Cardio EVK User Manual for RT1025 Cardioid Evaluation Board

Purpose

The RT1025 is an integrated AFE solution for Heart-Rate monitoring and Biopotential measurements. The RT1025 integrates low noise voltage and current sensing channels and is capable of sensing ECG (Electrocardiography) and PPG (Photoplethysmography) simultaneously. Richtek Technology developed an Android APP with the evaluation board to evaluate RT1025 performance. This document describes the operation manual of Cardio EVK for RT1025 evaluation board.

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Introduction

General Product Information

The RT1025 is an integrated AFE solution for Heart-Rate monitoring and measurements. The RT1025 integrates low noise voltage and current sensing channels and is capable of sensing ECG (Electrocardiography) and PPG (Photoplethysmography) simultaneously. The RT1025 has > 100dB dynamic range and can sense pulses accurately by detecting the heart's electric signals. The sampling rates of the high-precision voltage and current sensing channels in the RT1025 are configurable between 64 to 4kHz. The RT1025 solution need only few discrete components and is easy to use for low-power medical ECG/PPG, sports, and fitness applications. With high levels of integration and high-precision voltage and current sensing channels, the RT1025 solution is suitable for scalable medical instrumentation systems. The RT1025 is available in a 3.1mm x 3.4mm, 41-Ball, 0.4mm pitch, WL-CSP package.

The Cardio EVK is an Android APP to evaluate RT1025 performance with the Cardioid evaluation board. The evaluation board includes the RT1025 together with the BLE SiP and PPG modules to quickly evaluate the operation and performance of the RT1025. The evaluation board number is PCB106_V1. For more information, please find the related datasheet or application notes from Richtek website.

Cardio EVK Product Feature

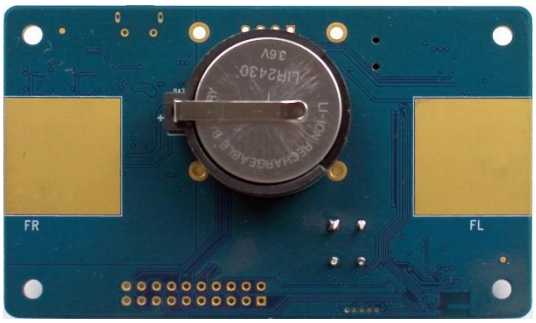
- **Support Android 6.0 above phone or tablet**
- **"Cardio EVK" can download from Google Store**
- **Support BLE connection**
- **Operated with Richtek Cardioid Evaluation Board**
  - **Evaluation Board Number : PCB106_V1**
  - **Dimension : 9cm x 5cm**

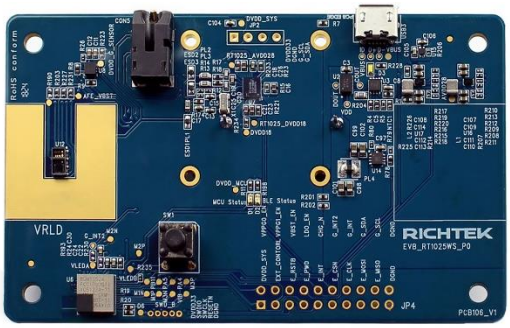
Usage with The Cardioid Evaluation Board

Measurement Procedure

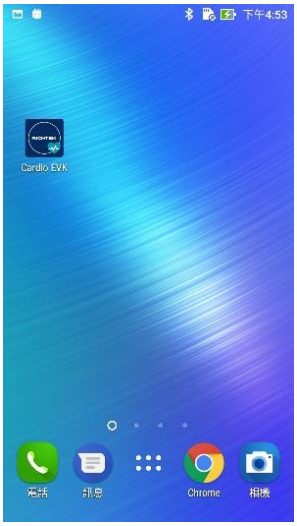
The RT1025 supports the reading of samples and device status upon interrupt or via polling. It contains 4kB SRAM for data buffering. The device is internally clocked to offer high-precision clock with external crystal. The flexible timing control enable the users to control the PPG device timing for different application and to power down the device for power saving. In order to achieve the high speed data acquisition, the RT1025 device was configured as a slave of SPI mode. The Cardioid evaluation board is fully assembled and tested. The usage of the evaluation board was shown in below figure.

1. Insert LIR2430 Battery in the battery case. The battery can be charged by applying 5V via the Micro USB port.
   - Once on, you should see a Red LED lighting for OK status.
   - If no light is present, check connections or try replacing the Battery with a fresh one.
   - If Red LED is flashing, check the I^2C or SPI device correct connections.

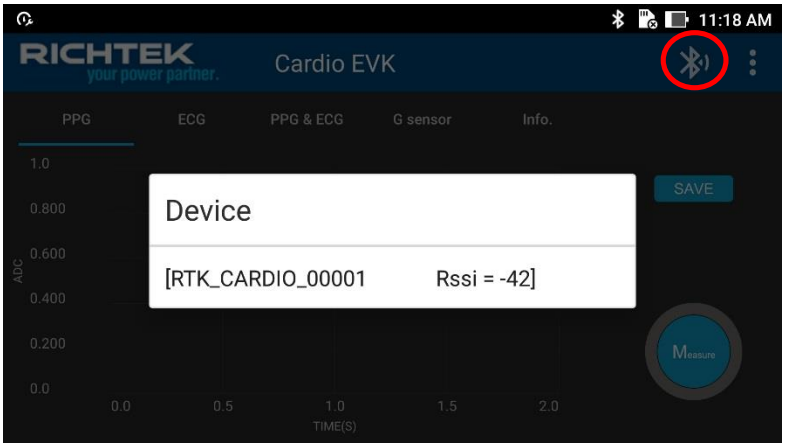




2. Make sure the evaluation board connect to the Android APP for ECG/PPG measurement.
   - Make sure Bluetooth is enabled on the phone/tablet. (Not need to pairing)
   - Launch the “Cardio EVK” application on your phone/tablet.



