

# FRDM-KW40Z Demo Application User's Guide

## 1. Introduction

This document describes the functionality and characteristics for the FRDM-KW40Z demo application. Demo functionality and usage with the smartphone application are explained here.

This document does not describe software APIs or architecture. Refer to FRDM-KW40Z Demo Software Reference Manual for that information.

## 2. Audience

This document is intended for anyone who wants to use the FRDM-KW40Z demo application and understand its features and characteristics.

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## 3. Demo Description

The FRDM-KW40Z demo application exposes all the available sensors and interfaces in the FRDM-KW40Z development board. It communicates with a smartphone application using Bluetooth Low Energy (BLE) where the user can control all the board features.

Every sensor/interface is represented as a different BLE service whose characteristics correspond to the proper measurements/controls. All the services and characteristics are graphically represented in the smartphone application.

The demo application features eight sensors/interfaces.

### 3.1. LED Control

LED Control allows the user to remotely turn on and off the on-board LEDs using the controls provided in the smartphone application.

### 3.2. Input Report

The Input Report displays on the smartphone screen the input events reported in the board. Every time a push button is clicked or a TSI is touched, the associated indicator turns on in the smartphone application.

### 3.3. Buzzer Control

Buzzer Control allows the user to remotely turn on and off the on-board buzzer using the controls provided in the smartphone application.

### 3.4. Chip Temperature

Chip Temperature reports the current on-chip temperature for the MKW40Z System on Chip (SoC). The temperature is reported at a fixed time interval and graphically represented on the smartphone application.

### 3.5. Potentiometer

The Potentiometer reports the current position for the FRDM-KW40Z on board potentiometer. The position is relative represented with a percentage from 0 to 100 that modifies a graphical item on the smartphone screen.

### 3.6. Accelerometer

The Accelerometer allows the user to read the on-board FXOS8700CQ sensor accelerometer data. A graph representing the X, Y, and Z accelerometer axis is displayed on screen and continuously

refreshed. Accelerometer sensitivity can be modified using the controls provided in the smartphone application for this purpose.

### **3.7. e-Compass**

The e-Compass shows the current magnetic north position of the board in degrees. The application obtains magnetometer data from the on-board FXOS8700CQ, calculates the magnetic north position, and reports it to the smartphone application to be displayed.

### **3.8. Remote Controller**

The Remote Controller allows the user to select a TV brand to control and command it using the buttons on the smartphone screen. The Infra-Red LED included in the FRDM-KW40Z board translates these commands to signals that can be interpreted by the selected TV.

## 4. Using the Demo

This chapter explains how to configure the demo components and use the smartphone application to connect with the FRMD-KW40Z board.

### 4.1. Jumper configuration

[Table 1](#) shows the jumper configuration that must be set in the board before starting using the demo.

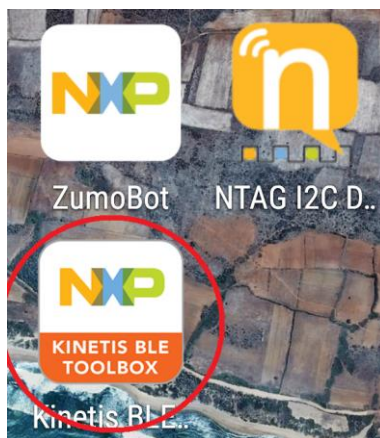
**Table 1. Jumper configuration**

Jumper	Default position	Position for demo
J8	1-2	1-2
J15	1-2	1-2
J16	3-4	1-2
J17	3-4	3-4
J18	2-4	1-2
J19	OPEN	OPEN
J20	1-2	1-2
J21	1-2	1-2
J22	3-5	1-3, 2-4, 5-6
J23	1-2	1-2
J24	1-2	1-2
J27	1-2	1-2
J28	1-2	1-2
J29	1-2	1-2
J30	1-2	1-2
J31	1-2	1-2
J33	1-2	1-2
J34	1-2	1-2

