Chipsmall

Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Remote Control
Demonstration Board

User's Guide

Note the following details of the code protection feature on Microchip devices:

• Microchip products meet the specification contained in their particular Microchip Data Sheet.

• Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.

• There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.

• Microchip is willing to work with the customer who is concerned about the integrity of their code.

• Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Trademarks

The Microchip name and logo, the Microchip logo, dsPIC, KEELOQ, KEELOQ logo, MPLAB, PIC, PICmicro, PICSTART, PIC^{32} logo, rfPIC and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

FilterLab, Hampshire, HI-TECH C, Linear Active Thermistor, MXDEV, MXLAB, SEEVAL and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, Application Maestro, chipKIT, chipKIT logo, CodeGuard, dsPICDEM, dsPICDEM.net, dsPICworks, dsSPEAK, ECAN, ECONOMONITOR, FanSense, HI-TIDE, In-Circuit Serial Programming, ICSP, Mindi, MiWi, MPASM, MPLAB Certified logo, MPLIB, MPLINK, mTouch, Omniscient Code Generation, PICC, PICC-18, PICDEM, PICDEM.net, PICkit, PICtail, REAL ICE, rfLAB, Select Mode, Total Endurance, TSHARC, UniWinDriver, WiperLock and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

All other trademarks mentioned herein are property of their respective companies.

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

QUALITY MANAGEMENT SYSTEM

CERTIFIED BY DNV

═ ISO/TS 16949 ═

Chapter 1. Introducing the Remote Control Demonstration Board

Thank you for purchasing the Remote Control Demo Board.

RF-based remote controls are gaining popularity for two reasons: two way communication, and the non-requirement of line-of-sight communication. Within RF medium, the RF4CE protocol is gaining popularity as a wireless protocol for consumer electronics. The radio used for the remote control is the MRF24J40MA, 2.4GHz IEEE 802.15.4 transceiver.

A high-end remote control typically has a graphics display, a number of keys or switches and a radio to communicate with the target devices. This remote control demonstrates an integrated solution of Microchip's Graphics Library, mTouch™ Solution Library, USB Library and RF4CE Protocol running on one 16-bit microcontroller.

1.1 HIGHLIGHTS

This chapter introduces the Remote Control Demo Board and provides an overview of its features.

1.2 WHAT'S INCLUDED

The Remote Control Demo Board can be purchased separately (DM240315), or as a kit with the ZENA™ Wireless Adapter (DM240315-2). Both options come with a mini USB-B cable for powering the board.

FIGURE 1-1:   REMOTE CONTROL DEMO BOARD

Remote Control Demo Board with ZENA™ Wireless Adapter (Part # DM240315-2)
Remote Control Demo Board without ZENA™ Wireless Adapter (Part # DM240315)
ZENA™ Wireless Adapter without Remote Control Demo Board (Part # AC182015-1)

1.3   REFERENCE DOCUMENTS

In addition to the content of the User's Guide, the following documents are also available from Microchip to support the use of the Remote Control Demo Board:

• *PIC24FJ256DA210 Data Sheet* (DS39969)

• *2K SPI Bus Serial EEPROM with EUI-48™ Node Identity* (DS22123B)

• *MRF24J40MA/MB PICtail™/PICtail Plus Daughter Board User's Guide* (DS51867A)

• *Microchip's ZigBee® RF4CE Protocol Stack* (DS01314A)

You can obtain these reference documents by downloading them from the Microchip web site (www.microchip.com).

Chapter 2. Getting Started

2.1   INTRODUCTION

The Remote Control Demo Board is preprogrammed with the complete firmware to demonstrate all remote control commands. In order to explore this software and the interface between the controller and the target of the ZENA Wireless Adapter, you will need to install software and pair the remote to the target. This section describes the basic features of the hardware included, and provides instructions for how to pair the Remote Control Demo Board and the ZENA Wireless Adapter.

2.2   HIGHLIGHTS

This chapter covers the following topics:

- Hardware Overview
- Installing the Software
- Running the Wireless Remote Control Utility
- Powering the Device and Running the Demo Program

Remote Control Demonstration Board User's Guide

2.3 HARDWARE OVERVIEW

The Remote Control Demo Board has a 3.5" QVGA display with a resistive touch screen in portrait mode, 11 mTouch Solution Capacitive Touch keys, five-way joy stick and a MRF24J40MA transceiver. A PIC24FJ256DA210 controls these features (**Section Figure 2-1: "Remote Control Demo Board"**).

FIGURE 2-1:   REMOTE CONTROL DEMO BOARD

Front View   Back View
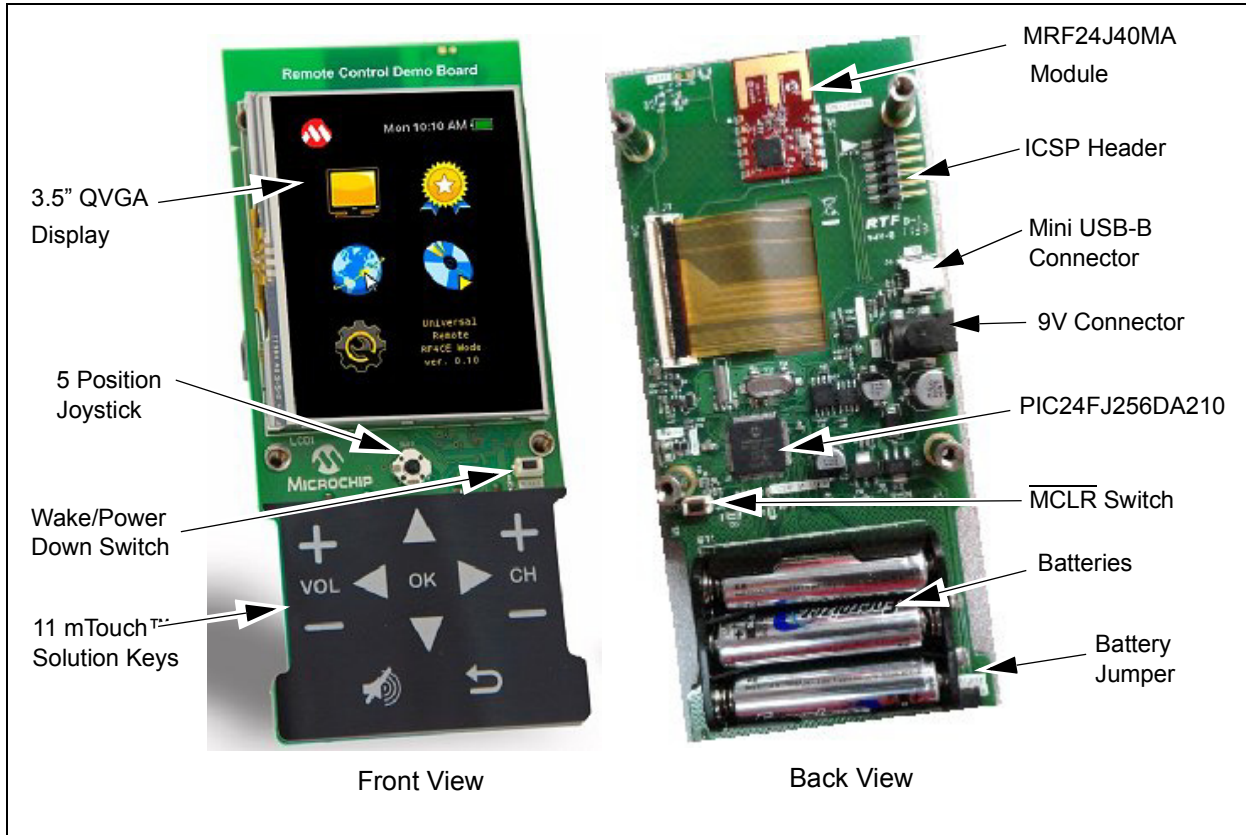
The Remote Control Demo Board is shipped preprogrammed with the code, the display images on the external Flash and the ZENA Wireless Adapter (Figure 2-2), paired with the remote control (if both were shipped together as a kit).