- Then, you will need to connect to the Cardioid evaluation board Hardware. Do this by selecting the “BLE ICON” that shows up upon opening the android application. Select the evaluation board ID (RTK_CARDIO_00XXXX) from pup-out menu for BLE paring.

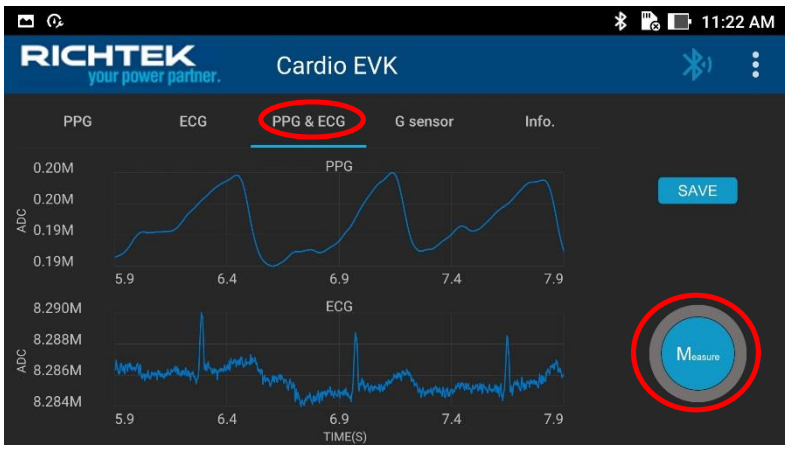


- After the Cardioid evaluation board BLE connection is successfully established, the “BLE ICON” will become blue and the main GUI will launch.

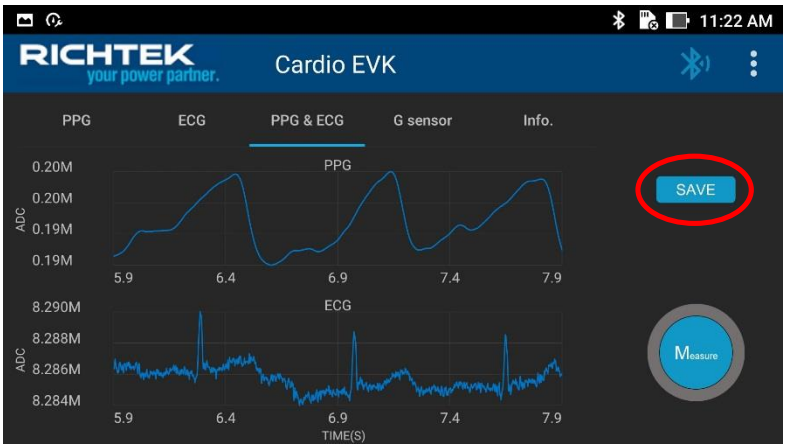
- Refer to detail “Description of ” from APP section for more information.

3. Put your fingers cover the VRLD and PPG sensor in the top, FR/FL in the bottom.

Select “PPG+ECG“ tab firstly, then press “Measure” to start PPG+ECG data acquisitions. Note that it may take a while to get stable results. Press “Stop”, once you finish the measurement.



