Zilog Education Solutions

Zilog Student Educational Platform

User Manual

UM026901-0517

www.zilog.com

Warning: DO NOT USE THIS PRODUCT IN LIFE SUPPORT SYSTEMS.

LIFE SUPPORT POLICY

ZILOG'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS PRIOR WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSEL OF ZILOG CORPORATION.

As used herein

Life support devices or systems are devices which (a) are intended for surgical implant into the body, or (b) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in a significant injury to the user. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.

Document Disclaimer

 Information in this publication concerning the devices, applications, or technology described is intended to suggest possible uses and may be superseded. ZILOG, INC. DOES NOT ASSUME LIABILITY FOR OR PROVIDE A REPRESENTATION OF ACCURACY OF THE INFORMATION, DEVICES, OR TECHNOLOGY DESCRIBED IN THIS DOCUMENT. ZILOG ALSO DOES NOT ASSUME LIABILITY FOR INTELLECTUAL PROPERTY INFRINGEMENT RELATED IN ANY MANNER TO USE OF INFORMATION, DEVICES, OR TECHNOLOGY DESCRIBED HEREIN OR OTHERWISE. The information contained within this document has been verified according to the general principles of electrical and mechanical engineering.

ZNEO, ZSED, and ZEDU are trademarks or registered trademarks of Zilog, Inc. All other product or service names are the property of their respective owners.

Revision History

Each instance in the Revision History table below reflects a change to this document from its previous version.

Date	Revision Level	Description	Page No
May 2017	01	Original issue.	All

Table of Contents

List of Figures

List of Tables

Introduction

The Zilog Student Educational (ZSED) Platform is designed to offer a comprehensive educational advantage to students who are pursuing degrees in the electronics and computer science fields. It is a modular development tool for teaching and learning these disciplines at the university level, yet can also serve the needs of students at the high school level.

The ZSED Platform's robust educational capabilities allow students to learn about microcontroller architecture, language programming, wireless communication, analog-to-digital conversion, sensing technologies, and security encryption methods; students can also experiment with creating industrial lighting, motor control, and smartphone application development applications.

In addition, the ZSED Platform can be configured as a data acquisition and remote control system; it ships with a command shell that allows control of the ZSED Platform without requiring additional programming.

Note: At power-on, the ZSED Platform starts in active Bluetooth communication mode, then searches its iOS connections for the ZEDUcation iPhone App. Any iPhone enabled with the ZEDUcation App and Bluetooth LE will be able to connect with a ZSED Platform that also contains a Z-PAN Bluetooth LE Shield.

The ZSED Platform's design layout allows students to use it with intuitive ease, thereby saving time, energy, and money. The ZSED Platform is complete in all aspects of its functionality. Attention has been given to many of the ZSED Platform's details, such as its integrated audio buzzer and a jumper that, when removed, can disable the backlight display from the LCD panel when power savings are important. While it can be powered from a 6V to 12V wall adapter, the ZSED Platform's battery power source allows for mobile capability when considering projects in the field.

The ZSED Platform features all of the necessary components and software to allow students to design with freedom, including a core module that contains a Zilog microcontroller and several interfaces to which additional optional modules can be attached. The premise of this modularity concept is one of economics, in that students will be able to separately purchase the individual modules they need toward engaging in their selected subjects of study.

These optional modules include:

- A 2-line by 16-character LCD module
- A 16-key keypad
- A traditional breadboard with a variety of SMD footprints and solderless work area
- An LED Test Shield, used to test all available GPIO lines; it can also be used to develop simple 8x5 pixel graphics
- A variety of application shields

Note: The LED Test Shield and an assortment of stackable application shields can be individually ordered from the Zilog Store.

Some of these optional ZSED modules can be combined (i.e., stacked) to study a variety of subjects simultaneously.

This document has been created to be a companion document to the Zilog Educational Shields User Manual (UM0256). Also available for this Platform is the third-party Kindle book, *Programming the Zilog ZNEO Microcontroller by Example: Volume 1 – Getting Started*, authored by Dan Eisenreich.

Notes: Operation of the ZSED Platform assumes a functional knowledge of basic computer principles on the part of the student.

Zilog offers two Educational Platforms:
– Zilog Educational Platform (Integrated) (UM0255), and
– Zilog Student Educational Platform (Modular) (UM0269)
The book, *Programming the Zilog ZNEO Microcontroller by Example*, applies to both platforms as they are functionally the same.

Kit Contents

The Zilog Student Educational Platform provides all of the hardware necessary to get started as soon as you open the box, including:

- Student Educational Platform Board
- LCD module
- 4x4 keypad
- USB SmartCable for debugging and programming
- USB (A to Mini-B) cable
- 9V wall adapter
- 9V battery
- Flash drive with documentation and drivers

Figure 1 shows the contents of the Zilog Student Educational Platform Kit.

Figure 1. The Zilog Student Educational Platform Kit

Figure 2 shows the ZSED Platform as a complete system.

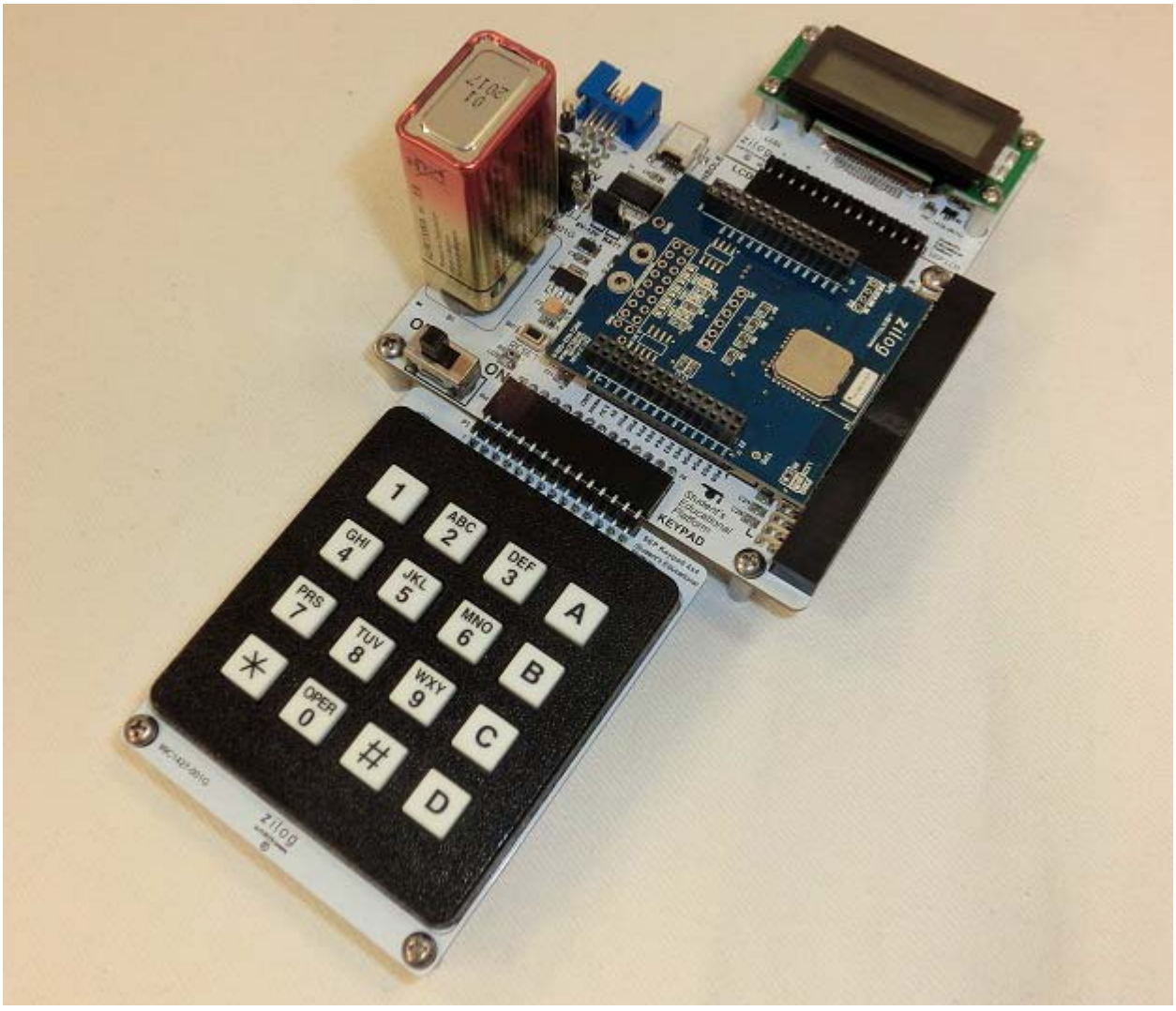

Figure 2. Student Educational Platform with ZPAN LE Shield Attached

Required Software

In addition to the hardware in your Kit, freely available software is required to properly conduct experiments and debug operations with the Zilog Student Educational Platform. All of the software items listed below are available for free online, as noted.

- ZDSII Integrated Development Environment for the ZNEO CPU (available as a free download from the Zilog website)
- USB SmartCable driver (available as a free download from the Zilog website)
- Terminal emulation program such as HyperTerminal or Tera Term
- FTDI USB (console) driver

Notes: Tera Term is used in this document, and it can be downloaded for free from http://log-mett.com/index.php?/download/tera-term-474-freeware.html. Zilog does not provide technical support for Tera Term or any terminal emulator program.

If you have not previously used an FTDI virtual COM port, you will be prompted for the FTDI USB driver when you connect the PC to Console Connector P1 on the ZSED Platform. This driver can be downloaded from the FTDI website at http://www.ftdichip.com/Drivers/VCP.htm.

ZSED Platform Features

The Zilog Student Educational Platform hardware is configured to offer versatility of function for enabling the speedy development of experiments. Its integrated command shell and stackable shields give the ZSED Platform a depth of purpose not common in the field, yet make learning more economical for students.

The ZSED Platform's key features include:

- Dual main power options: 6V–12V wall outlet or 9V battery for mobile operation
- Three voltages available to the breadboard when the ZSED Platform is powered with the included 9V wall outlet:
  - V_{MAIN}
  - 3.3V
  - 5V with a maximum current of 2.0 amps
- 47 GPIO lines
- Stackable application shield modules

- Preprogrammed command shell
- I/O signal access connector at the J7 expansion port
- Buzzer
- Optional items also available:
  - 16-key keypad and/or a PC console application
  - 16 x 2 LCD panel (can be used in conjunction with or instead of a standard PC monitor)
  - Dual-format breadboards, both standard and solderless

Figure 3 shows the Zilog Student Educational Platform with a System ZED Test Shield plugged in. This Test Shield is used to test all available GPIO pins for proper operation.

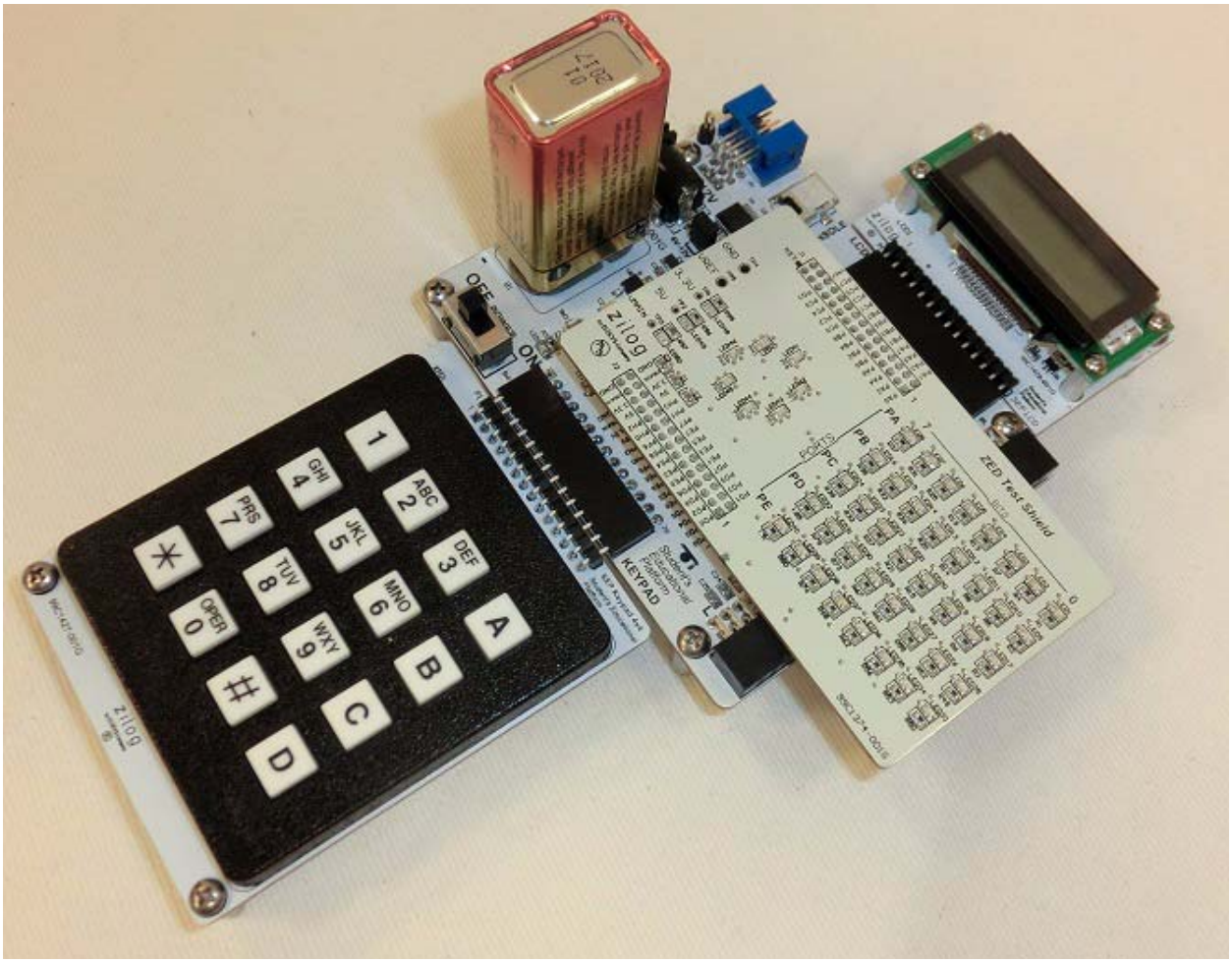

Figure 3. The Zilog Student Educational Platform with Test Shield

Figure 4 shows the arrangement of features on the ZSED Platform.

