



***Zilog Education Solutions***

# **Zilog Educational Shields**

**User Manual**

UM025603-0814



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

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# Revision History

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

<b>Date</b>	<b>Revision Level</b>	<b>Description</b>	<b>Page No</b>
Aug 2014	03	Updated Ordering Information table to include a product page link to the Zilog Store.	<a href="#">46</a>
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# Table of Contents

Revision History .....	iii
List of Figures .....	v
List of Tables .....	vii
Introduction .....	1
Educational Platform Setup .....	2
Connect Two Educational Platforms .....	9
The ZED Test Shield .....	11
Global GPIO Control .....	11
Individual GPIO Control .....	12
Demonstrate the ZED Test Shield .....	12
Graphic and Text String Display .....	14
The ZED Application Shields .....	16
ZED Shields and the Stackability Matrix .....	16
The ZED World of Sensors Shield .....	20
Demonstrate the ZED World of Sensors Shield .....	21
The ZED Z-PAN Shield .....	24
Establish A Wireless Connection .....	25
The ZED WLAN Shield .....	33
Establish A WiFi Connection .....	33
ZDSII Developer Studio for the ZNEO CPU .....	41
Ordering Information .....	46
Related Documentation .....	47
Appendix A. Schematic Diagrams .....	48
Customer Support .....	52

# List of Figures

Figure 1.	Key Alignment Between the Educational Platform and the Test Shield . . . .	3
Figure 2.	COM Port Selection . . . . .	4
Figure 3.	Tera Term New Initial Screen . . . . .	5
Figure 4.	Baud Rate Setting . . . . .	6
Figure 5.	Initial Command Shell Prompt . . . . .	6
Figure 6.	A List of Shell Root Commands . . . . .	7
Figure 7.	Command Parameters . . . . .	8
Figure 8.	The Results of the startshield List Command . . . . .	9
Figure 9.	WLAN WiFi Setup on a Single PC . . . . .	10
Figure 10.	ZED Application Shields . . . . .	11
Figure 11.	ZED Test Shield initialization . . . . .	12
Figure 12.	ZED Test Shield Command List . . . . .	13
Figure 13.	ZED Application Shields . . . . .	16
Figure 14.	Stacked Shields: Z-PAN and WoS . . . . .	17
Figure 15.	Stacked Shields: Initialization . . . . .	18
Figure 16.	Stacked Shields: Combined Command Set . . . . .	19
Figure 17.	The ZED World of Sensors Shield . . . . .	20
Figure 18.	Initializing the WoS Shield . . . . .	22
Figure 19.	The WoS Shield Command List . . . . .	23
Figure 20.	The Z-PAN Shield . . . . .	25
Figure 21.	List of Z-PAN Shield Commands . . . . .	26
Figure 22.	RN-41 Command Access . . . . .	27
Figure 23.	Module 1 Default Settings . . . . .	28
Figure 24.	Module 2 Default Settings . . . . .	28
Figure 25.	Z-PAN Shield Console Settings . . . . .	29
Figure 26.	Module 1 Remote Address Settings . . . . .	29
Figure 27.	Module 2 Remote Address Settings . . . . .	30
Figure 28.	Module 1 wredirect Command . . . . .	31

Figure 29. Module 2 wremotehost Command . . . . .	31
Figure 30. Module 1 Prompt After wremotehost Command . . . . .	32
Figure 31. The WLAN Shield . . . . .	33
Figure 32. WLAN Command List for Both Shields . . . . .	34
Figure 33. RN-171 Command Mode Access . . . . .	35
Figure 34. Module 1 RN-171 IP Settings . . . . .	36
Figure 35. Module 1 RN-171 WLAN Settings . . . . .	36
Figure 36. Module 2 RN-171 IP Settings . . . . .	37
Figure 37. Module 2 RN-171 WLAN Settings . . . . .	37
Figure 38. Client wredirect Command . . . . .	39
Figure 39. Host wremotehost Command . . . . .	40
Figure 40. Client wremotehost Response . . . . .	40
Figure 41. Schematic Diagram of the ZED Test Shield . . . . .	48
Figure 42. Schematic Diagram of the ZED World of Sensors Shield . . . . .	49
Figure 43. Schematic Diagram of the Z-PAN Shield . . . . .	50
Figure 44. Schematic Diagram of the WLAN Shield . . . . .	51

# List of Tables

Table 1.	ZED Test Shield Commands . . . . .	13
Table 2.	ZED Shield Stackability Matrix . . . . .	17
Table 3.	ZED World of Sensors Shield: Sensor Manufacturers . . . . .	21
Table 4.	ZED World of Sensors Shield Commands . . . . .	23
Table 5.	Zilog Educational Platform Ordering Information . . . . .	46
Table 6.	Zilog Educational Platform Documentation . . . . .	47

# Introduction

The Zilog Educational (ZED) Shields are application-specific modules that form part of a larger educational system, at the core of which is the Zilog Educational Platform. Each of these ZED shields is designed to teach a specific subject or application, and this document, which describes each ZED Shield, has been created to be a companion document to the [Zilog Educational Platform User Manual \(UM0255\)](#).

The ZED shields are designed to be modular and stackable to save time and effort, and thus allow flexibility for teaching and experimentation. Additionally, the Zilog Educational System can assist faculty toward streamlining any Electronics Engineering or Embedded Computer Engineering syllabus.

The ZED's stackable design features male/female connectors that can plug into or accept other shields. For ease of introduction, these shields can be operated directly from a pre-programmed command shell without requiring any additional programming. As a result, the novice engineer can develop a level of familiarity with the concepts behind each stackable shield before tackling the intricacies of in-depth programming.

This document describes how to understand and use the following four Zilog Educational Shields:

- Test Shield
- World of Sensors Shield
- Zilog Personal Area Network (Z-PAN) Shield based on Bluetooth technology
- Wide/Local Area Network (WLAN) Shield based on WiFi technology

Of these four shields, the Test Shield ships as part of the [Zilog Educational Platform Kit](#); the other three shields can be purchased separately from the [Zilog Store](#).

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► **Note:** Operation of the Zilog Educational Platform and shields assumes a functional knowledge of basic computer principles on the part of the student.

---

# Educational Platform Setup

The working configuration of the Educational Platform will vary according to the requirements of the shield(s) being used. Requirements for the example exercises contained in this manual will be described as they are presented. A typical setup consists of One Personal Computer with One Educational Platform attached and a shield of choice.

Out of the Box setups assume that a Terminal Emulator such as Tera Term or HyperTerminal has been installed on the target PC(s) and that the Educational Platform and Shield are still in the Kit Box.

This Manual uses Tera Term, it may be downloaded for free from the following link.

<http://logmett.com/index.php?/download/tera-term-475-freeware.html>

Wireless communication configurations may consist of two platforms, or alternatively, one platform and one ZED Shield, depending on the user requirements.



**Caution:** Always use a grounding strap to prevent damage resulting from electrostatic discharge (ESD).

---

Remove the contents of the Zilog Educational Platform Kit and observe the following procedure to connect the and ZED Test Shield.

1. Plug the ZED Test Shield into the Platform, taking care to match the Platform (Base Board) and Test Shield key markers on J1, as indicated in Figure 1.

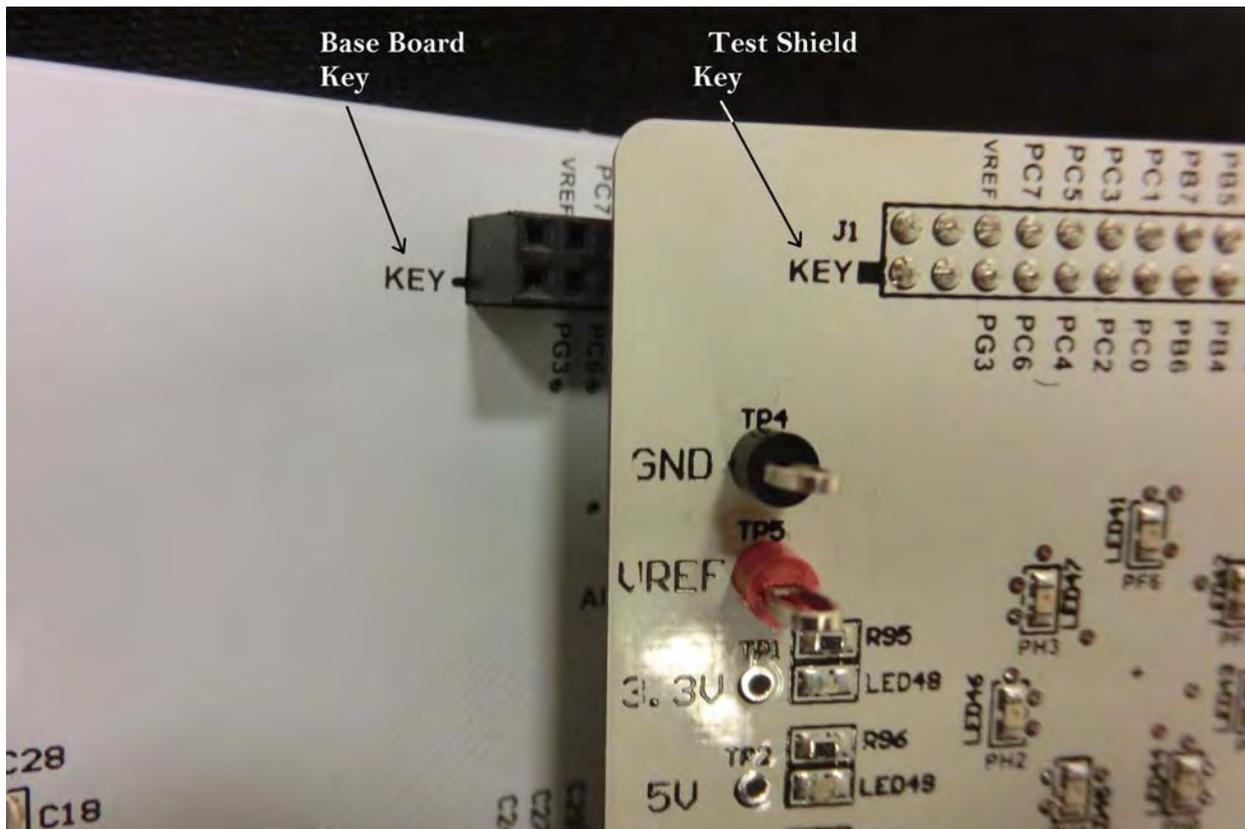


Figure 1. Key Alignment Between the Educational Platform and the Test Shield

2. Connect the 9V wall power adapter or the 9V battery to the Platform, but *do not turn the power on* to the Platform.
3. Connect the Mini-B connector end of the A to Mini-B USB cable to the J5 connector, and connect the other end of this cable to the target PC. Ensure that Power Select Switch SW2 is in the correct position for the type of power being applied. For example, if you are using the 9V battery, move the switch to BATT; if using power sourced from the wall outlet, move the switch to VMAIN.

---

► **Note:** If the Windows OS displays a `Driver Not Found` message, you must install a USB driver. A standard USB driver ships with the USB Flash drive you received with your Kit; however, the same driver can be downloaded for free from the FTDI website at <http://www.ftdichip.com/Drivers/VCP.htm>.

---

4. Locate Switch SW1 on the Educational Platform, and apply power to the Platform.
5. On the PC, launch the Tera Term program. In Tera Term's New connection screen, click the **Serial** radio button and select the COM port from the **Port:** drop-down menu, as indicated in Figure 2. If more than one COM port is available, you can determine which port is assigned to the Platform by disconnecting the USB A to Mini-B cable and noting which port has disappeared from the list of ports in the **Port:** drop-down menu. This port should reappear once the cable is reconnected. In the Figure 2 example, the COM44 port has been assigned.

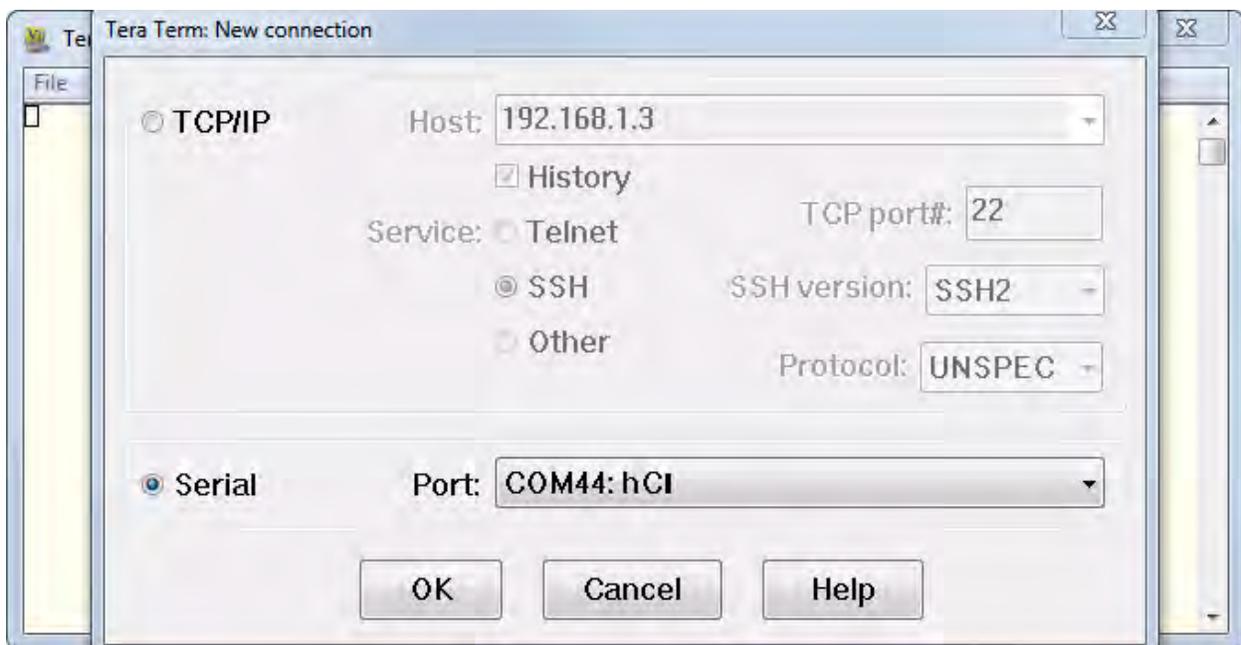
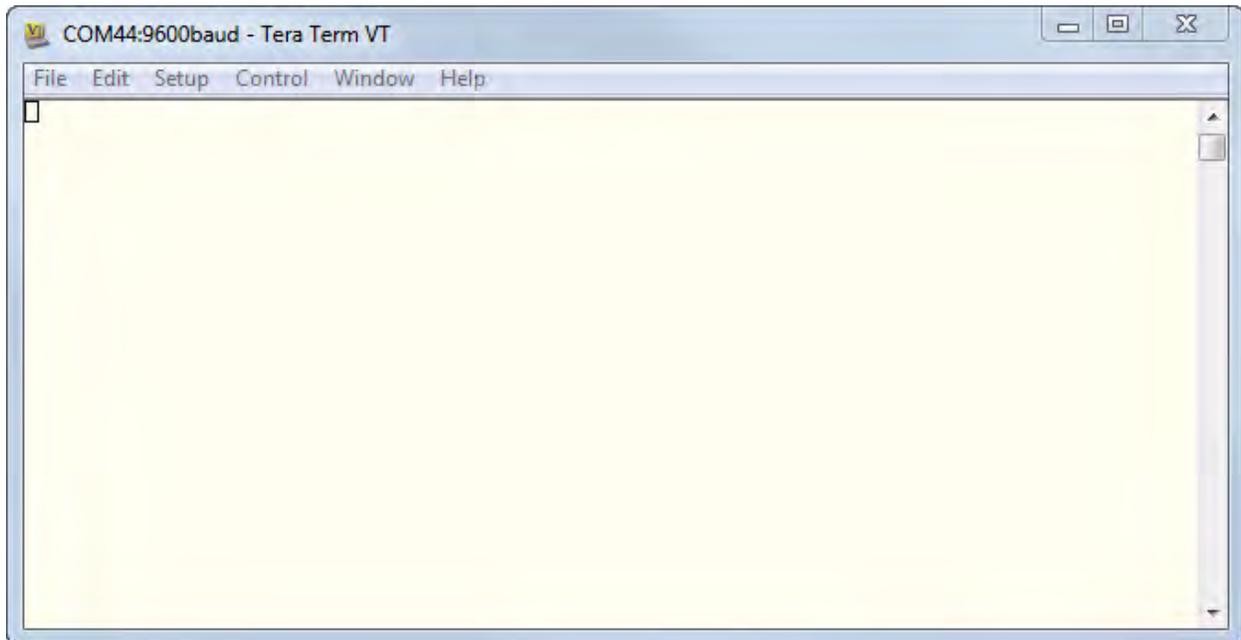


Figure 2. COM Port Selection

6. Click **OK**. The main Tera Term screen will appear, as shown in Figure 3.



**Figure 3. Tera Term New Initial Screen**

7. From the **Setup** menu in Tera Term, select **Serial Port** to open the **Tera Term Serial port setup** dialog shown in Figure 4. The COM port selected in [Step 5](#) will appear in the **Port:** drop-down menu in this dialog. Set the Baud Rate to 57600, and allow the remainder of the settings in this dialog to remain at their default values.