FIGURE 2-2:   ZENA™ WIRELESS ADAPTER 2.4 GHZ MRF24J40

2.4   INSTALLING THE SOFTWARE

In order for the Remote Control Demo Board and the ZENA Wireless Adapter to communicate, drivers must be installed on the computer connected to the ZENA Wireless Adapter. The following instructions provide for the correct installation of all required drivers.

In order to install the necessary USB Drivers for the Wireless Remote Control Utility (WRCU), the Microchip Application Libraries (MLA) (www.microchip.com/mla, version 2012-02-15 or later) must be installed.

2.4.1   Installing the USB Drivers for the Wireless Remote Control Utility (WRCU)

Once the MLA is downloaded, install the USB Drivers for the Wireless Remote Control Utility (WRCU) by running the Microchip Application Libraries Installer. This process automatically installs the .inf files required for the WRCU Utility.

2.5 RUNNING THE WIRELESS REMOTE CONTROL UTILITY

The Wireless Remote Control Utility (WRCU) is used to display messages received from the Remote Control Demo Board. The WRCU is included with the MLA and can be found at <installation dir>\Combo\Remote Control\PC Software. Open the jar file. Windows users may need to double click **launch_wireless_rc_utility.bat** to launch the WRCU.

The WRCU is written in JAVA and will only work if a Java Runtime Engine (JRE) is installed.

> **Note:** The target PC must have Java Runtime Engine (JRE) installed. The recommended version at the time of this release is JRE v1.6. For 32-bit machines, install JRE 32-bit. For 64-bit machines, install JRE-64-bit. To determine the version of your JRE, at a command or terminal prompt, type **java -version** and press ENTER. The JRE can be downloaded from http://www.oracle.com/technetwork/java/javase/downloads/index.html.

The WRCU uses the ZENA Wireless Adapter for wireless communication. Communication between this utility and the ZENA Wireless Adapter is done using drivers installed by the MLA installer. Therefore, copying and transferring this program by itself to another PC may not operate correctly.

The ZENA wireless adapter can be used with many different applications. It has a bootloader, and when switching to be used with a different application, the application can upload different firmware to the adapter. Please note that after the WRCU performs a firmware upload, the original software will not be able to be recovered by the WRCU, and will need to be uploaded again by another utility such as, but not limited to, Microchip's Wireless Development Studio.

2.6 POWERING THE DEVICE AND RUNNING THE DEMO PROGRAM

The remote controller will automatically begin running the demo program when power is connected to either the 9V supply, the USB port or 3 AAA batteries via J3. Only one power source should be connected to the Remote Control Demo Board. With the Remote Control Demo Board and the ZENA Wireless Adapter paired, the GUI will respond correctly to the user input. For more information on the demo program, refer to **Chapter 3. "Remote Control Demonstration Board Tutorial"**.

> **Note:** The 9V power supply Microchip Part Number is AC002014.

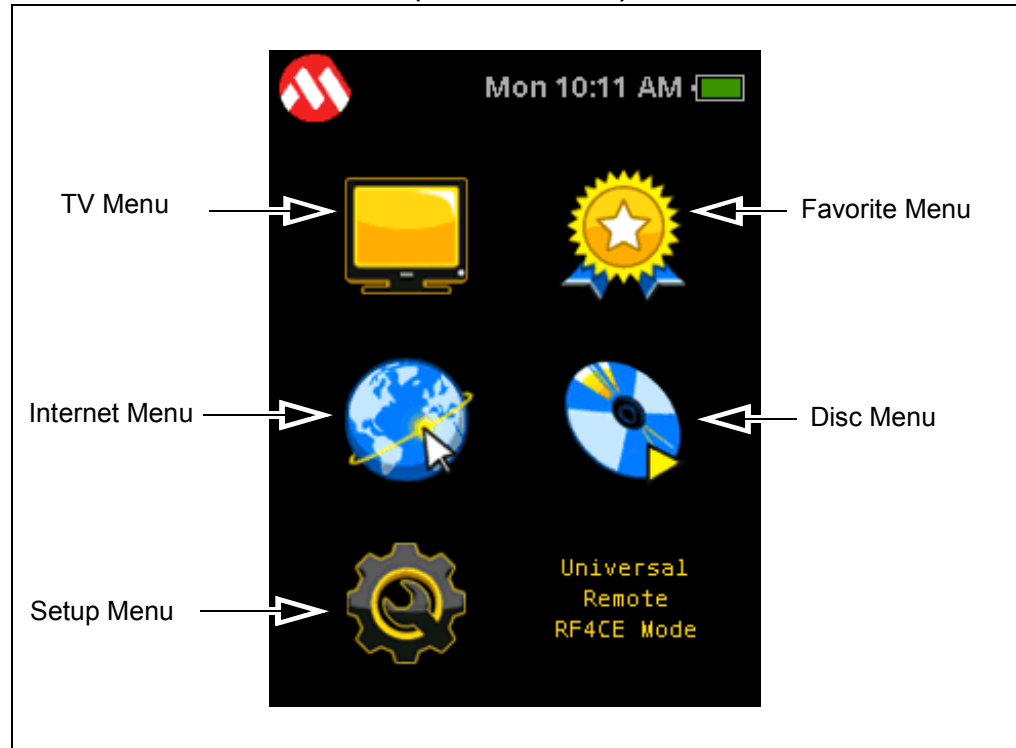# Chapter 3. Remote Control Demonstration Board Tutorial

3.1 INTRODUCTION

This chapter provides a high-level overview of the firmware programmed on the remote control. It is also an overview of the interworking between the controller and the target device.

