Health Monitoring Demo for iCE40 Ultra™ Wearable Development Platform User Guide

UG103 Version 1.0, September 2015

Demo Setup

Hardware Requirements

- iCE40 Ultra™ Wearable Development Platform
- Android smart phone with Android 4.3 or 4.4
  Note: Current design may not function correctly on Android 5.0.
- Windows PC or Linux machine for downloading the bit stream
- USB cable for programming the device

Software Requirements

- Lattice Diamond® Programmer software 3.3 or higher
- Android apk file *Health_Demo.apk*
- MachXO2™ device bitstream file *p2dsi.jed*
- iCE40 Ultra device bitstream file *wearable_health.bin*

Figure 1. Demo Setup

Smartphone with
Android 4.3 or higher

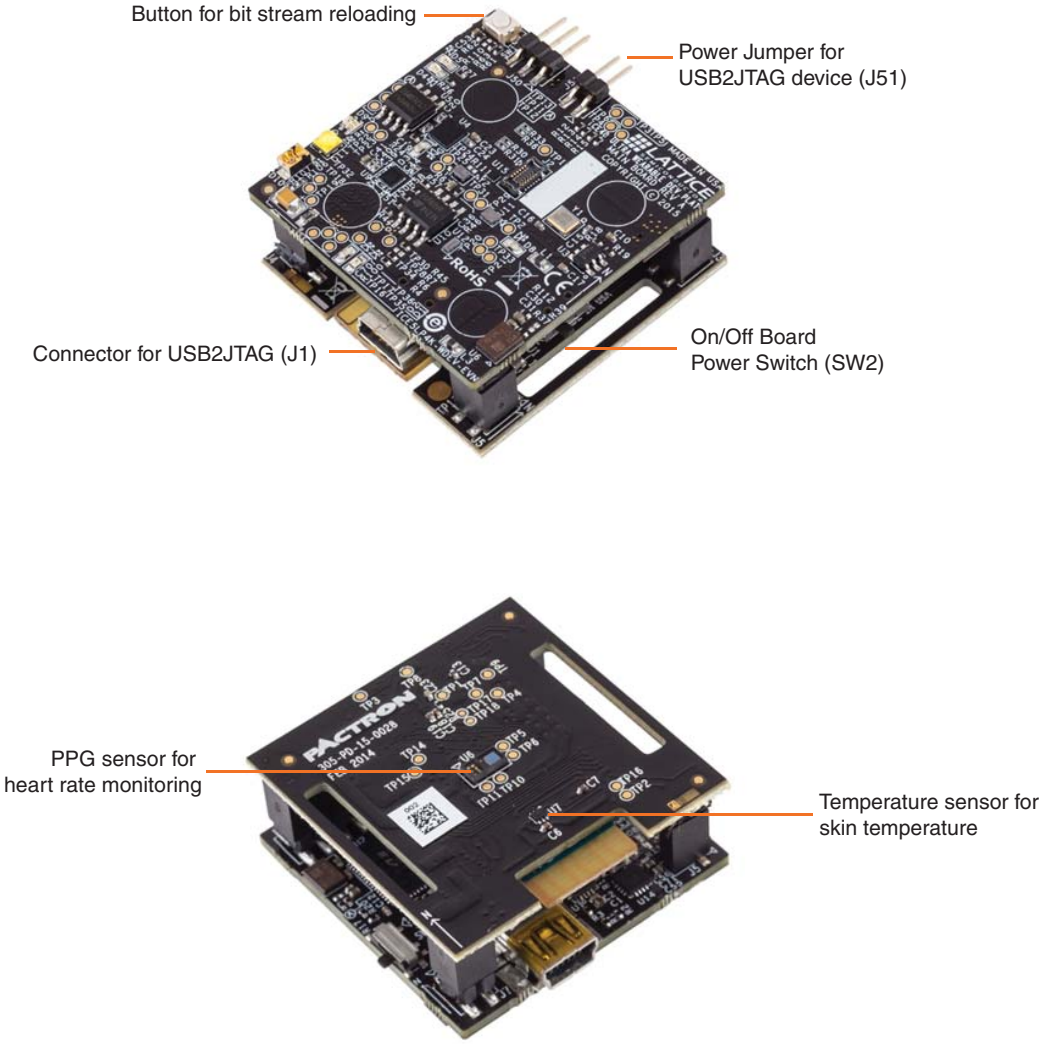
iCE40 Ultra Wearable
Development Platform

Jumper Settings for iCE40 Ultra Wearable Development Platform

Connect the USB2JTAG Power Jumper (J51) for FTDI device. For more information about the board, see EB100, iCE40 Ultra Wearable Development Platform User Guide.