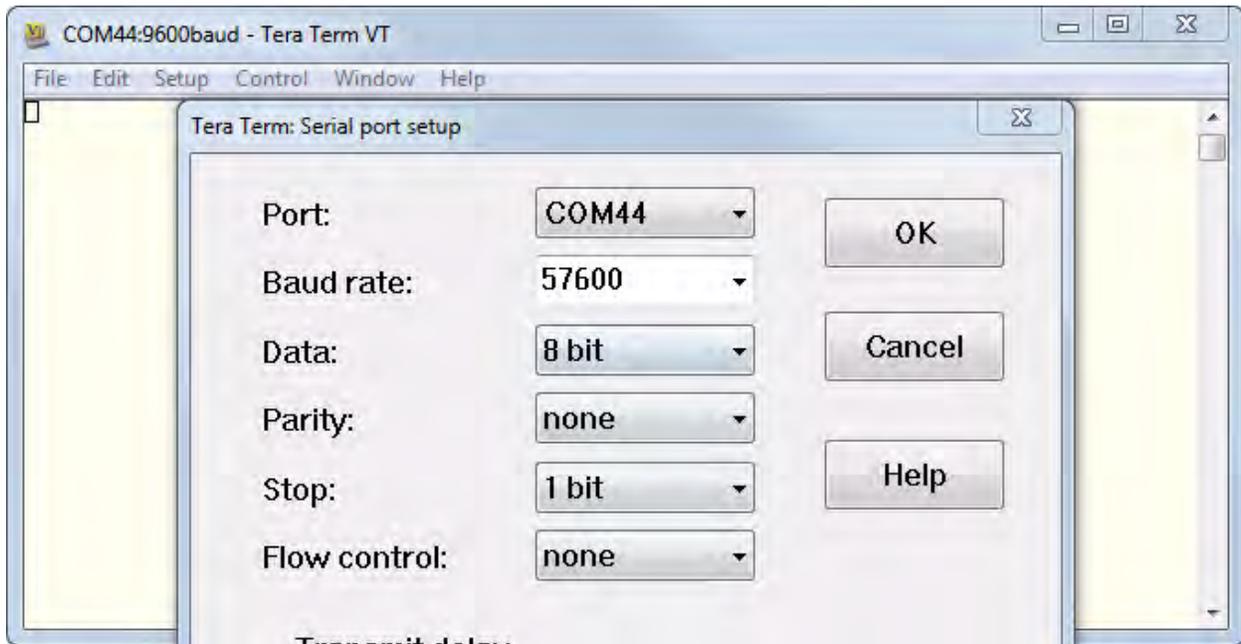


Figure 4. Baud Rate Setting

8. Click **OK** to complete the serial port settings.
9. Press the RESET button on the Platform. The command shell prompt should appear in Tera Term, as shown in Figure 5.

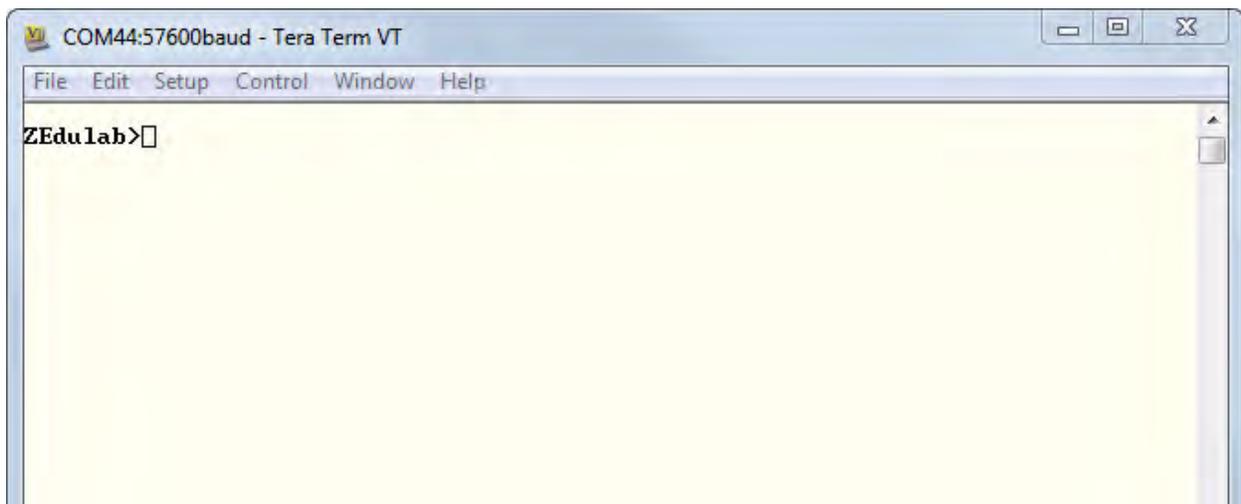
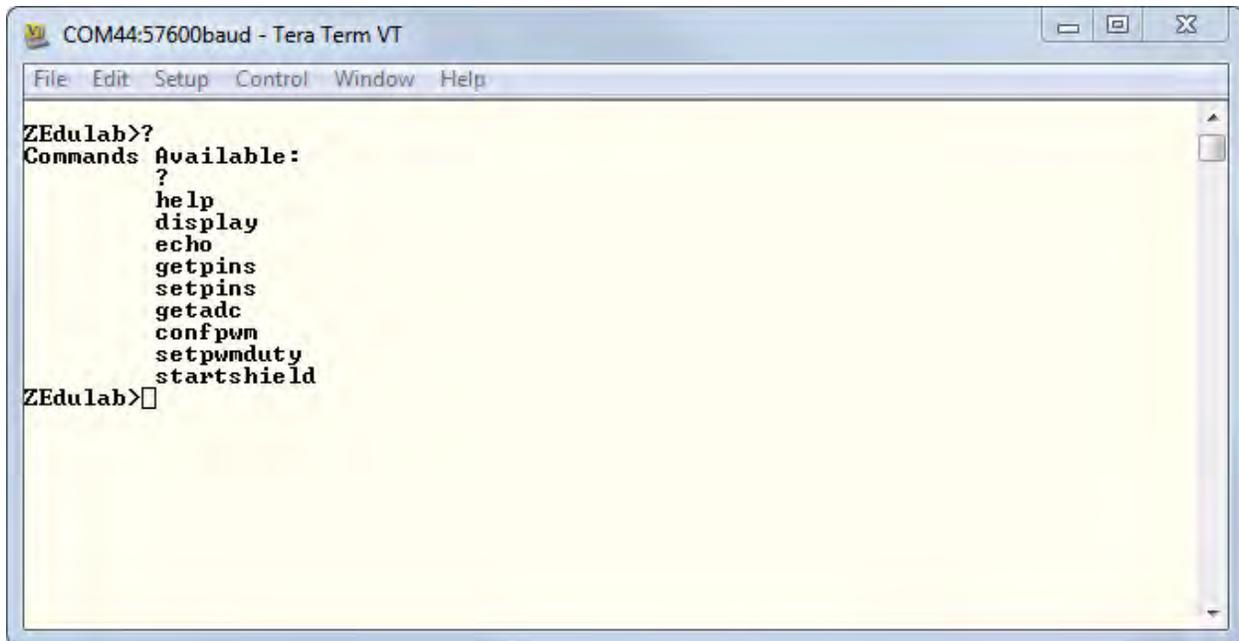


Figure 5. Initial Command Shell Prompt

10. At the ZEdulab> prompt, enter the question mark (?) symbol, then press the Enter key. The command shell will respond with a list of root commands, as shown in Figure 6.



```
COM44:57600baud - Tera Term VT
File Edit Setup Control Window Help
ZEdulab>?
Commands Available:
?
help
display
echo
getpins
setpins
getadc
confpwm
setpwm duty
startshield
ZEdulab>□
```

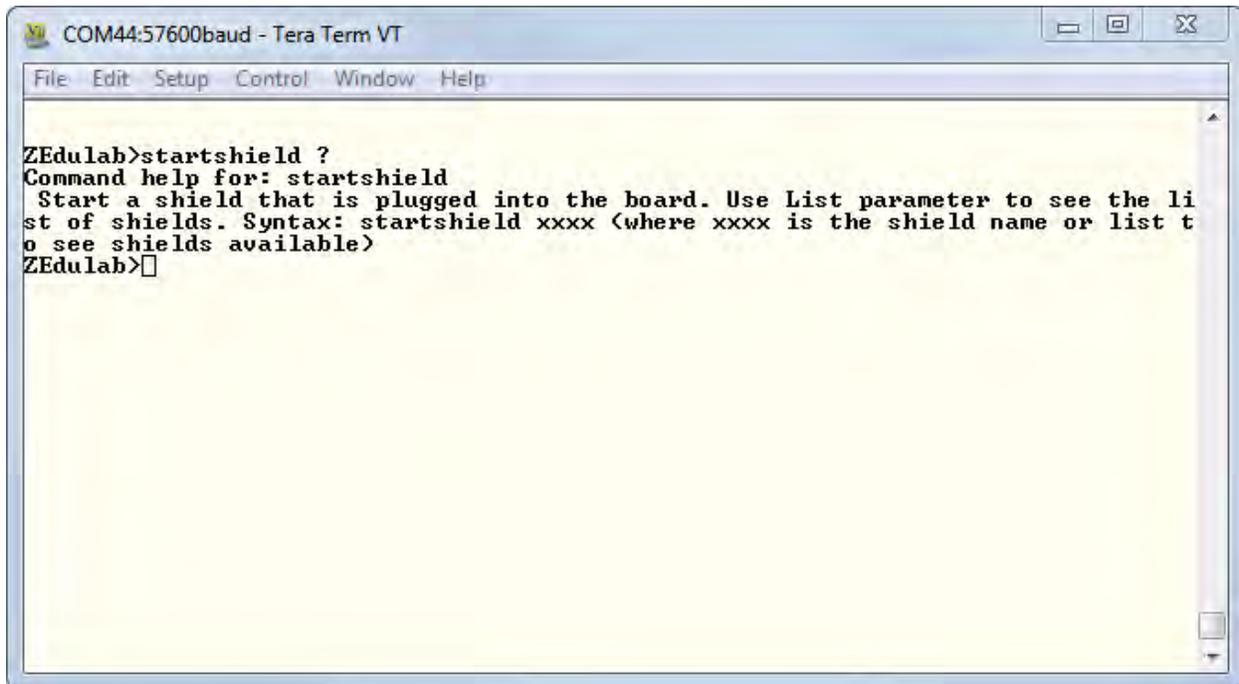
Figure 6. A List of Shell Root Commands

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► **Note:** As an alternative to the ? command, you can also enter help to view the same list of commands.

---

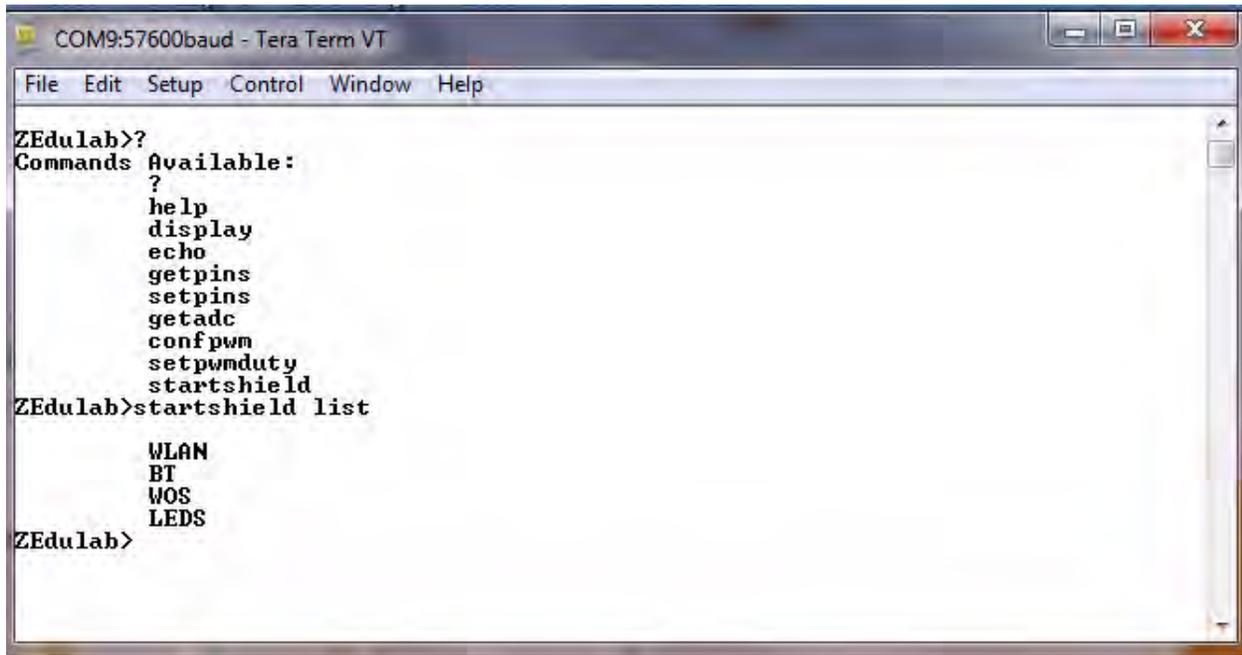
11. To see how to use any command, enter the command followed by the ? symbol, as shown in the startshield ? example in Figure 7.



```
COM44:57600baud - Tera Term VT
File Edit Setup Control Window Help
ZEdulab>startshield ?
Command help for: startshield
Start a shield that is plugged into the board. Use List parameter to see the list of shields. Syntax: startshield xxxx (where xxxx is the shield name or list to see shields available)
ZEdulab>
```

Figure 7. Command Parameters

12. As Figure 7 indicates, the parameters for the `startshield` command can be listed by entering the `startshield list` command string, which will list all of the available shields, as shown in Figure 8.



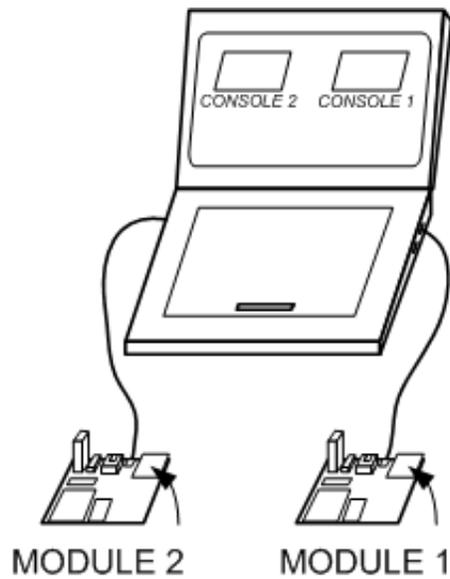
```
COM9:57600baud - Tera Term VT
File Edit Setup Control Window Help
ZEdulab>?
Commands Available:
?
help
display
echo
getpins
setpins
getadc
confpwm
setpwmduty
startshield
ZEdulab>startshield list
WLAN
BT
WOS
LEDS
ZEdulab>
```

Figure 8. The Results of the startshield List Command

## Connect Two Educational Platforms

Demonstrating the features of the ZED Application Shields may require that two Educational Platforms be connected to each other; e.g., when demonstrating a connection between two wireless modules. Observe the following brief procedure to connect two Zilog Educational Platforms and to establish their console connections.

1. For easy identification purposes during this procedure, label one Educational Platform MODULE 1: CLIENT, and label the second Educational Platform MODULE 2: HOST.
2. With two standard USB cables, connect the two Educational Platforms to your PC, as indicated in Figure 9.



**Figure 9. WLAN WiFi Setup on a Single PC**

3. Ensure that the ZED WLAN WiFi shields have been properly plugged into the Educational Platform, then apply power to the Platform.
4. Launch two Tera Term consoles (one on each PC), and configure their COM port settings to the settings shown in [Figure 4](#) on page 6.
5. Verify that the root shell prompt, `zEdu1ab>`, appears on both console terminals.



The following two examples demonstrate usage of this `setpins` command.