4. Check the measurement results. Press “SAVE” to store the measured data for analysis.

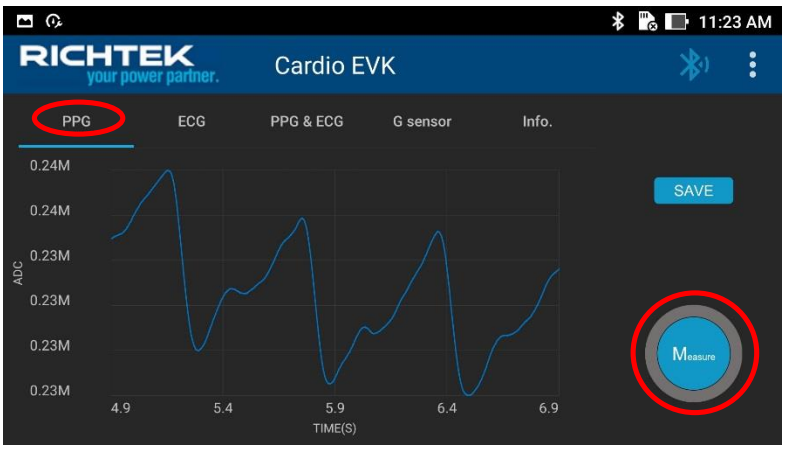


Description of Cardio EVK

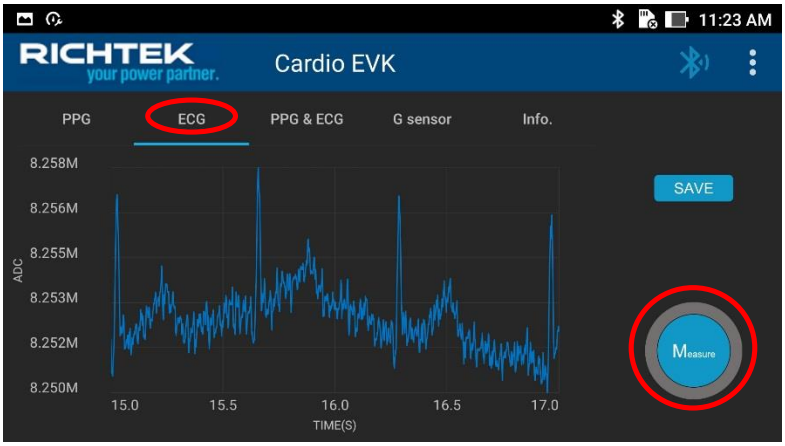
The “Cardio EVK” app provide the functions of ECG/PPG/G-sensor measurement and Cardioid Evaluation Board configuration. (“Cardio EVK” can download from Google Store)

PPG/ECG/G-sensor Measuring

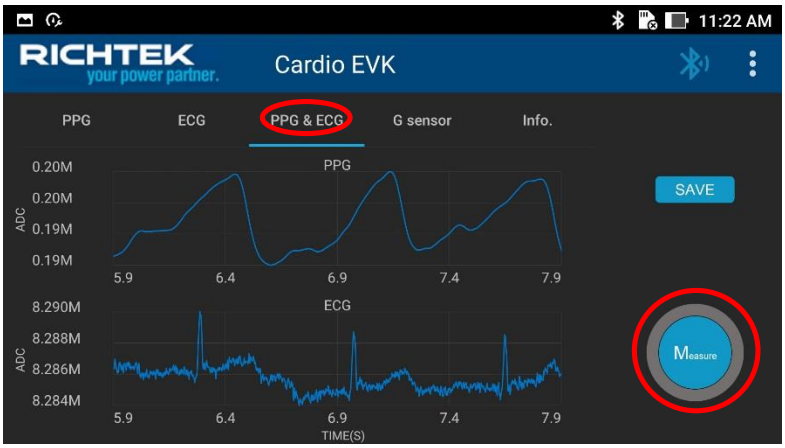
PPG : To acquire the PPG data, click “PPG” tab in the Cardio EVK first. Then press “Measure” to start the measurement. Press “Stop”, once you finish the measurement.



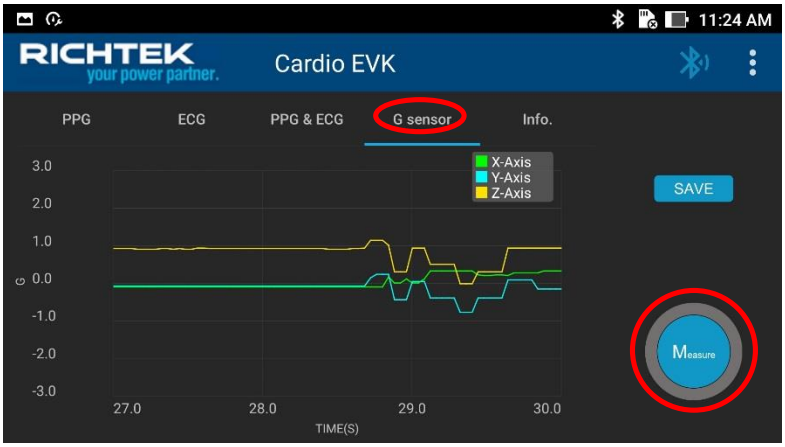
ECG : To acquire the ECG data, click “ECG” tab in the Cardio EVK first. Then press “Measure” to start the measurement. Press “Stop”, once you finish the measurement.



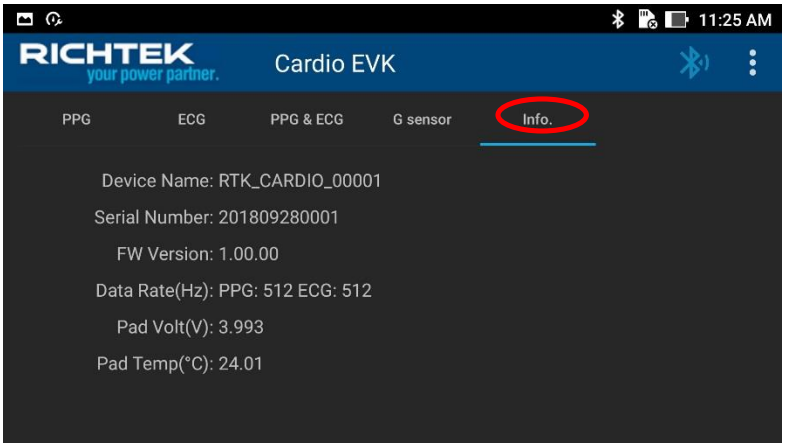
PPG & ECG : To acquire the PPG and ECG data at the same time, click “PPG & ECG” tab in the Cardio EVK first. Then press “Measure” to start the measurement. Press “Stop”, once you finish the measurement.



