USR-WIFI232-X- V4.3

Embedded WiFi Module User Manual

Overview of Characteristic

- Support IEEE802.11b/g/n Wireless Standards
- Support TCP/IP/UDP Network Protocols
- Support UART/GPIO/Ethernet Data Interface
- Support Work As STA/AP/AP+STA Mode
- Support Router/Bridge Mode Networking
- Support Internal/External Antenna Option
- Support Transparent Transmission Mode
- Support AT+ Instruction Set for Configuration
- Support Friendly Web Configuration Page
- Support Palmodic Signal
- Support UART Port Auto-Frame Function
- Single +3.3V Power Supply
- Small Size: 25 x 40mm
- FCC/CE Certificated

Remarks: This module is applicable to USR-WIFI232-A/B/C/D and its derivatives,for USR-WIFI232-2/610/L/G and the series of different, please refer to the corresponding document..

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HISTORY

Ed. V3.1 Created on 1-14-2012.

Ed. V4.0 Update AT command information on 6-25-2012.

Ed.V4.1 Update 2.1.3 AT+STA function using notes and related commands

Add built-in antenna 1.2.3

Update Appendix B,C on 10-15--2012

Ed.V4.2 Update EVB reference design and picture

Ed.V4.3 Delete Agreement transmission function

1. PRODUCT OVERVIEW

1.1. General Specification

Table 1 USR-WIFI232-X Module Technical Specifications

Class	Item	Parameters
Wireless Parameters	Certification	FCC/CE
	Wireless standard	802.11 b/g/n
	Frequency range	2.412GHz-2.484GHz
	Transmit Power	802.11b: +20 dBm (Max.)
		802.11g: +18 dBm (Max.)
		802.11n: +15 dBm (Max.)
		Configurable
	Receiver Sensitivity	802.11b: -89 dBm
		802.11g: -81dBm
		802.11n: -71dBm
	Antenna Option	External:I-PEX Connector
		Internal:On-board chip antenna
Hardware Parameters	Data Interface	UART: 1200bps - 230400bps
		GPIOs
		Ethernet: 100Mpbs
	Operating Voltage	3.3V (+/-5%)
	Operating Current	170mA~300mA
	Operating Temperature	-25℃- 85℃
	Storage Temperature	-40℃- 85℃
	Dimensions and Size	25×40×8mm
Software Parameters	Network Type	Station /AP mode/STA+AP
	Security Mechanisms	WEP/WAP-PSK/WAP2-PSK/WAPI
	Encryption	WEP64/WEP128/TKIP/AES
	Work Mode	Transparent Transmission
	Serial command	AT+instruction set
	Network Protocol	TCP/UDP/ARP/ICMP/DHCP/DNS/HTTP
	Max. TCP Connection	32
	User Configuration	Web Server＋AT command config.

1.2. Hardware Introduction

Figure 1.USR-WIFI232-X

1.2.1. Pins Definition

Pin type module Pins Map:

Pin type module Definition:

Table 2 USR-WIFI232-X Pins Definition

Pin	Description	Name	Direction	Note
1	Ground	GND	Power	
2	VCC	3.3V	Power	3.3V @ 350mA power input
3	UART Data Transmit	UART_TXD	O	If not use UART function, this 4 pins can be configured as GPIO pins, and can change GPIO pin status through AT command
	GPIO	GPIO3	I/O	
4	UART Data Receive	UART_RXD	I	
	GPIO	GPIO4	I/O	
5	UART sends request of data transmission	UART_RTS	O	
	GPIO	GPIO5	I/O	
6	UART receives data transmission	UART_CTS	I	

	permission			
	GPIO	GPIO6	I/O	
7	Module reset signal	RESET	I	“Low (0)” effective reset input. The reset duration should be kept more than 300ms
8	WiFi status Indication	nLink	O	“1”- WIFI connection available, “0”- No WIFI connection Can be configured as GPIO.
	GPIO	GPIO8	I/O	
9	Indicate the module status of power on process	nReady	O	“0” or “Palmodic Signal” - Finish module boot up process; “1” - Module boot up not finish. Can be configured as GPIO.
	GPIO	GPIO9	I/O	
10	Restore configuration	nReload	I	Module will Restore factory default configuration after set this pin “0” more than 1s, then set “1”.
	GPIO	GPIO10	I/O	
11	Ethernet Interface	PHY_RX+	I	+1.8V Ethernet Data Interface Support transformer and direct connection (AC couple) mode.
12	Ethernet Interface	PHY_RX-	I	
13	Ethernet Interface	PHY_TX+	O	
14	Ethernet Interface	PHY_TX-	O	

