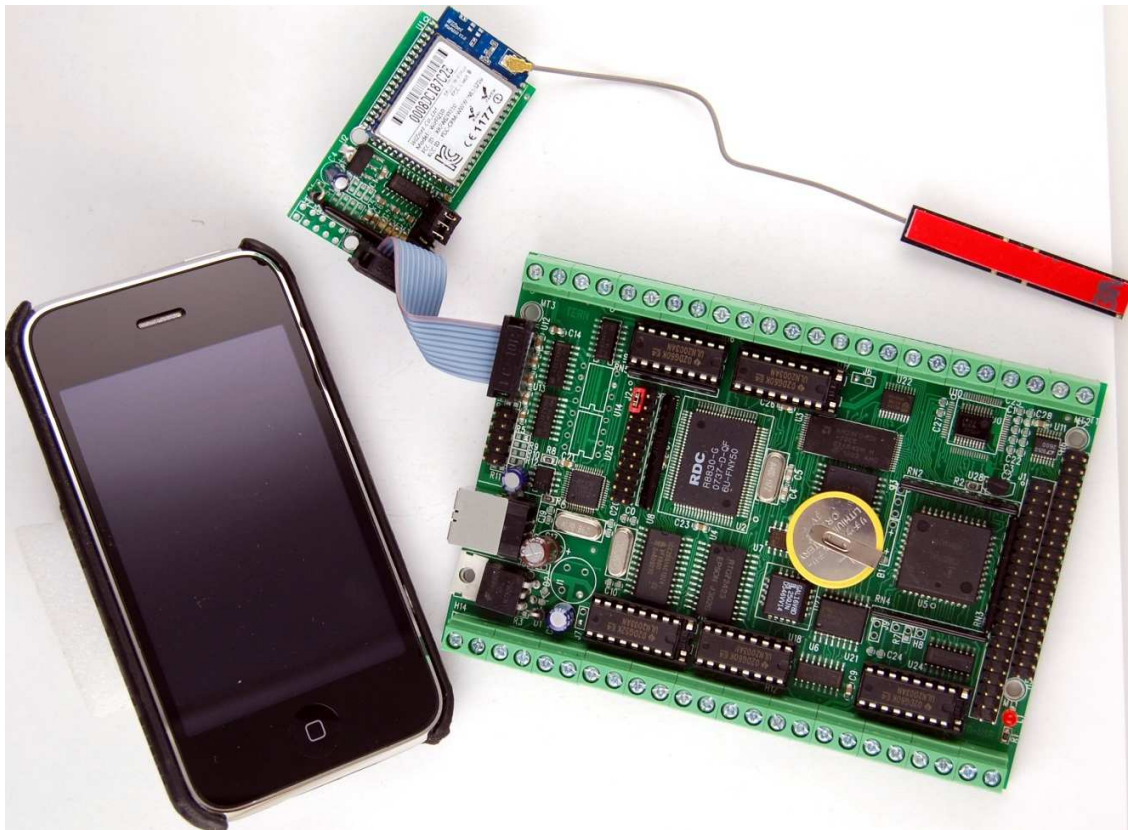


WiFi-Adaptor™

Low cost serial to Wi-Fi interface for TERN controllers



Technical Manual



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Chapter 1: Introduction

1.1 Functional Description

The WiFi-Adaptor™ is designed to provide a serial to Wi-Fi (802.11b) wireless networking solution for TERN controllers. The WiFi-Adaptor™ incorporates a WiFi210 wireless network module from WizNet. It can be driven by an RS232 serial port or a TTL UART at 115,200 baud. Data and configuration communication is supported by simple AT commands. Compatible TERN controllers include AE, EE, RE, TDU, 586E, or any TERN board with a TTL or RS232 UART.

Features:

- * Provide WiFi (802.11b) ability to a TERN controller
- * Convert WiFi to RS232 or TTL UART
- * Operate a TERN controller with iPad or iPhone
- * 2.03 x 1.21 inches, 135 mA at 5V DC power

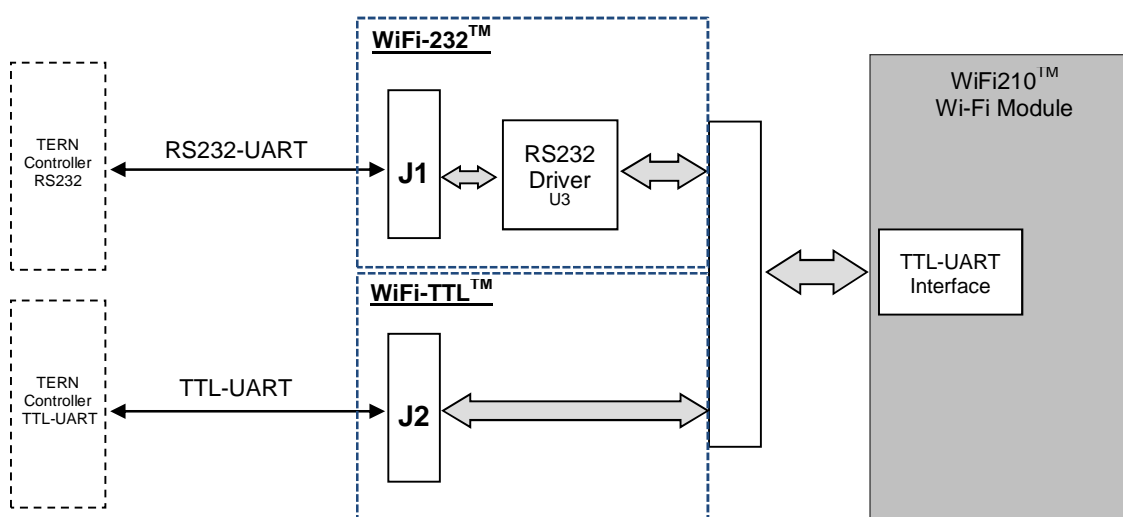


Figure 1.1 WiFi-Adaptor™ Functional Diagram

Physical Description

Below shows the physical layout of the WiFi-Adaptor™.