Wearable Board Details

Figure 2. Wearable Board Details

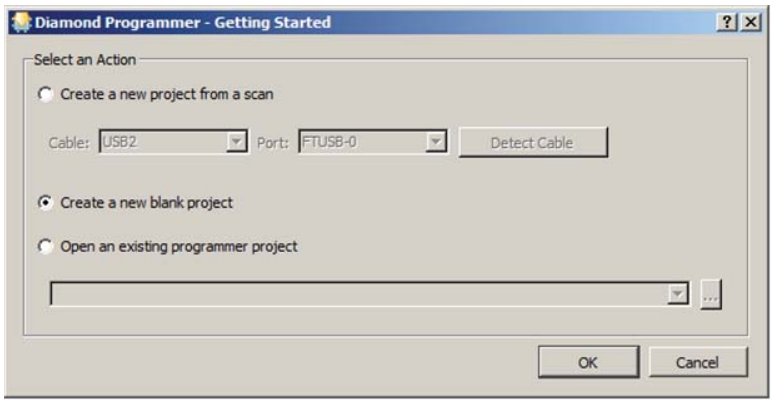


Flashing Bitmaps to Wearable Board

To flash bitmaps to wearable board:

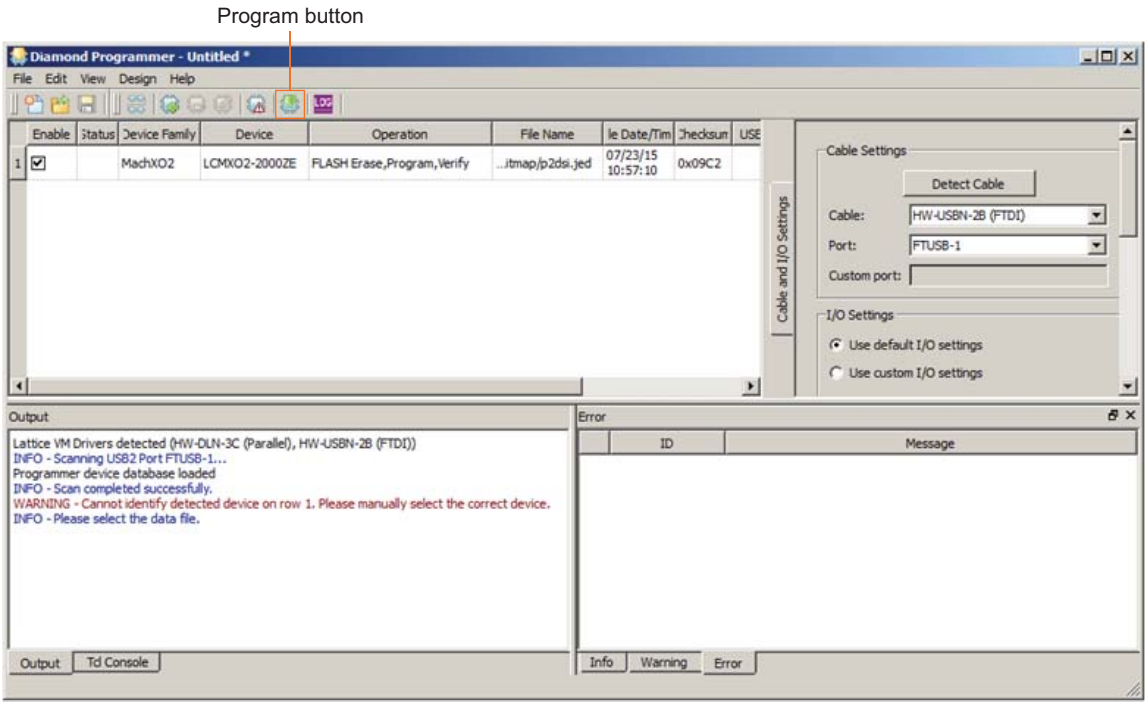
1. Connect jumper J51 to power on USB2JTAG device.
2. Connect the wearable board to the PC through the USB mini socket (see EB100, iCE40 Ultra Wearable Development Platform User Guide).
3. Power on the board using the Power Switch (see EB100, iCE40 Ultra Wearable Development Platform User Guide).
4. Start Diamond Programmer.
5. In the Getting Started dialog box, select **Create a new blank project** and click **OK**. This opens the main interface of Diamond Programmer.