SMD type module Pins Map:

Figure 2 USR-WIFI232-X Pins Map

Pin type module Definition:

SMD type module Definition:

Pin	Description	Name	Direction	Note
3,18,19, 20,24,26	GND	GND	Power	Ground
1, 2	VCC	3.3V	Power	3.3V @ 350mA power input
4	UART Data Transmit	UART_TXD	O	If not use UART function, this 4 pins can be configured as GPIO pins, and can change GPIO pin status through AT command
	GPIO	GPIO	I/O	
5	UART Data Receive	UART_RXD	I	
	GPIO	GPIO	I/O	
6	UART sends request of data transmission	UART_RTS	O	
	GPIO	GPIO	I/O	
7	UART receives data transmission permission	UART_CTS	I	
	GPIO	GPIO6	I/O	
8	Ethernet Interface	PHY_TX+	O	+1.8V Ethernet Data Interface(Module with external 1.8V reference voltage)
9	Ethernet Interface	PHY_TX-	O	
10	Ethernet Interface	PHY_RX+	I	
11	Ethernet Interface	PHY_RX-	I	
14	WiFi status Indication	nlink	O	“1”- WIFI connection available, “0”- No WIFI connection.Can be configured as GPIO.

15	Module reset signal	nRST	I	“Low (0)” effective reset input. The reset duration should be kept more than 300ms
16	Indicate the module status of power on process	nReady	O	“0” - Finish module boot up process; “1” - Module boot up not finish.Can be configured as GPIO.
17	Restore configuration	nReload	I	Module will Restore factory default configuration after set this pin “0” more than 1s, then set “1”.
21	UART1 Data Receive	NC	NC	
22	UART1 Data Transmit	NC	NC	
23	Output 1.8V	1.8V	O	**1.8V@300mA**, to the Eth application
25	2.4GHz Antenna	ANT	O	50ohm impedance control line
12,13	Retain	NC	NC	

1.2.2. Mechanical Size

USR-WIFI232-X modules physical size as follows:

Pin type module Mechanical Size:

SMD module Mechanical Dimension:

Figure 3 USR-WIFI232-X Mechanical Dimension

1.2.3. On-board Chip Antenna

USR-WIFI232-X supports a built-in antenna options, when customers choose a built-in antenna, must comply with the following built-in antenna module placement of notes and general rules:

- Be in the user's PCB board, and the red region (6X8MM) corresponding to the region cannot be placed components and with GND;
- Antenna must away from the metal, at least to the distance around the higher components above 10MM;
- Antenna cant be shielded by any meal enclosure; All cover, include plastic, shall away from antenna at least 10MM;

Figure 4 USR-WIFI232-X Chip Antenna Keep Out Region

USR technological suggestions USR-WIFI232-X module be placed in the following areas of user board, in order to reduce the antenna and a wireless signal influence, at the same time, please consult with technology and technical support staff to assist module placement and associated regions of Layout design.

Figure 5 Suggested Module Placement Region

1.2.4. External Antenna

USR-WIFI232-X modules support internal antenna and external antenna option for user dedicated application. If user select external antenna, USR-WIFI232-X modules must be connected to the 2.4G antenna according to IEEE 802.11b/g/n standards.

The antenna parameters required as follows:

Table 3 USR-WIFI232-X External Antenna Parameters

Item	Parameters
Frequency range	2.4~2.5GHz
Impedance	50 Ohm
VSWR	2 (Max)
Return Loss	-10dB (Max)
Connector Type	I-PEX or populate directly

1.2.5. Evaluation Kit

USR provides the evaluation kit to promote user to familiar the product and develop the detailed application. The evaluation kit shown as below, user can connect to USR-WIFI232-X module with the RS-232 UART port, 100M Eth port or Wireless port to configure the parameters, manage the module or do the some functional tests.

Pin type module Evaluation Kit:

Table 4 USR-WIFI232-X Evaluation Kit Interface Description

Pin type module Evaluation Kit Interface Description:

Function	Name	Description
External Interface	DC jack	5V power input connector
	DB9	Male serial jack of 9-pin,and used to connect to PC
	RJ-45	100M Eth Interface
	Module	2x7 2mm DIP connector
LED	Power (Red)	3.3V Power Indicator
	TXD	TXD Indicator
	RXD	RXD Indicator
	Ready	nReady/GPIO Indicator
	Link	nLink/GPIO Indicator
Button	Reset	Used to reset the module.
	Reload	Module restore to factory default configuration.