Figure 1.2 WiFi-232™



Figure 1.3 WiFi-TTL™

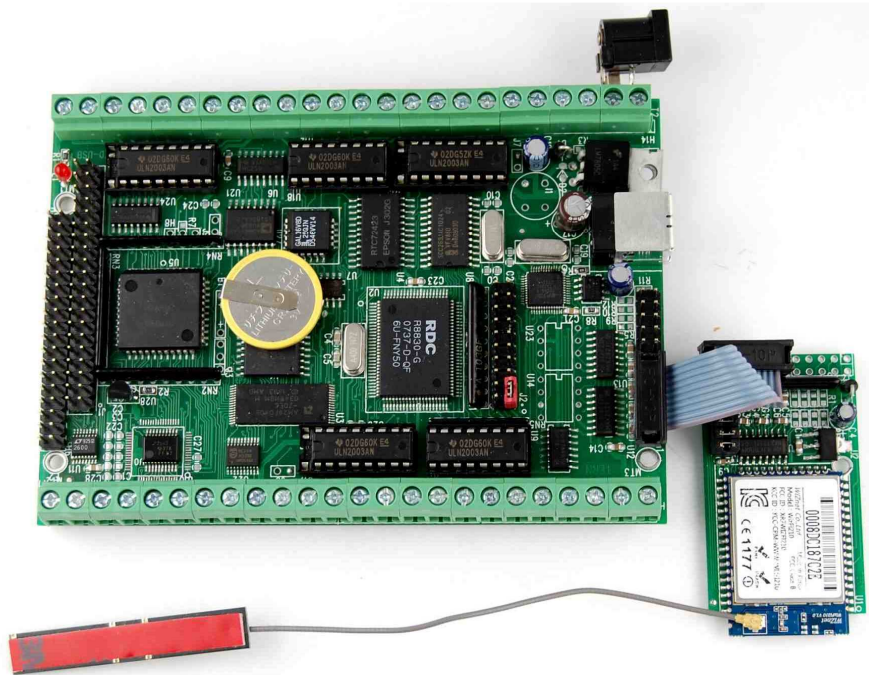


Figure 1.4 WiFi-232™ + TDU

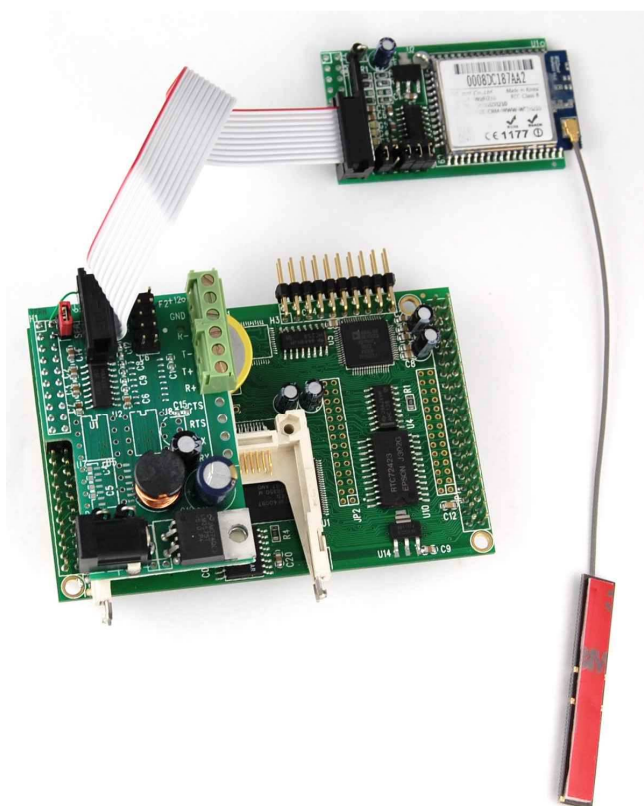


Figure 1.5 WiFi-232™ + BE + VE232

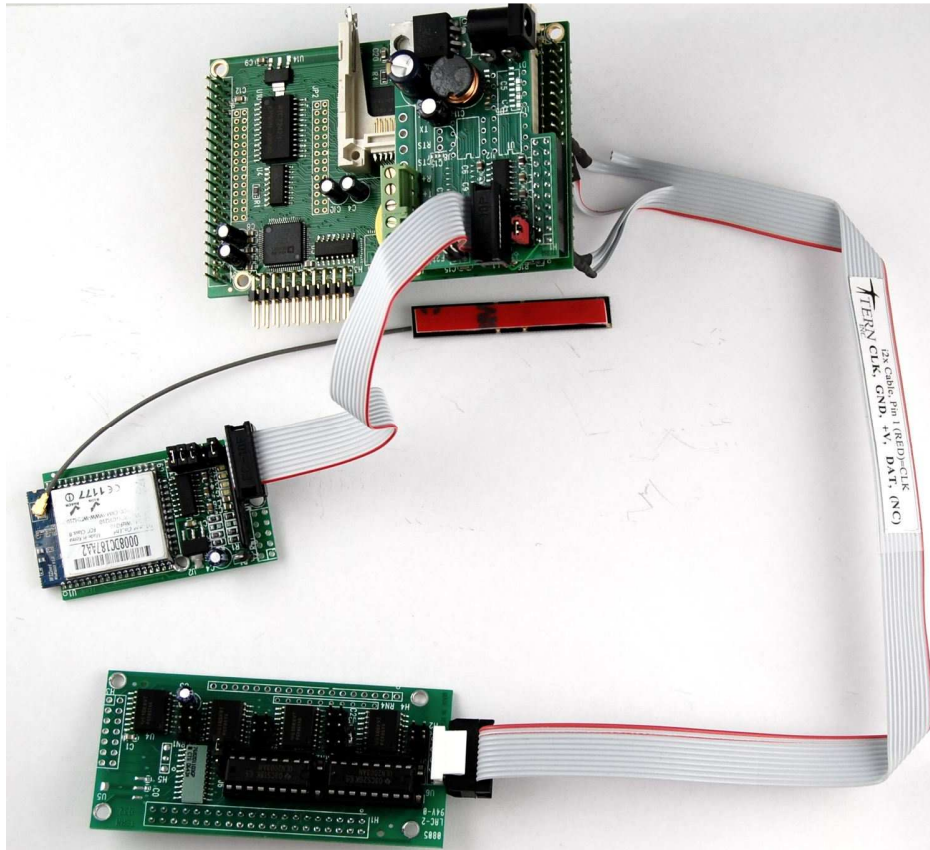


Figure 1.6 WiFi-232™ + BE + VE232 + D32

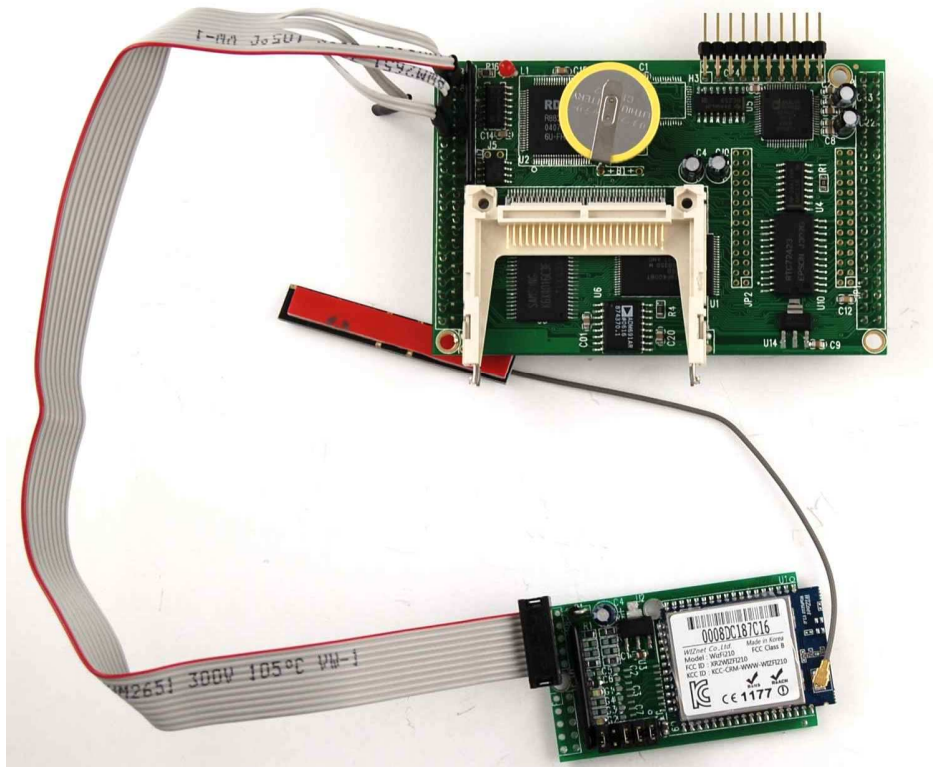


Figure 1.7 WiFi-TTL™ + BE

Chapter 2: Installation

2.1 Software Installation

Please refer to the “software_kit.pdf” technical manual on the TERN installation CD, under tern_docs\manual\software_kit.pdf, for information on installing software.

2.2 Hardware installation

The WiFi-Adaptor™ can be connected to a TERN controller directly via a 10-pin ribbon connector. WiFi-232™ versions will connect to the RS232 port of the TERN controller. WiFi-TTL™ versions will connect to the TTL UART pins of the TERN controller.

Note: The WiFi-Adaptor™ is powered by 5V from the TERN controller. Additional wiring may be required to route 5V to VIN pin-1 on J1 or J2 on the WiFi-Adaptor™.