Figure 3. Getting Started Dialog Box



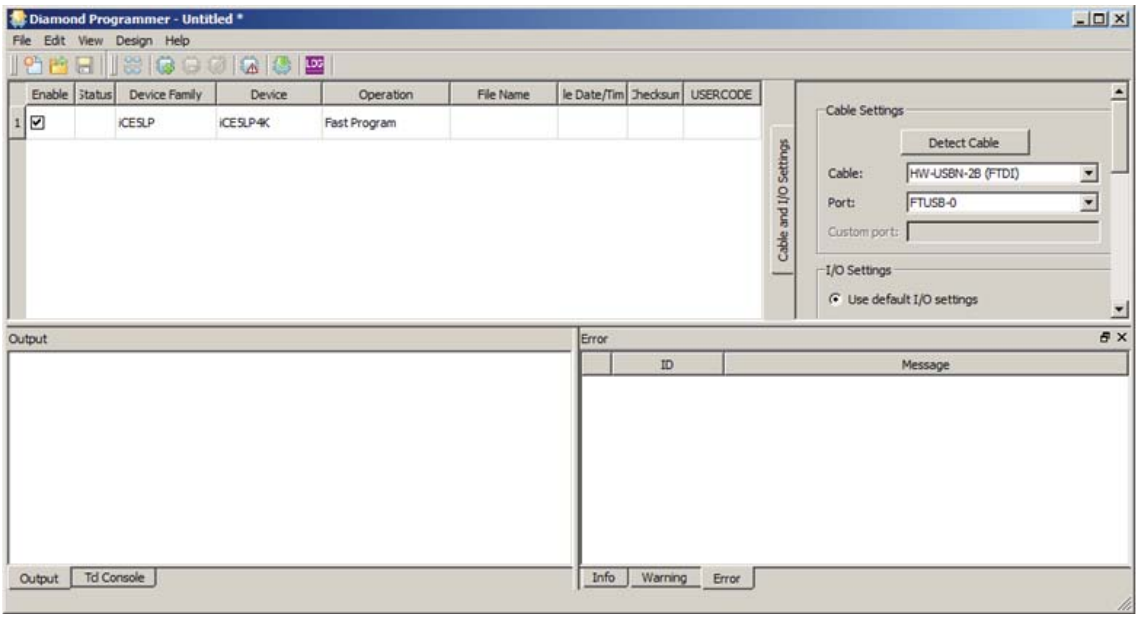
6. In the main interface, select the following options as shown in Figure 4.
   — Device Family: **MachXO2**
   — Device: **LCMXO2-2000ZE**
   — Cable: **HW-USBN-2B (FTDI)**
   — Port: **FTUSB-1**
   — File Name: **/Health/bitmap/p2dsi.jed**
7. Click the **Program** button to flash MachXO2 and check Status.