SMD module Evaluating Kit:

Figure 6 USR-WIFI232-X Evaluation Kit

The external interface description for evaluation kit as follows:

SMD module Evaluation Kit Interface Description:

Function	Name	Description
External Interface	DB9	Male serial jack of 9-pin,and used to connect to PC
	RJ-45	100M Eth Interface
	Mini USB	B－type interface,AS 5v@1A power input port
	Module	2x7 2mm DIP connector
LED	Power (Red)	3.3V Power Indicator
	CTS (Green 1)	CTS/GPIO Indicator
	RTS(Green 2)	RTS/GPIO Indicator
	Reload(Green 3)	nReload/GPIO Indicator
	Ready(Green 4)	nReady/GPIO Indicator
	Link(Green 5)	NLink/GPIO Indicator
Button	Reset	Used to reset the module.
	Reload	Module restore to factory default configuration.

1.3. Hardware Reference Design

1.3.1. Hardware Typical Application

Figure 7 USR-WIFI232-X Hardware Typical Application

Notes：

nRST- Module hardware reset signal. Input. Logics “0” effective.

There is 100K Ohm pull-up resister internal. When module power up or some issue happened, MCU need assert nRST signal “0” at least 300ms, then set” 1” to keep module fully reset.

nReady- Module boot up ready signal. Output. Logics “0” effective.

There is 4.7K Ohm pull-up resister internal. The module will output “0” “or “Palmodic Signal” after normal boot up. This signal used to judge if module finish boot up and ready for application or working at normal mode.

nLink- Module WIFI connection indication. Output.

There is 4.7K Ohm pull-up resister internal. When module connect to AP (STA mode) or some WiFi STA connect to module (AP mode), the module will output “0”. This signal used to judge if module already at WiFi connection status.

nReload- Module restore to factory default configuration.Input. Logics “0” effective.

User can assert nReload signal “0” more than 3’s through button or MCU pin, then release, module will restore to factory default configuration and re-start boot up process. User need add 4.7K~10K Ohm pull-up resister external the module. If not use this function, then can use AT command AT+FRLDEN=off to disable it.

UART_TXD/RXD- UART port data transmit and receive signal.
There is 1K Ohm pull-down resister internal. User can't add pull-up resister at these pins.

1.3.2. 10/100M Ethernet Interface

USR-WIFI232-X modules provide one 10/100M Ethernet PHY layer interface for data transition or user configuration. This Ethernet support with transformer and without transformer (PHY-to-PHY) 2 kinds of connection.

1.3.2.1. Ethernet Connection with Transformer

User board put Ethernet transformer and RJ-45 connector. This is a general 10/100M Ethernet phy layer connection. The reference design as following:

Figure 8 Ethernet Reference Design with Transformer

(Above is for USR-WIFI232-A/B/D pin type module, Below is for SMD type USR-WIFI232-C)

1.3.2.2. Ethernet Connection without Transformer

For this application, Ethernet will work as internal data transmition interface and save one transformer and RJ-45 connector. Ethernet PHY-to-PHY connection will use AC coupled connection. This is a space and cost optimized solution. Hardware reference design as following:
Note: VCC signal at reference design shall base on user board PHY chipset voltage level, such as 2.5V power supply for general Ethernet PHY chipset.

Figure 9 Ethernet Reference Design without Transformer

(Above is for USR-WIFI232-A/B/D pin type module, Below is for SMD type USR-WIFI232-C)

This module Ethernet interface default is for the application with transformer connection. If you need PHY-PHY directly connection, please change the hardware as follows:

1. Weld 0 ohm resistance in red position

2. Remove the component in yellow position

BOT side component

TOP side component

Specific PHY-PHY direct connection reference to user manual chapter 1.3.2.2 application of Ethernet without transformer. And AT+FEPTP command

Note:

1. Cable connection should be AC coupling, your cable need be pulled up to VCC (fit with PHY chip level)
2. Cable TX connected to RX. In PHY-PHY direct connection, PHY chip dose not support direct/ cross self-adaption
3. Your PHY chip on board should better to be forced into 100M work mode

1.3.3. UART Interface

UART interface is the serial data transmition interface mainly used for USR-WIFI232-X modules. User can add RS-232 chipset on user board and convert the signal to RS-232 voltage to communicate with outside equipment or sensors. USR-WIFI232-X modules UART interface include 4 general signals: TXD/RXD/RTS/CTS. The hardware reference design with RS-232 chipset as following:

Figure 10 UART Interface Reference Design

Notes: TXD pin is also hardware configuration pin internal module. So this pin MUST pull-down during module power up. USR-WIFI232-X modules provide internal pull-down resister, user can't add pull-up/pull-down resister on user board, which may cause module can't work.