**Example 1.** The `setpins PB FF ON` command turns on all Port B bits

**Example 2.** The `setpins PB FF OFF` command turns these bits off

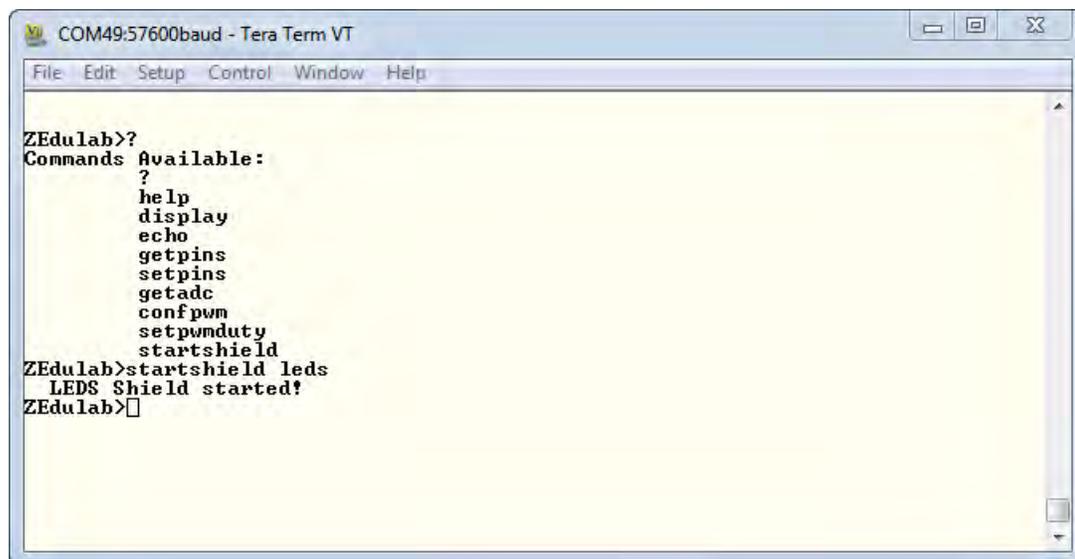
## Individual GPIO Control

The `setpins` command that controls individual port bits is not available after the ZED Test Shield has been initialized. Instead the ZED Test Shield, as controlled by the command shell, is primarily used to display text strings with the `LEDString` command. Characters will display on a 4x7 matrix instead of the more common 5x7 matrix because the PA4 and PA5 bits are reserved for use by the UART. If the UART is not in use (i.e., the USB console cable is not connected), the full 5x8 matrix will be available. Besides its graphics capabilities, the shield can also be used to teach basic binary math.

## Demonstrate the ZED Test Shield

Observe the following procedure to view a basic demonstration of the ZED Test Shield.

1. In Tera Term, enter the `startshield leds` command to initialize the ZED Test Shield. An `LEDS Shield started!` message will appear, as shown in Figure 11.



```

COM49:57600baud - Tera Term VT
File Edit Setup Control Window Help
ZEdulab>?
Commands Available:
?
  help
  display
  echo
  getpins
  setpins
  getadc
  confpwm
  setpwm duty
  startshield
ZEdulab>startshield leds
LEDS Shield started!
ZEdulab>
  
```

Figure 11. ZED Test Shield initialization

- The ZED Test Shield offers two menu commands, ? and help, with which you can view a comprehensive list of available Test Shield shell commands. At the ZEDulab> prompt, enter ? or help to see these commands, as shown in Figure 12.

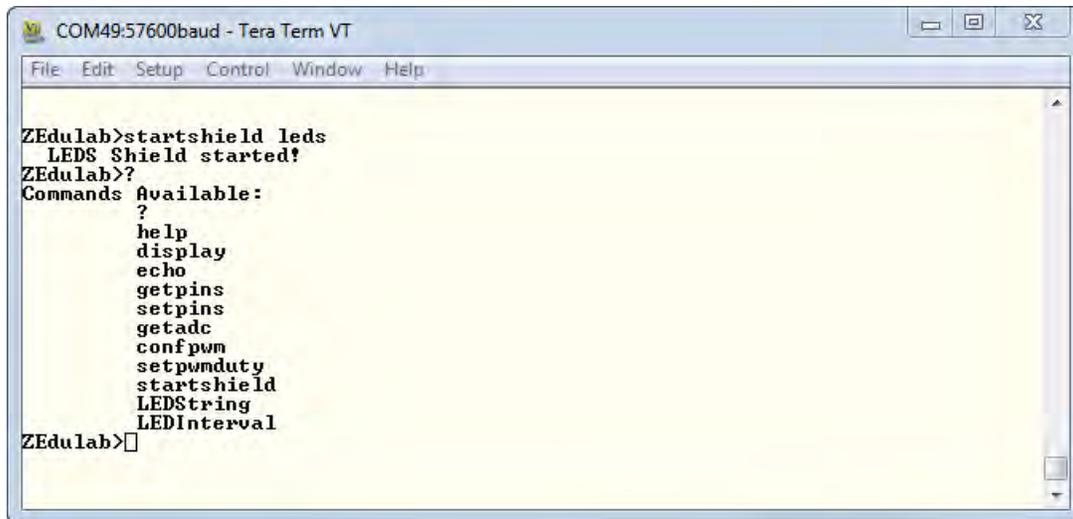


Figure 12. ZED Test Shield Command List

To view a list of parameters for each command, enter a command followed by the ? symbol. Table 1 describes all of the ZED Test Shield’s shell commands shown in Figure 12.

Table 1. ZED Test Shield Commands

Command	Description
?	Lists all of the available commands.
Help	Lists all of the available Help commands.
Display	Displays a command's function; parameters and syntax information; displays a string on the LCD; temporarily turns off any monitoring; displays the first parameter on line 1 and the second parameter on line 2. Syntax: displays "Hello World".
Echo	Turn echo keystrokes to the console on or off. Syntax: echo on/off.
Getpins	Sets the pin(s) to input. Retrieves the pin('s) values for specified port(s). Syntax: getpins PX [HexNumber] , in which Hex Number is the value specifying the pins to get; defaults to all pins.
Setpins	Sets pin(s) to output and sets the pin('s) values for a specified port. Syntax: setpins PX [HexNumber] ON OFF, in which Hex Number is the value specifying the pins to set.
getadc	Sets the port to alternative function then reads the ADC value from requested ADC 0–11. Syntax: getadc xx, in which xx is the ADC number 0–11.

**Table 1. ZED Test Shield Commands (Continued)**

Command	Description
<b>confpwm</b>	Configures the PWM cycle period in kHz (1–20); an absence of parameters displays the current setting. Syntax: confpwm 2.
<b>setpwmduty</b>	Configures the PWM channel's duty cycle from 0 to 100%. An absence of a duty parameter will display the current setting of the selected PWM. Syntax: setpwmduty xx [DD], which xx is a PWM number in the range 1–6, and DD is a duty cycle in the range 0–100.
<b>startshield</b>	Start a shield that is plugged into the board. Use the List parameter to see the list of shields. Syntax: startshield xxxx, in which xxxx is the shield's name or list to see the available shields.
<b>LEDString</b>	Set a string to display on LEDs.
<b>LEDInterval</b>	Set an interval between character displays on all LEDs (defaults to 500ms).

## Graphic and Text String Display

When using the `LEDString` command, characters display on a 4x7 LED matrix. Because bits PA4 and PA5 are reserved for use by the UART, Port A is not used for graphics. However, the full 5x8 matrix is available when the UART is not in use; i.e., when the USB A to Mini-B cable is not connected to the J5 console connector.

The following brief example demonstrates how to program a character in a 5x5 matrix. In this example, the ZDSII development environment is used instead of the command shell. A complete program that displays one text string a character at a time can be found in the [ZDSII Developer Studio for the ZNEO CPU](#) section on page 41.

► **Note:** The ZDSII development environment defaults to the C language. However, writing programs in Assembly language is also supported.

**Example.** Write the program below to display the letter Z on a 5x5 matrix, as shown in [Figure 10](#) on page 11.

```
#include <stdio.h>           #include "zneo.h"
Void LetterZ(void) {
    PAOUT = 0x7C;
    PBOUT = 0x08;
    PCOUT = 0x10;
    PDOUT = 0x20;
    PEOUT = 0x7C;
}
Void main(void){
```

```
PADD = 0x00;           // Configure PA as output
PBDD = 0x00;           // Configure PB as output
PCDD = 0x00;           // Configure PC as output
PDDD = 0x00;           // Configure PD as output
PEDD = 0x00;           // Configure PE as output
LetterZ(); }
```

# The ZED Application Shields

At the time of publication of this manual, the Zilog Educational System offers the ZED Test Shield and three ZED application shields. Each of these shields is shown in Figure 13; they are, from left to right: the Test Shield, the World of Sensors Shield, the Z-PAN Shield and the WLAN Shield.

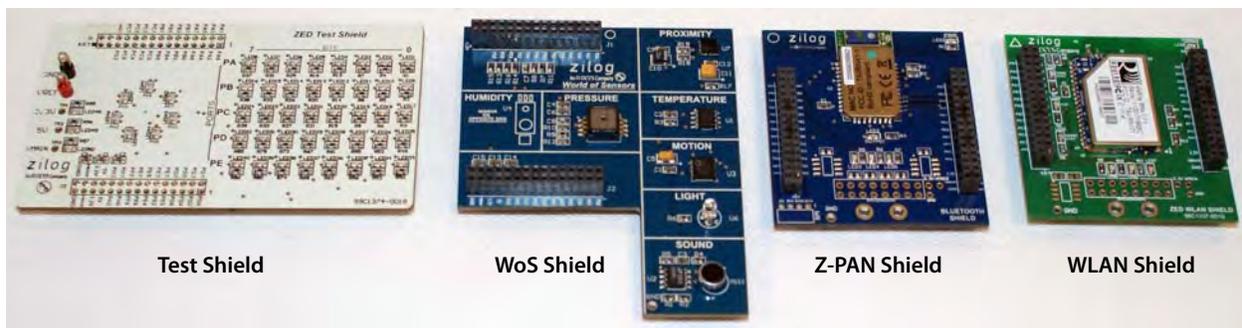


Figure 13. ZED Application Shields

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► **Note:** This manual will be regularly updated to include new shield releases. These new shields will appear in the **Applications** → **Education Solutions** navigation on the [Zilog website](#) and in the **Education Solutions** category of the [Zilog Store](#).

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## ZED Shields and the Stackability Matrix

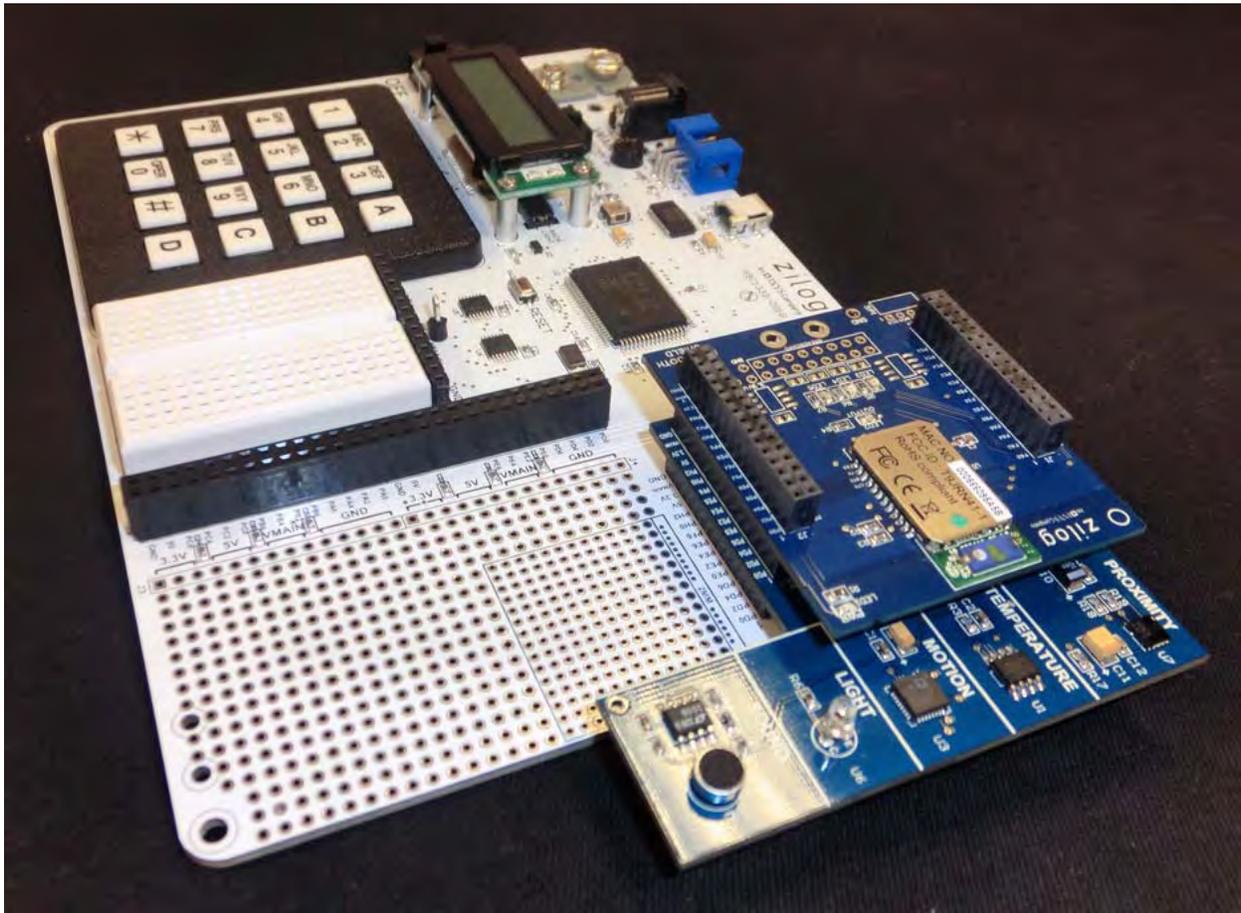
As mentioned earlier, the ZED shields, with the exception of the ZED Test Shield, are designed to be stacked on top of each other via their male/female headers. These headers can plug into or accept other shields, and are each keyed at Pin 29 of the J1 header. This pin has been trimmed to prevent attachment of the shields when they are oriented in the opposite direction.

Additionally, not all shields are stackable with each other. Table 2 presents a ZED Shield Stackability Matrix; the checkmark symbol (✓) indicates which shields can be stacked together.

**Table 2. ZED Shield Stackability Matrix**

	WoS	Z-PAN	WLAN
WoS		√	√
Z-PAN	√		
WLAN	√		

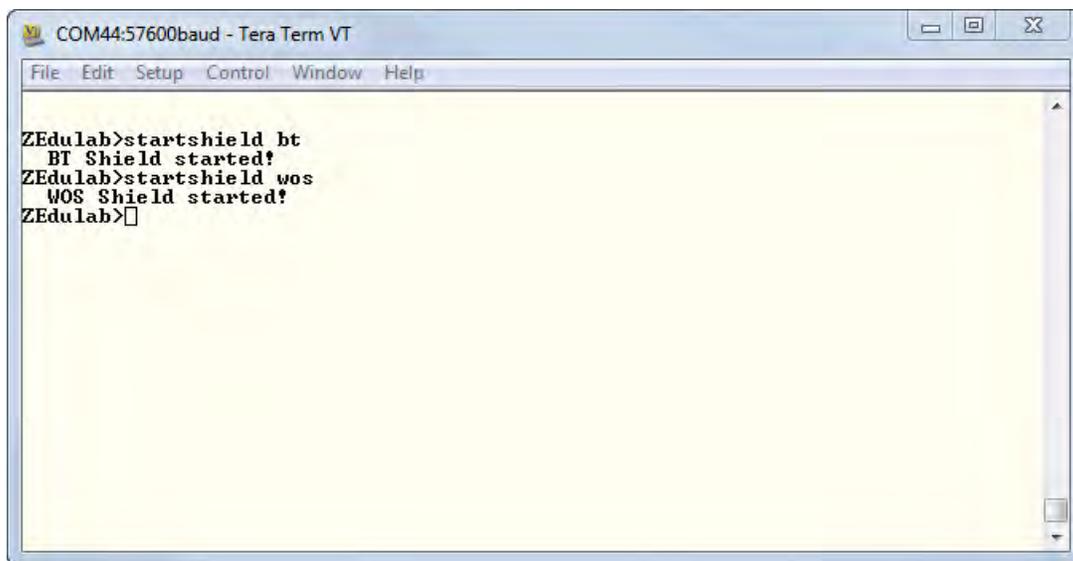
**Example.** Because the WoS Shield and the Z-PAN Shield can be stacked together, Figure 14 shows the Educational Platform with these two shields affixed to each other.