The WRCU utility does not control the PC hardware (such as volume). The WRCU utility only provides emulated feedback that it has received messages from the remote control. The purpose of the WRCU utility is to demonstrate the RF4CE communication using control codes defined in HDMI v1.3a specification.

3.2 HIGHLIGHTS

Once the Remote Control Demo Board is turned on, the screen shows the main menu page as shown in Figure 3-1.

FIGURE 3-1:   MAIN MENU (HOME SCREEN)

The TV menu, Favorite menu, Internet menu and the Disc menu are the mock up of the respective features. The sub menu screens are shown in Figure 3-2.

Remote Control Demonstration Board User's Guide

FIGURE 3-2:   **SUB MENU SCREENS**

TV Menu

Favorite Menu

Internet Menu

Disc Menu
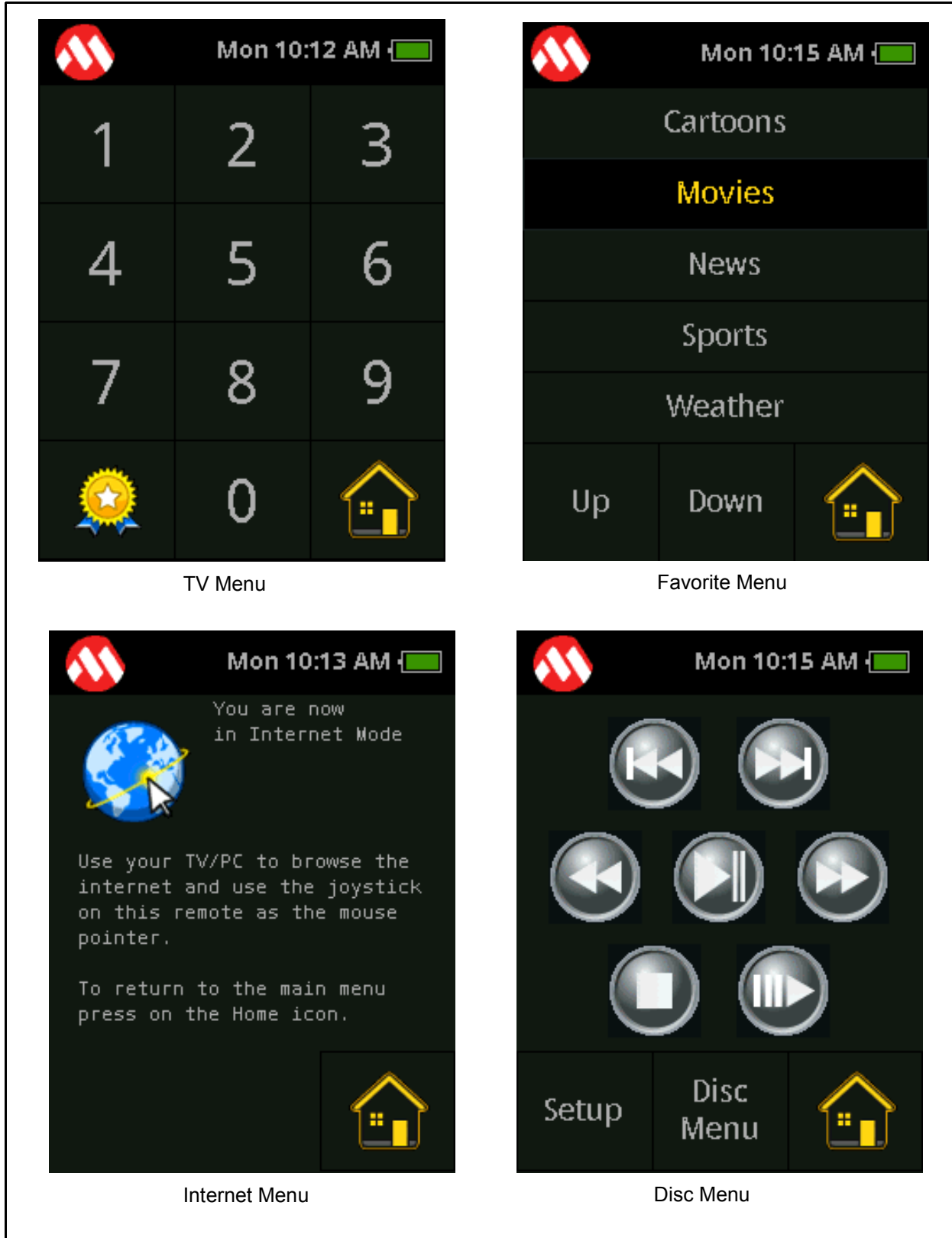
3.3   DESCRIPTION OF SUB MENUS

3.3.1   Setup Menu

The Setup Menu (Figure 3-10) allows the user to pair the remote control with the ZENA Wireless Adapter.

> **Note 1:** Nodes within a ZigBee RF4CE network may only communicate directly with other devices on the network if a pairing link exists between the originator and the target devices.
>
> **Note 2:** The ZENA Wireless Adapter is preprogrammed and paired with the Remote Control Demo Board. However, if the Remote Control Demo Board is unpaired with the ZENA Wireless Adapter, or if you would like to pair with a new ZENA adapter, refer to **Section 3.4 "Pairing the Remote Control Demo Board with The ZENA Wireless Adapter"**

Another feature implemented in the Setup Menu is the ability to set the date and time of the device. Set the date and time by selecting **Set Time** at the bottom of the Setup Menu. The current month, day, year, hour, minute and second can be configured. Once the attribute is selected, it is confirmed when the selection becomes highlighted. To change the selected attribute, use the arrows below the date and time. The left arrow decrements the selection, while the right arrow increments the selection. The selection process does roll over; if the month is incremented past December, January is selected, and if the minute selection is decremented past 0, 59 is the next option. Changes automatically update the date and time. The user can observe the changes on the time and day of the week text near the battery level icon. Exit the menu by pressing **Set RF** or the Home menu at the bottom of the screen.

3.3.2   Internet Menu

The Internet Menu is intended to show a remote feature where an end user can use the Remote Control Demo Board to control web browsing on the target device. Currently, the demo does not actually provide any ability to control the mouse on the target PC. The WRCU only provides emulated feedback on the joystick messages received.