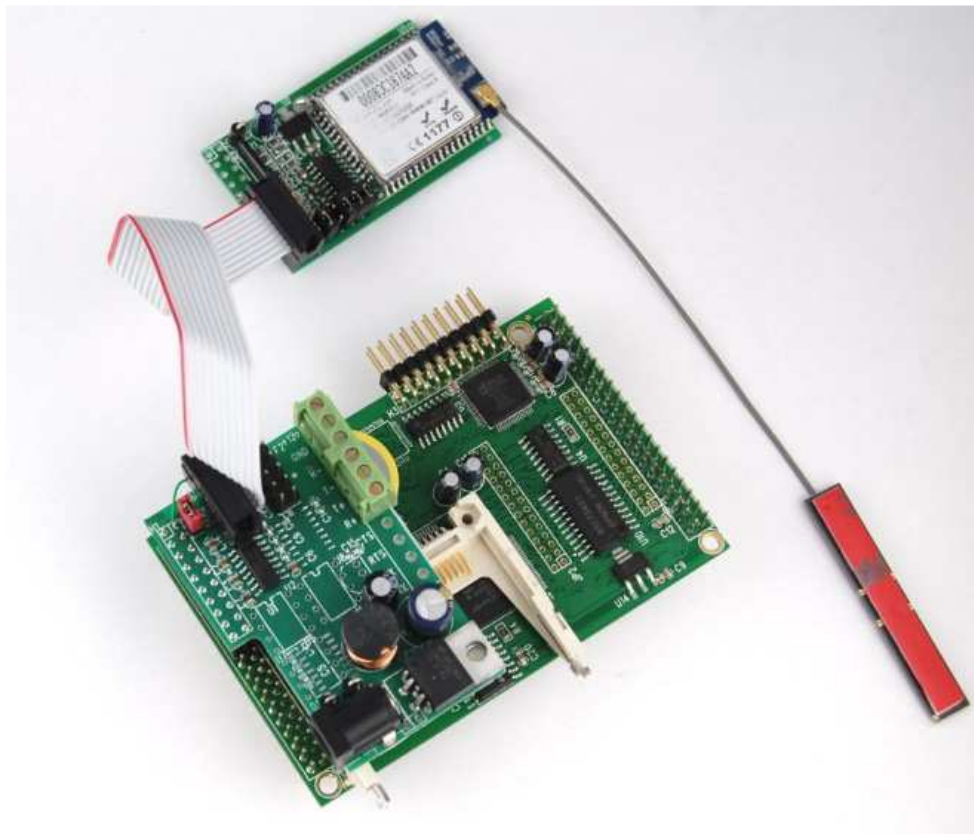


Figure 2.1 WiFi-232™ connected to B-Engine + VE232

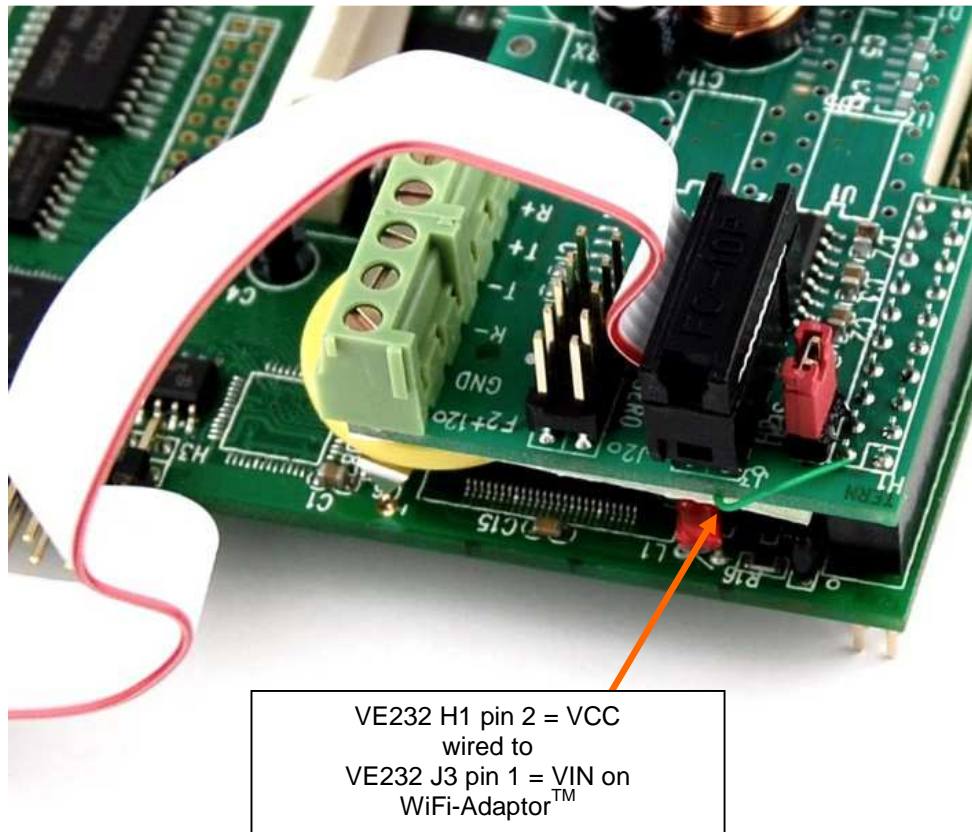


Figure 2.2 WiFi-232™ 5V = VIN Power Connection

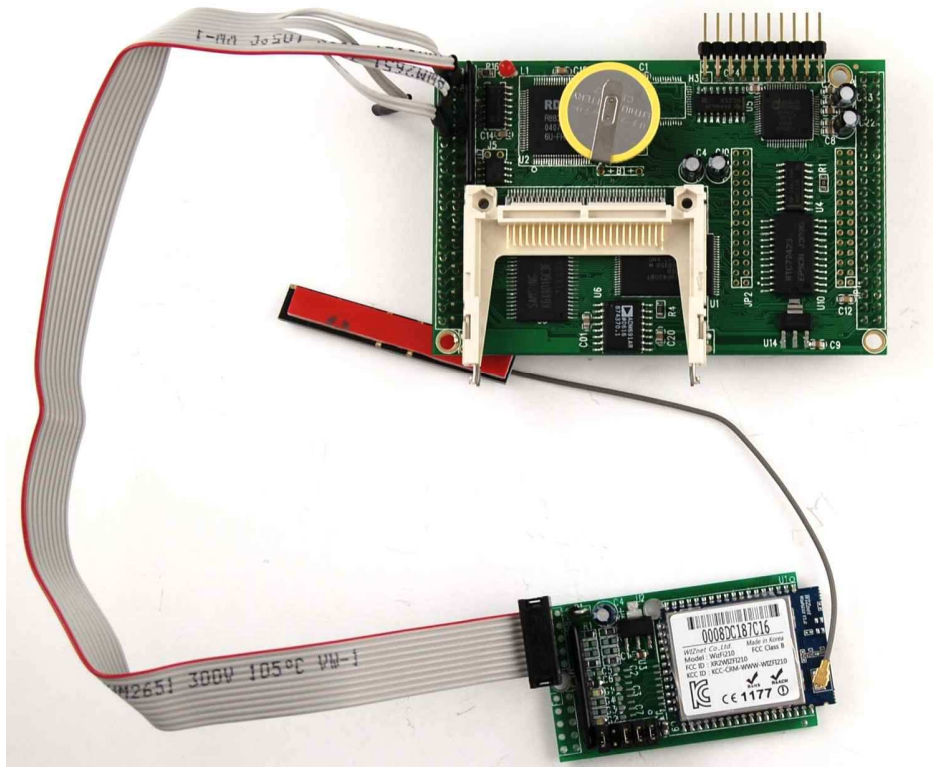


Figure 2.3 WiFi-TTL™ connected to B-Engine™ at header J2

Chapter 3: Hardware

3.1 Introduction

The WiFi-Adaptor™ is designed to provide a WiFi solution for TERN controllers. The WiFi-Adaptor™ supports a WizFi210 wireless module from WizNet. It can be driven by an RS232 serial port or a TTL (5V or 3.3V) UART at 115200 baud. Compatible TERN controllers include AE, EE, RE, i386E, 586E, or any TERN board with a TTL-UART or an RS232 UART.

3.2 WizFi210 Features

The WizFi210 is a fully certified module that offers a quick, easy, and cost effective way to add Wi-Fi capabilities to TERN controller products. The module provides a serial UART interface which enables connection to any of TERN's controllers. The WizFi210 is an ideal solution for organizations with limited or no Wi-Fi or RF expertise, as it not only dramatically reduces RF design time but also removes the burden of testing and certification; allowing customers to focus on their core application, product, or expertise. The module supports data rates up to 11 Mbps, and is compliant with 802.11b.

Features:

- Brings Wi-Fi connectivity to any device with a microcontroller and serial HOST interface (UART)
- Minimal Serial to Wi-Fi “driver” footprint on host microcontroller and minor changes to existing host MCU firmware
- Offloading of smaller host microcontrollers from the Wi-Fi and TCP/ IP networking
- Simple AT commands for configuration and data communication
- DHCP/Static IP, TCP/UDP, Server/Client, DNS
- Reduces development time, testing and certification burden, accelerating time to market
- Easy device provisioning through our utility or Wi-Fi Protected Set-up (WPS)
- Ultra low power consumption through dynamic power management
- Operates with standard 802.11 b/g/n access points at speed up to 11 Mbps (802.11b)
- 802.11i Security (WEP, WPA, WPA2-PSK, Enterprise)
- Rich I/O interfaces (SPI, UART, GTTL, I2C, ADC, JTAG)
- Low power modes, Alarm Input for wake-up
- High-throughput hardware AES and RC4 encryption/decryption engines
- Limited AP Feature (Direct Connection to iPhone, iPad and Android-Phone without AP)

3.3 Wireless Interface

TERN controllers can interface the WiFi-Adaptor™ either directly via TTL-UART with the WiFi-TTL™ or over an RS232 serial cable with the WiFi-RS232™

WiFi-232™

The WiFi-232™ version of the WiFi-Adaptor™ connects using an onboard RS232 converter. The controller communicates with the WiFi-232™ module over RS232.