1.3.4. Power Interface

USR-WIFI232-X module support single +3.3V power supply. The peak current shall about 350mA and normal WiFi working current shall about 200mA. The power save (WiFi OFF) mode will about 100mA

Decoupling at power pin suggested, At least one 100uF and one 10uF capacitor required at user board and put near module power input pin will increase the reliability and performance.

1.4. Software Reference Design

When USR-WIFI232-X modules boot up phase, the general user board MCU software flow chart will as following:

Figure 11 User MCU Software Flow Chart

USR-WIFI232-X modules provide two kinds of work mode and one configuration mode.
Work mode is **Transparent Transmission** and **Agreement Transmission.**
Configuration mode is through **AT+instruction set** to finish module setting and configuration.

Attention: V4.xx **dose not** support **Agreement Transmission** any more, only v3.xx support

When USR-WIFI232-X modules boot up, user can select one work mode base on the setting, and user can switch to the configuration mode at any kinds of work mode.

1.4.1. Transparent Transmission Mode

USR-WIFI232-X modules support serial interface transparent transmission mode. The benefit of this mode is achieves a plug and play serial data port, and reduces user complexity furthest. In this mode, user should only configure the necessary parameters. After power on, module can automatically connect to the default wireless network and server.

As in this mode, the module's serial port always work in the transparent transmission mode, so users only need to think of it as a virtual serial cable, and send and receive data as using a simple serial. In other words, the serial cable of users' original serial devices is directly replaced with the module; user devices can be easy for wireless data transmission without any changes.

The transparent transmission mode can fully compatible with user's original software platform and reduce the software development effort for integrate wireless data transmission.

Notes: Transparent transmission mode as a low level phy layer data transmitting can't keep zero error rates by itself. User can enable UART port's hardware flow control CTS/RTS function or though higher layer protocol such as TCP to lower error rate and mange the data completeness. USR recommend when doing large amounts of data transmitting in transparent transmission mode, hardware flow control should be enabled, so as to fully ensure reliable data transmission. In the applications which doesn't need flow control, users can simply leave RTS / CTS pin vacant.

1.4.2. Configuration Mode

In configuration mode, user can finish USR-WIFI232-X module configuration management and parameters setting work. In work mode (Transparent Transmission or Agreement Transmission), user can switch to the configuration mode through AT+instruction, detailed switch operation refer to "AT+ instruction set" chapter.

1.4.3. Multi-TCP Link Connection

When USR-WIFI232-X module configured as TCP Server, it supports Multi-TCP link connection, and maximum 32 TCP clients permit to connect to USR-WIFI232-X module. User can realize multi-TCP link connection at each work mode.

Multi-TCP link connection will work as following structure:

Upstream: All dates from different TCP connection or client will be transmitted to the serial port as a sequence.

Downstream: All data from serial port (user) will be duplicate and broadcast to every TCP connection or client.

Detailed multi-TCP link data transmission structure as following figure:

Figure 14 Multi-TCP Link Data Transmission Structure

1.4.4. TCPB Function

USR-WIFI232-X support 2xTCP function, which means module can support 2 network connections at the same time. The 2nd net work connection called TCPB. TCPB only works as TCP Client and its configuration can only through AT command, not Web configuration supported. The command as following,

- AT+TCPB=on, Enable TCPB function;
- AT+TCPPTB=<port>, Set TCPB port number;
- AT+TCPADDB=<IP or domain>, Set TCPB's server address;
- AT+TCPTOB=<time>, Set TCPB timeout;
- AT+TCPLKB, Query TCPB link status;

Detailed command description refer to AT instruction chapter. After enable TCPB function, two network interfaces' work mode like "Multi-TCP Link", All dates from each TCP connection will be transmitted to the serial port as a sequence and all data from serial port (user) will be duplicate and broadcast to each TCP connection.