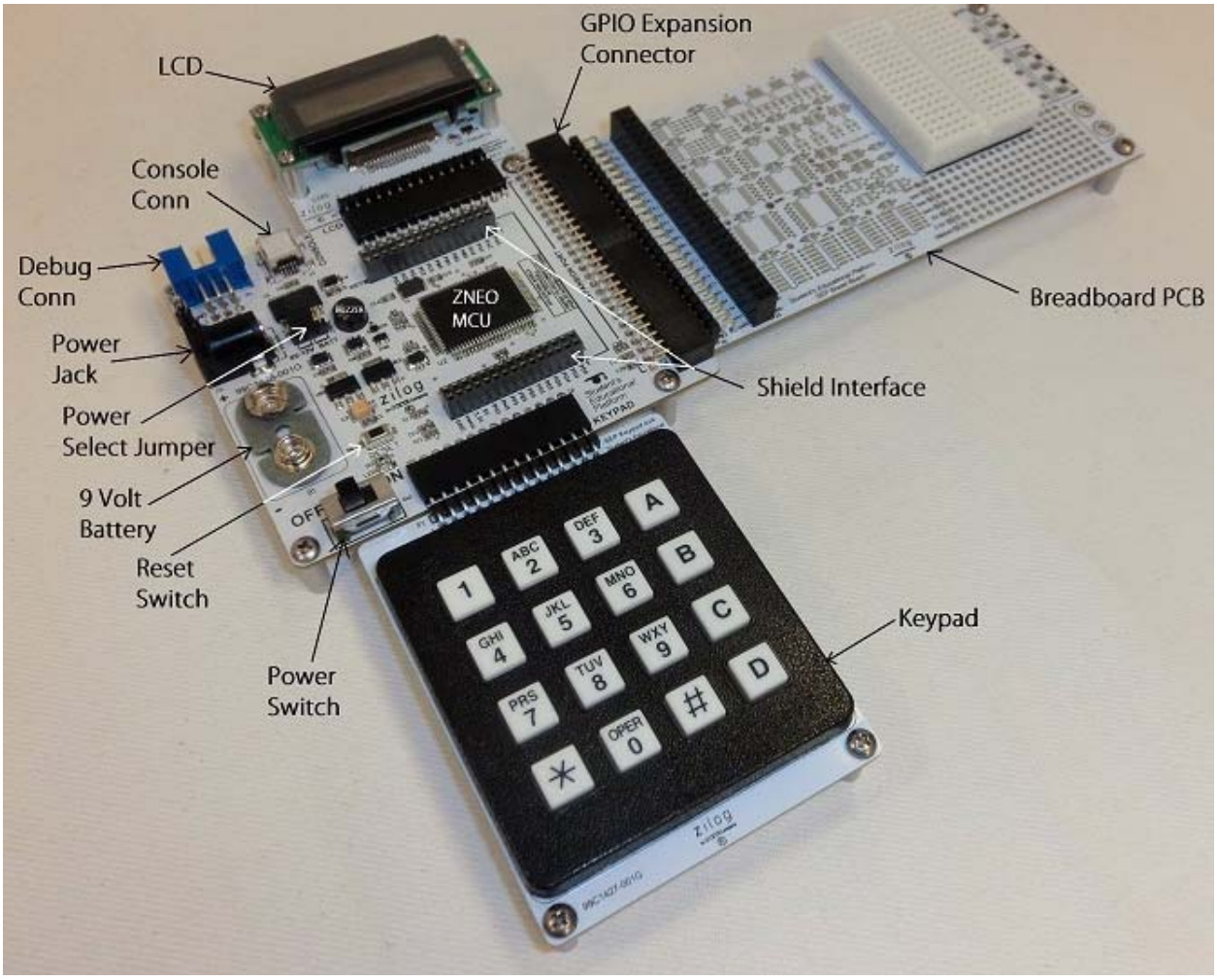

Figure 4. Elements of the Zilog Student Educational Platform

Setup and Operation

This section describes how to set up the Zilog Student Educational Platform and operate it in Serial Mode or iOS App Mode. Before proceeding, it is important that you observe standard antistatic precautions when removing the contents of the Kit from its box. Do not apply power to the ZSED Platform until you have established all hardware connections.

Caution: When unpacking and working with the Zilog Student Educational Platform and its application shields, always use a grounding strap to prevent damage resulting from electrostatic discharge (ESD).

Setup

Observe the following procedure to establish the ZSED Platform's hardware connections in Serial Mode.

Note: Two additional operating modes are described in this document. To learn more about these two modes, refer to the Modes of Operation section on page 22.

If you purchased the LED Test Shield, perform the following procedure:

1. Mount the Test Shield. With the Power Switch on the ZSED Platform set to OFF, insert the Test Shield into interface connectors J8 and J9. Align the *Key* locations on both the Base and Shield boards.

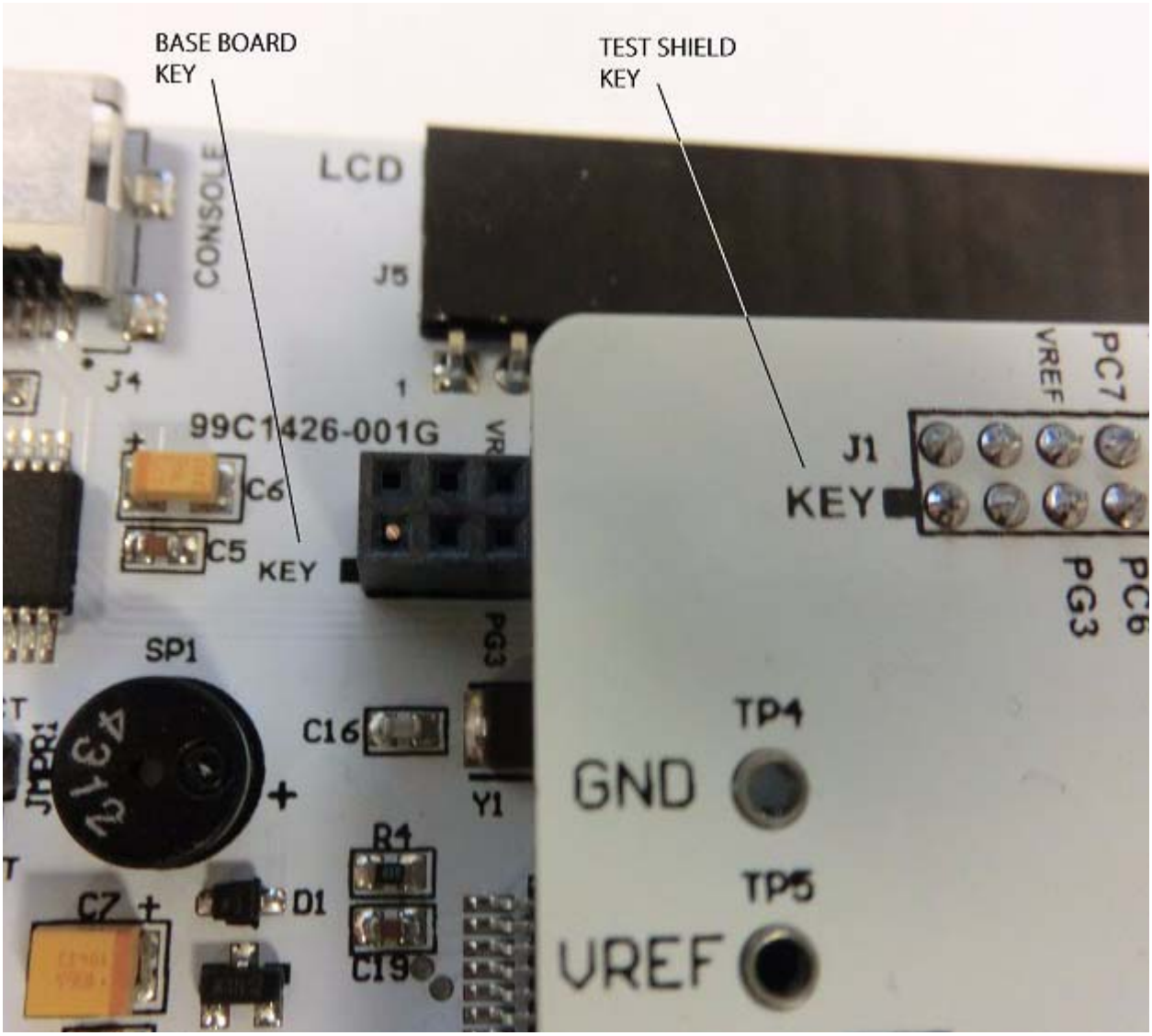

Figure 5. Key Alignment BaseB Shield

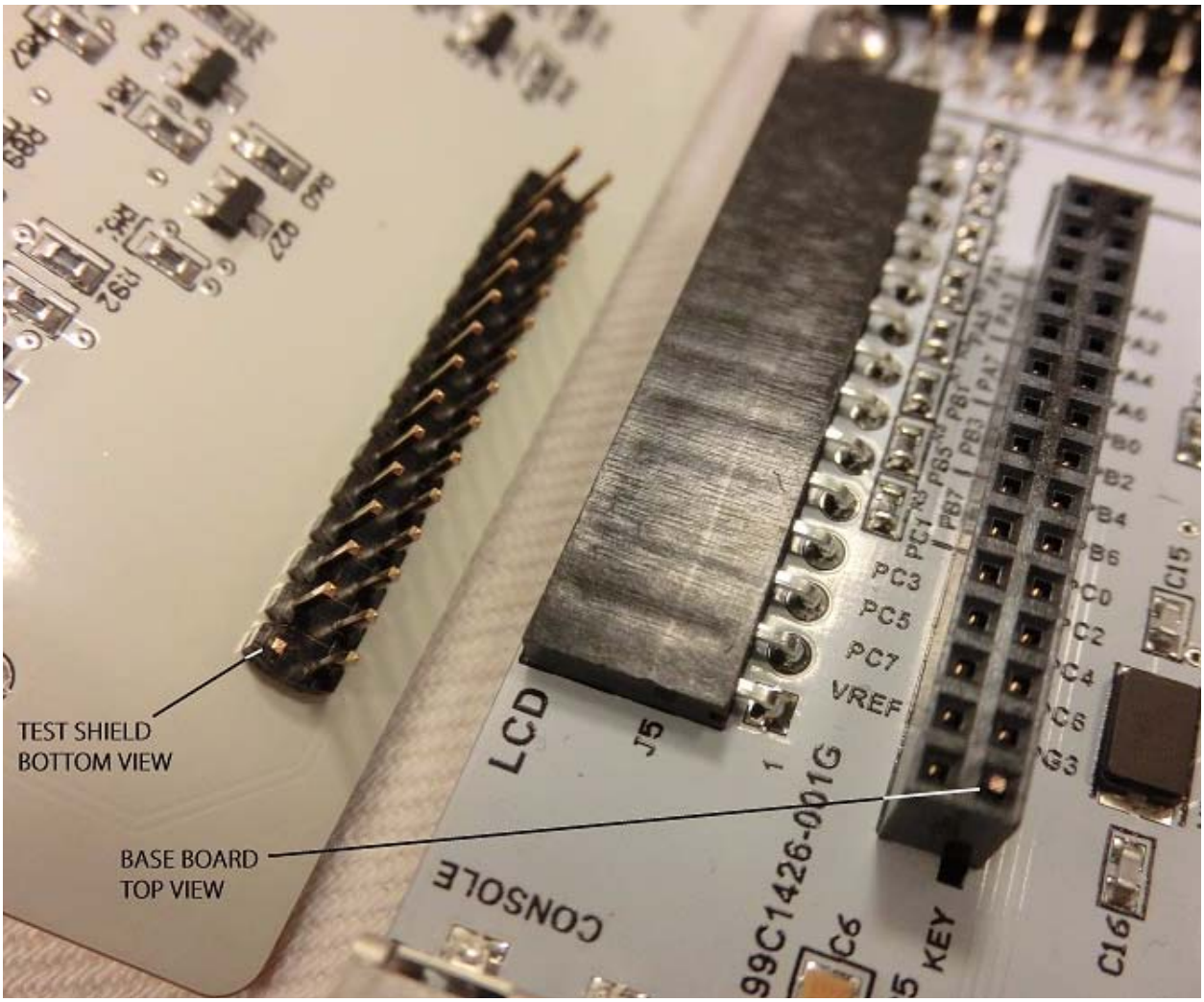

Figure 6. Key Pins Trim Plug

2. Connect the USB (A to Mini-B) cable to your PC and to the J4 console connector on the ZSED Platform.

Notes: At power-on, the ZSED Platform is in a Bluetooth LE active communication mode that searches for the ZEDUcation iPhone App, which must be Bluetooth LE-enabled. The iOS ZEDUcation App v1.0 can be downloaded from the iTunes Store at https://itunes.apple.com/us/app/zeducation/id970764547?mt=8. To exit iOS Mode and enter the integrated shell, press **Ctrl+D**, then enter a question mark (`?`) to view a list of available commands. To view a list of shield drivers, enter