3.3.3   Disc Menu

The Disc Menu shows how the remote control can be implemented to control the operation of a CD, DVD or other media. In this demonstration, the WRCU will provide emulated feedback corresponding to the control options chosen. The options in this menu are:

• The top-left and top-right buttons transmit a skip, or move forward/backward command
• The middle-left and middle-right buttons send rewind and fast forward commands
• The middle row Play/Pause button toggles between sending commands to play and freeze content
• The bottom-left and bottom-right Stop and Eject buttons will send commands to halt playback and eject the media, respectively

The Setup Menu and Disc Menu icons select the setup or root menu of the media in playback. When these options are selected, the command is displayed in the display window of the Wireless Remote Message Table (Figure 3-3).

Remote Control Demonstration Board User's Guide

FIGURE 3-3:   **WIRELESS REMOTE MESSAGE TABLE**

Time	Type	Peer Ad...	Description
0.110	Power State	0x0000	Power State: ON
7.594	Command	0x213B	Frame Control: 0x00 Profile ID: 0x01 Control Code: Backward
9.313	Command	0x213B	Frame Control: 0x00 Profile ID: 0x01 Control Code: Forward
12.016	Command	0x213B	Frame Control: 0x00 Profile ID: 0x01 Control Code: Rewind
15.656	Command	0x213B	Frame Control: 0x00 Profile ID: 0x01 Control Code: Fast Forward
17.062	Command	0x213B	Frame Control: 0x00 Profile ID: 0x01 Control Code: Play
18.203	Command	0x213B	Frame Control: 0x00 Profile ID: 0x01 Control Code: Pause
19.594	Command	0x213B	Frame Control: 0x00 Profile ID: 0x01 Control Code: Stop
20.844	Command	0x213B	Frame Control: 0x00 Profile ID: 0x01 Control Code: Eject

On the WRCU, the relevant button on the application window is also highlighted; Figure 3-4 shows an example of the Play button being pressed.

FIGURE 3-4:   **DISC MENU**

3.3.4 Favorite Menu

The Favorite Menu showcases the ability to group themes or categories of content into easily accessible options. The touchscreen allows for directly selecting the categories, as well as using the Up and Down icons to toggle between selections. In the current firmware, the user's Favorites Menu selection is not transmitted back to the WRCU.

3.3.5 TV Menu

The TV Menu can be used to enter channel selections into the WRCU. When this menu has been selected, the desired channel number can be input by entering the channel number on the touch screen. To verify that this has happened, the number will be displayed in the WRCU Wireless Remote Message Table, and the number will be presented in the Channel window (Figure 3-5). Pressing the mTouch Solution **OK** key selects the input number as the new channel. The channels can also be navigated with the mTouch Solution CH+ and CH- keys to increment or decrement the selected channel. To return to the previous channel, select the Previous Channel button.

FIGURE 3-5:   **CHANNEL WINDOW**

The Volume level, indicated by the WRCU, can be modified by pressing the mTouch Solution VOL+ or VOL- keys, above and below the word "VOL". When one of these is selected, the press is registered in the command window. Also, when the Volume Up is pressed, an upward-oriented arrow displays next to the Volume Bar, and the Volume Bar is increasingly filled to signify the volume gain relative to its maximum capacity (Figure 3-6).

**FIGURE 3-6:**   **VOLUME BAR**

When the Volume Up is pressed, an Up arrow displays, and the Volume Bar increases. When the Volume Down button is pressed, a Down arrow displays, and the Volume Bar decreases. The Mute button immediately silences the volume.

Remote Control Demonstration Board Tutorial

There are also several general purpose navigation buttons that can be utilized to increase the functionality of the device. There are four navigational arrows that allow the user to choose up, down, left and right. When these are pressed, the command is registered in the display window, and the direction pad lights up with the appropriate direction. Figure 3-7 shows the application's response to the Up arrow being pressed.

**FIGURE 3-7:   NAVIGATION BUTTONS**
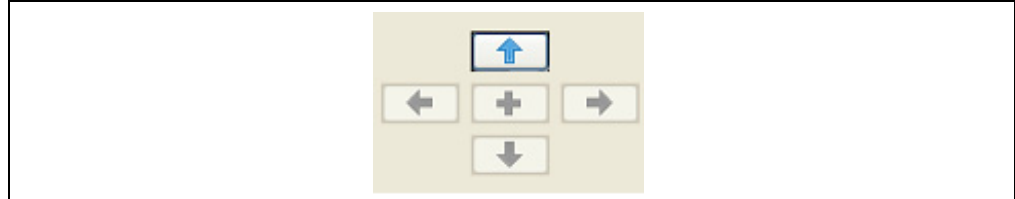
3.4   PAIRING THE REMOTE CONTROL DEMO BOARD WITH THE ZENA WIRELESS ADAPTER

The RF4CE protocol requires pairing between the target and controller devices for proper operation. The Setup Menu on the remote is used for pairing the Remote Control Demo Board with the ZENA Wireless Adapter target device.

To pair a remote control and a ZENA Wireless Adapter together, complete the following procedure:

1. Insert the ZENA Wireless Adapter into the USB port on the target computer. On the adapter, if the green LED turns on, the pairing table contains at least one valid entry. If the red LED turns on, the pairing table contains no valid entry. If no LED turns on, the ZENA Wireless Adapter radio is in Power Save mode.