### 4.2. Connecting with the application

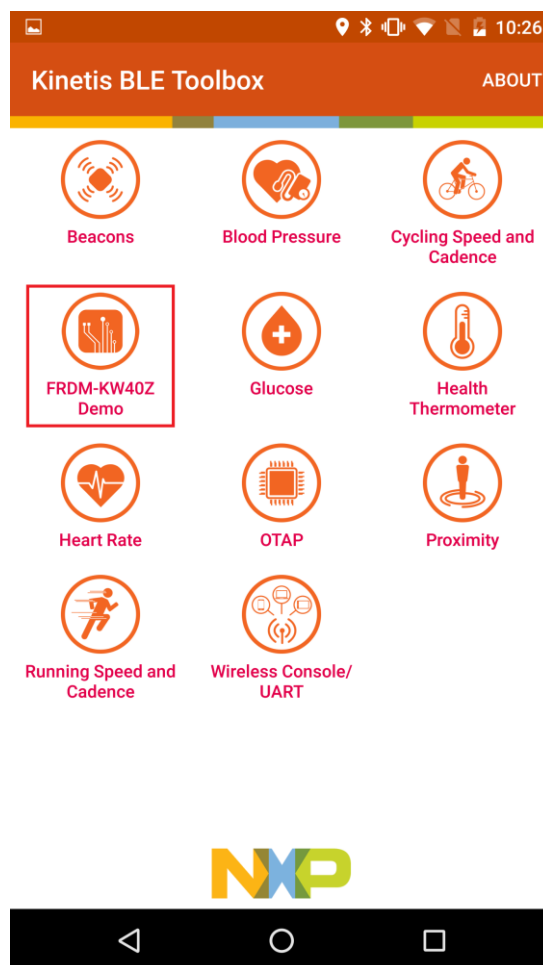
The FRDM-KW40Z demo communicates with smartphones enabled with BLE and which have the Kinetis BLE Toolbox application installed. Make sure that both requirements are supported before attempting to connect with the demo.

Enable the Bluetooth module on your smartphone. Check on your smartphone's operating system manual on how to do this. Click the Kinetis BLE Toolbox icon (as shown in [Figure 1](#)) to open the application.



**Figure 1. Kinetis BLE Toolbox icon**

In the application screen, locate the FRDM-KW40Z Demo icon and click it.



**Figure 2. Application icon**

The device selection screen will appear.

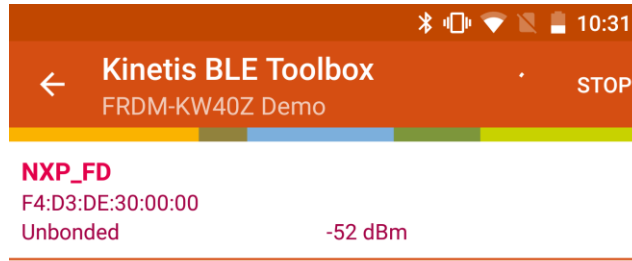
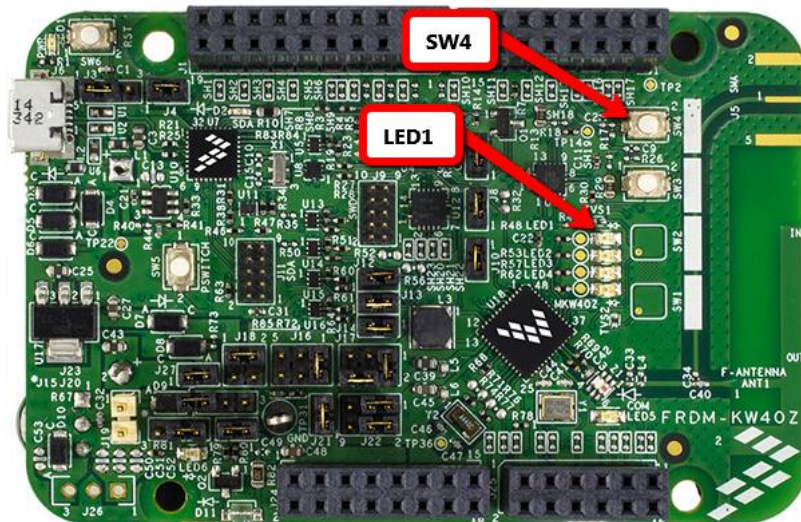


Figure 3. Device selection screen

Click SW4 on the FRDM-KW40Z board to start advertising. LED1 will start blinking, indicating advertising has started. Look for the device named “FRDM-KW40Z\_Demo” and click it to start a connection. LED1 will remain on indicating that the connection has been established.