**Figure 14. Stacked Shields: Z-PAN and WoS**

When attached in stacked fashion upon the Educational Platform, controlling each shield with the command shell can be managed as described in the [The ZED Application Shields](#) chapter of this manual.

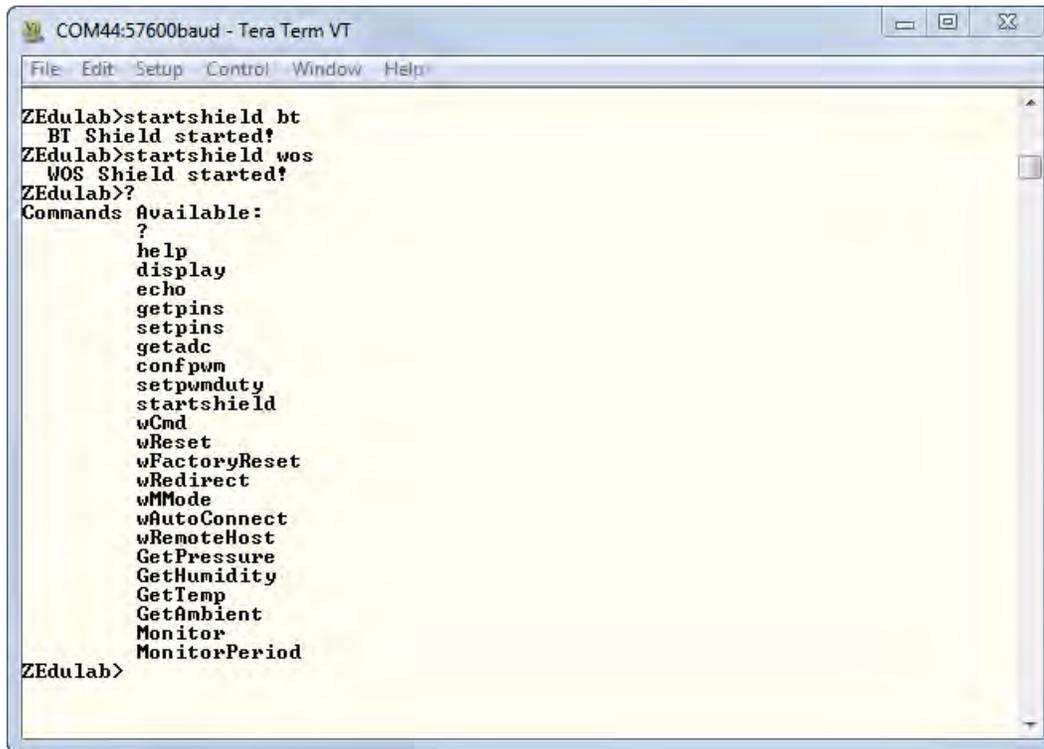
**Example.** To initialize the ZED World of Sensors Shield and the ZED Z-PAN Bluetooth Shield when stacked together (as shown in Figure 14), simply issue the commands `startshield bt` and `startshield wos`, one after the other in no particular sequence, as illustrated in Figure 15.



```
COM44:57600baud - Tera Term VT
File Edit Setup Control Window Help
ZEdulab>startshield bt
BT Shield started!
ZEdulab>startshield wos
WOS Shield started!
ZEdulab>
```

**Figure 15. Stacked Shields: Initialization**

After both shields have been initialized, entering the `?` symbol will display a list the command set for both shields, as shown in Figure 16.



```

COM44:57600baud - Tera Term VT
File Edit Setup Control Window Help
ZEdulab>startshield bt
BT Shield started!
ZEdulab>startshield wos
WOS Shield started!
ZEdulab>?
Commands Available:
?
help
display
echo
getpins
setpins
getadc
confpwm
setpumduty
startshield
wCmd
wReset
wFactoryReset
wRedirect
wMode
wAutoConnect
wRemoteHost
GetPressure
GetHumidity
GetTemp
GetAmbient
Monitor
MonitorPeriod
ZEdulab>
  
```

Figure 16. Stacked Shields: Combined Command Set

As shown in [Figure 8](#) on page 9, entering the `startshield list` command string will list the commands unique to each ZED shield. For example, if you have plugged the Bluetooth-enabled Z-PAN Shield into the Platform, simply enter the following command into your terminal console to initialize the Z-PAN Shield and access its commands:

```
startshield bt
```

Each individual shield is described in the following sections.



**Caution:** Disconnect the power from the Platform before inserting or removing any of the ZED shields, and always use a grounding strap to prevent damage resulting from electrostatic discharge (ESD).

## The ZED World of Sensors Shield

As determined from [Table 2](#) on page 17, the ZED World of Sensors (WoS) Shield is stackable with the Z-PAN Shield and the WLAN Shield, but is not stackable with another WoS Shield. The WoS Shield is shown in Figure 17.

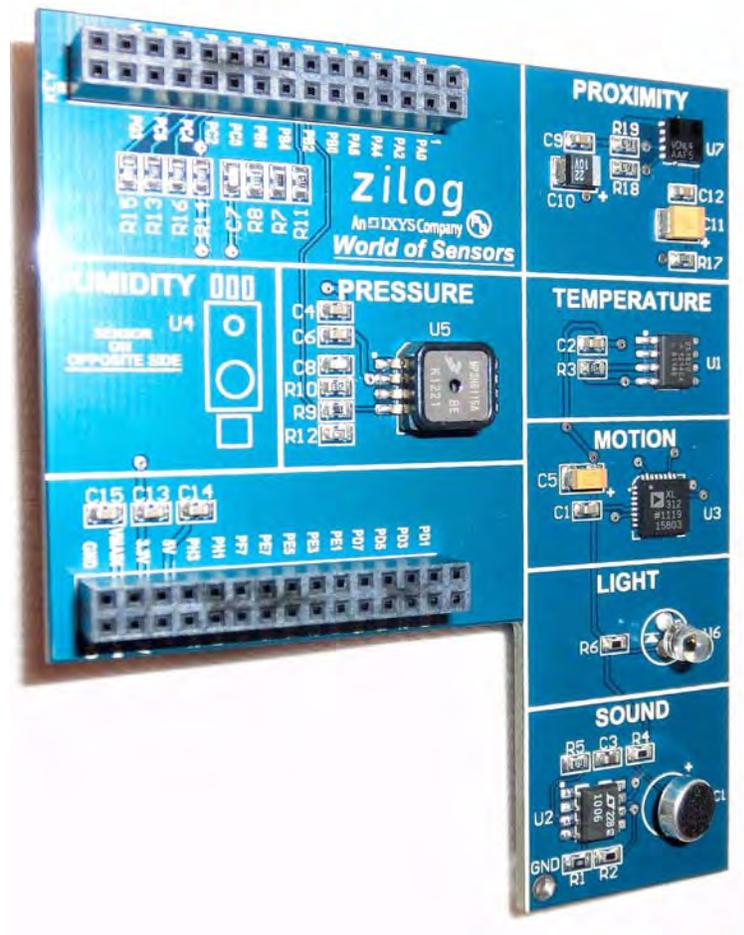


Figure 17. The ZED World of Sensors Shield

The WoS Shield contains seven sensors; each of these sensors is briefly described in Table 3.

**Table 3. ZED World of Sensors Shield: Sensor Manufacturers**

Sensor Enter	Manufacturer	Manufacturer's Part Number
Humidity	Honeywell	HIH-5031-001
Proximity	Vishay	VCNL4000-GS08
Temperature	Maxim	DS18S20Z+
Motion	Analog Devices	ADXL312ACPZ
Ambient Light	Vishay	TEPT4400
Sound	Panasonic	WM-64PNT
Pressure	Freescale	MP3H6115A6U

A schematic diagram of the ZED WoS Shield can be found in [Appendix A](#), which begins on page 48.

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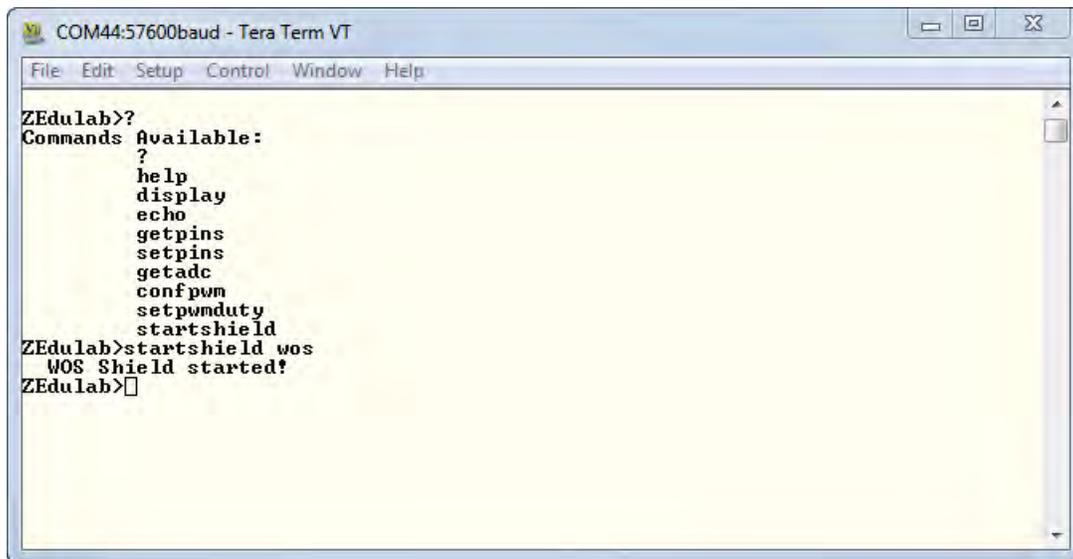
► **Note:** To gain a comprehensive understanding of each of the sensors on the World of Sensors (WoS) Shield, Zilog suggests researching the manufacturer of each sensor. Additionally, you can obtain sensor-specific programming information by studying Zilog's supplied Command Shell C program, which includes functions for every sensor.

---

## Demonstrate the ZED World of Sensors Shield

Observe the following procedure to view a basic demonstration of the ZED World of Sensors Shield.

1. In Tera Term, enter the `startshield wos` command to initialize the WoS Shield. A `WOS Shield started!` message will appear, as shown in Figure 18.



```
COM44:57600baud - Tera Term VT
File Edit Setup Control Window Help
ZEDulab>?
Commands Available:
?
  help
  display
  echo
  getpins
  setpins
  getadc
  confpwm
  setpwm duty
  startshield
ZEDulab>startshield wos
WOS Shield started!
ZEDulab>
```

**Figure 18. Initializing the WoS Shield**

2. The WoS Shield offers two menu commands, `?` and `help`, with which you can view a comprehensive list of available WoS Shield shell commands. At the `ZEDulab>` prompt, enter `?` or `help` to see these commands, as shown in Figure 19.

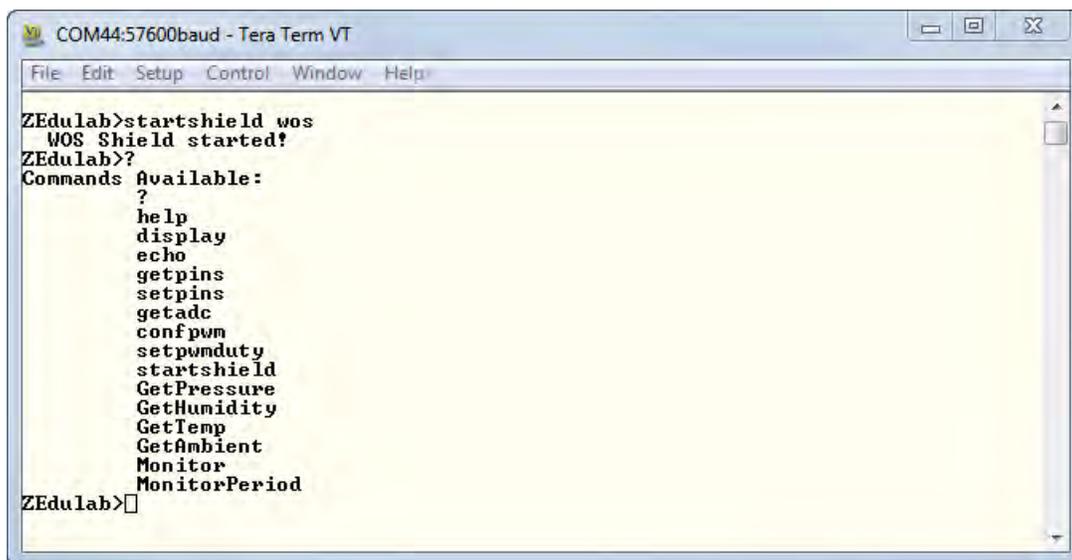


Figure 19. The WoS Shield Command List

In contrast to the ZED Test Shield, the ZED World of Sensors Shield includes six sensor-related commands. To view a list of parameters for each command, enter a command followed by the ? symbol. Table 4 describes all of the ZED WoS Shield’s shell commands shown in Figure 19.

Table 4. ZED World of Sensors Shield Commands

Command	Description
?	Lists all of the available commands.
Help	Lists all of the available Help commands.
Display	Displays a command's function; parameters and syntax information; displays a string on the LCD; temporarily turns off any monitoring; displays the first parameter on line 1 and the second parameter on line 2. Syntax: displays "Hello World".
Echo	Turn echo keystrokes to the console on or off. Syntax: echo on/off.
Getpins	Sets the pin(s) to input. Retrieves the pin('s) values for specified port(s). Syntax: getpins PX [HexNumber] , in which Hex Number is the value specifying the pins to get; defaults to all pins.
Setpins	Sets pin(s) to output and sets the pin('s) values for a specified port. Syntax: setpins PX [HexNumber] ON OFF, in which Hex Number is the value specifying the pins to set.
getadc	Sets the port to alternative function then reads the ADC value from requested ADC 0–11. Syntax: getadc xx, in which xx is the ADC number 0–11.

**Table 4. ZED World of Sensors Shield Commands (Continued)**

Command	Description
<b>confpwm</b>	Configures the PWM cycle period in kHz (1–20); an absence of parameters displays the current setting. Syntax: confpwm 2.
<b>setpwmduty</b>	Configures the PWM channel's duty cycle from 0 to 100%. An absence of a duty parameter will display the current setting of the selected PWM. Syntax: setpwmduty xx [DD], in which xx is a PWM number in the range 1–6, and DD is a duty cycle in the range 0–100.
<b>startshield</b>	Start a shield that is plugged into the board. Use the List parameter to see the list of shields. Syntax: startshield xxxx, in which xxxx is the shield's name or list to see the available shields.
<b>LEDString</b>	Set a string to display on LEDs.
<b>LEDInterval</b>	Set an interval between character displays on all LEDs (defaults to 500ms).
<b>GetPressure</b>	Displays a Pressure Sensor reading on the console; no parameters. Syntax: getpressure.
<b>GetHumidity</b>	Displays a Humidity sensor reading on the console; no parameters. Syntax: gethumidity.
<b>GetTemp</b>	Displays a Temperature sensor reading on the console; no parameters. Syntax: gettemp.
<b>GetAmbient</b>	Displays an Ambient Light sensor reading from the ADC on the console; no parameters. Syntax: getambient.
<b>Monitor</b>	Command to monitor and display sensor data on the LCD. This command allows you to add sensors to the the list of sensors being monitored, monitor all sensors or just monitor one sensor. Each time the Monitor command is executed with a new sensor, the sensor is added to the list of sensors being monitored. Syntax: monitor xxx all list [only], in which xxx is the sensor name to monitor. To select only one sensor, use <i>only</i> as the third parameter. To list all available sensors, enter <i>monitor list</i> . To display all sensors on the LCD, enter <i>monitor all</i> . To add a sensor to the list being monitored, enter <i>monitor sensor</i> . To monitor one specific sensor, enter <i>monitor sensor only</i> .
<b>MonitorPeriod</b>	Sets the relative time period each sensor is monitored and displayed in the range 5–60. Syntax: monitorperiod 10.

## The ZED Z-PAN Shield

As determined from [Table 2](#) on page 17, the Zilog Personal Area Network (Z-PAN) Shield is stackable with the WoS Shield, but is not stackable with the WLAN Shield or another Z-PAN Shield.

The Zilog Personal Area Network (Z-PAN) Shield uses a Roving Networks Class 1 (2,402-2,480MHz) Bluetooth RN-41 Module that conforms to the IEEE 802.15 standard. The ZED Z-PAN Shield is shown in Figure 20.