`startshield list` and press the **Enter** key. To work with the iOS iPhone app, refer to the iOS App Mode section on page 23.

If the Windows OS displays a *Driver Not Found* message, a USB driver must be installed. A standard USB driver is resident on the Flash drive that you received with your Kit; however, this driver can also be downloaded from the FTDI web-site at http://www.ftdichip.com/Drivers/VCP.htm

3. Connect the 9V power adapter to the P1 jack or insert the 9V battery; set the Power Selection jumper accordingly.

Serial Mode Operation

The ZSED Platform is connected by USB cable from a PC to console connector J4 on the ZSED Platform. It is primarily controlled by means of its pre-programmed command shell, which can be accessed through a terminal emulation program. Any emulator, such as Tera Term or HyperTerminal, can be used to access the shell. COM port settings will be the same for all emulators.

Note: Tera Term is used in this document, and it can be downloaded for free from http://log-mett.com/index.php?/download/tera-term-474-freeware.html. Zilog does not provide technical support for Tera Term or any terminal emulator program.

Observe the following procedure to establish the port connections in Serial Mode.

1. Launch Tera Term and select the serial COM port assigned to the ZSED Platform from the **Port:** drop-down menu, as indicated in Figure 7.

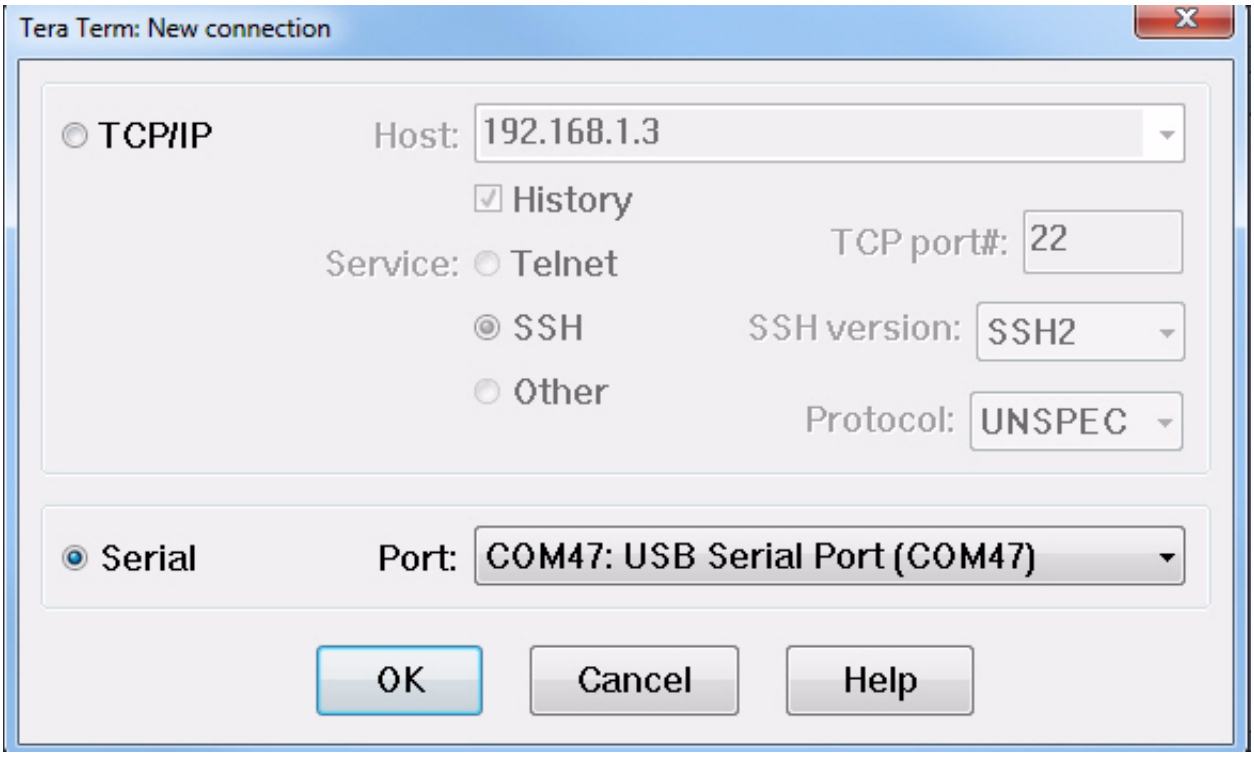

Figure 7. Selecting the Serial Port in Tera Term's New Connection Dialog

Note: To determine which port is assigned to the ZSED Platform, first plug in, then unplug the USB cable from connector J4 (Console) on the ZSED Platform. The assigned port will appear, then disappear, in the Tera Term window. As an alternative, port assignment can also be monitored using the Windows OS Device Manager Port viewer. In the Figure 7 example, COM47 has been assigned.

2. Click **OK**. The initial Tera Term dialog appears, as shown in Figure 5.

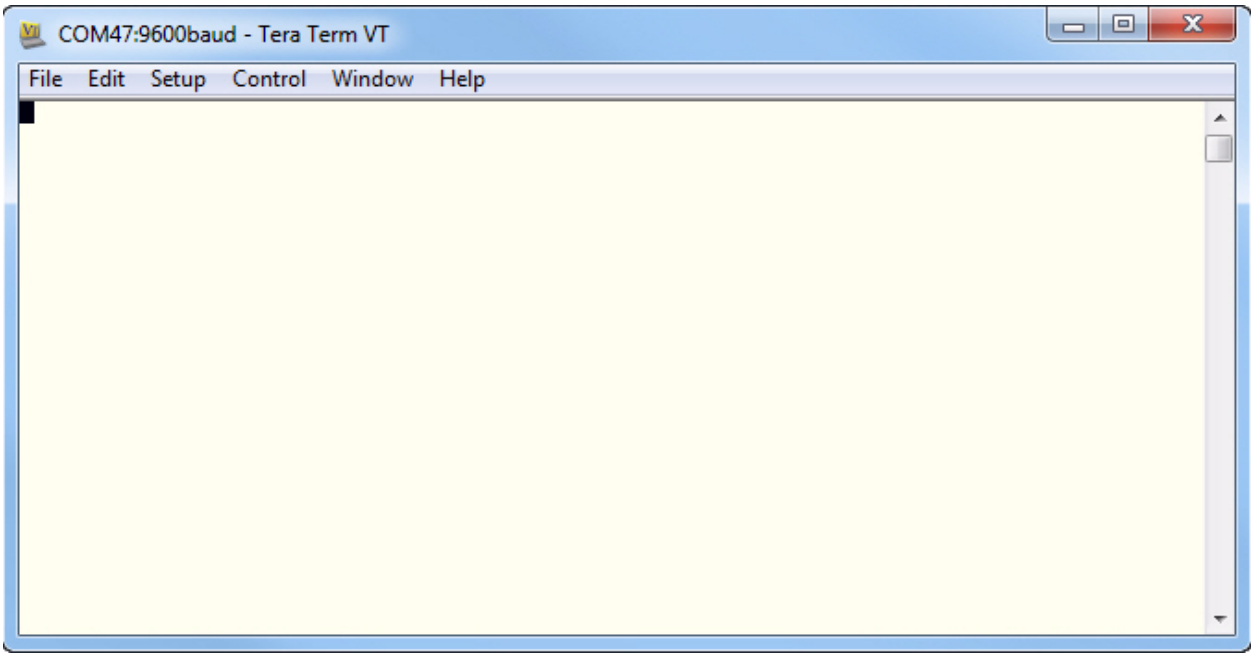

Figure 8. Tera Term Initial Dialog

3. Click **Setup**. The Baud Rate Setting dialog will appear, as shown in Figure 9.

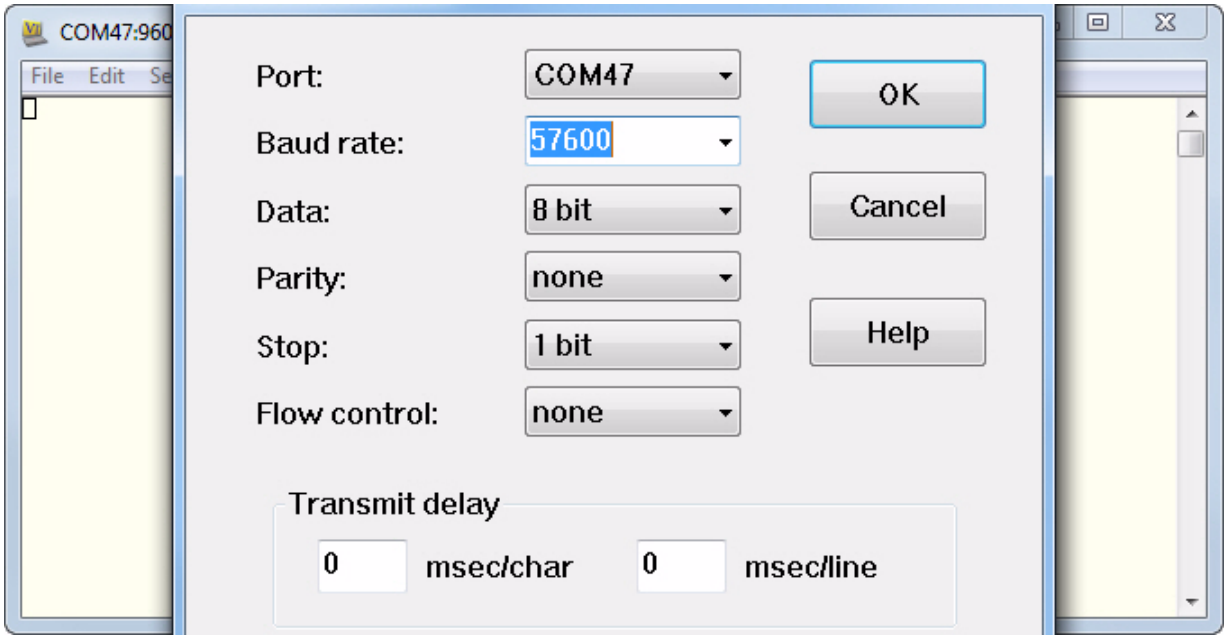

Figure 9. Baud Rate Setting

4. Enter `57600` in the **Baud rate:** field, and allow the other settings to remain at their defaults. Click **OK**.
5. Press the ZSED Platform's RESET switch, indicated in Figure 10.