1.4.5. GPIO Function

USR-WIFI232-X module support 2 GPIO mode: GPIO-1 and GPIO-2. At GPIO-1 mode, UART (TXD/RXD/CTS/RTS) defined as GPIO and others (nReady/nLink/nReload) defined as functional pin. At GPIO-2, all these 7 pins defined as GPIO. So, GPIO mode not supports UART communication.

When module works at GPIO mode, PC and other equipments can setup connection (TCP/UDP) through WiFi, then read/write GPIO information through command.

- GPIO n IN, Set GPIOn as input, Response GPIO OK or GPIO NOK;
- GPIO n OUT 0, Set GPIOn as output and output '0', Response GPIO OK or GPIO NOK;
- GPIO n OUT 1, Set GPIOn as output and output '1', Response GPIO OK or GPIO NOK;
- GPIO n SW, Set GPIOn as output and switch the output status, Response GPIO OK or GPIO NOK;

- GPIO n PWM m1 m2, Set GPIOn output a wave: m1 is 'high' duration and m2 is 'low' duration (Time unit is 'ms' and minimal is 10ms), Response GPIO OK or GPIO NOK;
- GPIO n GET, Read GPIOn status, Response I0,I1,O0,O1, means"input low","input high","output low","output high"

Notes: n can be 3, 4, 5, 6, 8, 9, 10 corresponding module pin. GPIO 4 and 10 can only defined as input and GPIO 3 can only defined as output.

GPIO READ returns all current IO status, and GPIO n GET said method. Such as, I1I1I0I0I0I0O1, I said input, O output. 0 low, 1 express high.4 and 10 of the two pin is negated. Read the 1 actual 0 actual 1, read the 0.

1.4.6. Palmodic Signal

Base on selected factory default setting, nReady signal can have two output statuses:

- Status One: The module will output "0" after normal boot up. This signal used to judge if module finish boot up and ready for application.
- Status Two: The module will output "Palmodic Signal" after normal boot up.The palmodic signal is 0.5Hz square wave with dutyfactor 1:1. User can query this signal to judge if moduleis active "live" or need to re-boot. When module switches to command mode, it will output "0", which used to distinguish work mode and command mode.

Notes:

This function is user selected factory setting and RELD instruction will not effective for this function. If user not requires this function, the default factory setting is Status One. Contact with USR Technology for more detailed support.

2. FUNCTIONAL DESCRIPTION

2.1. Wireless Networking

USR-WIFI232-X module can be configured as both wireless STA and AP base on network type. Logically there are two interfaces in USR-WIFI232-X. One is for STA, and another is for AP. When USR-WIFI232-X works as AP, other STA equipments are able to connect to wireless LAN via USR-WIFI232-X module. Wireless Networking with USR-WIFI232-X is very flexible.

Following figure shows the functional architecture of USR-WIFI232-X module:

Figure 15 USR-WIFI232-X Functional Architecture

Notes:

AP: that is the wireless Access Point, the founder of a wireless network and the center of the network nodes. The wireless router we use at home or in office may be an AP.

STA: short for Station, each terminal connects to a wireless network (such as laptops, PDA and other networking devices) can be called with a STA device.

2.1.1. Basic Wireless Network Based On AP (Infrastructure)

Infrastructure: it's also called basic network. It built by AP and many STAs which join in.

The characters of network of this type are that AP is the center, and all communication between STAs is transmitted through the AP. The figure following shows such type of networking.

Figure 16 USR-WIFI232-X Basic Wireless Network Structure

2.1.2. Wireless Network Based On Adhoc Network (Adhoc)

Adhoc: It's also called independent basic service set, and it's built by two or more STAs without AP, this type of network is a loose structure, all the STAs in the network can communicate directly.

As showing in the figure below, USR-WIFI232-X (1) can be treat as an AP, and USR-WIFI232-X (2), USR-WIFI232-X (3) and the laptop are STAs connected to USR-WIFI232-X (1). Meanwhile, all USR-WIFI232-X modules can connected to user device via UART interface. All USR-WIFI232-X modules can be operated and managed through the laptop. So it is convenient to O&M all USR-WIFI232-X modules. Moreover, in such Adhoc network structure, the whole coverage of a wireless network can be extended easily.