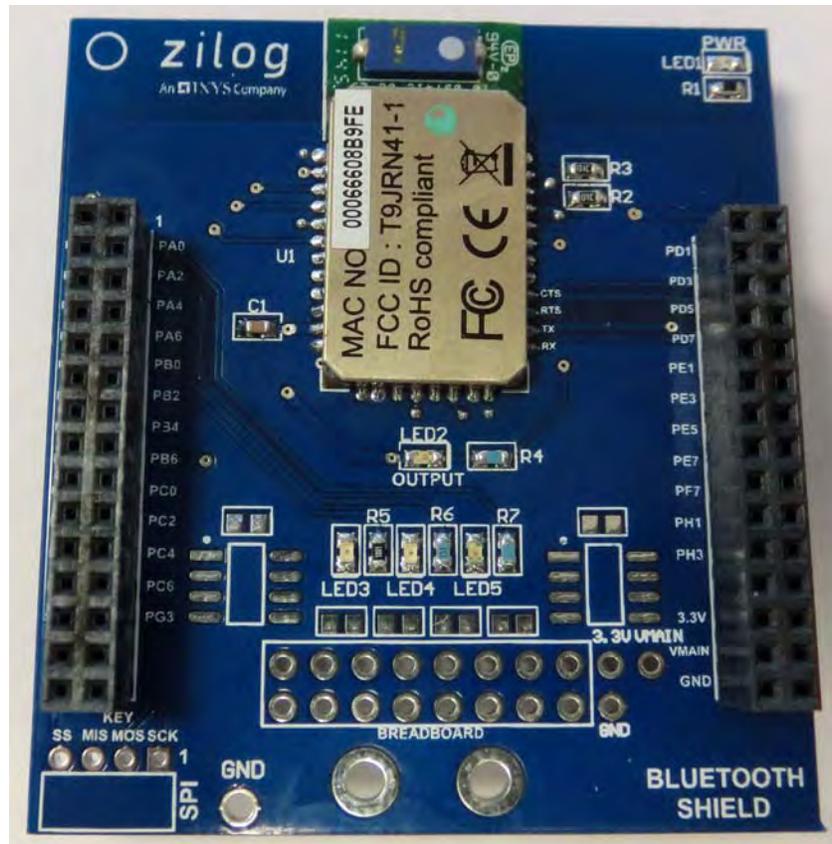


Figure 20. The Z-PAN Shield

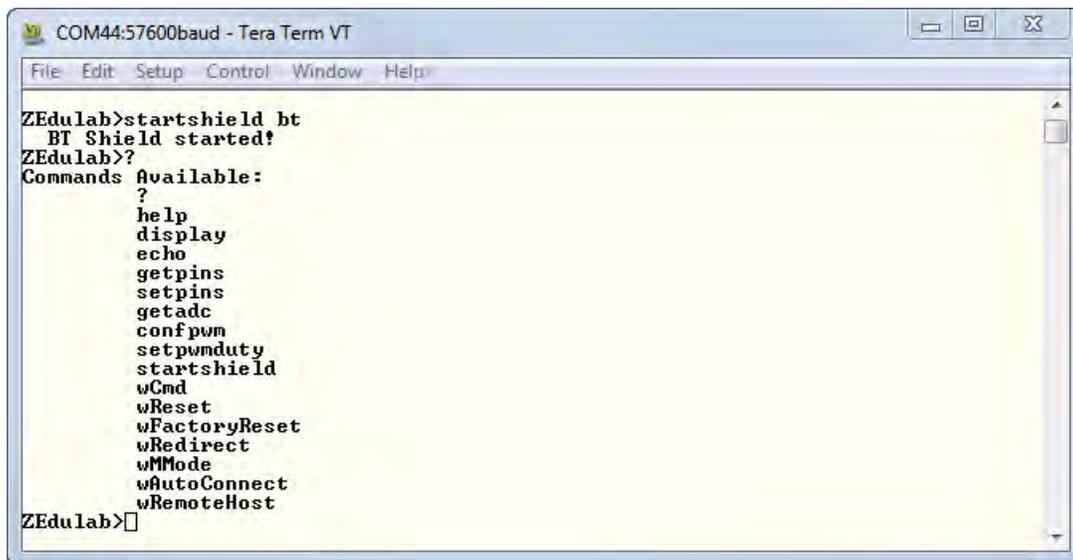
The following instructions will describe how to set up a working Bluetooth link between two Educational Platforms. Alternatively, this link can be established between an Educational Platform and a Z-PAN Mini-Z Module. To connect two Educational Platforms, see the [Connect Two Educational Platforms](#) section on page 9 before proceeding.

A schematic diagram of the ZED Z-PAN Shield can be found in [Appendix A](#), which begins on page 48.

## Establish A Wireless Connection

The following procedure describes how to view a basic demonstration of the ZED Z-PAN Shield, and requires that two Educational Platforms be connected together.

1. Enter the `startshield bt` command on both console screens, and press each Enter key. A message displaying `BT Shield started!` will appear on each terminal. Enter the `?` symbol on one of the two consoles to list all of the available ZED Z-PAN Shield commands; see Figure 21.

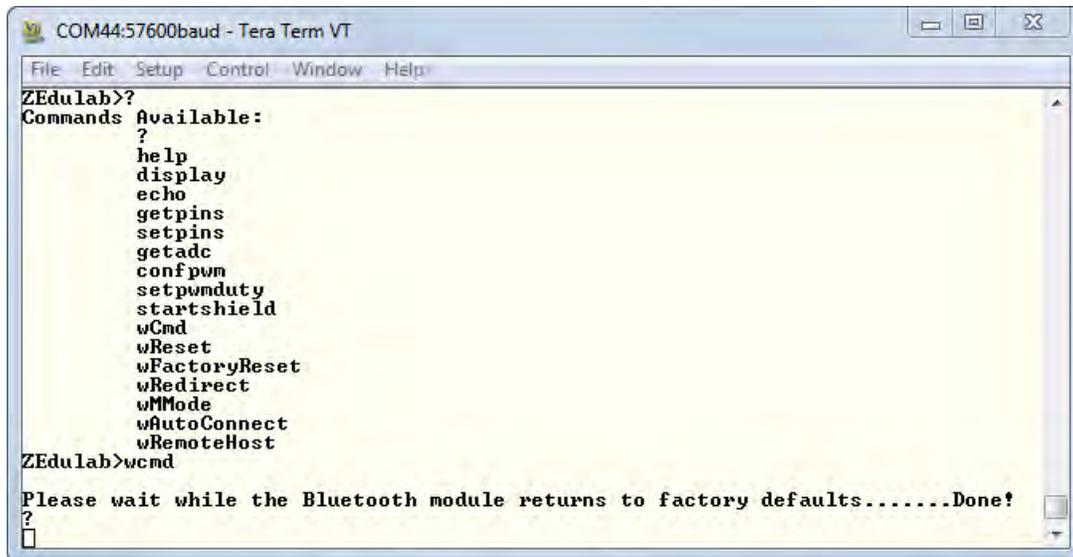


```
COM44:57600baud - Tera Term VT
File Edit Setup Control Window Help
ZEdulab>startshield bt
BT Shield started!
ZEdulab>?
Commands Available:
?
help
display
echo
getpins
setpins
getadc
confpwm
setpwm duty
startshield
wCmd
wReset
wFactoryReset
wRedirect
wMMode
wAutoConnect
wRemoteHost
ZEdulab>
```

**Figure 21. List of Z-PAN Shield Commands**

2. At the `ZEdulab>` prompt in each Tera Term console, enter the `wCmd` command to initiate each RN-41 module's command mode. A question mark prompt (`?`) will appear.

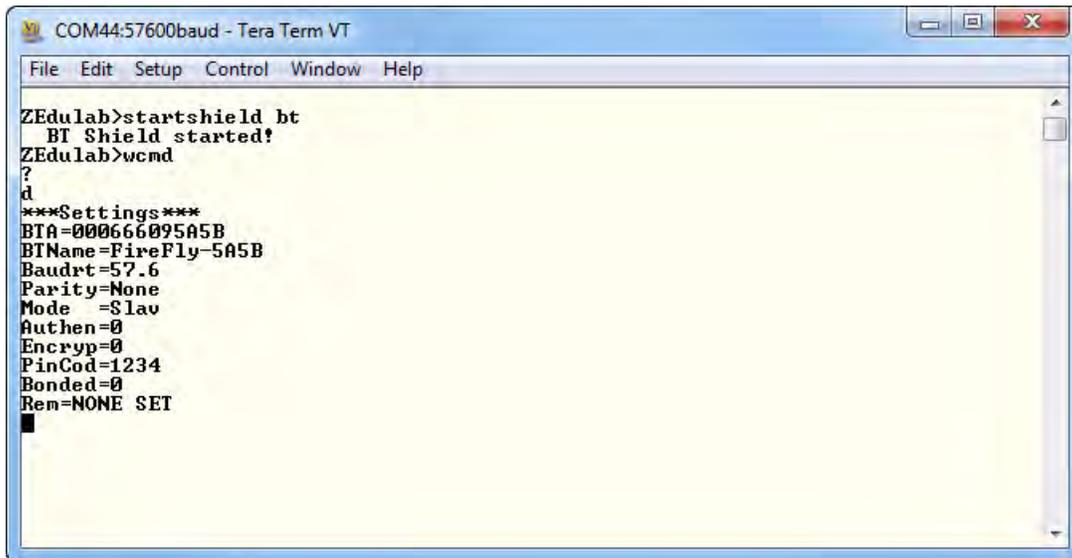
- **Note:** If the RN-41 Module is being used for the first time, a *factory settings reset* message may appear, followed by a momentary processing delay, as indicated in Figure 22.



```
COM44:57600baud - Tera Term VT
File Edit Setup Control Window Help
ZEdulab>?
Commands Available:
?
help
display
echo
getpins
setpins
getadc
confpwm
setpwm duty
startshield
wCmd
wReset
wFactoryReset
wRedirect
wMMode
wAutoConnect
wRemoteHost
ZEdulab>wcmd
Please wait while the Bluetooth module returns to factory defaults.....Done!
?
█
```

Figure 22. RN-41 Command Access

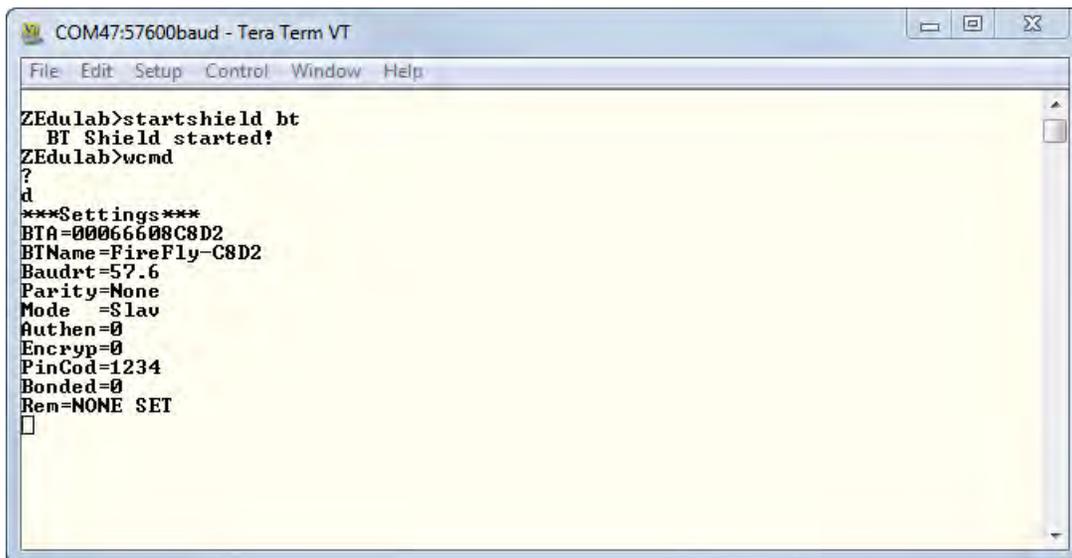
3. At the ? prompt, enter the d command on both terminals to display each of the RN-41 shields' default settings, as indicated in Figures 23 and 24.



```

COM44:57600baud - Tera Term VT
File Edit Setup Control Window Help
ZEdulab>startshield bt
  BT Shield started!
ZEdulab>wcmd
?
d
***Settings***
BIA=000666095A5B
BTName=FireFly-5A5B
Baudrt=57.6
Parity=None
Mode =$lav
Authen=0
Encryp=0
PinCod=1234
Bonded=0
Rem=NONE SET
  
```

Figure 23. Module 1 Default Settings



```

COM47:57600baud - Tera Term VT
File Edit Setup Control Window Help
ZEdulab>startshield bt
  BT Shield started!
ZEdulab>wcmd
?
d
***Settings***
BIA=00066608C8D2
BTName=FireFly-C8D2
Baudrt=57.6
Parity=None
Mode =$lav
Authen=0
Encryp=0
PinCod=1234
Bonded=0
Rem=NONE SET
  
```

Figure 24. Module 2 Default Settings

In Figures 23 and 24, the final line on the terminal console reads Rem=NONE SET. This line refers to the BTA address that the unit will connect to; the sr command will

set the values for this remote connection. See these BTA numbers depicted in Figure 25 and in each terminal output shown in Figures 26 and 27.

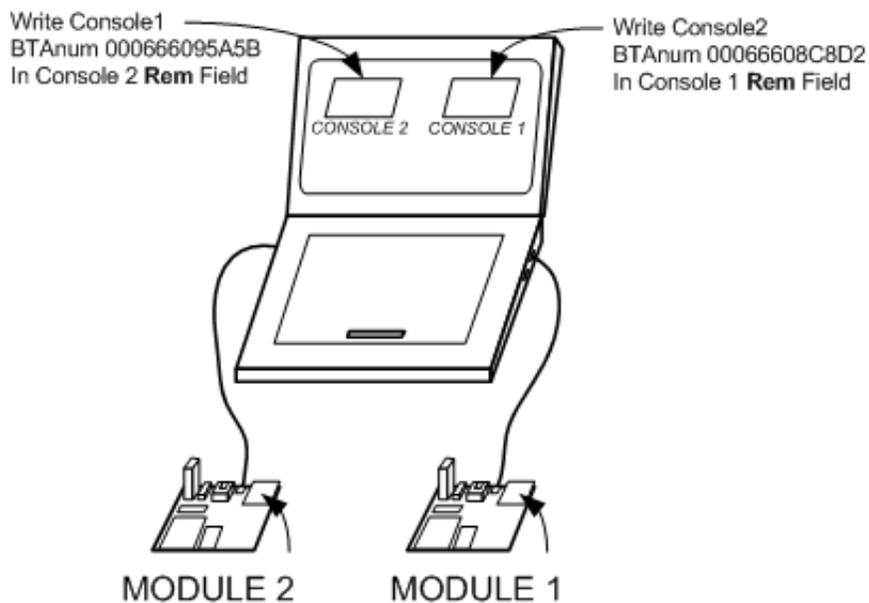


Figure 25. Z-PAN Shield Console Settings

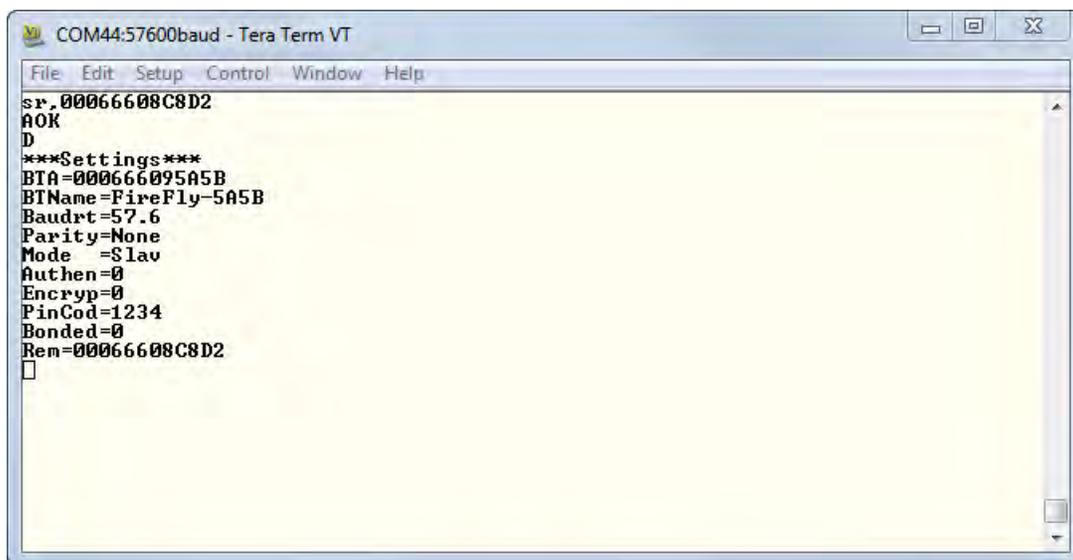
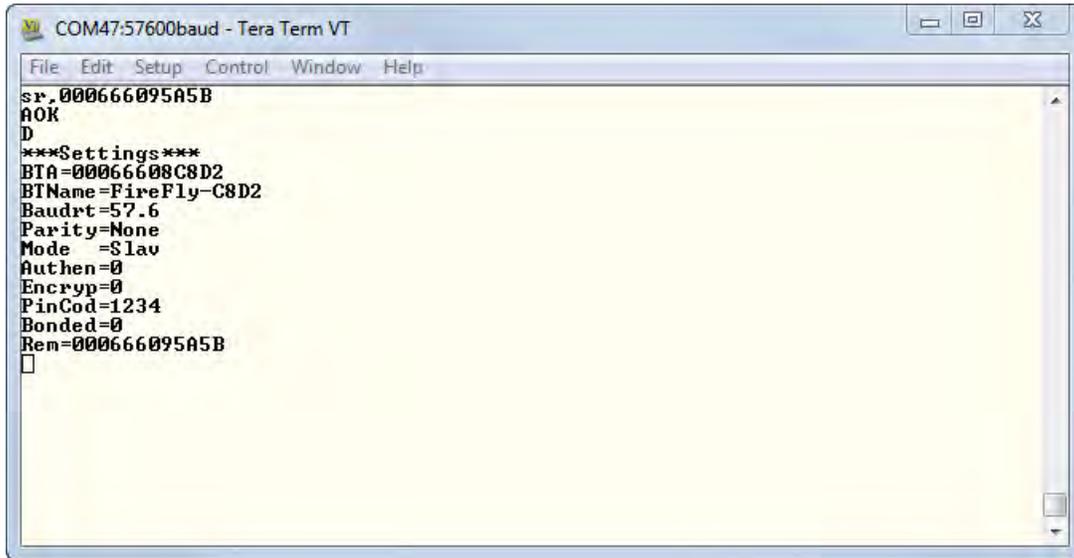


Figure 26. Module 1 Remote Address Settings



```

COM47:57600baud - Tera Term VT
File Edit Setup Control Window Help
sr,000666095A5B
AOK
D
***Settings***
BTA=00066608C8D2
BTName=FireFly-C8D2
Baudrt=57.6
Parity=None
Mode=$lav
Authen=0
Encryp=0
PinCod=1234
Bonded=0
Rem=000666095A5B

```

Figure 27. Module 2 Remote Address Settings

4. At the blinking square prompt in each console screen, and with Figures 26 and 27 as your guide, enter the BTA number generated in your shield's remote address settings.