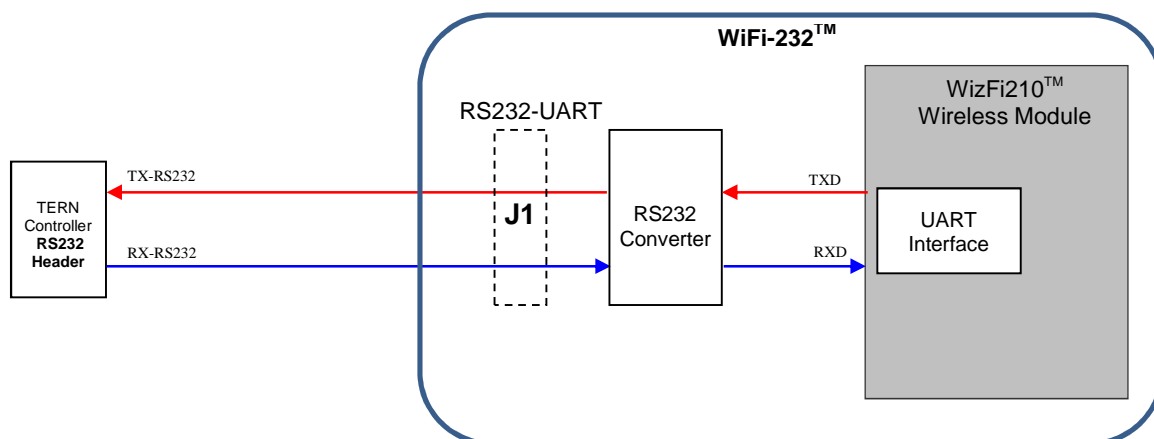


Figure 3.1 WiFi-232™

WiFi-TTL™

The WiFi-TTL™ version of the WiFi-Adaptor™ connects directly to the UART on the WizFi210 module. The controller communicates with the WiFi-TTL™ module over a 0-5V or 0-3.3V UART connection.

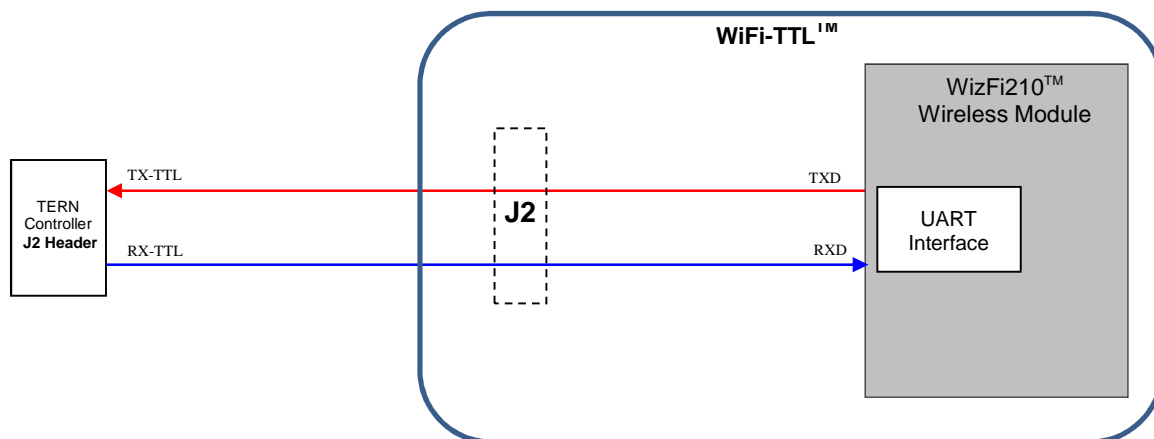


Figure 3.2 WiFi-TTL™

3.4 Power Supply

The WiFi-Adaptor™ has an on-board 3.3V linear regulator by default. The linear regulator requires 5VDC input at pin VIN, J1 pin 1 or J2 pin 1.

Chapter 4: Software

4.1 Introduction

The WizFi210 chip is controlled by series of AT commands**. All of the Wi-Fi overhead is managed by the module and transparent to the user. The commands are used to set up the mode of the module and communicate data. The module can be configured to communicate with an existing wireless network or can act as a limited access point and allow devices to connect to it.

Sample programs/projects for the WiFi-Adaptor™ can be found in the following directories depending on your controller:

`c:\tern\186\samples\wifi`

`c:\tern\386\samples\wifi`

`c:\tern\586\samples\wifi`

**** See *WizFi210 User Manual for AT command reference***

4.2 Wi-Fi Wireless Network

In a typical Wi-Fi network setting, the WiFi-Adaptor™ logs into a wireless router. The WiFi-Adaptor™ can either use a static IP address or request an IP address from the wireless router. Once it has an IP address, the module can create a TCP server socket, which listens for incoming TCP requests, or a TCP client socket that establishes a connection to a TCP server. The figure below illustrates a Wi-Fi network with multiple WiFi-Adaptors™ configured as TCP clients connecting to a WiFi-Adaptor™ configured as a TCP server.