G sensor : To acquire the G-sensor value, click “G sensor” tab in the Cardio EVK first. Then press “Measure” to start the measurement. Shaking the EVB in different directions will produce below results. Press “Stop”, once you finish the measurement.

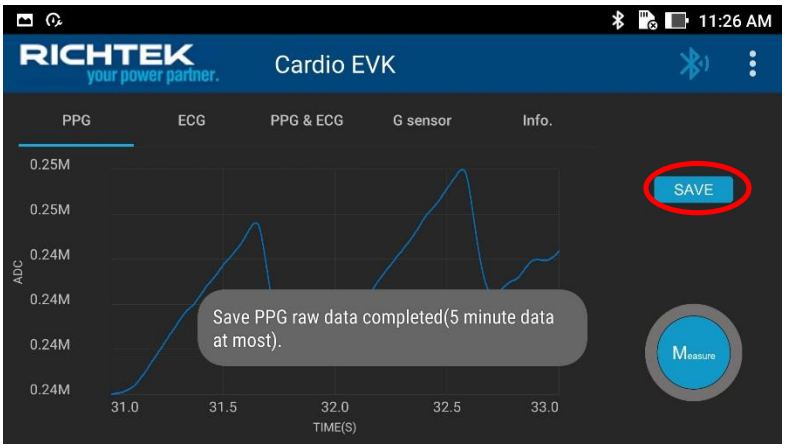


Info. : To obtain the FW version, battery and temperature value of the Cardioid Pad device, click “Info.” tab in the Cardio EVK first. Then the information of the Cardioid Pad device will be shown as below.

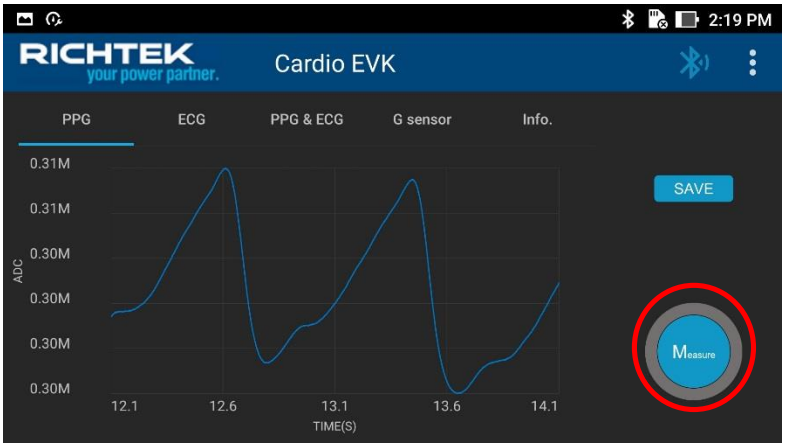


Data Logging / Measuring

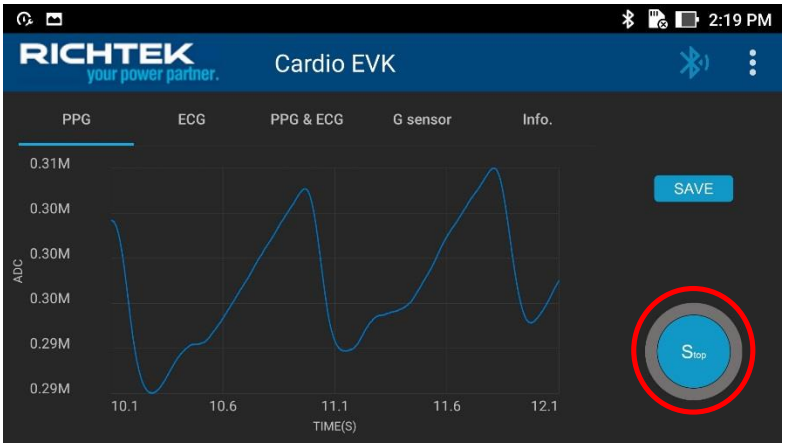
SAVE : To save logging data after stop acquire the data, click “SAVE” in the left-hand of the Cardio EVK screen that displays the waveforms. This will log and timestamp LED source, raw measuring data, and other device information into a csv file located in the phone’s main directory, entitled “rtk_cardio_ppg_DATE_TIME.csv”, “rtk_cardio_ecg_DATE_TIME.csv”, “rtk_cardio_ecgppg_DATE_TIME.csv” or “rtk_cardio_gs_DATE_TIME.csv”.



Measure : The “Measure” button is used to measure the PPG/ECG/PPG&ECG/G-sensor signal from Cardioid Pad device. During the data acquiring, the button will be changed to “Stop”

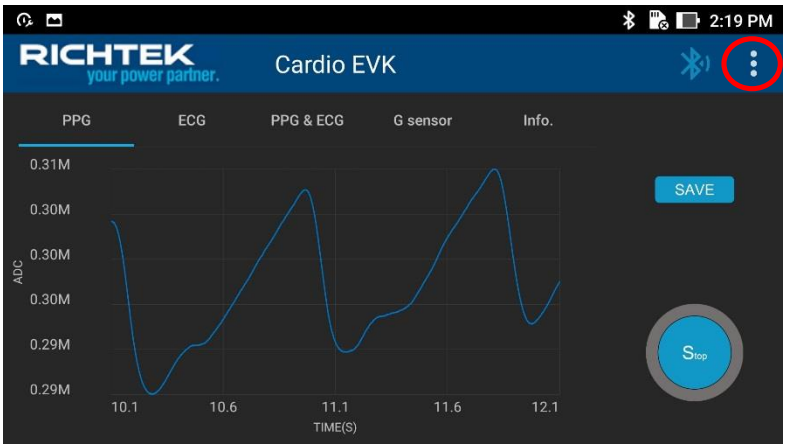


Stop : To stop acquire the data, click “STOP” in the left-hand of the Cardio EVK screen that is acquiring the data.