Figure 4. Program Button



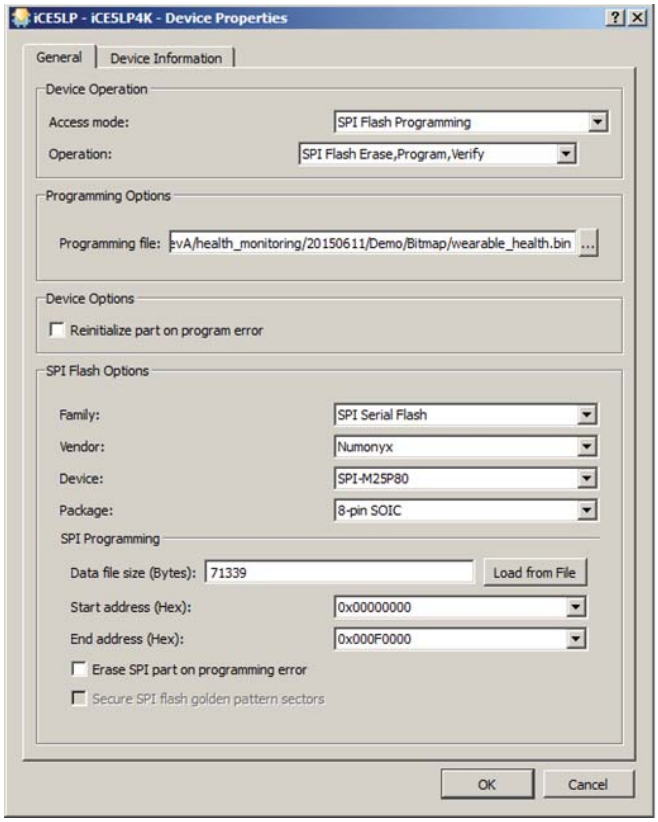
8. After programing MachXO2, select the following options as shown in Figure 5:
   — Device Family: **iCE5LP**
   — Device: **iCE5LP4K**
   — Cable: **HW-USBN-2B (FTDI)**
   — Port: **FTUSB-0**.

Figure 5. Programming the iCE40 Ultra Device



9. Double-click on a blank area in Operation to open the Device Properties dialog box.

Figure 6. Device Properties



10. Configure the settings as shown in Figure 6.
11. Select the program file **/Health/bitmap/wearable_health.bin**. Then click **OK**.
12. Click the **Program** button to flash the iCE40 device and check Status.

Installing Health_Demo.apk to Android Phone

To install Health_Demo.apk to Android:

1. In the Android phone, go to **Settings > Security > Unknown sources** to allow the installation of the APK directly to the Android phone.
2. Connect the Android phone with the PC and make sure the driver is ok.
3. There are two methods to install the application.
   — Open a Windows command line tool and change the directory to /Health/apk/. Install the application by using the command below.

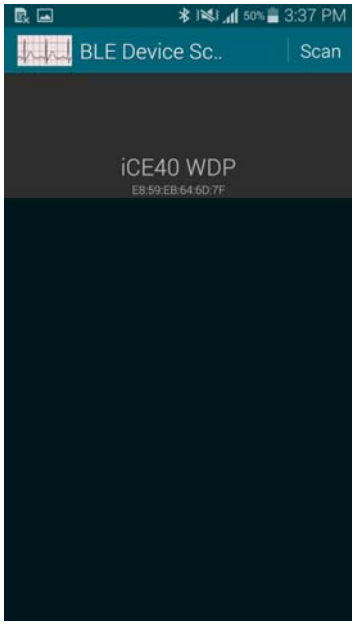
     ```
     adb install Health_Demo.apk
     ```

   — Go to the /Health/apk/ directory. Copy the Health_Demo.apk into the phone, and then install it on the phone.
4. Deselect the **Unknown sources** option.

Connecting the iCE40 Ultra Wearable Board to the Android Phone

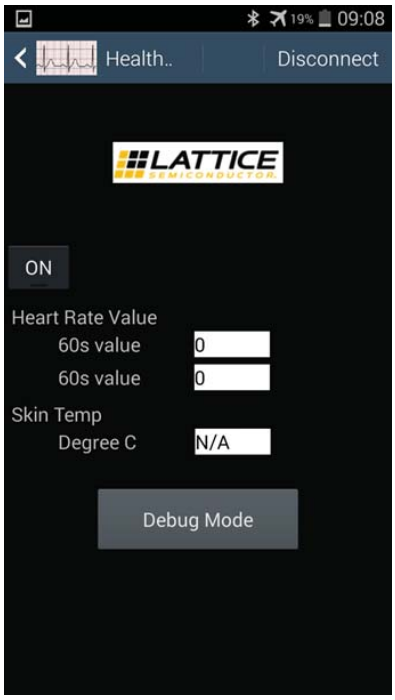
1. Power on the board using the Power Switch (see EB100, iCE40 Ultra Wearable Development Platform User Guide).
2. Enable Bluetooth on the Android phone.
3. Go to the Apps menu and click the **Health Monitor** icon to open the installed application.
4. Click the **Scan** button on the top right of the screen. An iCE40 Ultra BLE device is detected.