---

► **Note:** In the remaining steps for this procedure, this BTA number will be referred to as BTAnum.

---

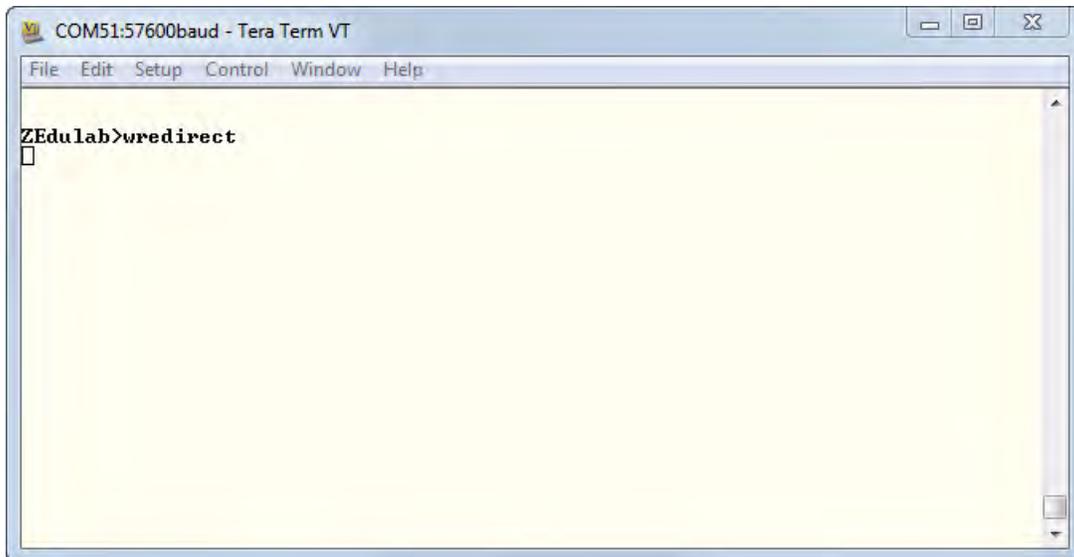
5. On one console, enter the `sr, BTAnum` command, then press the Enter key twice.
6. Enter the `d` command, and verify that the value of `Rem` has now changed to the other shield's address, as shown in Figures 26 and 27.
7. Enter the `c` command on the same console to establish a wireless connection.
8. Enter the `Ctrl-D` command on both terminals to return to the `ZEdulab>` prompt in the root shell.
9. Enter the `wreset` command to reset the shields on both consoles.

---

► **Note:** The `wreset` command must be executed for the changes to the remote address to take effect. As an alternative to the `wreset` command, a power on/off reset can also be executed.

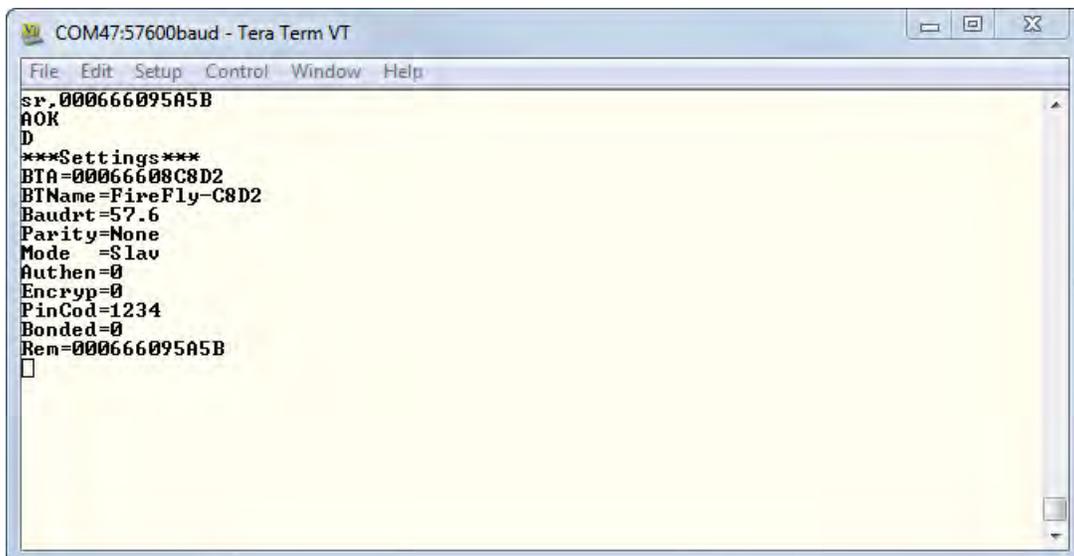
---

- At the ZEdulab> prompt on Console 1, enter the `wredirect` command and press Enter; the result of this command is shown in Figure 28. On Console 2, enter the `wremotehost` command and press the Enter key; see the result in Figure 29.



The screenshot shows a Tera Term VT window titled "COM51:57600baud - Tera Term VT". The window has a menu bar with "File", "Edit", "Setup", "Control", "Window", and "Help". The main text area contains the prompt "ZEdulab>" followed by the command "wredirect" and a cursor on the next line.

Figure 28. Module 1 wredirect Command



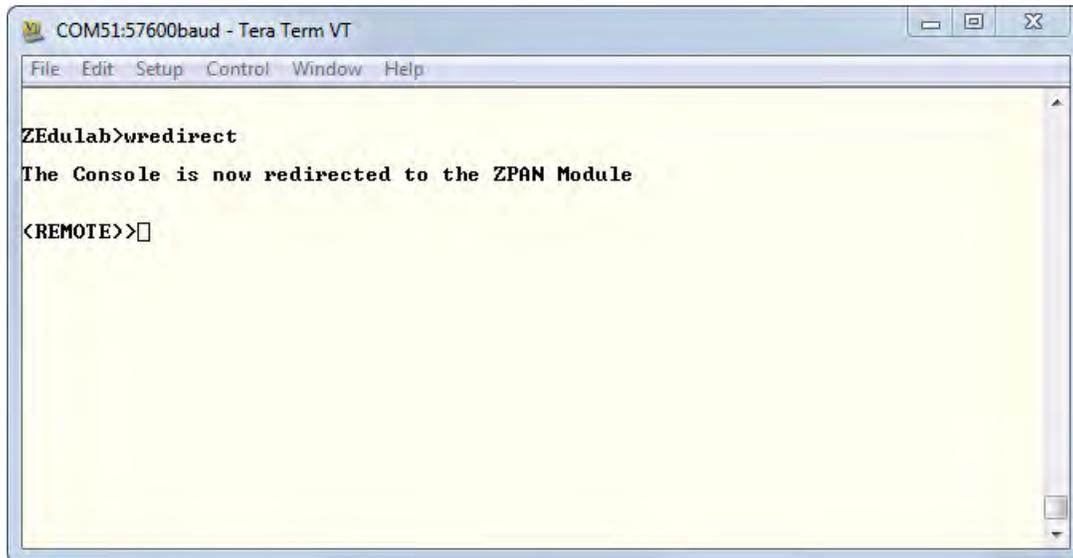
The screenshot shows a Tera Term VT window titled "COM47:57600baud - Tera Term VT". The window has a menu bar with "File", "Edit", "Setup", "Control", "Window", and "Help". The main text area contains the following output:

```
sr.000666095A5B
AOK
D
***Settings***
BTA=00066608C8D2
BTName=FireFly-C8D2
Baudrt=57.6
Parity=None
Mode =Slave
Authen=0
Encryp=0
PinCod=1234
Bonded=0
Rem=000666095A5B

```

Figure 29. Module 2 wremotehost Command

- Observe the Console 1 prompt change to <REMOTE>>, as shown in Figure 30.



**Figure 30. Module 1 Prompt After wremotehost Command**

- The wireless link is now established, and the commands issued on Console 1 at the <REMOTE>> prompt will remotely control Console 2. To verify that this link is operating correctly, the output status LED on the Z-PAN Shield will now be illuminated in a solid green color, and should not be blinking.
- Demonstrate the control of Console 2 by entering the following command on Console 1:  

```
Setpins pa 07 on
```

The PA0, PA1 and PA2 LEDs on the Test Shield connected to Console 2 should now be illuminated.
- To turn off Port A bits 0, 1, and 2, enter the following command:  

```
Setpins pa 07 off
```
- To close the communication link, enter the Ctrl-D command on both consoles, or press the reset button on the Platform. To gain remote control of the opposite shield, simply reverse this procedure.

## The ZED WLAN Shield

As determined from [Table 2](#) on page 17, the Zilog Wide/Local Area Network (WLAN) Shield is stackable with the WoS Shield, but is not stackable with the Z-PAN Shield or another WLAN Shield. This shield uses a Roving Networks (2.4GHz) WiFi RN-171 module, which conforms to the 802.11 b/g standard. The ZED WLAN Shield is shown in Figure 31.

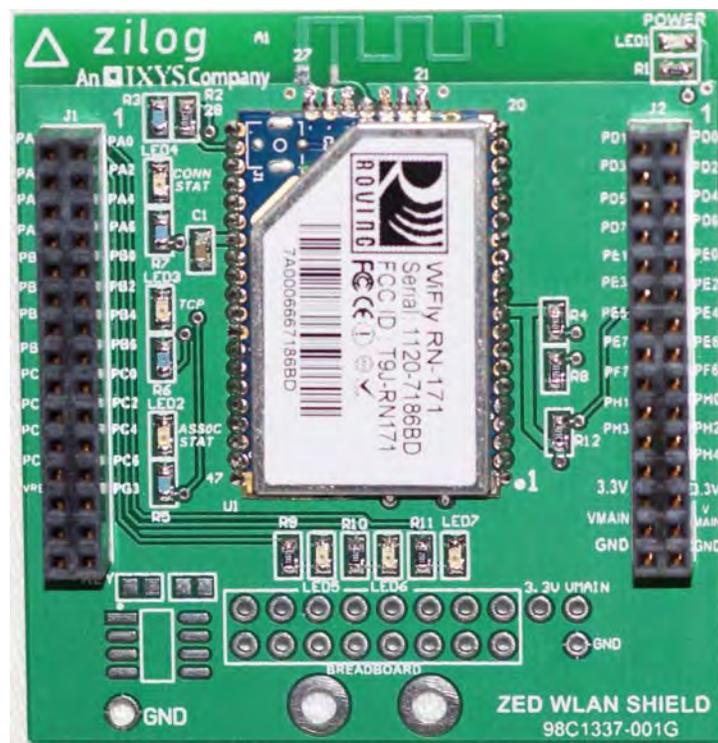


Figure 31. The WLAN Shield

A schematic diagram of the ZED WLAN Shield can be found in [Appendix A](#), which begins on page 48.

## Establish A WiFi Connection

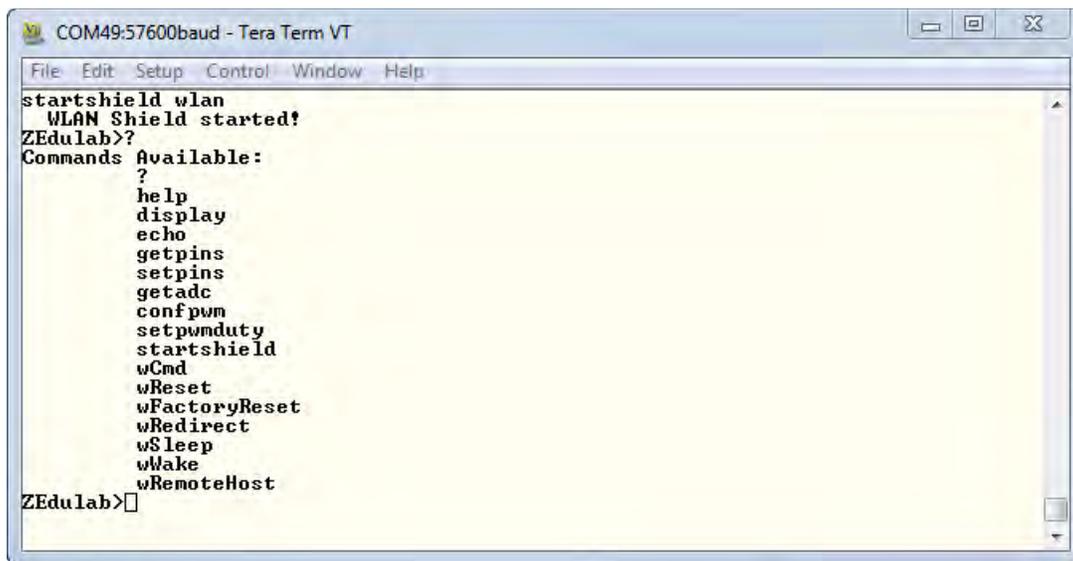
The following procedure describes how to set up a working WiFi link between two Educational Platforms. This setup can be staged using a single PC and connecting two Educational Platforms via two USB cables to this PC, then running two instances of Tera Term, one on each PC. To connect two Educational Platforms together, see the [Connect Two Educational Platforms](#) section on page 9 before proceeding.

---

► **Note:** Alternatively, this WiFi link can be established by using one Educational Platform and one ZED WLAN Shield.

---

1. Begin configuring the system shown in [Figure 9](#) on page 10 by entering the `startshield wlan` command at each of the two console prompts. Press the Enter key on each console. A `WLAN Shield started!` message will appear on both consoles. Enter the `?` symbol on one of the consoles to list all of the available ZED WLAN Shield commands; see Figure 32.



```

COM49:57600baud - Tera Term VT
File Edit Setup Control Window Help
startshield wlan
WLAN Shield started!
ZEdulab>?
Commands Available:
?
help
display
echo
getpins
setpins
getadc
confpwm
setpwm duty
startshield
wCmd
wReset
wFactoryReset
wRedirect
wSleep
wWake
wRemoteHost
ZEdulab>
  
```

**Figure 32. WLAN Command List for Both Shields**

2. On MODULE 1, enter the `wcmd` command and press Enter to access the RN-171 command mode. A `<2.32>` prompt will appear, as shown in Figure 33.

---

► **Note:** Commands to the RN-171 Module are case-sensitive.