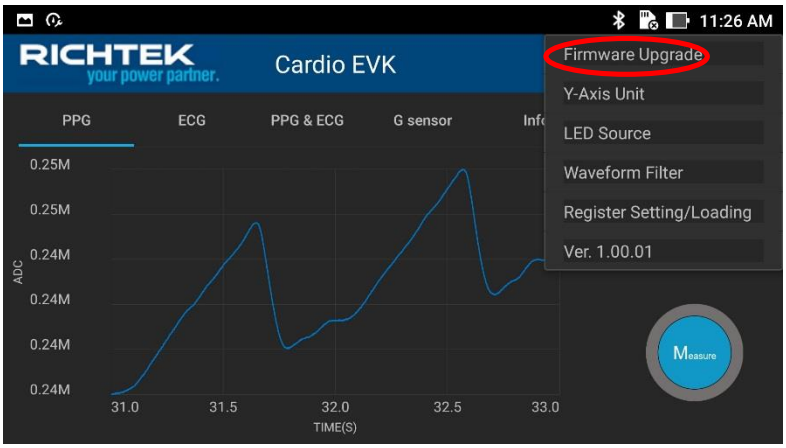


Configuration

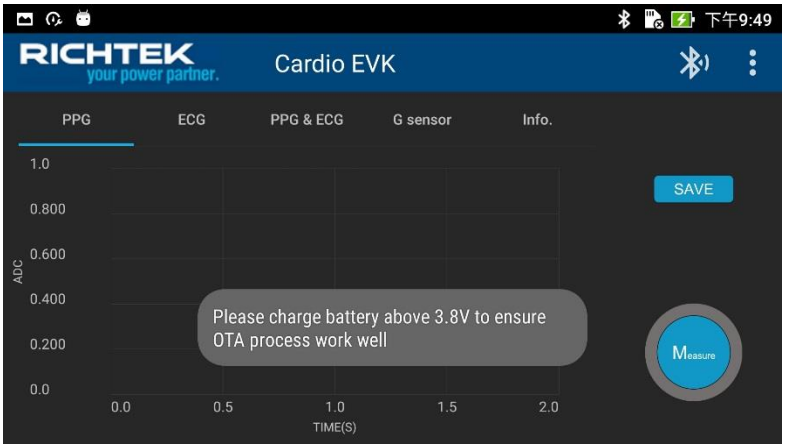
To configure the Cardioid Pad, click “More Icon” in the upper right-hand of the Cardio EVK screen.



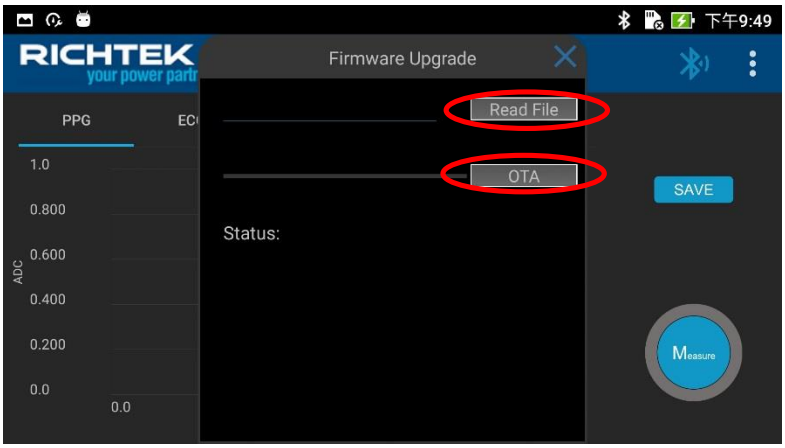
Firmware Upgrade : This function will update the firmware of the Cardioid Pad via the phone. Please find the latest firmware information from Richtek website. Please do not close the APP and Cardioid Pad during the update to avoid the update failure.



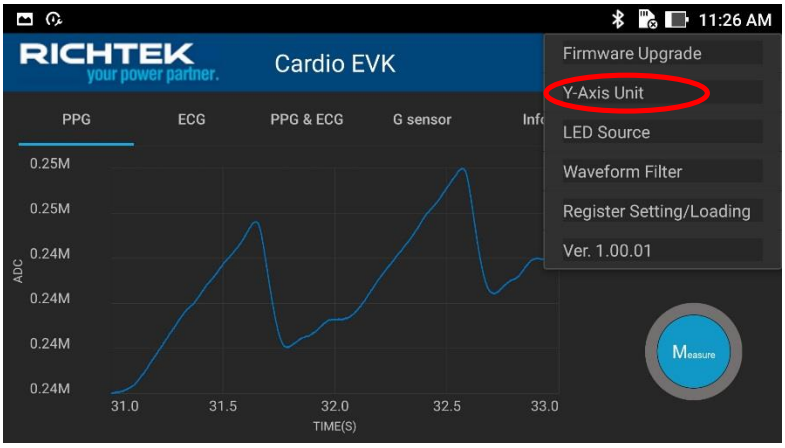
The battery voltage needs to be greater than 3.8V when FW upgrade.