2. Open **Wireless Remote Control Utility (WRCU)** from <installation dir>/Combo/Remote Control/PC Software/wireless_rc_utility.jar. The **Wireless Remote Control Utility** screen opens (Figure 3-8).
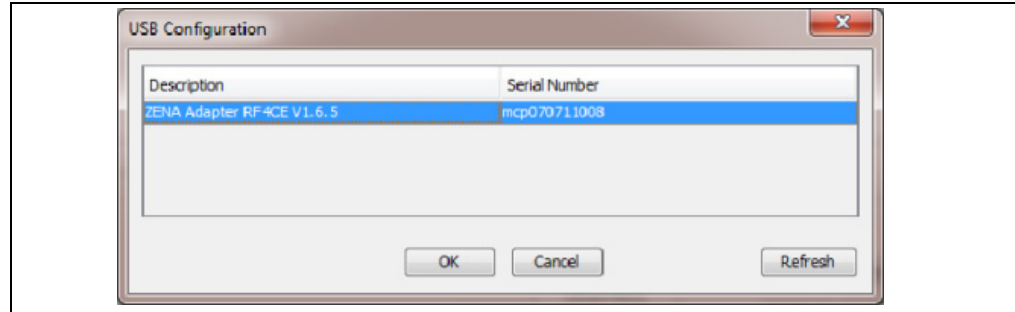
FIGURE 3-8:   WIRELESS REMOTE CONTROL UTILITY
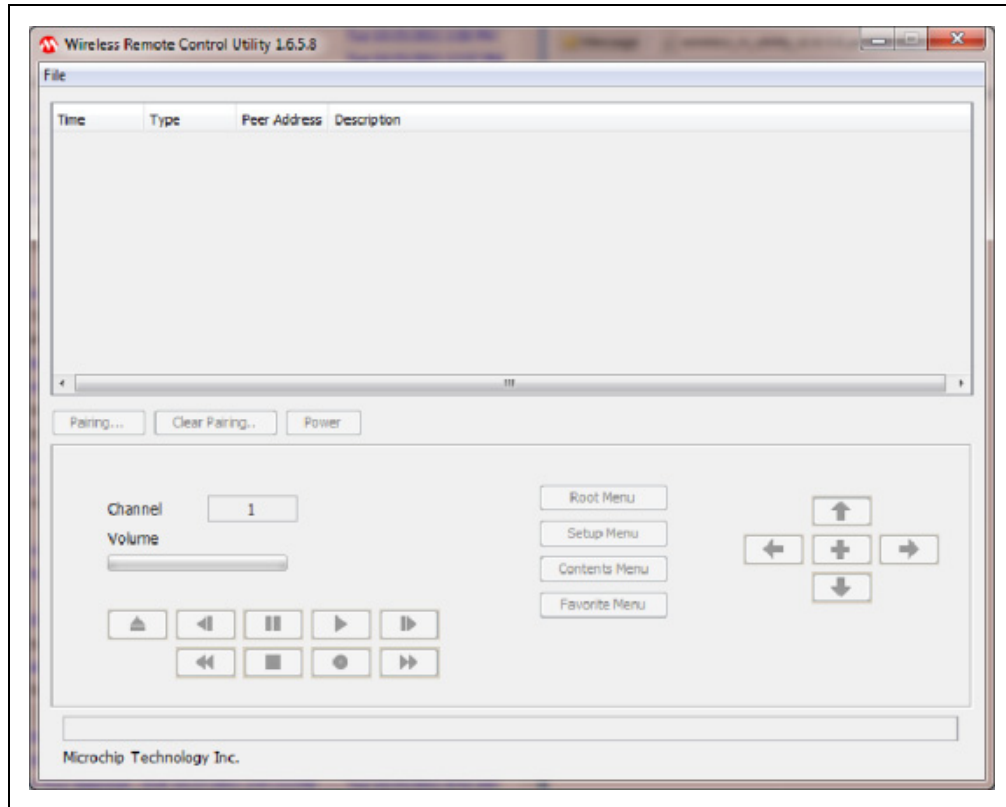
3. Click the **File** menu and select **Configure ZENA Wireless Adapter**. A dialog box with all the ZENA adapters connected to the computer appears (Figure 3-9).

FIGURE 3-9:   ZENA™ ADAPTER SELECTION

There may be multiple ZENA adapters in the list. If so, select the adapter that has the same serial number as that on the ZENA Wireless Adapter.

4. On the Remote Control Demo Board, press the Setup Menu icon. The Setup Menu opens and displays the MAC address of the remote control, and the list of paired device MAC addresses, as shown in Figure 3-10.

FIGURE 3-10:   SETUP MENU
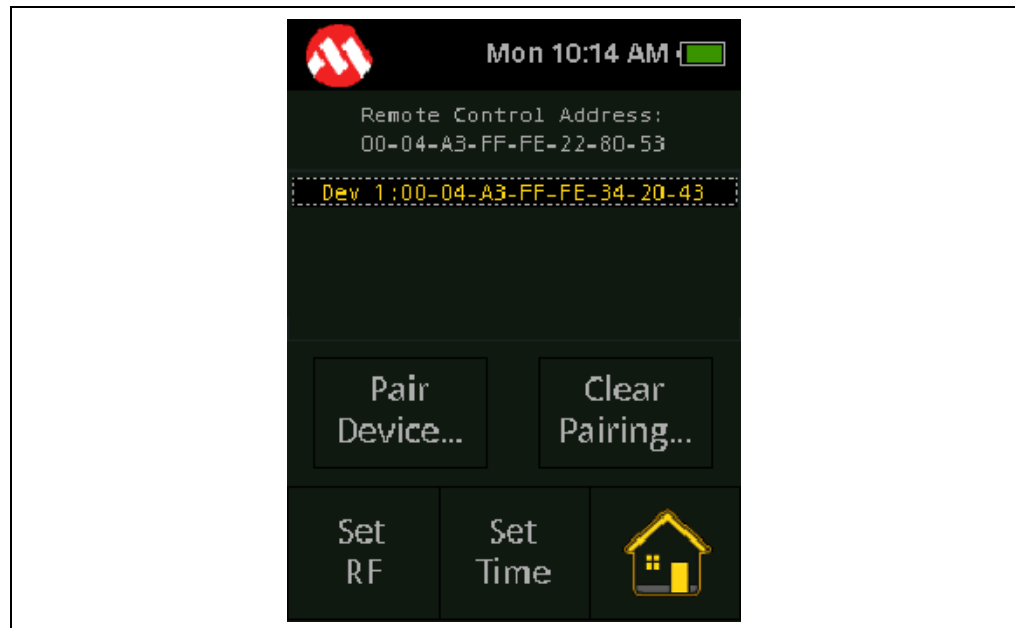
5. Press **Pair Device** on the remote control and **Pairing** on the WRCU. The sequence of pressing the buttons is not important, but should be within a few seconds of each other. At the time of initial firmware release, the remote control can only support one pairing entry at a time. If the pairing entry slot is already used, the end user may have to clear the pairing table on the remote first.

When the remote control is paired with the ZENA Wireless Adapter, "Pairing Success" is displayed on the remote control screen. Now the remote control is ready to use with the utility.

> **Note:**   If the pairing fails, or if the pairing table is erased on the remote control, a red LED on the Remote Control will flash continuously, indicating that the pairing table on the remote is empty and contains no valid entry. When the remote control is paired with a target device, the red LED is turned off. The WRCU Utility functions are described in the Help on the Utility menu.

3.5   WRCU HELP TOPICS

For any further information regarding the WRCU features and interactivity, open the Help File by selecting **Help**, and clicking **Help Topics.** The Wireless Remote Control Utility File.pdf will open (stored under <MLA Install>\Combo\Remote Control\PC Software). The Help file includes information for exploring the WRCU, using the utility as well as troubleshooting any issues that may come up with the WRCU.

Chapter 4. Development Hardware

4.1 INTRODUCTION

This chapter outlines the hardware implemented in the Remote Control Demo Board, as well as in the ZENA Wireless Adapter.