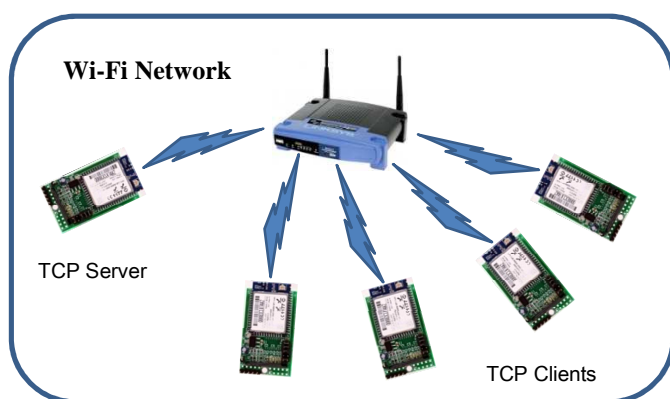


Figure 4.1 Standard Wi-Fi Network

TCP Server

The following AT commands establish WiFi-Adaptor™ as a TCP server at port 5000

```
// Connect to TERNTEST WIFI network, password "TernTest"
AT
AT+WWPA=terntest // wifi network password
AT+NDHCP=1 // enable dhcp for dynamic ip address
AT+WA=TernTest,,0 // wifi network name (ssid)

//After connected to WIFI network, set as TCP Server
"AT+NSTCP=5000" // Start a TCP server listening on port 5000
```

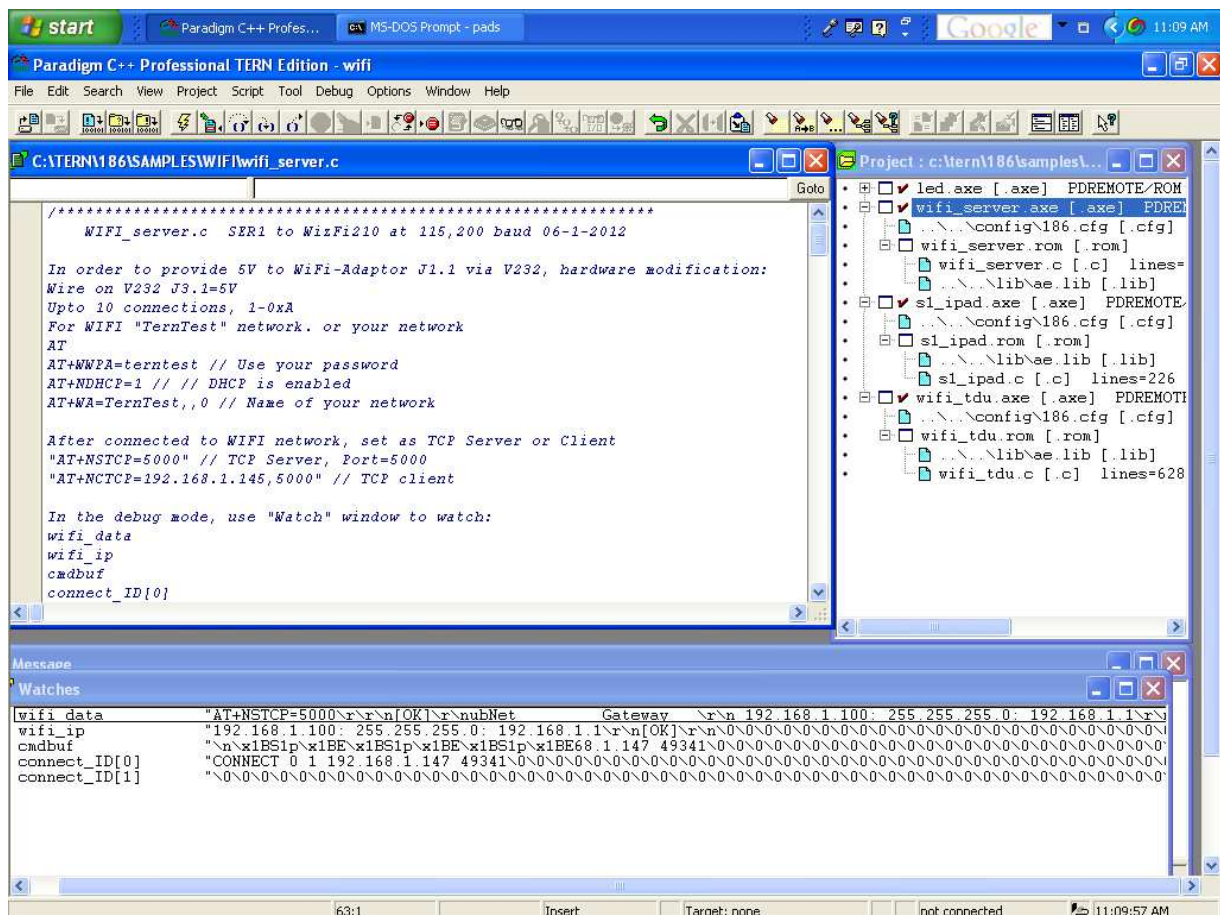


Figure 4.2 TCP Server Sample `wifi_server.c`

Sample program `wifi_server.c` in the WiFi sample directory demonstrates creating a TCP server. Watch the following variables: `wifi_data`, `wifi_ip`, `connect_ID[0]`, and `connect_ID[1]`.

TCP Client

The following AT commands establish WiFi-Adaptor™ as a TCP client:

```
// Connect to TERNTEST WIFI network, password "TernTest"
AT
AT+WWPA=terntest    // wifi network password
AT+NDHCP=1          // enable dhcp for dynamic ip address
AT+WA=TernTest,,0    // wifi network name (ssid)

//After connected to WIFI network, create client socket
"AT+NCTCP=192.168.1.145,5000"    // TCP client connection to 192.168.1.145 port: 5000
```

Auto Connection

Auto connection mode acts as a cable replacement insofar that the interface acts like a serial interface and no commands or user intervention are required for connection management. In this mode, the WiFi-Adaptor™ transfers data transparently between the Host and Target in data mode. No status information is sent to the controller.