---

```
COM49:57600baud - Tera Term VT
File Edit Setup Control Window Help
ZEdulab>?
Commands Available:
?
help
display
echo
getpins
setpins
getadc
confpwm
setpwm duty
startshield
wCmd
wReset
wFactoryReset
wRedirect
wSleep
wWake
wRemoteHost
ZEdulab>wcmd
Please wait while the Wifi module returns to factory defaults.....Done!
<2.32>
```

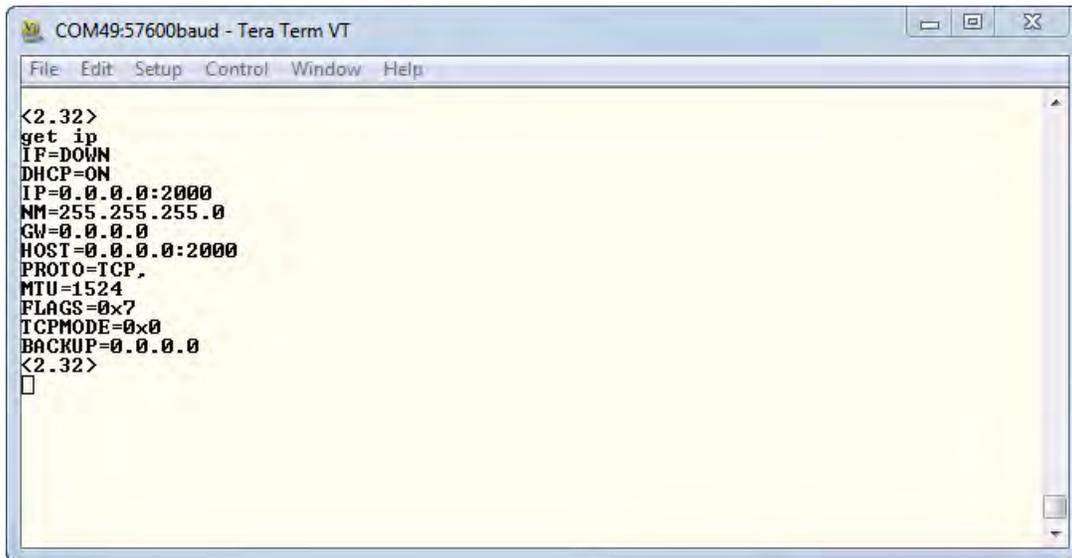
Figure 33. RN-171 Command Mode Access

---

► **Note:** The first time a `wcmd` command is issued, a *factory default settings reset* message may appear. The `<2.32>` prompt will appear after a momentary processing delay.

---

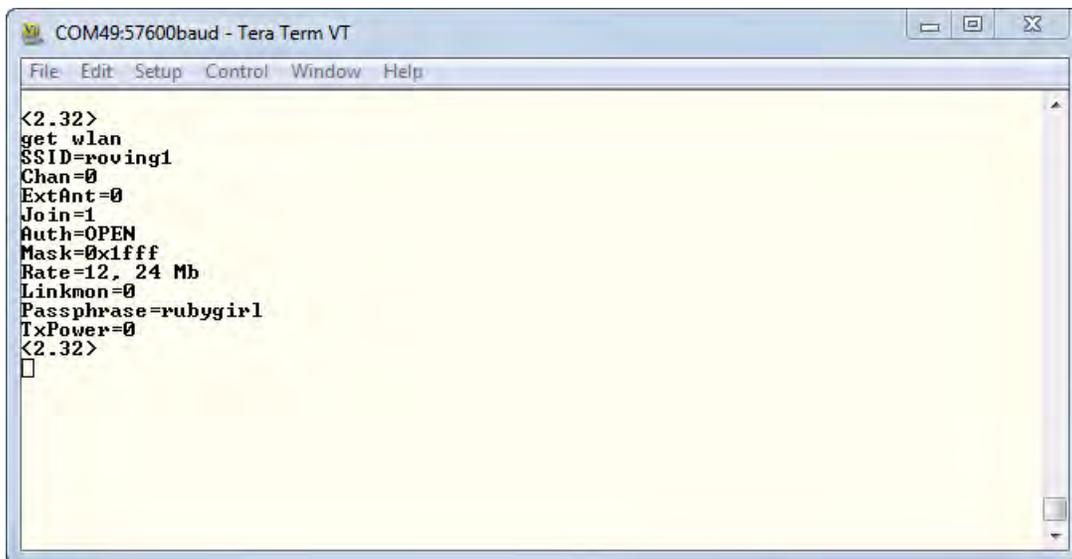
3. At the `<2.32>` prompt on MODULE 1, enter the `get ip` command and press the Enter key. The ZED WLAN Shield's default IP settings will appear, as shown in Figure 34.



```
COM49:57600baud - Tera Term VT
File Edit Setup Control Window Help
<2.32>
get ip
IF=DOWN
DHCP=ON
IP=0.0.0.0:2000
NM=255.255.255.0
GW=0.0.0.0
HOST=0.0.0.0:2000
PROTO=TCP,
MTU=1524
FLAGS=0x7
TCPMODE=0x0
BACKUP=0.0.0.0
<2.32>
□
```

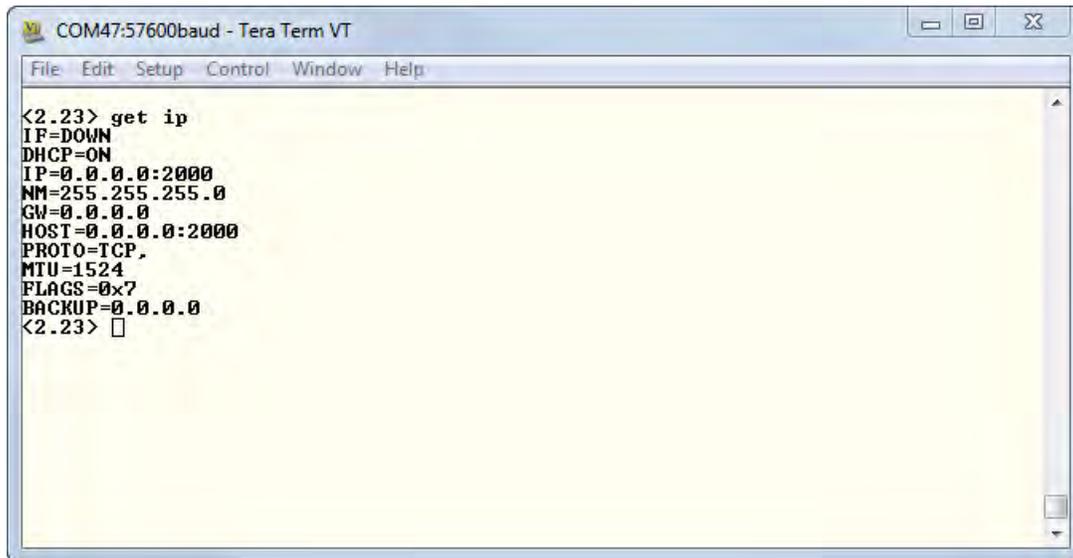
Figure 34. Module 1 RN-171 IP Settings

4. Enter the `get wlan` command on MODULE 1 to view the ZED WLAN Shield's default WLAN settings, as shown in Figure 35. Figures 36 and 37 show the corresponding default settings for MODULE 2.



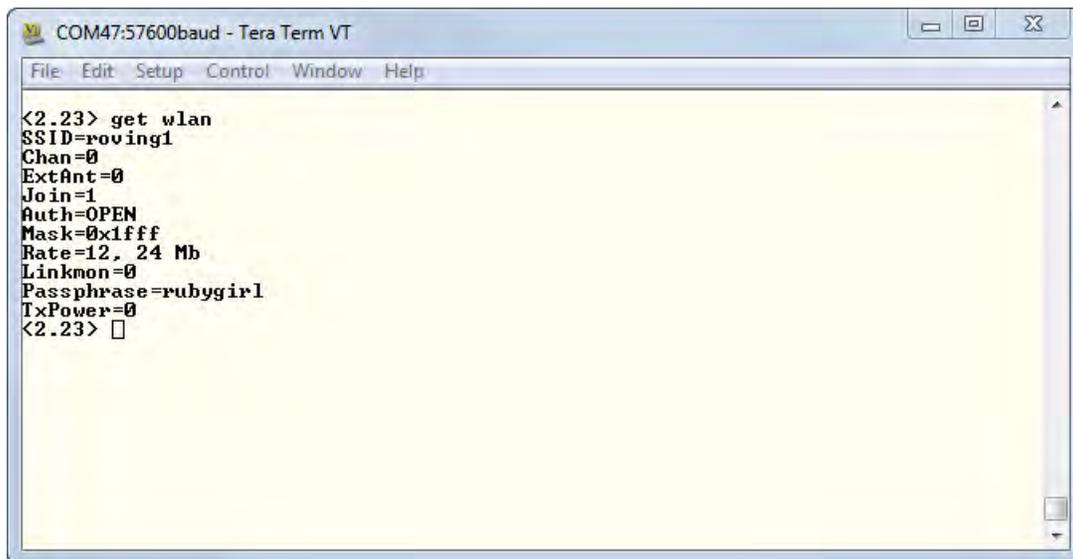
```
COM49:57600baud - Tera Term VT
File Edit Setup Control Window Help
<2.32>
get wlan
SSID=roving1
Chan=0
ExtAnt=0
Join=1
Auth=OPEN
Mask=0xffff
Rate=12.24 Mb
Linkmon=0
Passphrase=rubygirl
TxPower=0
<2.32>
□
```

Figure 35. Module 1 RN-171 WLAN Settings



```
COM47:57600baud - Tera Term VT
File Edit Setup Control Window Help
<2.23> get ip
IF=DOWN
DHCP=ON
IP=0.0.0.0:2000
NM=255.255.255.0
GW=0.0.0.0
HOST=0.0.0.0:2000
PROTO=ICP,
MTU=1524
FLAGS=0x7
BACKUP=0.0.0.0
<2.23> □
```

Figure 36. Module 2 RN-171 IP Settings



```
COM47:57600baud - Tera Term VT
File Edit Setup Control Window Help
<2.23> get wlan
SSID=roving1
Chan=0
ExtAnt=0
Join=1
Auth=OPEN
Mask=0x1fff
Rate=12. 24 Mb
Linkmon=0
Passphrase=rubygir1
TxPower=0
<2.23> □
```

Figure 37. Module 2 RN-171 WLAN Settings

5. At the Module 1 prompt, enter the following sequence of commands, each command followed by the Enter key, to configure the CLIENT.

---

► **Note:** The following commands are case-sensitive.

---

- a. `set wlan join 4`
  - b. `set wlan ssid CLIENT`
  - c. `set wlan chan 0`
  - d. `set wlan auth 6`
  - e. `set ip address 169.254.1.1`
  - f. `set ip netmask 255.255.0.0`
  - g. `set ip dhcp 0`
  - h. `set ip proto 3`
  - i. `set ip localport 2000`
6. Enter `save`, then press the Enter key. Next, enter `reboot`, then press `Ctrl-D` to exit the RN-171 module's command mode and return to the Platform's root shell, which is indicated by the `ZEDulab>` prompt.
  7. At the Module 2 prompt, enter the following sequence of commands, each command followed by the Enter key, to configure the HOST.
    - a. `set wlan join 4`
    - b. `set wlan ssid HOST`
    - c. `set wlan chan 1`
    - d. `set wlan auth 6`
    - e. `set ip address 169.254.1.2`
    - f. `set ip netmask 255.255.0.0`
    - g. `set ip dhcp 0`
    - h. `set ip proto 3`
    - i. `set ip localport 80`
  8. Enter `save`, then press the Enter key. Next, enter `reboot`, then press `Ctrl-D` to exit the RN-171 module's command mode and return to the Platform's root shell.
  9. To establish the WiFi link between the two ZED WLAN shields first requires a scan to ensure that the CLIENT shield can detect the HOST shield. Enter the `wcmd` command on both console terminals, then enter the `scan` command on MODULE 1 (i.e., the CLIENT). A brief delay may occur as the module scans for available networks. When the list of networks is returned, press Enter to return to the `<2.32>` prompt.
  10. If the host appears in the list, enter the `join HOST` command on the CLIENT console, and press Enter.

The following message should appear on the MODULE 1 console:

```
Listen on 2000
```

The following message should appear on the MODULE 2 console:

Listen on 80

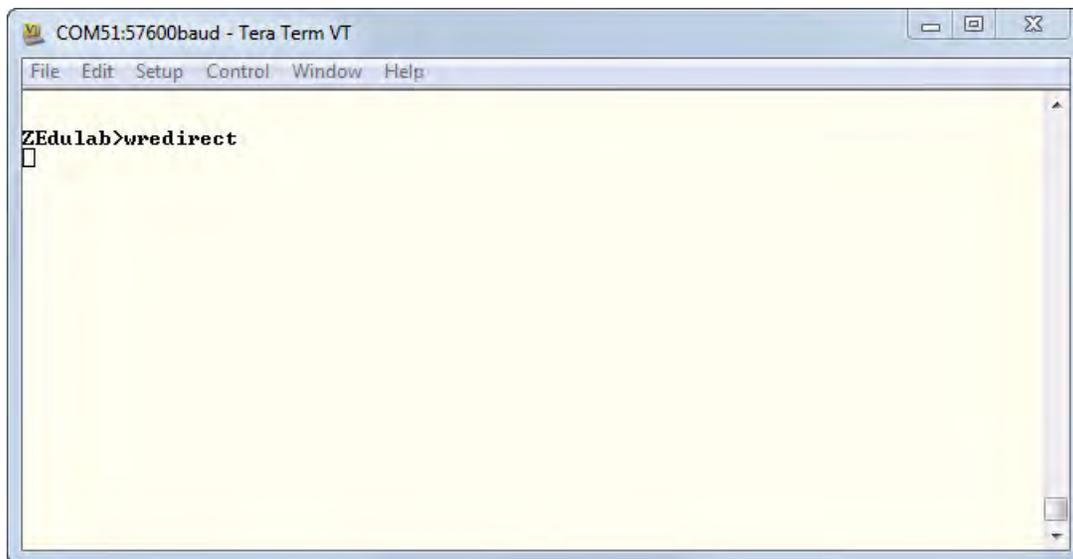
11. On the MODULE 1 console, enter the `open 169.254.1.2 80` command, and press Enter. The following message will appear on both console terminals:

```
*OPEN**HELLO*
```

The GREEN status LED on both shields will also illuminate without blinking.

12. Enter the Ctrl-D command on both consoles to exit the RN-171 command mode and enter the Platform's command shell. The YELLOW status LED will blink once, and the `ZEdulab>` prompt will appear.

13. At the `ZEdulab>` prompt on the MODULE 1 console, enter the `wredirect` command, then press Enter; the result is shown in Figure 38.