**Figure 4. SW4 and LED1 location in board**

After the device has successfully connected, a screen with a list of all the available sensors and controllers will show up in the smartphone.

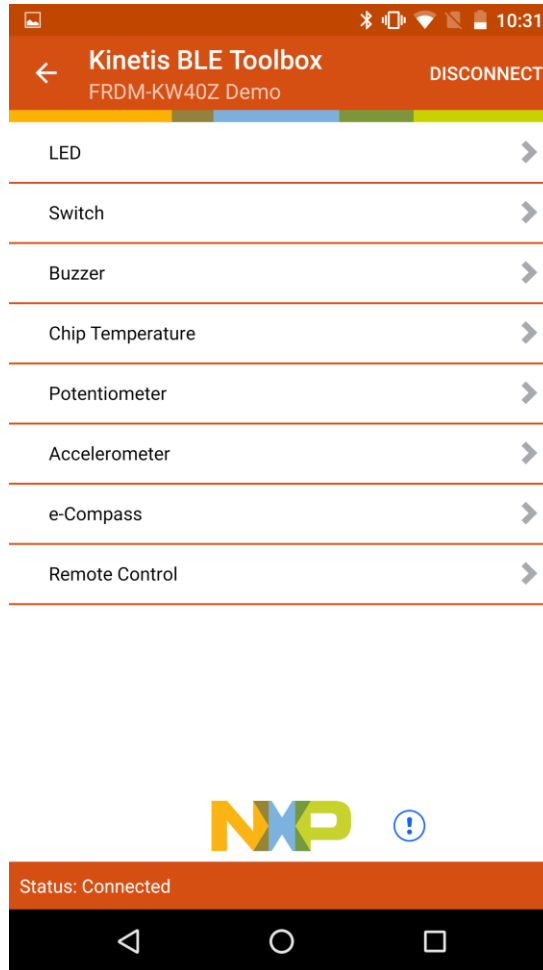


Figure 5. List of available sensors

### 4.3. LED Controller

The LED Controller application will open after clicking the LED Controller element in the sensors and controllers list. A total of three virtual switches will appear on the smartphone screen (as shown in [Figure 6](#)), one per controllable LED in the FRDM-KW40Z board. The LEDs that can be controlled using this application are LED2, LED3, and LED4. LED1 is reserved to indicate the connection status of the board.

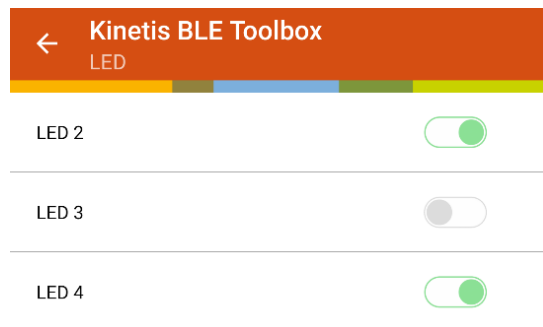


Figure 6. LED Controller screen



Changing a switch's position from on to off determines the LEDs' status. Moving a switch to the on position will cause the respective LED to turn on. Moving a switch to the off position will cause the respective LED to turn off.

## 4.4. Input Report

The Input Report application will open after clicking the Input Report element in the sensors and controllers list. A total of three indicators will appear on the smartphone screen (as shown in [Figure 7](#)), one per switch in the FRDM-KW40Z board. The switches that can be sensed using this application are SW1, SW2, and SW3. SW4 is reserved to command the demo for moving among the connection states (advertise – disconnect).