Auto Server Connection

```
AT+WWPA=terntest    // wifi network password
AT+NDHCP=1          // enable dhcp for dynamic ip address
AT+WAUTO=0,TernTest,,0    // wifi network name (ssid)
AT+NAUTO=1,1,,5001      // TCP server, listen on port: 5001
ATA                  // start server auto connection
```

Auto Client Connection

```
AT+WWPA=terntest    // wifi network password
AT+NDHCP=1          // enable dhcp for dynamic ip address
AT+WAUTO=0,TernTest,,0    // wifi network name (ssid)
AT+NAUTO=0,1,192.168.1.225,5042    // TCP client connection to 192.168.1.225 port: 5042
ATA                  // start client auto connection
```

4.3 Wi-Fi Limited Access Point

The WiFi-Adaptor™ can also act as an access point for other wireless devices such as iPhones, iPads and Android Smart Phones. As an access point, devices can log into the WiFi-Adaptor™ and communicate with it. It is considered “limited” because the WizFi210 can only manage a few connections at a time. Once a device is connected, telnet software or specifically designed software can communicate with the TERN controller via TCP/IP.

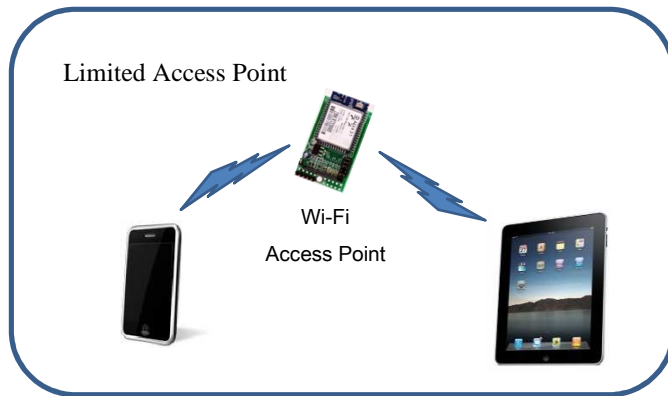
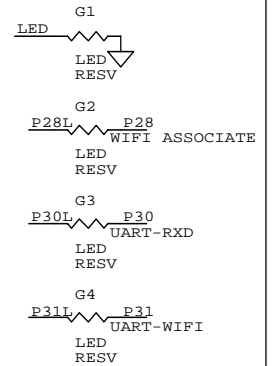
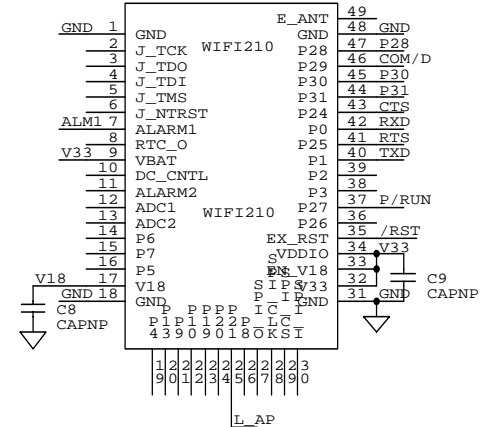
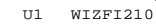
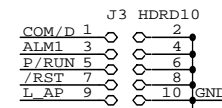
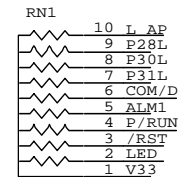
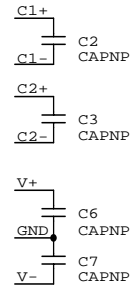
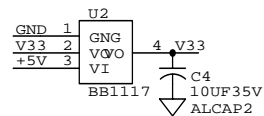
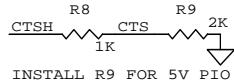
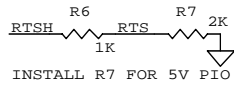
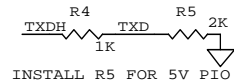
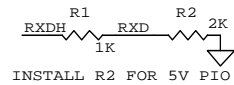
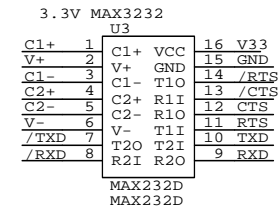
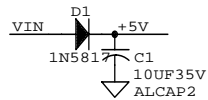
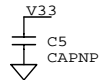
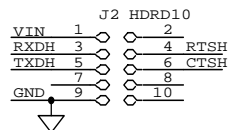
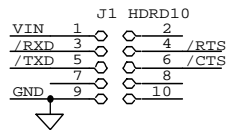


Figure 4.3 Limited Access Point

The following commands establish a limited access point named LimitedAP

```
// Create limited access point "LimitedAP"
AT+WM=2                // operating mode 2 = limited AP
AT+WAUTH=1             // authentication = open
AT+WWEPI=1234567890    // wep key = 1234567890
AT+NDHCP=0             // disable dhcp
AT+NSET=192.168.55.1,255.255.255.0,192.168.55.1 //static ip address, mask and gateway
AT+WA=LimitedAP,,8     // set network name = LimitedAP, channel = 8
AT+DHCSRVR=1           // enable dhcp server to assign ip addresses
AT+NAUTO=1,1,,5000     // enable auto connect as tcp server, port 5000
ATA2                   // start auto connect
```

See sample program “s1_ipad.c” in the WiFi sample directory.



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