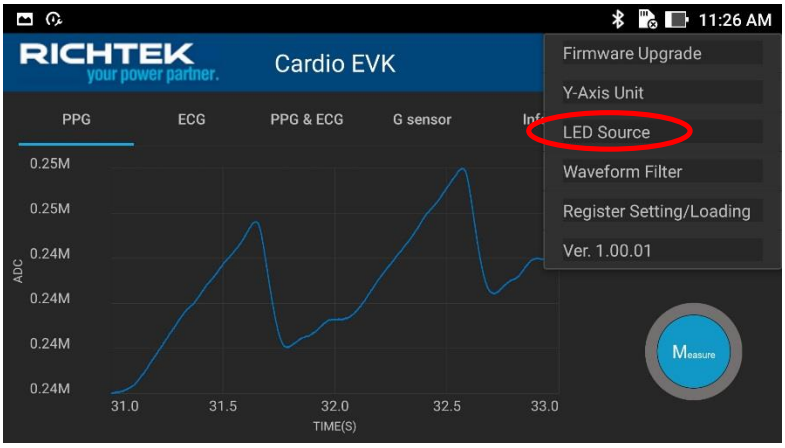
Download the firmware file to phone, pressing the "Firmware Upgrade" after connecting the Cardioid Pad, the pop-up menu will appear. Select the firmware file and pressing "OTA" button, Cardioid PAD will start upgrade Firmware.



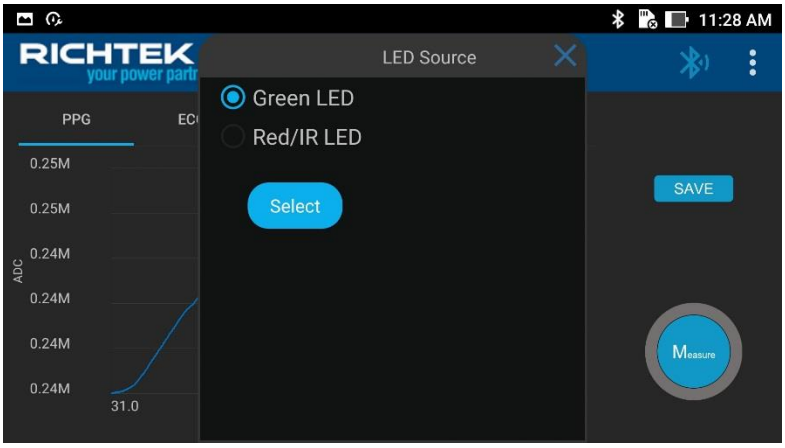
Y-Axis Unit : This function can use to switch the ADC raw code and Voltage or G values in the waveform display.



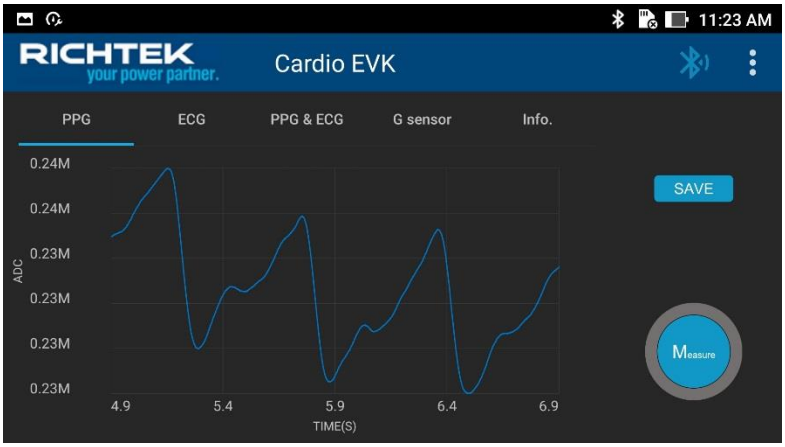
LED Source : Cardioid PAD provide the Green and the Red/IR LED sources for PPG measurement. This function can switch the LED source for PPG measurement.



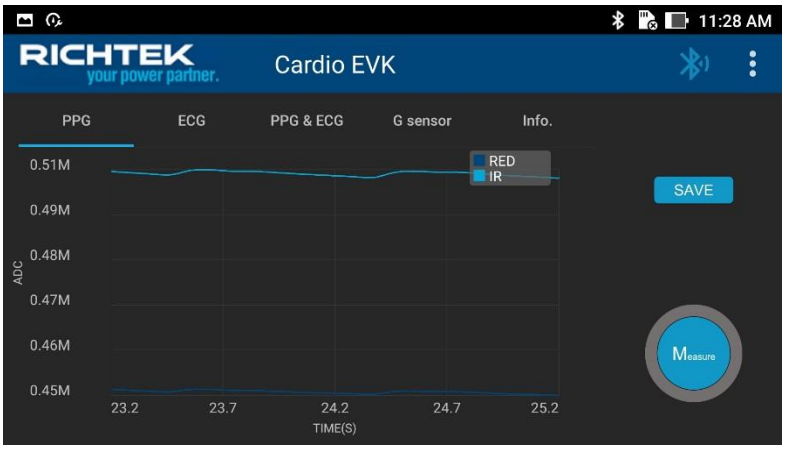
Pressing the “LED source”, the pop-up menu will appear. Select the respective LED source you would like to change and press the button. After pressing the “SELECT” button, the Cardioid PAD LED source will switch to corresponding LED automatically.