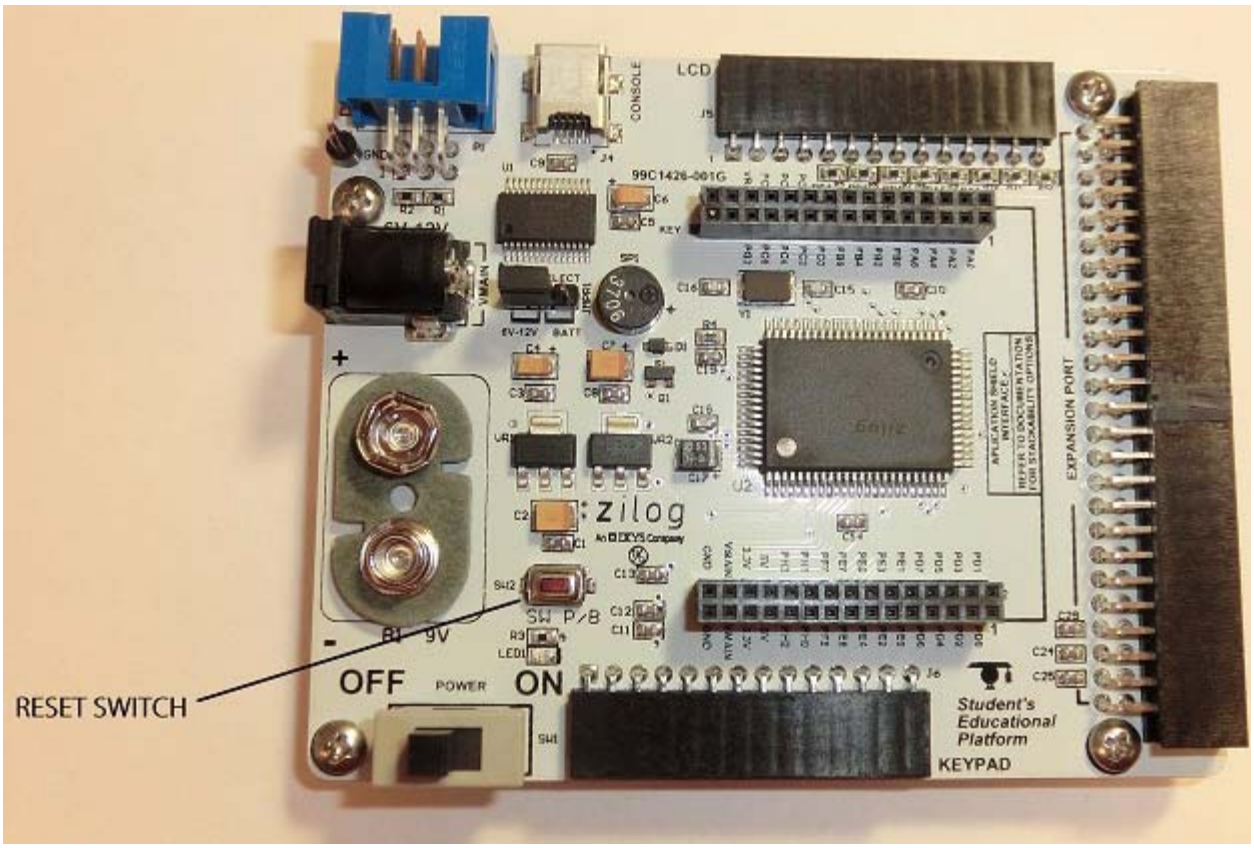

Figure 10. The Location of the ZSED Platform's RESET Switch

6. As a result, the Shell Prompt dialog will appear, as shown in Figure 11.

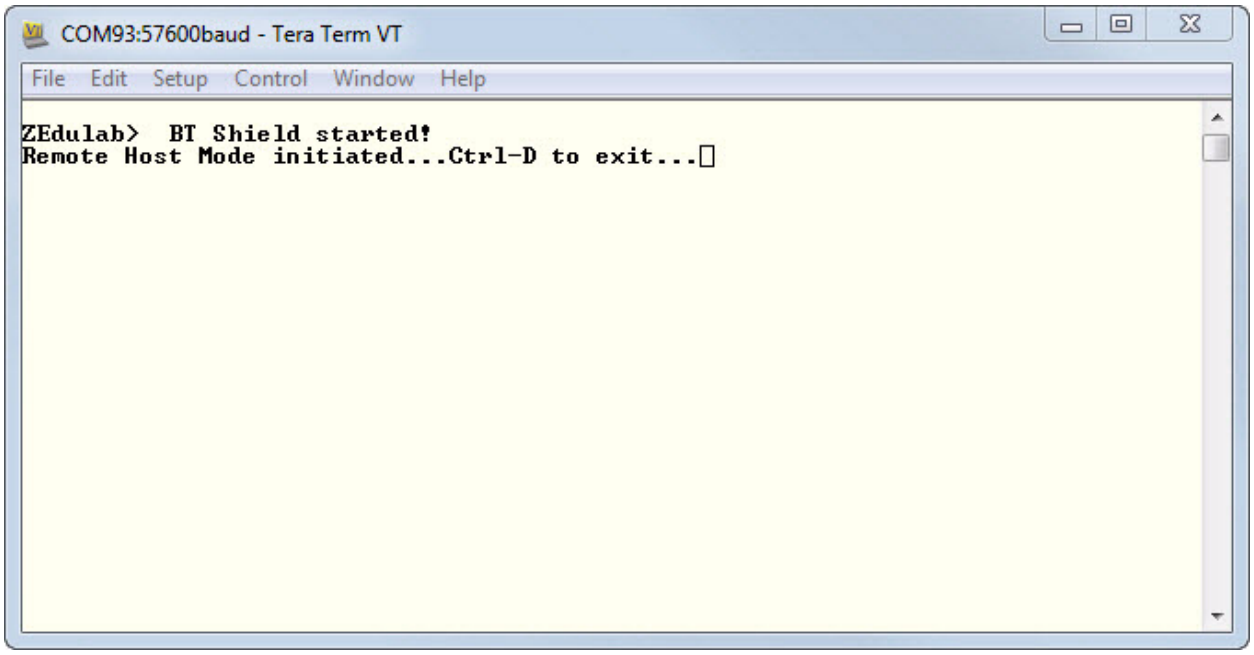

Figure 11. Shell Prompt

Note: At power-on, the Zilog Student Educational Platform starts in active Bluetooth iPhone Search mode – the platform is looking for an iPhone running the ZEDUcation App. Any iPhone enabled with Bluetooth LE and running the App will be able to connect to the Platform (a Bluetooth LE Shield is required for this operation).
To see the ZEDUcation instructions, see the iOS App Mode section on page 23. However, if you do not wish to connect to an iPhone, simply press **Ctrl+D** to enter the native Shell Mode.

7. Press **Ctrl+D** to exit Bluetooth iOS connection search mode.
8. At the ZEdulab prompt, enter a question mark (?) and press the **Enter** key to display a list of basic Shell commands as shown in Figure 12.

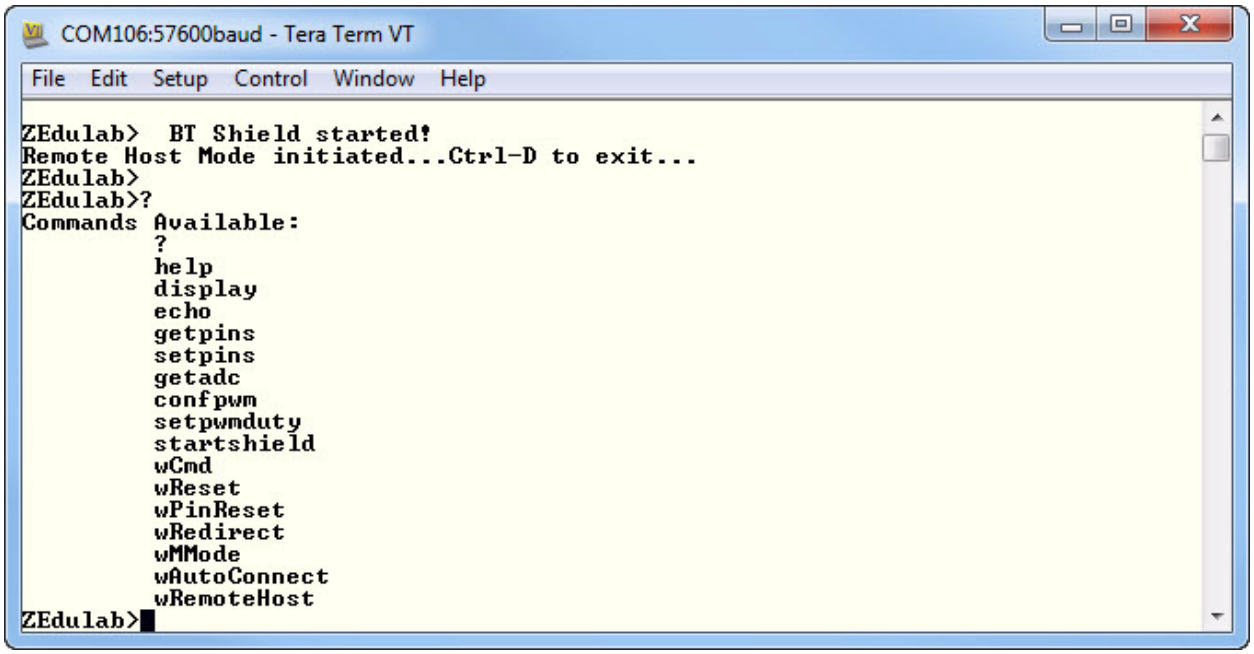

Figure 12. Shell Command List

Shell Commands

Table 1 lists the standard Shell commands for controlling the Zilog Student Educational Platform. These commands are described in greater detail in the Mini-Z Shell and Flash Loader Reference Manual (RM0061).

Table 1. Shell Commands

Command	Description
?	Lists all available commands.
Help	Lists all available commands.
Display	Displays a string on the LCD panel. Turns off any monitoring, displays the first parameter on line 1, and displays the second parameter on line 2.
Echo	Turns Echo Keystrokes to the console ON or OFF. Syntax: echo on|off
Getpins	Sets the pin(s) to INPUT and retrieves the pin values for a specified port. Syntax: getpins PX HexNumber, in which HexNumber is the value specifying the pins to get; defaults to ALL.
Setpins	Sets the pin(s) to OUPUT and sets the pin values for a specified port. Syntax: setpins PX HexNumber ON|OFF, in which HexNumber is the value specifying the pins to set.
Getadc	Sets the port to alternative function, then reads the ADC value from the requested ADC 0–11. Syntax: getadc xx, in which xx is an ADC number from 0 to 11.
Confpwm	Configures the PWM cycle period from 1–20 kHz. The absence of a parameter will result in a display of the current setting. Syntax: confpwm 2
Setpwmduty	Configures the PWM channel's duty cycle, from 1 to 100. The absence of a duty parameter will result in a display of the current selected PWM setting. Syntax: setpwmduty xx [DD], in which xx is the PWM number from 1 to 6, and DD is the duty cycle, from 0 to 100.
Startshield	Starts a shield that is plugged into the ZSED Platform. Use the List parameter to view the list of shields. Syntax: startshield xxxx, in which xxxx is the shield name, or list to view all available shields.
wCmd	Allows you to directly interface with the Bluetooth module using AT commands. Press **Ctrl+D** to exit.
wReset	Resets the Bluetooth module using AT commands.
WPinReset	Resets the Bluetooth module using pin signals.
wRedirect	Routes all incoming packets to the console and console out to the WLAN module. Press **Ctrl+D** to exit.
wMMode	Allows you to set the Master Mode (Hardware). ON is Master, OFF is Slave (requires the wReset command to be executed to take effect).

Table 1. Shell Commands

Command	Description
wAutoConnect	Allows you to control Auto Discovery options (requires the wReset command to be executed to take effect).
wRemoteHost	Allows clients to control this unit wirelessly (must have established a connection first)

Example 1. To view a command's parameters, enter the command, followed by the **?** character, as shown in the following example:

```
Setpins ?
```

The console will display the following response:

```
Sets the pin(s) to output and sets the pin(s) values for a
specified port.
Syntax: setpins PX HexNumber ON|OFF (Hex number is the value
specifying the pins to set)
Example: setpins PA FF on : Will set all pins of Port A to 1s
```

Example 2. To view a list of application shields integrated into the root shell, enter the following command:

```
startshield list
```

The console will display the following response:

```
WLAN
BT
WoS
RF
```

Note: If the Test Shield was purchased, the command testing routine listed in the following section can be visibly carried out; otherwise, a DVM or Oscilloscope can be used to monitor the GPIO pins.

Testing Shell Commands

To test a shell command, observe the following procedure.

1. Insert the shield into place and use the `setpins` command to test PA thru PE and seven individual ports, as follows:

   ```
   Setpins PA FF ON
   ```

   As a result, all pins on Port A are turned ON.

   ```
   Setpins PA 55 ON
   ```

   The command above turns on all alternating bits, as diagrammed below.

   ```
   Weight      8 4 2 1 8 4 2 1      →      8 4 2 1 8 4 2 1
   Bit         7 6 5 4 3 2 1 0      →      7 6 5 4 3 2 1 0
   PA = 0x55   0 1 0 1 0 1 0 1   PA = 0xFF   1 1 1 1 1 1 1 1
   ```

Note: On Port A, bits 4 and 5 can be controlled only when the UART is not in use; otherwise, these pins are used as the Tx and Rx signals.