Figure 7. BLE Device Scan



5. Click **iCE40 WDP** to connect the iCE40 Ultra Wearable Development Platform and open the demo interface.

Figure 8. Health Monitor Device Connected



6. In Figure 8, if the top right text box displays Connect, it means that the device has been disconnected. Click **Connect** or click the **Back arrow** on the top left corner to reconnect the device.

Demo Procedure

Follow all the steps mentioned above so that the wearable board and the phone are ready with necessary bitmap and application respectively. The demo application also should be connected to the board via BLE.

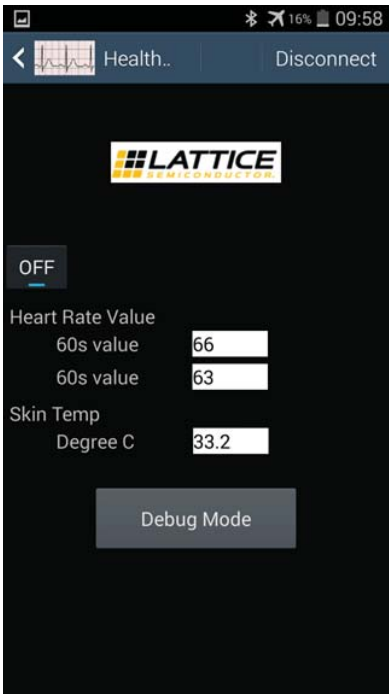
Strap the wearable board on the wrist to ensure accurate monitoring.

To run the demo:

1. On the main interface, the heart rate has two text boxes for displaying different calculation results. The first one is an instantaneous value that updates every 20 seconds. The second one is an average value that updates every minute.

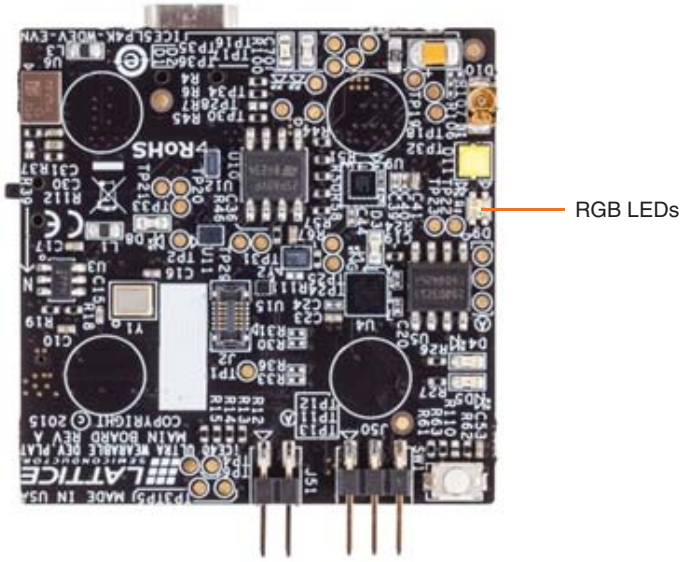
   The skin temperature text box is below the heart rate text boxes and its value updates every second. Click the **ON** button to start the monitoring. The skin temperature result is displayed in one second. The instantaneous heart rate value is displayed in 20 seconds and the average value is displayed in 1 minute.

Figure 9. Heart Rate and Temperature Monitoring



2. As shown in Figure 10, on the wearable board, RGB LEDs provide the heart rate monitoring status. The green LED blinks every second when the heart rate monitoring is disabled. The blue LED blinks based on the heart rate detection result. It lights for 300 ms after one heart rate is detected.

Figure 10. RGB LEDs



Technical Support Assistance

Submit a technical support case through www.latticesemi.com/techsupport.

Revision History

Date	Version	Change Summary
September 2015	1.0	Initial release.