**Figure 7. Input Report screen**

Clicking SW1, SW2, or SW3 turns on and off the indicators in the smartphone application.

## 4.5. Buzzer

The Buzzer application will open after selecting the Buzzer element in the sensors and controllers list. A button represented with a buzzer icon will appear in the center of the screen. By clicking it, the buzzer included in the FRDM-KW40Z board will turn on and off.

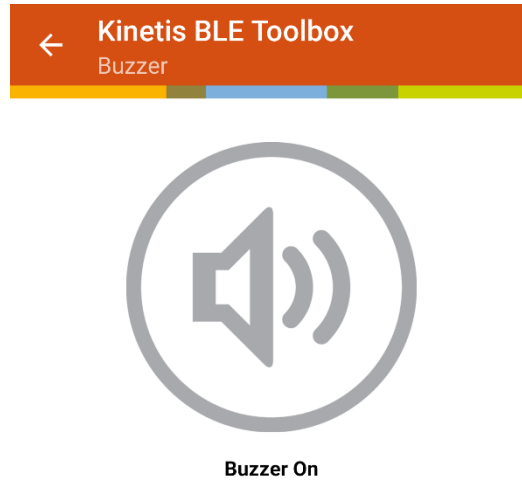


Figure 8. Buzzer screen

## 4.6. Chip Temperature

The Chip Temperature application will open after selecting the Chip Temperature element in the sensors and controllers list. A virtual thermometer will appear in the center of the screen and will automatically update every 2 – 3 seconds with the current chip temperature.

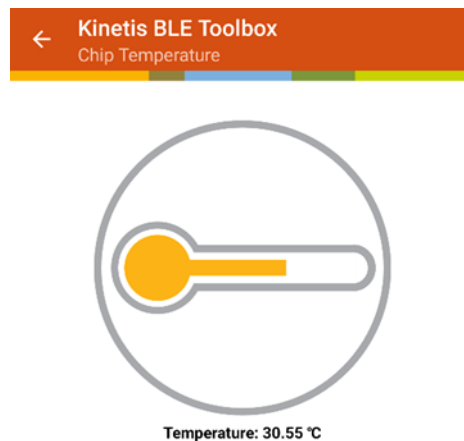


Figure 9. Chip Temperature screen

## 4.7. Potentiometer

The Potentiometer application will open after clicking the Potentiometer element in the sensors and controllers list. A virtual gauge indicator will appear in the center of the screen indicating the relative position of the potentiometer in a range from 0 % to 100 %. The virtual gauge will automatically update every time the position of the potentiometer embedded in the FRDM-KW40Z board changes.

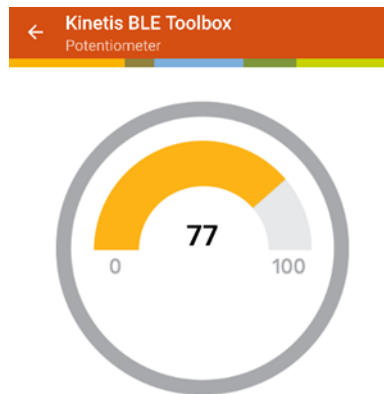


Figure 10. Potentiometer screen

## 4.8. Accelerometer

The Accelerometer application will open after clicking the Accelerometer element in the sensors and controllers list.

The main screen is composed of two elements; a button on the top of the screen that enables or disables the accelerometer data acquisition, and a graph in the center of the screen that shows the real time values of the accelerometer x, y, and z axis.