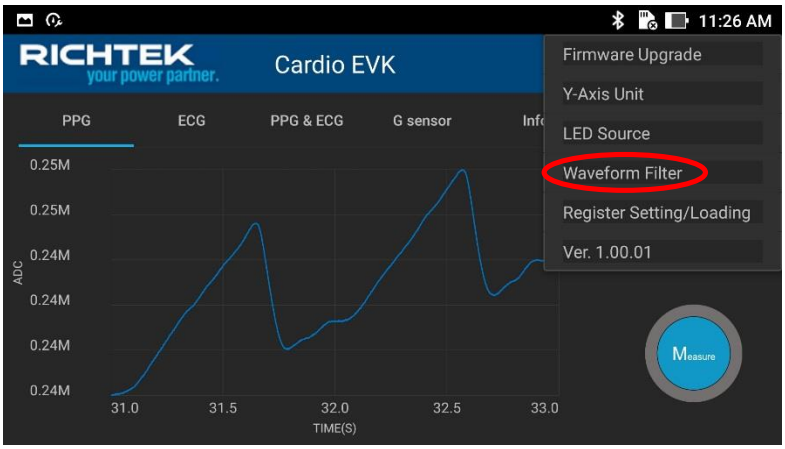
If the Green LED was selected, only one PPG data will display the waveform on PPG Tab.

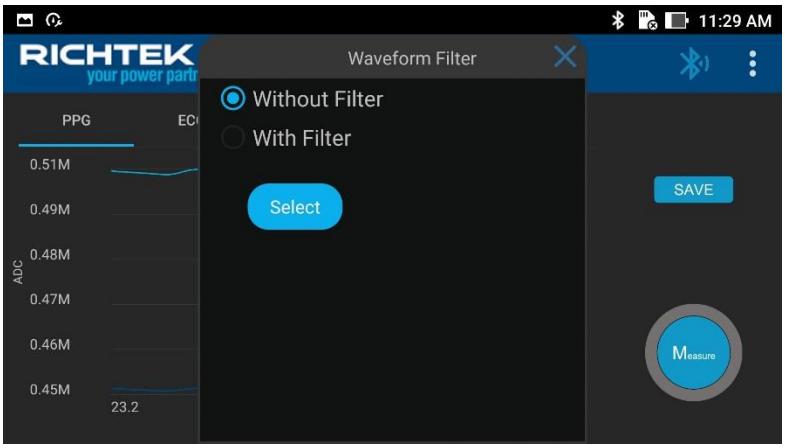


If the Red/IR LED was selected, two PPG data for both Red and IR LED will display the waveform on PPG Tab. (RED/IR LED method has different capability; i.e. SpO2 (Blood oxygen level))

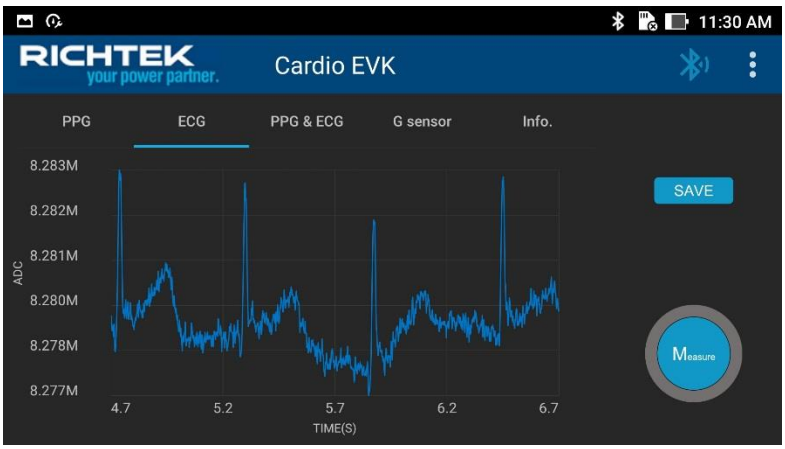


Waveform Filter : This function provides the smooth filter for the waveform. Pressing the “Waveform Filter”, the pop-up menu will appear. Select the “With Filter” and press the button, the display waveform will be filtered. Please note that the raw data without filter will be saved, if the “SAVE” button was pressed.