2. Repeat Step 1 for ports PB, PC, PD, and PE. All LEDs should illuminate.
3. Issue a `setpins Px FF OFF` command to turn all LEDs off.
4. The remaining seven I/O pins can be tested individually. For example, use the following command to turn Port H, bit 1 on:

   ```
   setpins PH 01 ON
   ```

The Zilog Student Educational Platform as a Development Board

The Zilog Student Educational Platform facilitates the development of many applications by providing a full complement of features for building and testing many advanced concepts.

Modes of Operation

The ZSED Platform features the following four modes of operation; these modes are described in the following pages.

- Serial Interface Mode
- iOS App Mode
- Program/Debug Mode
- Independent/Mobile Mode

Note: Refer to the Application Shields User Manual (UM0256) for operation and program flashing instructions specific to these four modes.

Serial Interface Mode

For students just learning about the Zilog Student Educational Platform, Zilog recommends Serial Interface Mode as the best operating mode to begin with. In Serial Interface Mode, a USB/serial cable is used to connect the ZSED Platform to a PC. The ZSED Platform is managed through a pre-programmed command shell and a terminal emulator. The source code for the command shell is provided on the USB Flash drive that is shipped with the Zilog Student Educational Platform Kit.

A procedure for running the ZSED Platform in Serial Mode is described in the Serial Mode Operation section on page 12. This procedure shows how to acquire and set up a console application and how to begin and perform basic operations with the command shell and the Test Shield.

iOS App Mode

The ZEDUcation iPhone application interacts with the Zilog Student Educational Platform through the Bluetooth LE protocol to issue remote commands to the ZSED Platform's native Shell application. At the time of this writing, commands via the ZEDUcation App apply only to the World of Sensors Shield; however, other shields are planned for future inclusion with the ZSED Platform.

Note: This scenario potentially creates a business opportunity for enterprising application developers to write smartphone apps for Zilog's Educational Platforms.

The configuration of the ZSED Platform's shield interface makes it possible for two or more shields to be stacked on top of each other. As an example, Figure 13 shows the Bluetooth LE and World of Sensors shields stacked onto each other.

Caution: Beware of potential signal conflict when stacking shields. The schematic of each shield includes the signals used by that particular shield to help minimize errors.

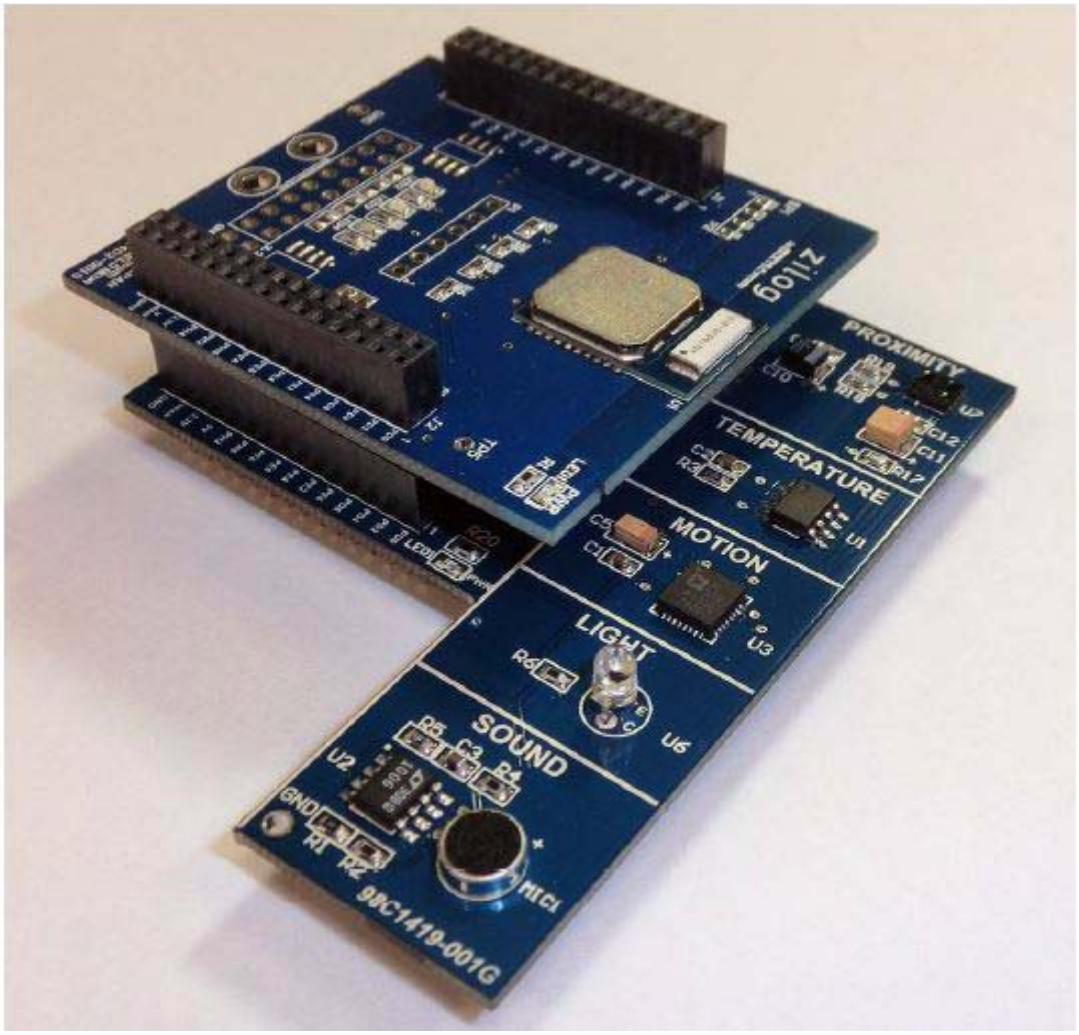

Figure 13. Stacked Bluetooth LE and World of Sensors Shields

Note: When inserting one stacking shield onto another, be aware that GPIO line interference between the shields can occur if the shields are not properly or completely aligned.

Student Exercise #1

The following exercise will establish a Bluetooth connection between the ZEDUcation iPhone app and the ZSED Platform using BlueRadio LE technology. The following materials are required:

- One ZSED Platform
- One Bluetooth LE Shield
- One World of Sensors Shield
- One iPhone with the ZEDUcation application installed

1. With the ZSED Platform's power turned off, insert both shields onto the Platform so that the assembly of shields and Platform appears as shown in Figure 14.

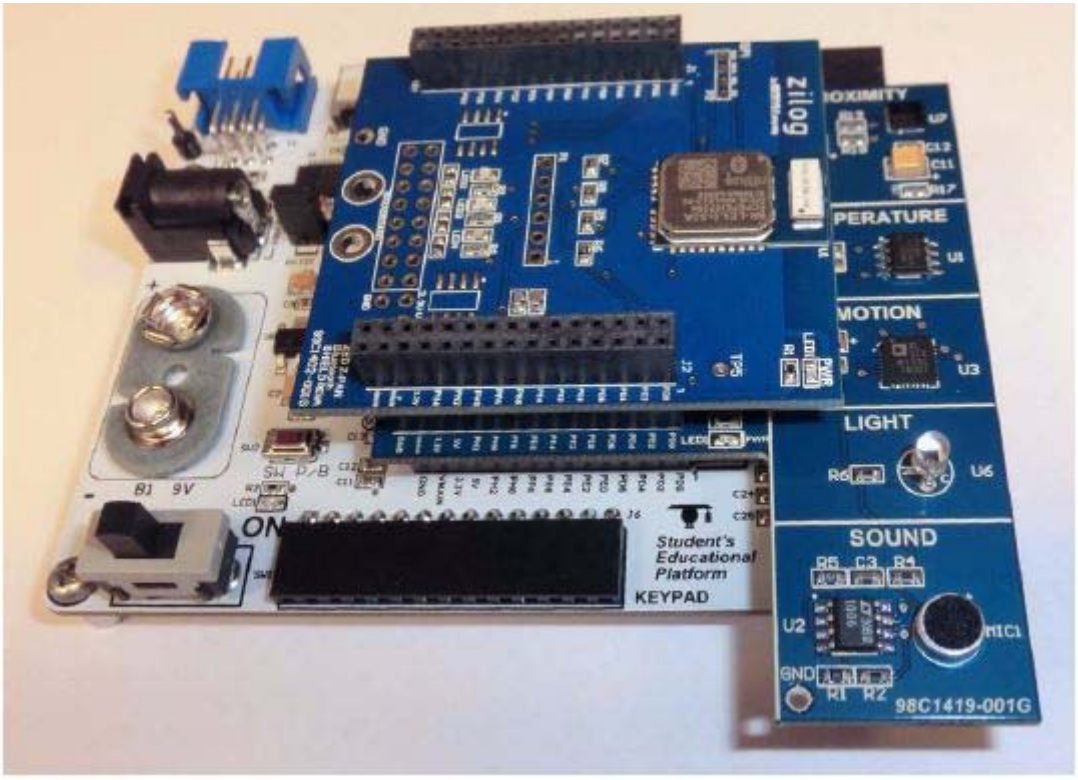

Figure 14. Shields Stacked onto the ZSED Platform

2. Apply power to the Platform, either with a 9V battery or with an AC/DC wall adapter; the voltage of the power adapter can range from 6V to 12V. Pay close attention to the Power Selector switch.
3. On the iPhone, tap to launch the ZEDUcation application. The initial screen is shown in Figure 15.

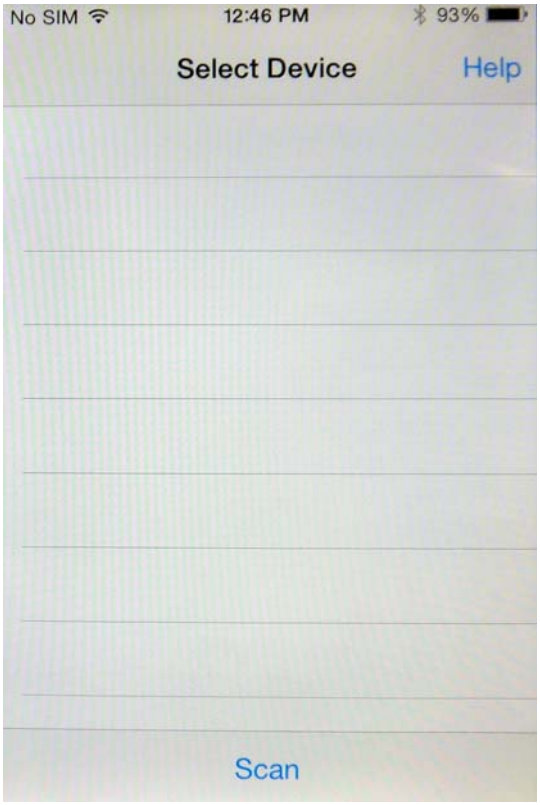

Figure 15. The Initial ZEDUcation iPhone App Screen

4. Tap the **Scan** button to display the Select Device screen. A BlueRadio LE device will be listed on the screen, as shown in the example in Figure 16.

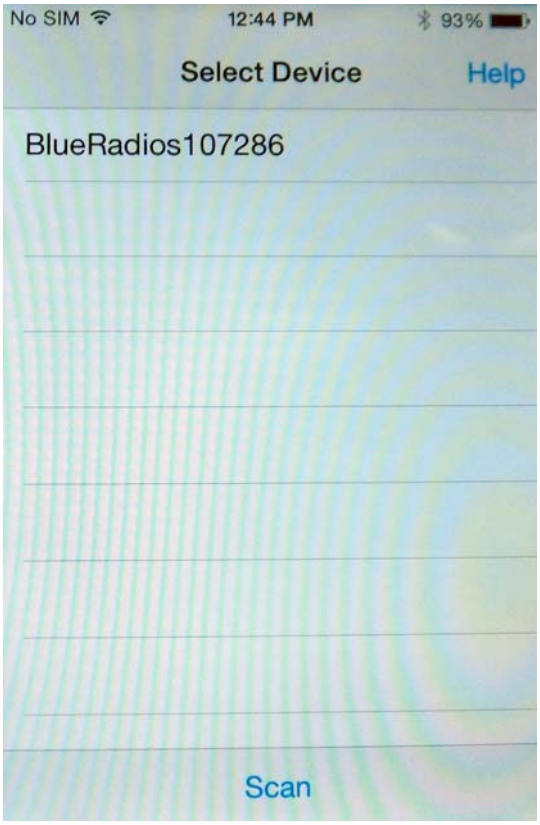

Figure 16. The ZEDUcation Select Device Screen

Note: Each BlueRadio LE device is identified by a unique number, as indicated in Figure 16. If more than one Educational Platform with a Bluetooth LE shield is in use, each Bluetooth LE shield will have its own unique identification number. Ensure that you select the appropriate device.

5. Tap the BlueRadio LE device that appears in the Select Device screen. After a moment, the Zilog Educational Platform command screen shown in Figure 17 will appear.