**Figure 38. Client wredirect Command**

14. On the MODULE 2 console, enter the `wremotehost` command, then press Enter. The following message will appear on the MODULE 2 console, as shown in Figure 39.

```
A Remote Host Mode Initiated....Ctrl-D to exit...
```

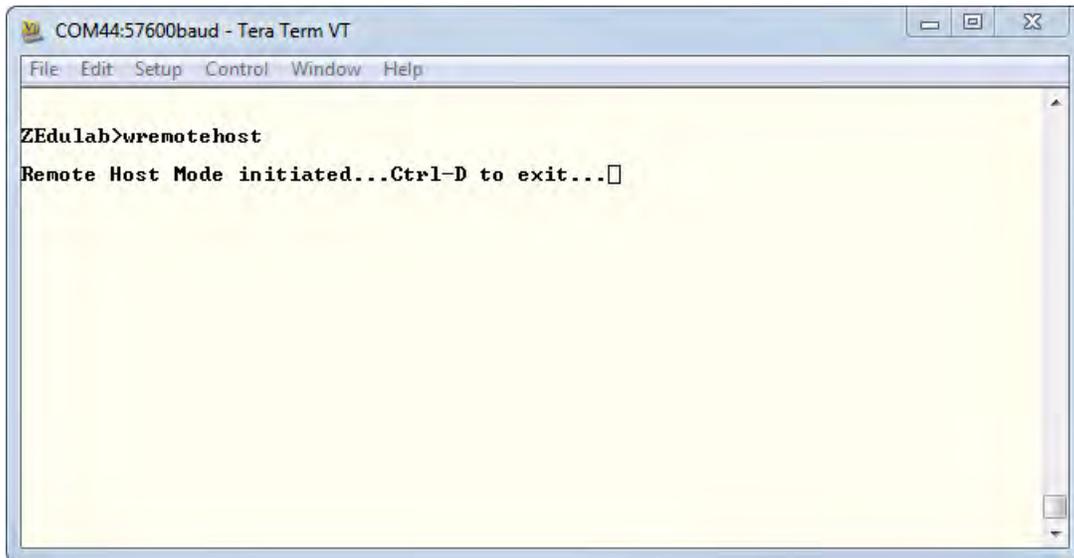


Figure 39. Host wremotehost Command

At the same time, the CLIENT's console prompt on MODULE 1 will also change to display the following prompt; see Figure 40:

```
<WLANREMOTE>>
```

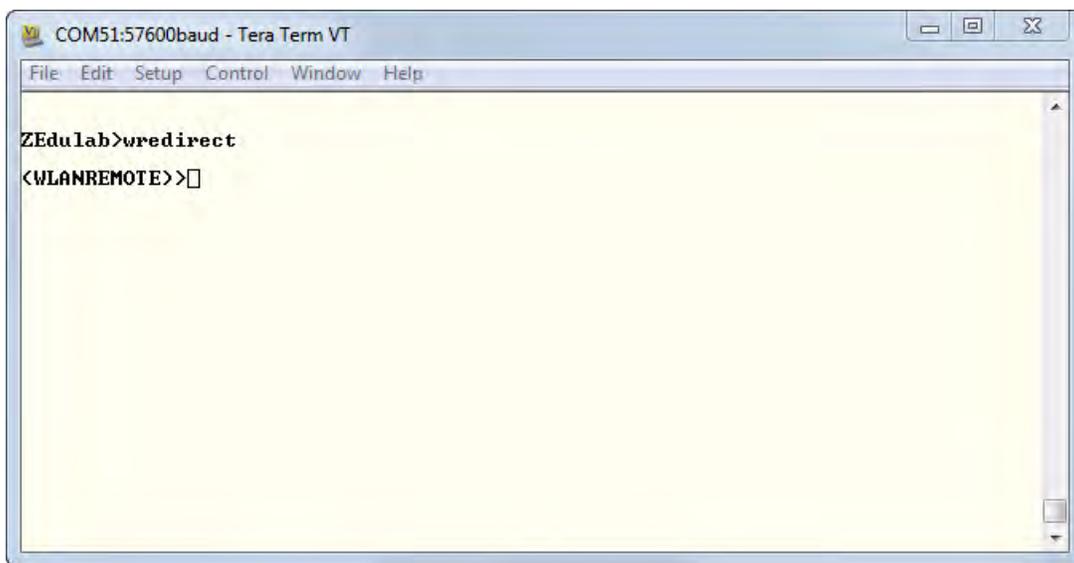


Figure 40. Client wremotehost Response

15. The wireless link has now been established and you are now able to remotely control the MODULE 2 (HOST) shield with the commands issued on the MODULE 1 (CLIENT) console.

16. Verify this working link by entering the following command on the MODULE 1 console:

```
setpins pa 07 on
```

17. Three LEDs on MODULE 2 should illuminate. To turn these LEDs off, enter the following command:

```
setpins pa 07 off
```

## ZDSII Developer Studio for the ZNEO CPU

The Zilog Developer Studio (ZDSII) Integrated Development Environment is used to program, debug, and test your code on the Zilog Educational Platform, which is based on Zilog's ZNEO CPU. The latest version of ZDSII – ZNEO is available free for download from the [Zilog Store](#).

The USB Flash drive that shipped with your Zilog Educational Platform contains two project files that are located in the Samples folder; these two files are described below.

**GalaxZshell.zdsproj.** The principal program which contains all of the functions necessary to run the Zilog Educational Platform under console control. The hex file contained in this program gets burned into Flash memory using the Flash Loader Utility found in the Tools drop-down menu located on the ZDSII toolbar.

**LightmeUp.zdsproj.** A simple introductory program that will display the word ZILOG on the ZED Test Shield. This program does not use the console; therefore, the full 5x8 LED matrix is available to it.

To debug and test with ZDSII, Zilog's USB SmartCable must be connected to the P1 connector on the Platform. The USB (A to Mini-B) cable for the console is not required for debugging purposes.

After you have downloaded and installed the ZDSII software, insert the USB SmartCable into the P1 connector and run the ZDSII program, open the file LightmeUp.zdsproj found in the Sample Programs folder of the USB Flash Drive that came with the Kit or download it from the Zilog's website.

---

► **Note:** The ZDSII development environment defaults to C language, although writing programs in Assembly language is also possible.

---

**Example.** The code segment below displays the letters ZILOG on a 5x5 matrix. The letter Z is shown in Figure10.

```

/*****
 *
 * File: main.c
 *
 * Description: This file contains the main function that writes
 * the string ZILOG on a 5x5 matrix and blinks the LEDs in the
 * circular pattern on the Test Shield that is mounted on the Zilog
 * Educational Platform.
 *
 *****/
#include <stdio.h>
#include "zneo.h"

void delay()
{
long y;
y = 110000;
while(y--);
}
void delay2()
{
long z;
z = 20000;
while(z--);
}
void delay3()
{
long t;
t = 5000;
while(t--);
}
void click()
{
long w;
w= 10000;
while(w--)
PFOUT = 0x20;
PFOUT = 0x00;
}

void LetterZ(void)
{
delay2();

```

```
    delay2();
    PAOUT = 0x7C;
    PBOUT = 0x08;
    PCOUT = 0x10;
    PDOUT = 0x20;
    PEOUT = 0x7C;
    delay2();
    delay2();
} //End LetterZ

void LetterI(void)
{
    delay2();
    delay2();
    PAOUT = 0x10;
    PBOUT = 0x10;
    PCOUT = 0x10;
    PDOUT = 0x10;
    PEOUT = 0x10;
    delay2();
    delay2();
} //End LetterI

void LetterL(void)
{
    delay2();
    delay2();
    PAOUT = 0x40;
    PBOUT = 0x40;
    PCOUT = 0x40;
    PDOUT = 0x40;
    PEOUT = 0x7C;
    delay2();
    delay2();
} //End LetterL

void LetterO(void)
{
    delay2();
    delay2();
    PAOUT = 0x38;
    PBOUT = 0x44;
    PCOUT = 0x44;
    PDOUT = 0x44;
    PEOUT = 0x38;
    delay2();
    delay2();
} //End LetterO
```

```
void LetterG(void)
{
    delay2();
    delay2();
    PAOUT = 0x3C;
    PBOUT = 0x40;
    PCOUT = 0x5C;
    PDOUT = 0x44;
    PEOUT = 0x3C;
    delay2();
    delay2();
} //End LetterG
```

```
void Circle(void)
{
    PFOUT = 0x40;
    delay2();
    PFOUT = 0x00;
    delay2();
    PFOUT = 0x80;
    delay2();
    PFOUT = 0x00;
    delay2();
    PGOUT = 0x0F;
    delay2();
    PGOUT = 0x00;
    delay2();
    PHOUT = 0x01;
    delay2();
    PHOUT = 0x00;
    delay2();
    PHOUT = 0x02;
    delay2();
    PHOUT = 0x00;
    delay2();
    PHOUT = 0x04;
    delay2();
    PHOUT = 0x00;
    delay2();
    PHOUT = 0x08;
    delay2();
    PHOUT = 0x00;
    delay2();
    PFOUT = 0x40;
    delay2();
    PFOUT = 0x00;
    delay2();
}
```

```
}//end circle

/*****
main
Starting function for the the application.
Requires:
Nothing
Returns:
Nothing
*****/

void main()
{
PADD = 0x00;// Port A Data Direction 0x00=Output : 0x01=Input
PBDD = 0x00;
PCDD = 0x00;
PDDD = 0x00;
PEDD = 0x00;

PFDD = 0x00;
PGDD = 0x00;
PHDD = 0x00;
while(1)
{
click();
LetterZ();
delay3();
Circle();
LetterI();
delay3();
Circle();
LetterL();
delay3();
Circle();
LetterO();
delay3();
Circle();
LetterG();
delay3();
Circle();
}
} //End main
```

# Ordering Information

The ZED shields can be purchased from the Zilog Store – simply click the Store Product IDs listed in Table 5.

**Table 5. Zilog Educational Platform Ordering Information**

Item	Zilog Part Number	Store Product ID
ZED World of Sensors Shield	EZEDUWS0100ZACG	<a href="#">ED10003</a>
ZED Z-PAN Shield	EZEDUZP0100ZACG	<a href="#">ED10004</a>
ZED WLAN Shield	EZEDUWL0100ZACG	<a href="#">ED10005</a>
ZED Test Shield	EZEDUTS0100ZACG	<a href="#">ED10006</a>

## Related Documentation

The documents associated with the Zilog Educational Platform are listed in Table 6. Each of these documents can be obtained from the Zilog website by clicking the link associated with its Document Number.

**Table 6. Zilog Educational Platform Documentation**

<b>Document Number</b>	<b>Description</b>
<a href="#">UM0255</a>	Zilog Educational Platform User Manual
<a href="#">UM0256</a>	This Zilog Educational Shields User Manual
<a href="#">PS0220</a>	ZNEO Z16F Series Product Specification
<a href="#">UM0188</a>	ZNEO CPU Core User Manual
<a href="#">UM0181</a>	USB SmartCable User Manual

# Appendix A. Schematic Diagrams

Figure 41 shows a schematic diagram of the ZED Test Shield.

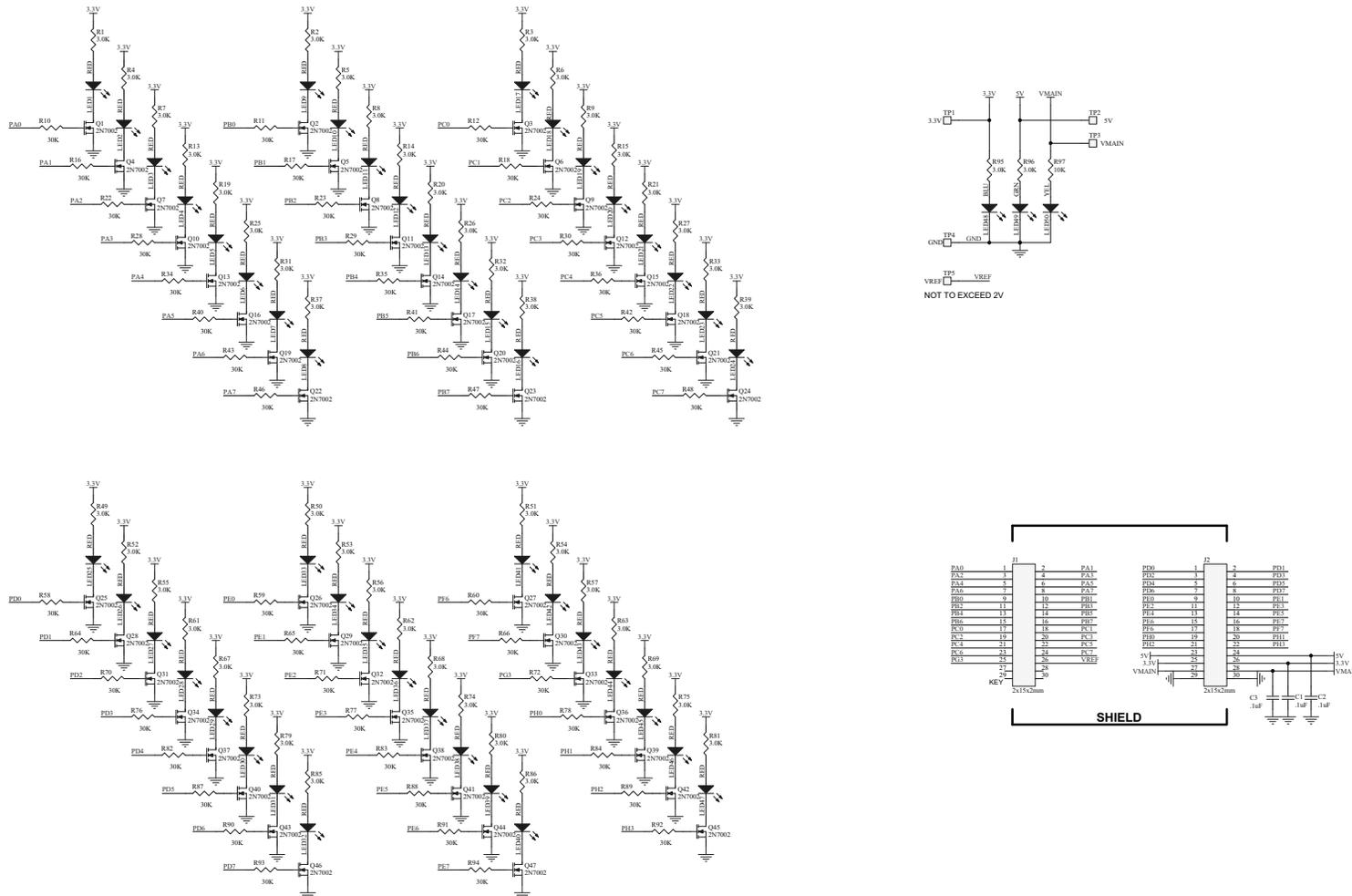


Figure 41. Schematic Diagram of the ZED Test Shield

Figure 42 shows a schematic diagram of the ZED World of Sensors Shield.

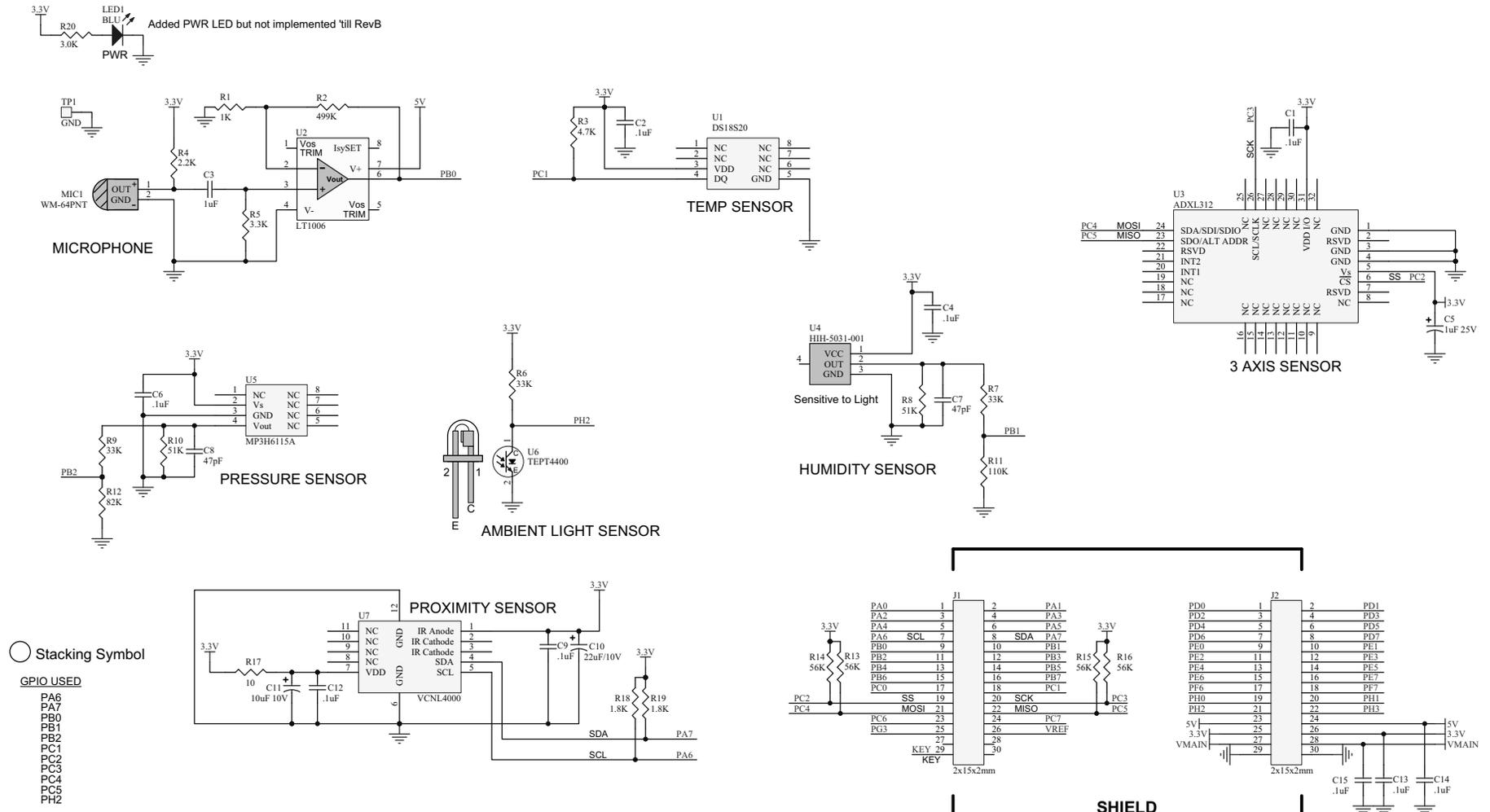


Figure 42. Schematic Diagram of the ZED World of Sensors Shield





# 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](#).

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