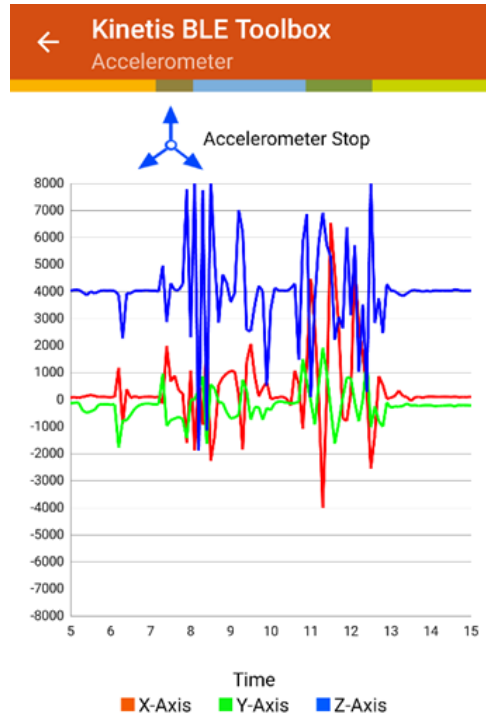


Figure 11. Accelerometer main screen

After enabling the accelerometer readings by clicking the Enable button, real time graphics for the x, y, and z axis will show up in the screen. Moving the FRDM-KW40Z board in any direction will cause these values to change. To stop the accelerometer readings, the user must click the Enable button again or return to the sensors and controllers list screen.



Figure 12. Accelerometer Start/Stop buttons

## 4.9. e-Compass

The e-Compass application will open after clicking the e-Compass element in the sensors and controllers list.

The main screen is composed of two elements; a button in the top of the screen that enables or disables the e-Compass, and a virtual compass that points to the earth's magnetic north.

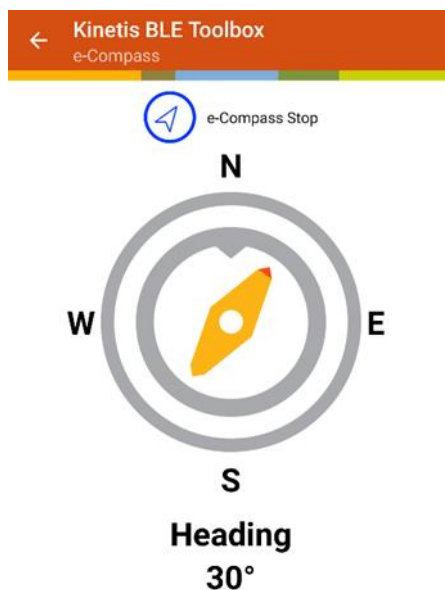


Figure 13. e-Compass screen

Clicking the button in the top of the screen will start the e-Compass and the virtual compass will rotate pointing to the FRDM-KW40Z board's position relative to the earth's magnetic north. Rotating the FRDM-KW40Z board will cause the virtual compass to move accordingly. Clicking the start/stop button again will cause the e-Compass to stop.

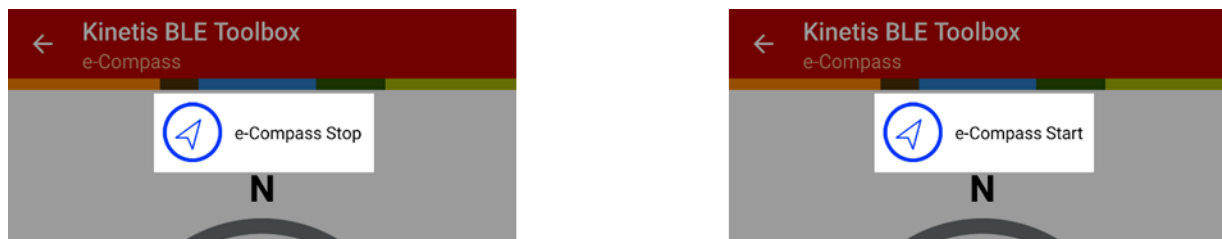


Figure 14. e-Compass start/stop buttons

## 4.10. Remote Controller

The Remote Controller application will open after clicking the Remote Controller element in the sensors and controllers list. The Remote Controller application emulates a commercial TV remote controller and includes the following buttons:

- Power on/off
- Mute
- Volume +/-
- Channel +/-

Figure 15 shows the application's main screen. In the bottom of the screen a brand selector allows the user to define the brand of the TV that will be controlled. The user must pick the correct TV brand before attempting to use the demo.