4.2 OVERVIEW

This section covers the following topics:

- QVGA Display Screen
- mTouch Solution Keys
- Five-Position Joystick
- Wake Button
- RF4CE Wireless Operations
- ICSP™ Header
- Mini USB-B Connector
- 9V Connector
- PIC24FJ256DA210
- Batteries
- Humidity Sensor
- 3-Axis Accelerometer

4.3 QVGA DISPLAY SCREEN

The Remote Control Demo Board uses a QVGA 320x240 pixel TFT screen to display the user menus and allow for user interaction. The 320 x 240 screen is oriented in portrait format. The screen senses touch from pressure applied to it, and does not have to be pressed by a specific implement.

The part number of the touch screen is TFT320240-91-E. The data sheet and other information can be found at www.trulydisplays.com.

4.4 mTouch SOLUTION KEYS

To provide a rich and modern user interface, the Remote Control Demo Board not only has a fully interactive touchscreen, but also eleven mTouch Solution Capacitive Keys to interact with the target application (Figure 4-1). The capacitive touch keys offer a high impact user interface at a lower total system cost; push buttons have several moving parts which significantly decrease the reliability. These keys are tasked with controlling the target device volume and channel selection, along with a 4-direction pad and an OK button to select the desired choice. The buttons are implemented as Direct Keys as defined in the Microchip Library of Applications (MLA). Refer to the MLA for more information on Direct Key implementation and mTouch solution technology. Visit http://www.microchip.com/mtouch for more details.

Remote Control Demonstration Board User's Guide

Figure 4-1:   **mTouch™ SOLUTION KEYS**
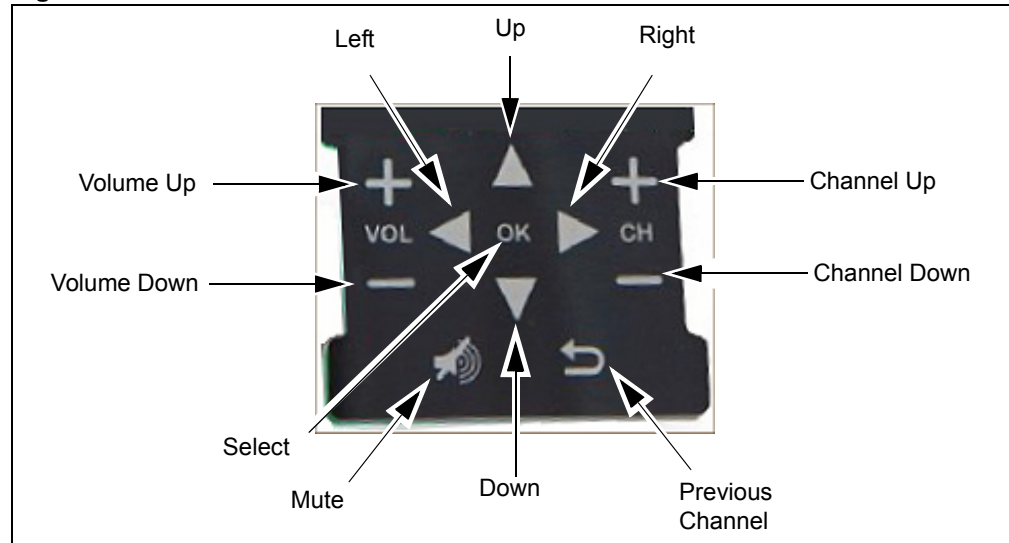
4.5 FIVE-POSITION JOYSTICK

The joystick included on the device provides a means to navigate along two axes; left/right, up/down and pressing down on the joystick to indicate a selection. Joystick movement is registered in the same way as pressing the direction mTouch Solution Keys (the WRCU registers the direction and a green LED (D10) lights up).

4.6 WAKE BUTTON

The Wake/Power Down switch allows for power optimization and battery life extension when the remote control is not in use. When the remote control is in normal operation, the remote control will operate at full features and full power. If the user would like to reduce the power consumption of the controller, but not go through the difficulty or hassle of disconnecting the power, the Power Down button will put the PIC24FJ256DA210 into sleep mode, significantly reducing the power consumption of the device. The remote control sends a power down command to the utility. In this mode, the display backlight is also turned off.To resume operation, simply press the button again. The state of the remote controller is not lost when it powers down; when it resumes full power operation, the menu previously in use will be in use again when the Wake operation occurs.

4.7 RF4CE WIRELESS OPERATIONS

The ZigBee RF4CE specification defines a simple, robust and low-cost remote control communication network that allows wireless connectivity in consumer electronics applications. The ZigBee RF4CE specification enhances the IEEE 802.15.4 standard by providing a simple networking layer and standard application profiles that can be used to create multi-vendor interoperable solutions for use within the home.

A ZigBee RF4CE Personal Area Network (PAN) is composed of two types of devices: a target device (or node) and a controller device (or node). A target device has full PAN coordinator capabilities and can start a network. A controller device can join networks started by target devices by pairing with the target and multiple ZigBee RF4CE PANs can communicate between each other. For this implementation, the remote control is the controller device, and the ZENA Wireless Adapter is the target device.

For more information on the RF4CE standard, refer to http://www.microchip.com/rf4ce or http://www.zigbee.org/Standards/ZigBeeRemoteControl/Overview.aspx

4.8 ICSP™ HEADER

The ICSP programming header is used to program the PIC® microcontroller, or run the firmware in Debug mode. The pin signified by the white arrow is Pin 1, to be connected to MCLR.

4.9 MINI USB-B CONNECTOR

The Mini USB-B can be used to power the remote control. This adds redundancy and the capability of performance, lacking batteries or a 9V power source. In addition to being another power source for the remote control, the USB-B connector is used to load images onto the Flash and communicate with the PIC MCU. The communication is possible because the PIC MCU has an integrated USB On-the-Go (USB OTG) module, which provides functionality as a USB embedded host.

4.10 9V CONNECTOR

The 9V connector can be used to connect a 9V power source to the remote control, offering a third power supply option. This is ideal for situations when the batteries are run down, or there is no available USB port to connect.

4.11 PIC24FJ256DA210

The PIC24FJ256DA210 is a 16-bit microcontroller with integrated graphics, USB and Charge Time Measurement Unit (CTMU) modules. It is used to control the operation of the Remote Control Demo Board. The microcontroller has three graphics hardware accelerators to facilitate rendering of block copying, text and unpacking of compressed data. The accelerator also contains a color look-up table and a programmable display resolution. Refer to the data sheet at http://www.microchip.com/PIC24FJ256DA210 for more information, or other general information about Microchip Graphics Solutions at www.microchip.com/Graphics.

4.12 BATTERIES

The device can be powered by 3 AAA batteries. This allows for truly wireless operation of the Remote Control Demo Board. To use the batteries, connect J3 for device power.