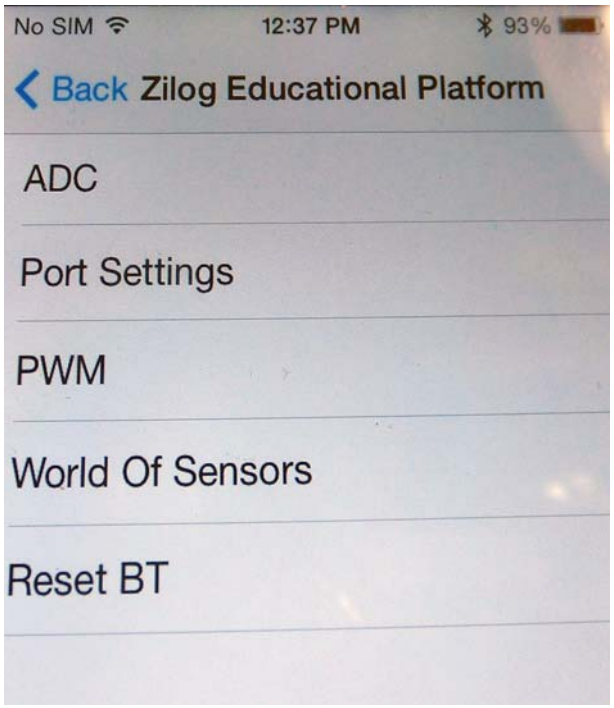

Figure 17. The ZEDUcation Command Screen

ZEDU Command Functions

The first three commands in the ZEDUcation command screen, namely the ADC, port settings, and PWM commands, are ZSED Platform functions. The latter two commands control the World of Sensors Shield and to return the Bluetooth connection settings to their factory defaults. This section describes all five of these commands.

ADC Command. The ADC command displays the voltages applied to the ADC inputs.

Caution: Students are advised not to exceed 1.2 volts DC.

Port Settings Command. The Port Settings screen displays sliding buttons for eight port bits that control the Z16F2810 MCU's port pins. In the example shown in Figure 18, the **Port:** setting shows that Port A (PA) is selected.

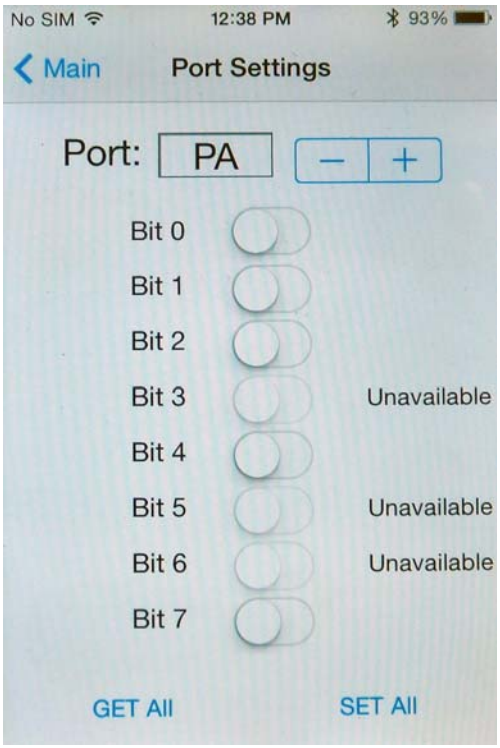

Figure 18. The Initial Port Settings Screen

Sliding all switches (i.e., bits 0 through 7) to the right will place a High on all of the available Port A pins. Bits 0, 1, and 2 are wired to LEDs on the shield; therefore they will illuminate when these switches are turned on.

Note: Some pins may not be available if they have been previously prioritized to another task.

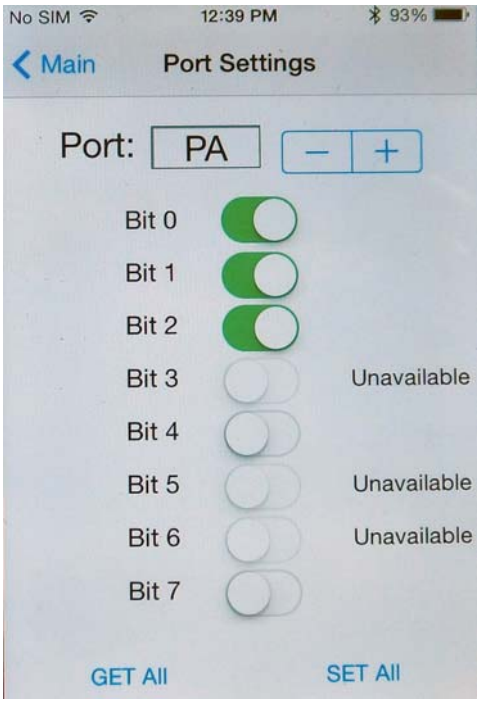

Figure 19. The Port Settings Screen with Some Port A Bits Turned On

The three LEDs that are turned on in the Figure 18 example can each be turned off by sliding these switches to the left. Additional ports can be turned on or off for all selected bits by tapping the + or – symbols and selecting a different port.

PWM Command. This command allows intuitive control of PWM outputs. For example, both the frequency and the duty cycle of PWM1 can be adjusted and monitored on PC6 of the shield interface's J8 connector at Pin 23.

World of Sensors Command. This command presents the World of Sensors menu, which displays the three selections shown in Figure 20.

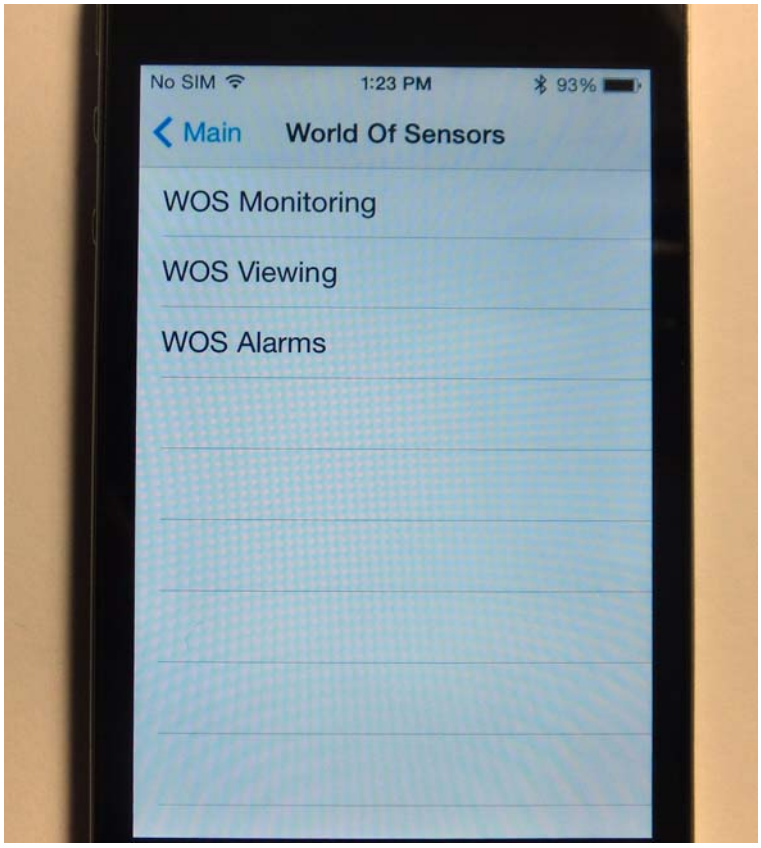

Figure 20. The World of Sensors Menu

WoS Monitoring. The output from this command can only be seen if the ZSED Platform's optional LCD Module is attached to the Platform. All seven sensors (i.e., humidity, ambient light, motion detection, pressure, proximity, sound, and temperature) display their output on this LCD Module in a 10-second cycle, as shown in Figure 21.

Figure 21. A Humidity Reading on the ZSED Platform's Optional LCD Module

WoS Viewing. If no LCD Module is available, the sensor output can still be viewed by selecting this command. In WoS Viewing Mode, the output of each individual sensor, or even all of the sensors, can be displayed on the iPhone screen in a continuously refreshed mode.

WoS Alarms. This command sends alerts to the iPhone when a sensor threshold has been triggered. For example, the Humidity sensor can show a Current Value, a Low Limit Alarm value, and a High Limit Alarm value. The Current Value will display the humidity level for your current geographical location.

Reset BT Command. This command is issued only if a factory reset of the Bluetooth LE radio is desired. This situation may result if the student, while experimenting, changes any of the settings and wishes to quickly return to a known state.

Student Exercise #2

The following exercise allows students to test the Humidity High Limit Alarm using the sensor in the World of Sensors Shield. As in Student Exercise #1, the following materials are required:

- One ZSED Platform
- One Bluetooth LE Shield
- One World of Sensors Shield
- One iPhone with the ZEDUcation application installed

1. Set the High Limit Alarm 5 to 10 points higher than the value that is currently shown in the WoS Alarms Humidity screen.
2. Ensure that the plastic cover has been removed from the Humidity Sensor at the bottom of the Sensor Shield. Next, locate the active slider (soft switch) button, found at the bottom of the Humidity screen, and slide it to the right.
3. Take a breath and blow some air over the Humidity Shield. As a result, the humidity threshold should soon be exceeded, and the High Limit Alarm will sound and be displayed on the iPhone's Humidity screen.

Program/Debug Mode

The Zilog Developer Studio Integrated Development Environment (ZDSII IDE) for the ZNEO CPU is the software environment that is used to program, flash, debug, and control the ZSED Platform. In Program/Debug Mode, ZDSII replaces the pre-programmed command shell that is used in Serial Mode.

The following procedure describes how to get ZDSII – ZNEO up and running.

Caution: Do not apply power to the ZSED Platform until you have established all hardware connections.

1. Download the latest version of the ZDSII – ZNEO software from the Zilog website and follow the prompts to install it on your development PC. A ZDSII – ZNEO icon will appear on your desktop.
2. Locate the USB Smart Debug Cable that shipped with your Kit. Insert the cable's USB A connector into a USB port on the PC, and insert the 6-pin connector on the other end of the cable to the Base Board P1 (Console) connector.

Note: The A to Mini-B USB cable is not required for this function.

3. After the USB Smart Debug Cable is connected, apply power to the ZSED Platform and double-click the ZDSII – ZNEO icon to launch the ZDSII Development Environment.
4. In ZDSII, navigate via the **File** menu to the **Samples** folder on your Kit's USB drive, and open a project file labelled `LightMeUp.zdsproj`.
5. If your system does not recognize the USB SmartCable, you will be prompted for the location of the USB SmartCable driver. If your system recognizes the USB SmartCable, proceed to Step 6.

Note: The USB SmartCable driver can be found in the Drivers folder of the USB Flash Drive that shipped with your Kit. It is also located in the ZDSII – ZNEO directory that you just installed on your PC, and it can also be found in the RD0005-SC01.zip file, which is available free for download from the Zilog website.

6. From the **Project** menu in ZDSII, select **Settings** to open the Project Settings dialog. From the **Configuration:** drop-down menu located at the top of this dialog, select **Debug**, as shown in Figure 22.

Figure 22. Selecting the Debug Tool from the ZDSII Taskbar

7. In the Debug Tool pane at the bottom of the Project Settings dialog, select **USBSmartCable** from the **Current:** drop-down menu (if it is not already selected); see Figure 23.

