltd.	*Apache 2.0*	https://os.mbed.com/handbook/Apache-Licence
SDFileSystem	mbed_official	*MIT*	https://os.mbed.com/users/mbed_official/code/SDFileSystem
System Controls 2.0	National Instruments	*Sample Code*	http://sine.ni.com/nips/cds/view/p/lang/pl/nid/209118

Table A.1. Used items' licenses.