4.13 HUMIDITY SENSOR

The board has a humidity sensor (HCH-1000-001) which can be implemented to measure moisture, humidity or other environmental attributes. Although it is not implemented in the example program, it is a capacitive sensor that can be measured using the Charge Time Measurement Unit (CTMU). For an example algorithm, refer to **"PIC24F Family Reference Manual, Section 11: Charge Time Measurement Unit."**

4.14 3-AXIS ACCELEROMETER

The board has a 3-axis accelerometer Bosch BMA-150 connected on a SPI port to the PIC24FJ256DA210. This feature is not incorporated into the default firmware, but it can be used to save power consumption when the remote control is inactive for a given time, and it can be put to sleep. When the remote control is picked up again, the 3-axis accelerometer senses the movement and wakes up the application. The accelerometer also has the ability to acknowledge high-g and freefall scenarios, which can be incorporated into the remote control firmware to take appropriate action in the event of these circumstances.

4.15 ZENA WIRELESS ADAPTER

The ZENA Wireless Adapter is a multi-function USB wireless adapter that connects USB-equipped desktop or notebook computers with Microchip wireless products for development or application uses. As a development tool, the ZENA Wireless Adapter can be used as a protocol analyzer or as a diagnostic tool. It can also be used to connect the computer as a wireless node to the network for application uses. The ZENA Wireless Adapter is capable of performing a variety of functions and each function can be programmed into the adapter using the built in USB boot loader.

The ZENA Wireless Adapter is preprogrammed with a MiWi™ Wireless Protocol Sniffer application. This allows the user to display MiWi Wireless Protocol packets in a graphical format in the Wireless Development Studio. The WRCU can upload the new firmware required by this remote control demo setup.

Additional software and firmware updates, along with more information on the ZENA Wireless Adapter, can be downloaded from the Microchip website:
http://www.microchip.com/zena

Chapter 5. Upgrading the Remote Control Firmware

5.1   INTRODUCTION

This chapter covers how to program the remote control firmware and the external memory containing the graphics information employed by the device. The Remote Control Demonstration Board is preprogrammed with the firmware described in this user's guide. The information in this chapter describes the method for updating the firmware or adding any customization to the program, if desired.

5.2   HIGHLIGHTS

This section covers the following topics:

• Programming the Microcontroller Device
• Programming the Icons in External Flash Memory
• Steps for Programming the External Flash Memory

5.3   PROGRAMMING THE MICROCONTROLLER DEVICE

The source code for the remote control is installed with the MLA and can be found at <MLA Install>\Combo\Remote Control\Firmware. In order to edit the firmware, the following software is needed:

• MPLAB® IDE 8 or MPLAB X IDE (www.microchip.com/MPLAB)
• C30 compiler (www.microchip.com/c30)

If changes to the firmware are required on the Remote Control Demo Board, a programmer can be connected via the ICSP pins connected to the controller. After editing the appropriate files, select the appropriate programmer from the Program menu, compile the software, and program the file to the PIC microcontroller. From there, the program memory could be read back to confirm it was programmed correctly.

> **Note:**   When using an MPLAB ICD3 or MPLAB REAL ICE™ for programming or debugging, use the **RJ-11 to ICSP Adapter** (Microchip Part Number AC164110) to interface with the ICSP™ header on Remote Control Demo Board.

5.4   PROGRAMMING THE ICONS IN EXTERNAL FLASH MEMORY

The remote control firmware uses external Flash memory to store the icons displayed in the demonstration program. The demo will not run if the icons are not programmed into the external SPI Flash memory of the board. The remote control will come with the original icons preprogrammed; in order to alter the icons used, or to reload the icons (provided in <MLA Install>\Combo\Remote Control\Firmware\Resources), follow the procedure outlined in Figure 5-1.

The demo code automatically detects if the external Flash memory content is valid for this demo, and if not, prompts the users to send the external Flash data. Users can also manually select to erase the external Flash memory content, this manual erase process is shown in the bottom half of the flow diagram.