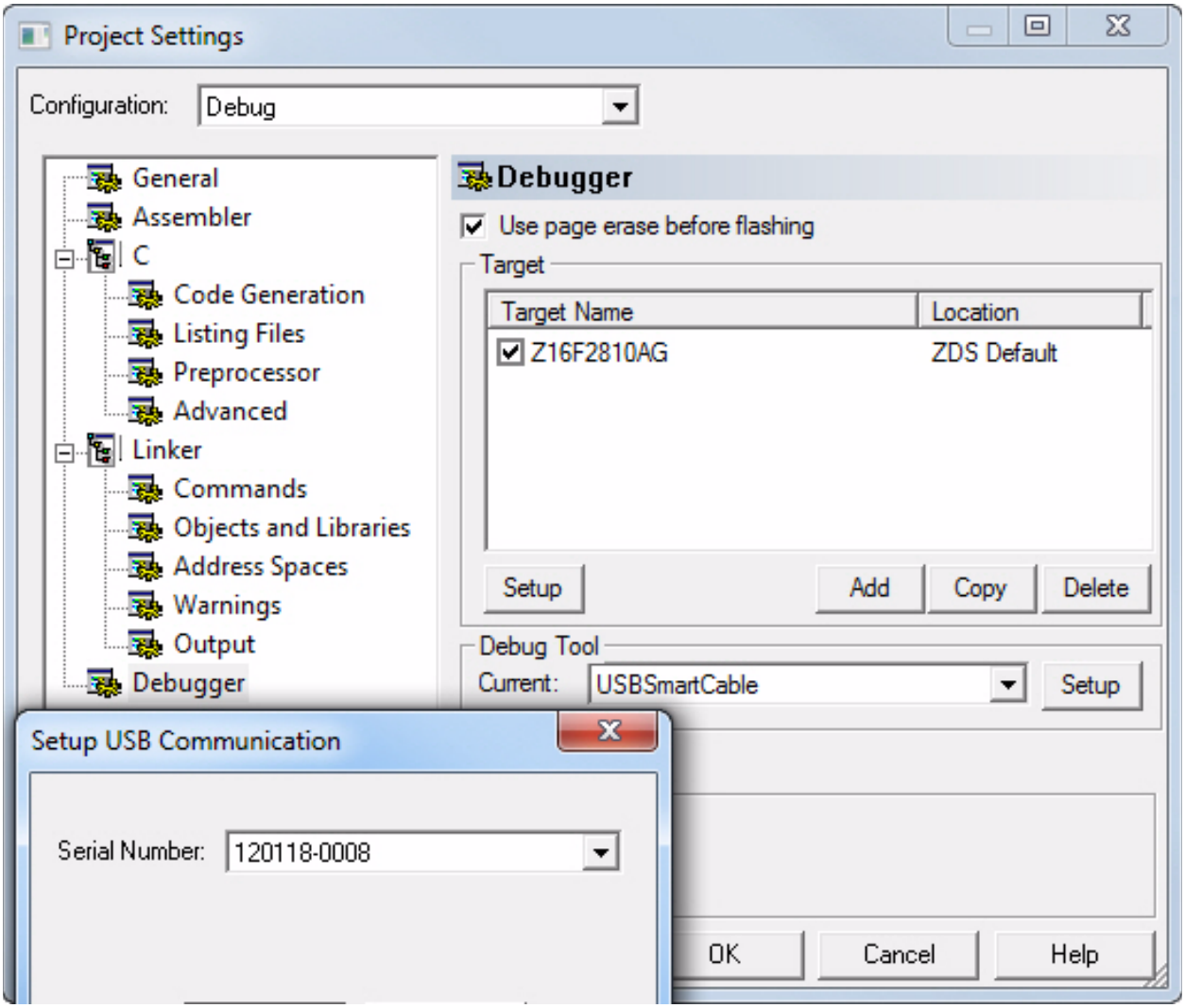

Figure 23. USB SmartCable Serial Number Register

8. Click the **Setup** button in this Debug Tool pane to prompt ZDSII to recognize the serial number of your USB SmartCable (seen in the Setup USB Communication dialog in Figure 23).
9. Click **OK** to exit the Project Settings dialog.
10. Locate the USB Flash drive that shipped with your Kit and insert it into a USB port on your PC.

11. From the **File** menu in ZDSII, select **Open Project...** to open the Open Project dialog. In this dialog, browse to the **C_Projects** folder on the USB Flash drive, and open the `LightMeUp.c` project file.
12. With the `LightMeUp.c` project displayed on your PC's monitor, compile it by clicking **Build** in the ZDSII taskbar.
13. From the selection of commands listed in the **Build** drop-down menu, select **Rebuild All**. The compile process that ensues will create several files that will be placed in the Debug folder, which is located in the Project directory. One of these files will display a `.hex` extension; this file will be used to burn the program into Flash memory in a procedure described in the Student Exercise #3 section on page 38.
14. When the rebuild is complete, a `Build Complete` message will appear in the Message Window at the bottom of the ZDSII screen; see Figure 24.

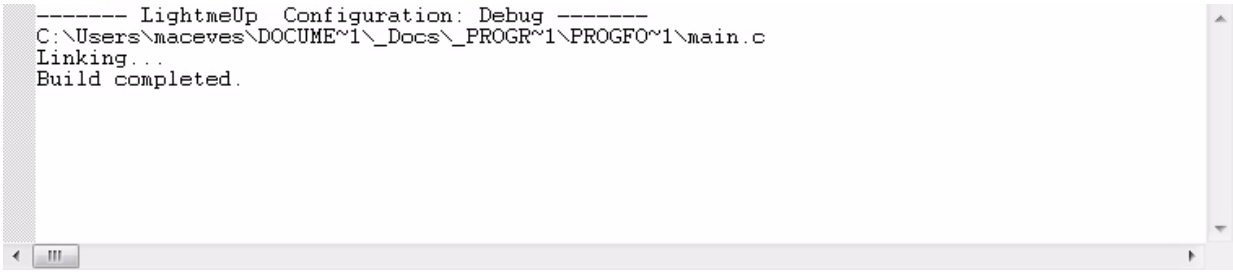

Figure 24. Build Completed Message

15. In the ZDSII taskbar, click **Debug** to open the Debug Command Window.
16. In the Debug Command Window, select **Connect to Target**, and observe the progress of the debug operation in the progress window. When the debug is complete, a `Successfully initialized target` message will appear, as shown in Figure 25.

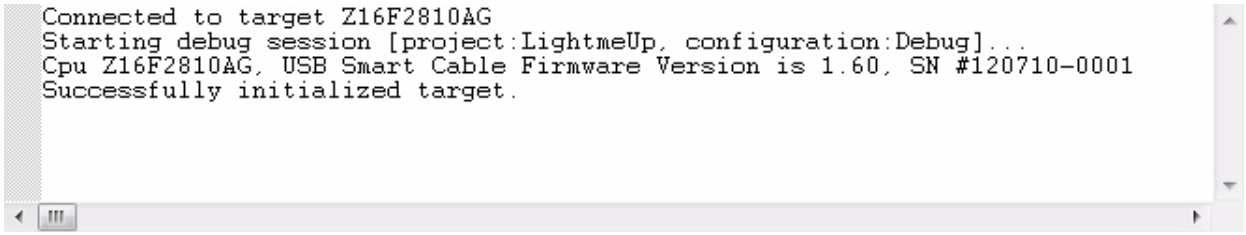

Figure 25. Connected Successfully Screen

Note: If you are unable to establish a successful connection, return to Step 5.

17. Click **Debug** on the taskbar a second time, and select **Download Code** from the drop-down menu. If ZDS II prompts you to rebuild the project, click **Yes**. When the debug operation is complete, you should see a `Load successful` message in the progress window.

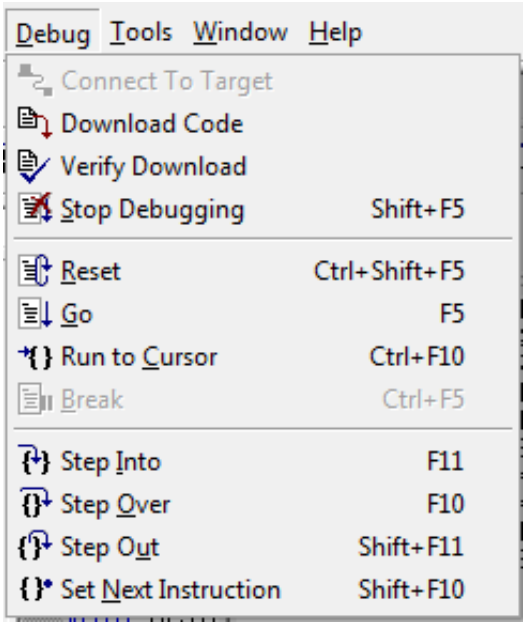

Figure 26. Select Download Code from the Debug Drop-Down Menu

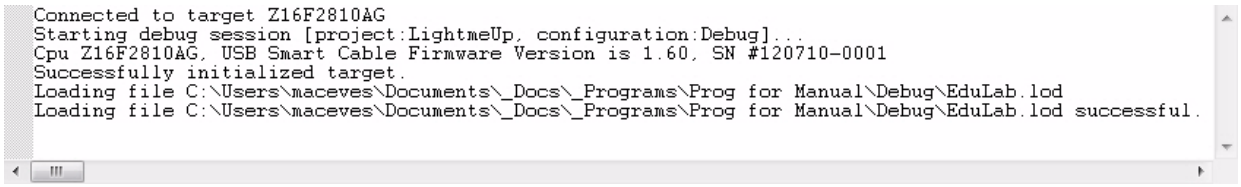

Figure 27. Load Successful Message

18. Click **Debug** on the taskbar a third time, then select **Go**. The `LightMeUp` project will run, and you should now see light patterns displayed on the Test Shield.

Student Exercise #3

The following exercise will help students become familiar with flashing a hex program to memory. Before proceeding with this exercise, the USB SmartCable must be connected as described in the Program/Debug Mode section on page 33.

When flashing a program to memory, ZDSII must not be running in Debug Mode. To stop Debug Mode, click **Debug** on the ZDSII taskbar and select **Stop Debugging**.

Observe the following procedure to flash the `LightMeUp` project to MCU memory.

1. Click **Tools** on the taskbar, and select **Flash Loader**. The Flash Loader Processor dialog appears, as shown in Figure 28.

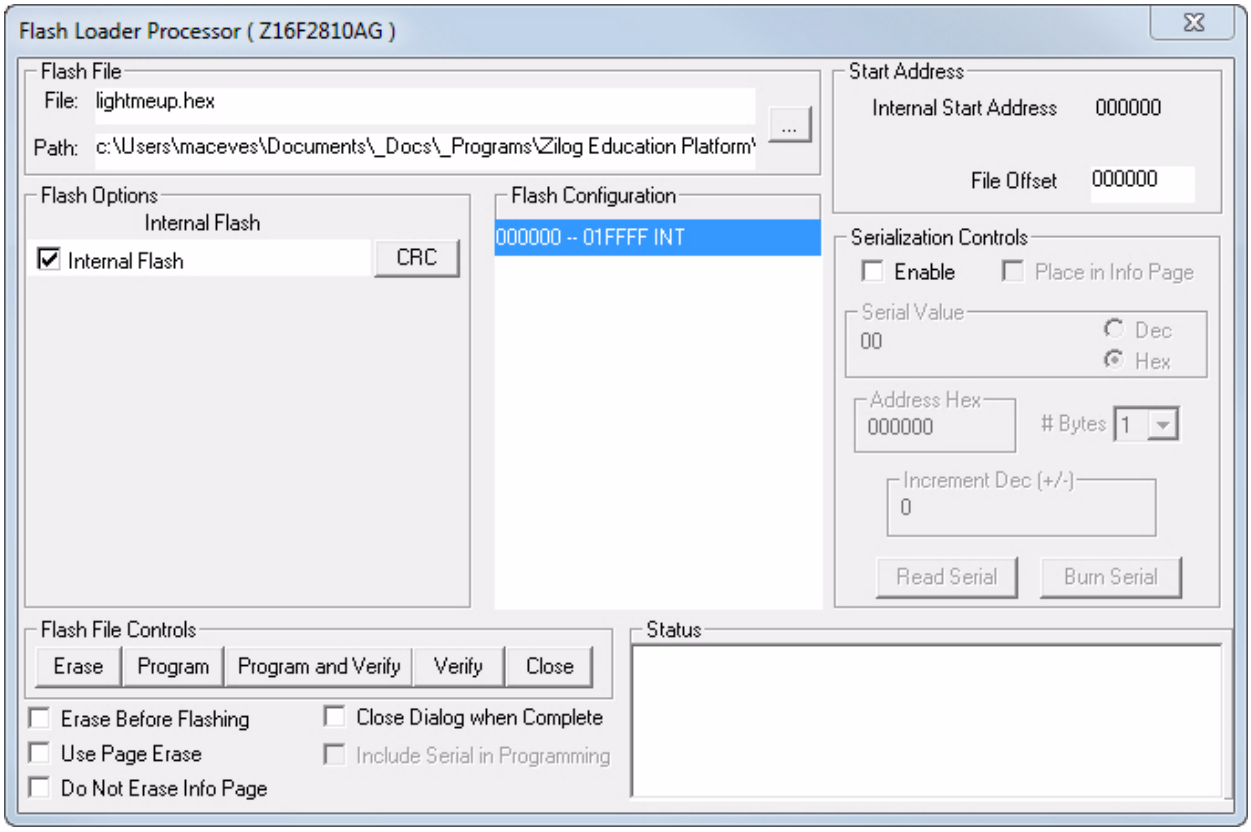

Figure 28. Flash Loader Screen

2. In this dialog, click the **...** icon in the Flash File pane to navigate to the `LightMeUp.hex` file, which is located in the Debug folder contained within the **LightMeUp** project directory. Once you have selected the file, allow all other options in this dialog to remain at their default settings.

Note: A different *.hex file name and path are used in this example.

3. In the Flash File Controls pane, click the **Erase** button to erase any possible preexisting code in memory.
4. Click the **Program and Verify** button. The programming and verifying process will take a few seconds to complete. When this process is complete, click the **Close** button.
5. Switch off the power to the ZSED Platform, and disconnect the USB SmartCable.
6. Reapply power to the ZSED Platform, and press the ZSED Platform's RESET button to ensure that the `LightMeUp` project will run from the beginning of the program.