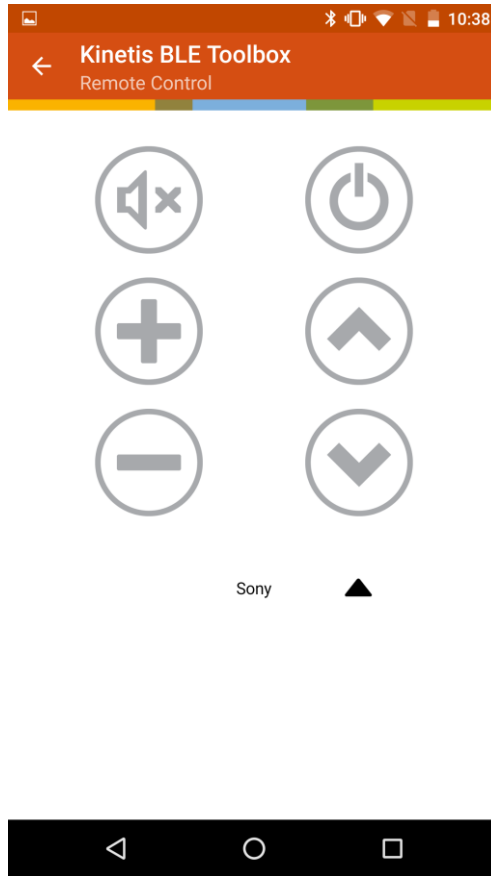


Figure 15. Remote controller screen

The FRDM-KW40Z board must be positioned so that the Infra-Red LED (D11) faces the front side of the TV that is to be controlled (as shown in the following figure).

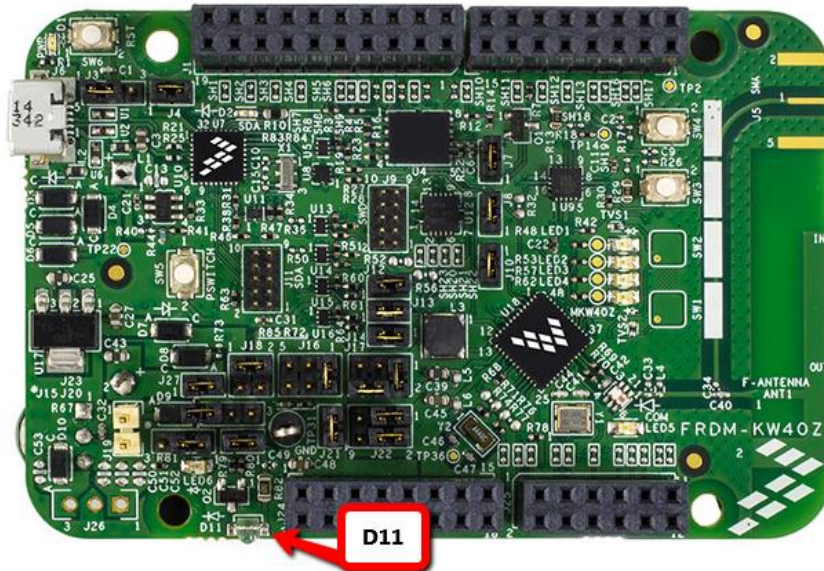


Figure 16. D11 location in the board

Clicking the screen buttons causes the TV to be controlled as if a typical remote controller is being used. Clicking the power button causes the TV to turn on and off. The mute button mutes the TV and the Volume and Channel buttons change the TV volume and channels.

## 4.11. Disconnecting from the application

Demo can be disconnected from the smartphone application in two ways.

1. Clicking SW4 in the FRDM-KW40Z board causes the connection to be terminated immediately (Figure 4).
2. Clicking the Disconnect button at the top of the smartphone screen causes the connection to be terminated by the application, as shown in the following figure:



Figure 17. Disconnect button

## 5. Revision History

Table 2. Revision history

Revision number	Date	Substantive changes
0	09/2016	Initial release



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