FIGURE 5-1:   PROGRAMMING FLOW DIAGRAM

Note 1:   When Flash is erased, CRC check will also be erased.
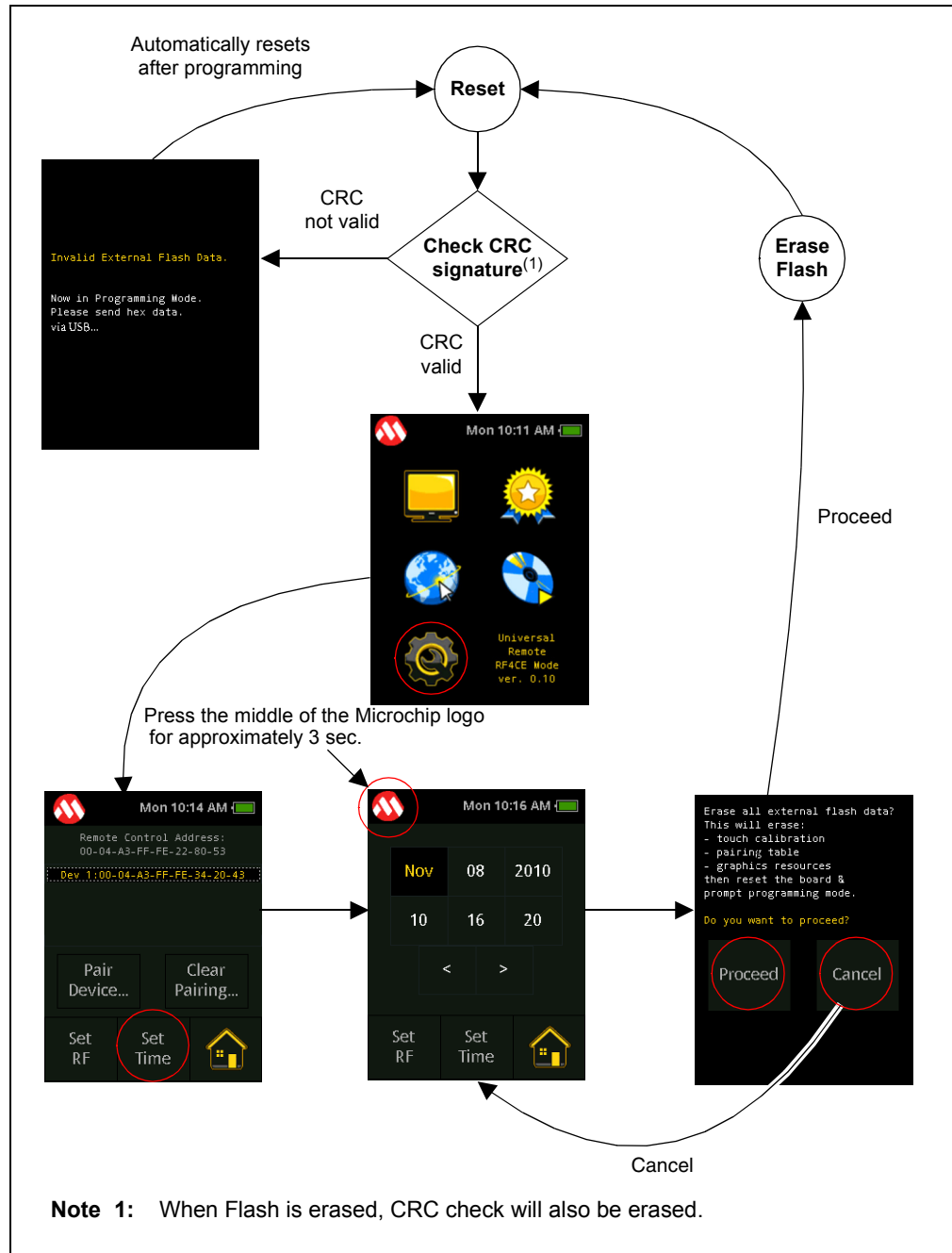
To initiate the external Flash reprogram, press and hold the Microchip logo on the Set Time menu for longer than 3 seconds. The Microchip logo is located on the top left corner of on the screen. Note that the reprogram is initiated only from the Set Time menu. From reset, the firmware automatically checks for the presence of the required data in the external memory by reading the address of the external memory where the CRC signature of the fonts and icons. The CRC signature is then compared to the expected CRC signature to verify if the data is indeed present in the external memory. When the read CRC signature does not match the expected values, the firmware prompts the user for the external Flash programming. When the Flash programming mode is prompted, the Invalid External Flash Data screen appears.
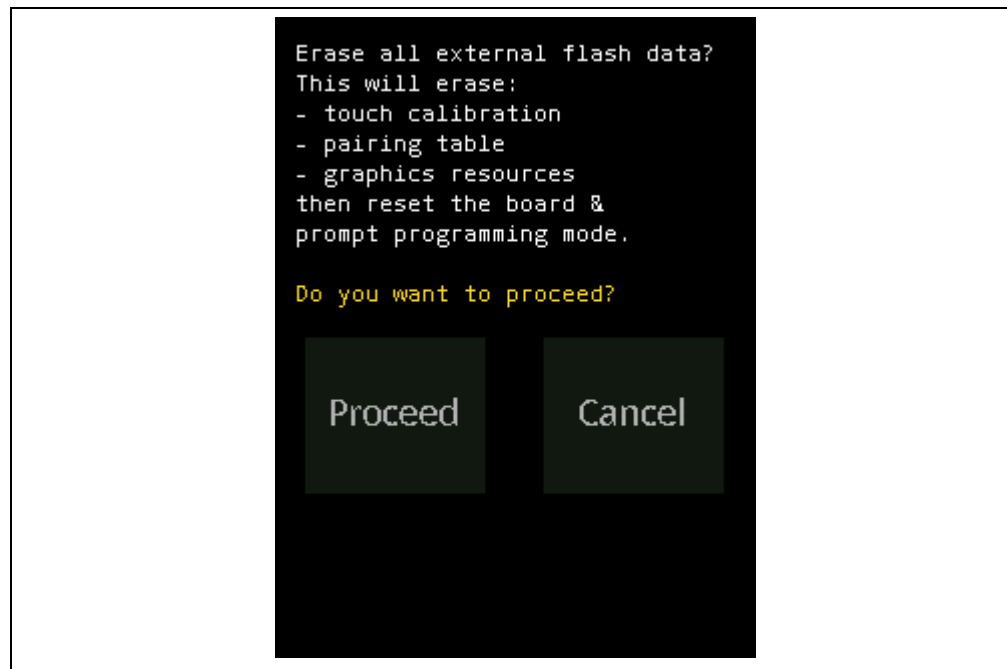
When the screen shows the flash programming mode prompt, the board is ready to receive data from the **memory_programmer.jar** running on a host PC.

> **Note:** The External Memory Programmer is included in the MLA and can be found at <MLA Install>\Microchip\Graphics\bin\memory_programmer.

When a valid CRC signature is read, the automatic prompt for Flash programming will not happen. Manual prompting of the external Flash programming mode is still possible. This can only be performed from the Set Time and Date screen.

To access the erasing screen prompt, press the Microchip icon from the Set Time and Date screen for approximately 3 seconds (for proper operation use a stylus or a similar pointer and press in the middle of the Microchip icon until the screen changes to flash programming confirmation screen). After the timed press on the icon is detected, the firmware attempts to confirm if erasing the external Flash is indeed desired. The confirmation screen is shown in Figure 5-2.

FIGURE 5-2:   CONFIRMATION SCREEN


```
Erase all external flash data?
This will erase:
- touch calibration
- pairing table
- graphics resources
then reset the board &
prompt programming mode.

Do you want to proceed?
```

Proceed   Cancel

If **Cancel** is selected, the screen returns to Set Time and Date. If **Proceed** is selected, the external Flash memory is erased and resets the board. After reset, the CRC check will fail and show the Flash programming mode prompt.

When programming the external Flash, use the hex data (<MLA install>\Combo\Remote Control\Firmware\Resources\ExternalResource-RemoteControl.hex) Use the memory_programmer.jar utility to program the data. The programming is through the USB port of the Remote Control Board. Refer to the memory_programmer.jar help file for instructions how to program the external Flash memory of the board using the USB port.

In case there is a failure in the programming of the Flash, and some icons do not appear on the screen, the Microchip icon is replaced with a green square. This green square is the area where the prolonged press should be performed to open the external Flash programming confirmation screen.

> **Note:** The INF file necessary to install the USB driver for this external memory programmer mode can be found at <MLA Install>\Microchip\Utilities\USB Drivers\MPLABComm\Windows\MPLABCommWinUSB.inf, for Windows.

5.5   STEPS FOR PROGRAMMING THE EXTERNAL FLASH MEMORY

Follow this procedure to program the external Flash memory:

1. Configure the Remote Control Board to go to the Flash programming mode prompt.
2. Run the **memory_programmer.jar** in the host computer.
3. Connect the Remote Control Board to the host PC using the USB connection.
4. Load the **ExternalResource-RemoteControl.hex** file to the **memory_programmer.jar**.
5. In **memory_programmer.jar**, select the Communication Settings to **USB**.
6. Start programming.
7. Once all the data is sent to the Remote Control Board, the firmware will reset the board.

Refer to the **External Memory Programmer Help** file for details on the usage of the program.