PC Independent/Mobile Mode

Operation in PC Independent/Mobile Mode requires the user to write an application. For the ZSED Platform to perform independently from a PC, it must first be flashed (i.e., preprogrammed) with a self-contained program that utilizes the keypad as its main source of input and control. This control can also be performed wirelessly by another Bluetooth-enabled device; e.g., an iPhone application that will issue commands to or request information from the ZSED Platform.

PC Independent/Mobile Mode is dependent on a specific application designed for mobile use. For example, field measurements of differing environmental conditions can be gathered by Bluetooth-enabled sensors on a battery-powered ZSED Platform populated with a ZPAN (Bluetooth LE) shield.

Hardware

The Student Educational Platform features the following hardware items:

- Application Shield Interface
- Two parallel 30-pin connectors to accept stackable application shields
- One 50-pin connector to serve as an expansion port for future peripherals
- Smart USB/serial cable, used for programming and debugging, interfaces the PC-based ZDSII environment to the ZNEO-based ZSED Platform
- Power selector jumper between wall power and 9V battery
- Integrated buzzer generates audible signals
- Standard 2.1mm x 5.5mm wall outlet power jack

- Mini-USB connector
  - Connects the ZSED Platform to the PC via a Serial/UART USB cable
  - Console software interface for the command shell
- Optional LCD Module displays two 16-character lines and includes a backlight disable jumper
- Optional 16-button keypad

The shield interface provides two 30-pin indexed sockets that allow access to 48 general-purpose I/O lines. Each shield is stackable, but careful analysis of the GPIO lines must be performed to avoid interference. Each of the shield schematic diagrams listed in Appendix A of the Zilog Educational Shields User Manual (UM0256) lists the GPIO lines used with its corresponding shield.

Firmware

The ZSED Platform is preprogrammed with a command shell that allows control of the ZSED Platform out of the box; full C source code is provided.

Software

The ZSED Platform requires two USB drivers for operation. These drivers, named Driver 1 and Driver 2, are described in this section.

Driver 1

Driver 1 is used to enable the USB SmartCable connection to the PC and to the ZDSII development software; this driver is supplied by Zilog and can be found in the USB Flash drive that shipped with your Kit. Alternatively, it can be found in the folder containing the ZDSII software that you downloaded and installed on your computer; the default path to this driver is:

C:\Program Files(x86)\Zilog\ZDSII_ZNEO_5.0.1\device drivers\USB Smart Cable

Driver 2

Driver 2 is used to enable the PC console serial connection used by the command shell. Like Driver 1, this driver can be found in the USB Flash drive that shipped with your Kit. Alternatively, it can be downloaded from the following path on the FTDI website: http://www.ftdichip.com/drivers/VCP.htm.

A terminal emulator program is also required to link the PC with the ZSED Platform. As previously stated, Tera Term is used in this document, but any terminal emulation program can be used.

Note: Tera Term can be downloaded for free from http://logmett.com/index.php?/download/tera-term-474-freeware.html. Zilog does not provide technical support for Tera Term or any terminal emulator program.

Electrical Specifications

Table 2 describes the electrical characteristics of the ZSED Platform and reflects all available data as a result of testing prior to qualification and characterization. As such, the data presented in this table is subject to change.

Table 2. Electrical Specifications for the ZSED Platform

Parameter	Min	Max	Units	Notes
VIN Range	6	12	Volts	
Max voltage range on all other pins	–0.3	5.5	Volts	I/O pins and Reset; ADC pins are not 5V-tolerable.
Max current for I/O pin connection points	–25	25	Milliamps (mA)	
Max V_{IN} current	–	1	Amperes	
Ambient temperature	–40	105	°C	
Storage temperature	–65	150	°C	

Note: Stresses greater than those listed in Table 2 may cause permanent damage to the Zilog Student Educational Platform. These ratings are stress ratings only. Operation of the device at any condition outside those indicated in the operational sections of these specifications is not implied. Exposure to absolute maximum rating conditions for extended periods affects device reliability. For improved reliability, unused pins must be tied to one of the supply voltages (V_{DD} or V_{SS}).

Packaging

Figure 29 shows the overall dimensions of the Zilog Student Educational Platform.

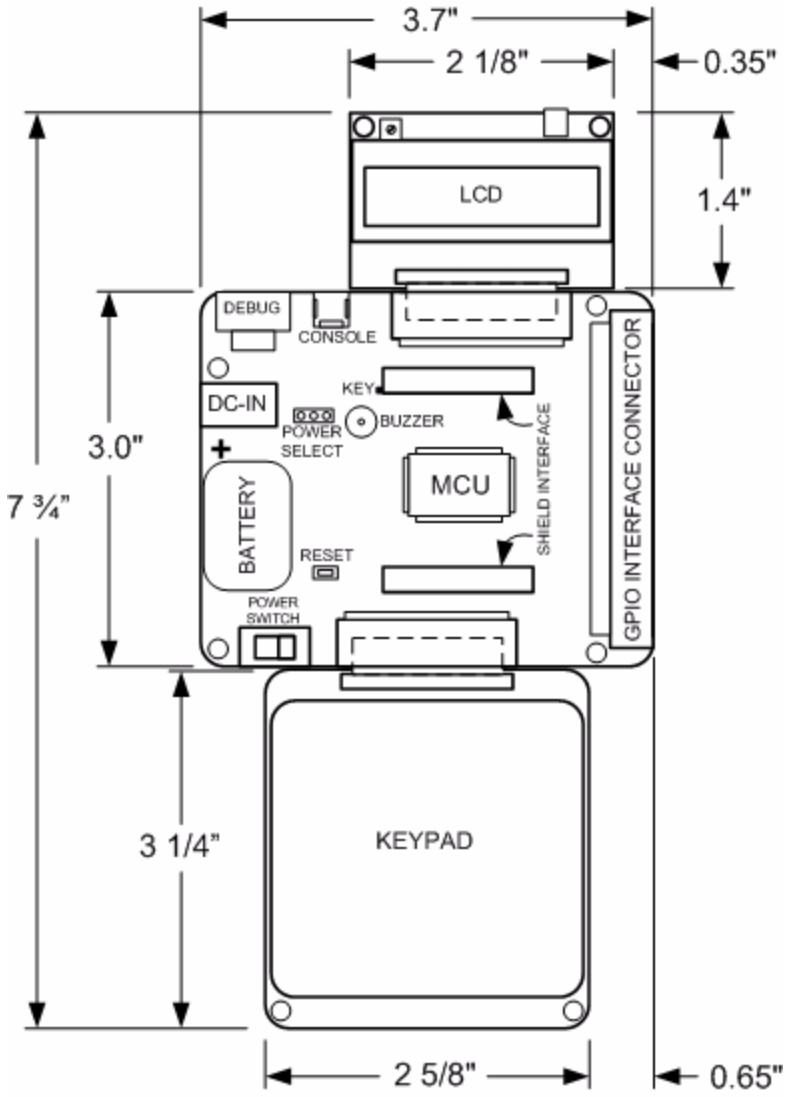

Figure 29. ZSED Platform Dimensions

Mechanical Profile

Figure 30 shows a side view of the Zilog Student Educational Platform, with dimensional aspects.

Figure 30. ZSED Platform Side View

Ordering Information

The Zilog Student Educational Platform can be ordered as a stand-alone product or as a kit. Application shields are also available at the Zilog Store – simply click the Store Product IDs listed in Table 3.

Table 3. Zilog Student Educational Platform Ordering Information

Item	Zilog Part Number	Store Product ID
Zilog Educational Platform	EZEDU16F100MDSG	ED10001
Zilog Educational Platform Kit	EZEDU16F100KITG	ED10002
Zilog Student Educational Platform	EZEDU16F200MODG	ED10007
Zilog Student Educational Platform Kit	EZEDU16F200MDSG	ED10008
ZED World of Sensors Shield	99C1419-001G	ED10003
ZED Z-PAN LE Shield	99C1402-001G	ED10004
ZED WLAN Shield	99C1337-001G	ED10005
ZED Test Shield	99C1374-001G	ED10006

Related Documentation

The documents associated with the Zilog Student Educational Platform are listed in Table 4. Each of these documents can be obtained from the Zilog website by clicking the link associated with its Document Number.

Table 4. Zilog Student Educational Platform Documentation

Document Number	Description
UM0269	This Zilog Student Educational Platform User Manual
UM0255	Zilog Educational Platform User Manual
UM0256	Zilog Educational Shields User Manual
PS0220	ZNEO Z16F Series Product Specification
UM0188	ZNEO CPU Core User Manual
UM0181	USB SmartCable User Manual

Appendix A. Schematics

Figure 31 shows a schematic diagram of the Zilog Student Educational Platform.

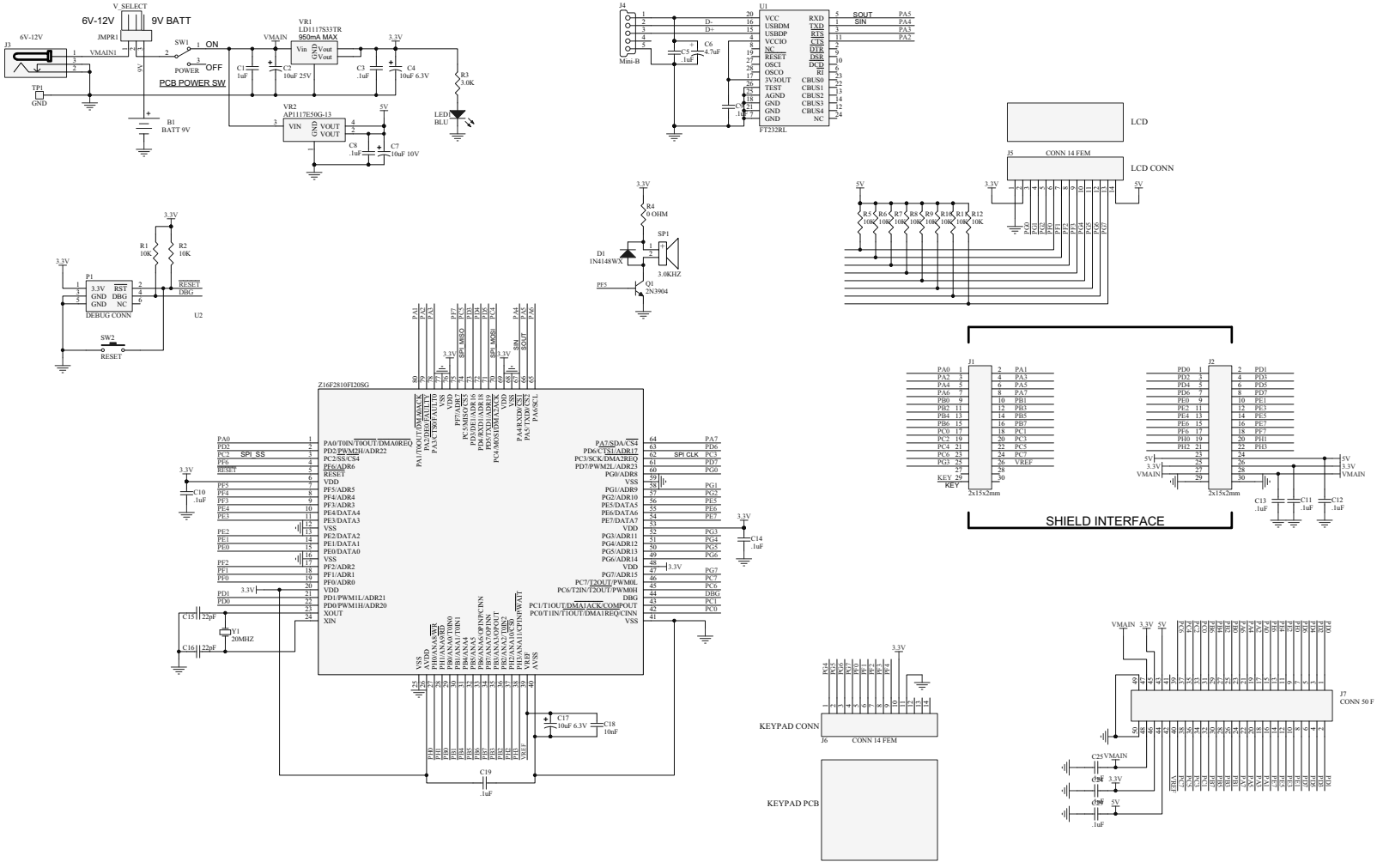

Figure 31. Schematic Diagram of the Zilog Student Educational Platform

Customer Support

To share comments, get your technical questions answered, or report issues you may be experiencing with our products, please visit Zilog's Technical Support page at http://support.zilog.com.

To learn more about this product, find additional documentation, or to discover other facets about Zilog product offerings, please visit the Zilog Knowledge Base or consider participating in the Zilog Forum.

This publication is subject to replacement by a later edition. To determine whether a later edition exists, please visit the Zilog website at http://www.zilog.com.