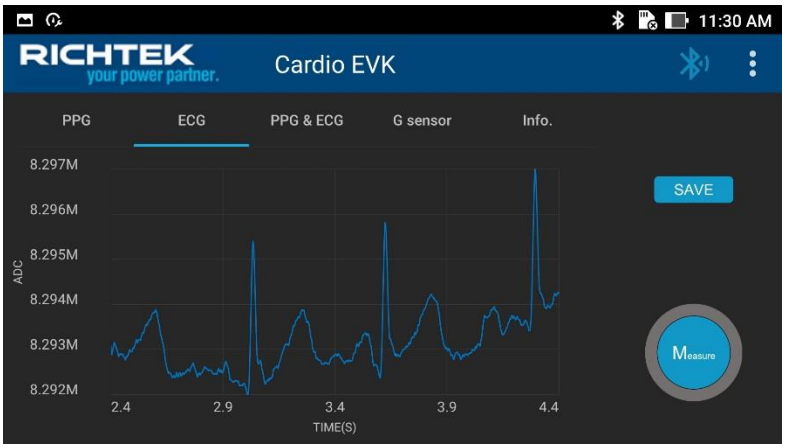




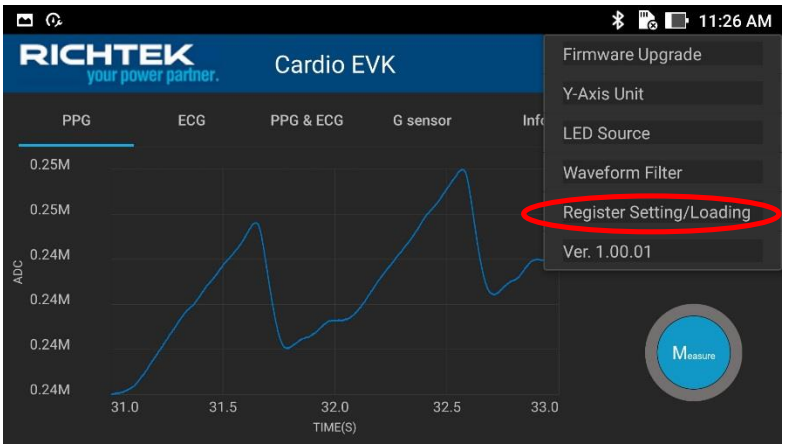
Measured ECG waveform without filter



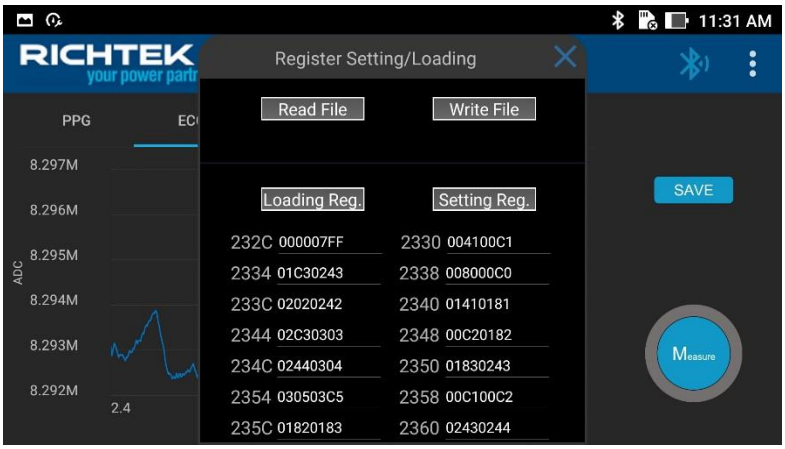
Measured ECG waveform with filter



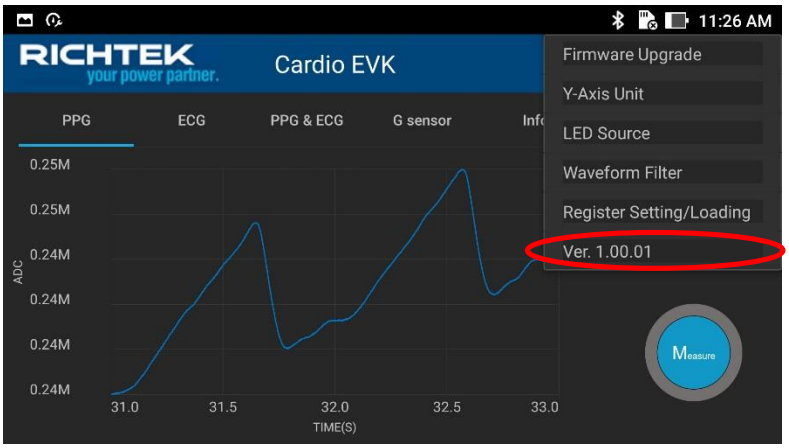
Register Setting/Loading : This function provides the RT1025 register setting and loading for the RT1025 tuning and evaluating. Pressing the “Register Setting/Loading”, the pop-up menu will appear.



Select the respective RT1025 register you would like to change and press the button. After pressing the “Setting Reg.” button, all of the RT1025 registers will switch to be updated automatically. This pop-up menu also can read or write all of the RT1025 register values from or to the file. Please allow a few seconds for the BLE handshake to update after pressing the “Loading Reg.” or “Setting Reg.”. All of the register setting also can be read or written to the file. This file will be located in the phone’s main directory, entitled “rtk_cardio_reg_DATE_TIME.rcg”.



Ve r: To obtain the APP version.



More Information

For more information, please find the related datasheet or application notes from Richtek website http://www.richtek.com.

Important Notice for Richtek Evaluation Board