Figure 17 USR-WIFI232-X Adhoc Network Structure

2.1.3. Wireless Network Based On AP+STA

USR-WIFI232-X module support AP+STA network mode, means module support one AP interface and one STA interface at the same time, as following figure,

Figure 18 USR-WIFI232-X AP+STA Network Structure

When module enables AP+STA function, Module's STA interface can connect with router and connect to TCP server in the network. At the same time, module's AP interface is also active and permit phone/PAD to connect through TCPB, then phone/PAD can control user device and and setting the module parameters,

The advantage of AP+STA mode is:

- Users can easily setting and track user device through Phone/PAD and not change the orginal network setting.
- Users can easily setting module's parameters through WiFi when module works as STA mode.

AP+STA Mode Setting:

AP+STA mode need serial AT command to enable as follows:

- AT+FAPSTA=on, Enable AP+STA mode;

- Then, when you configure module works as STA mode, it's AP interface still active;

AP+STA Mode Notes:

When user enable AT+STA function,the STA port need to keep connected with other router(AP), or STA port will have to scan the AP frequently ,which will affect AP port function and may cause some date loss.

So ,if user confirm STA port can't connect with AP at some time,user can disable the STA scan through the following command:

- **AT+STTC=on/off**,on:Scan AP;off:NO Scan AP.

After re-start module,this command not saved;

- **AT+FSTTC=on/off**;

This command is saved after re-staring the module;

2.2. Auto- Frequency Function

When module works as STA, USR-WIFI232-X will adjust its wireless channel to keep the same channel with associated AP and connect in.

When module works as AP and USR-WIFI232-X enable Auto-frequency function, then when module boot up, it will select the best wireless channel based on surrounding environment.

2.3. Security

USR-WIFI232-X module supports multiple wireless encryption mechanisms, and enables to protect the security of user's data transmission, the mechanisms include:

- WEP
- WPA-PSK/TKIP
- WPA-PSK/AES
- WPA2-PSK/TKIP
- WPA2-PSK/AES

2.4. UART Frame Scheme

2.4.1. UART Free-Frame

USR-WIFI232-X support UART free-frame function. If user select open this function, module will check the intervals between any two bytes when receiving UART data. If this interval time exceeds defined value (50ms default), USR-WIFI232-X will think it as the end of one frame and transfer this free-frame to WiFi port, or USR-WIFI232-X will receive UART data until 4K bytes, then transfer 4KB frame to WiFi port.

USR-WIFI232-X's default interval time is 50ms. User can also set this interval to fast (10ms) through AT command. But user have to consider if user MCU can send UART data with 10ms interval ,or the UART data may be divide as fragment.

Through AT command: AT+FUARTTE=fash/normal, user can set the interval time: fast (10ms) and normal (50ms). This command is factory default setting command and AT+RELD can't change its value.

2.4.2. UART Auto-Frame

USR-WIFI232-X support UART auto-frame function. If user select open this function and setting auto-frame trigger length and auto-frame trigger time parameters, then module will auto framing the data which received from UART port and transmitting to the network as pre-defined data structure.

- **Auto-frame trigger length**: The fixed data length that module used to transmitting to the network.
- **Auto-frame trigger time:** After the trigger time, if UART port received data can't reach auto-frame trigger length, then module will transmitting available data to the network and bypass the auto-frame trigger length condition.

Detailed UART auto-frame function can refer to AT+ instruction set "UARTF/UARTFT/UARTFL" introduction.

2.5. Address Binding

USR-WIFI232-X module supports the feature of binding the BSSID address of target network.
According to the provisions of 802.11 protocol, different wireless networks can have a same network name (i.e. SSID / ESSID), but must correspond to a unique BSSID address (i.e. MAC address). Illegal intruders can create a wireless network with the same SSID / ESSID, it will make
STAs in the network to join to the illegal AP, thereby and then network leakage happen.

Users can prevent STA from joining to illegal network by binding the BSSID address, to improve wireless network security.

2.6. Ethernet Interface Communication

USR-WIFI232-X module provides one 100M Ethernet interface. With this Ethernet interface, user can easily realize the three interface (WiFi, UART, and Ethernet) intercommunication and networking. USR-WIFI232-X module can configured as **Bridge Mode** or **Router Mode** base on different networking technology.

Notes: As the Ethernet mode will increase additional consumption, so it is default closed. If you need this function, pls use AT+FEPHY=on to open it and RELD can't change this. For different application, USR-WIFI232-610 need version switch via commands (such as following description of N-ver and Z-ver). With command AT+FVER=n to switch to N-ver and with command AT+FVER=z to switch to Z-ver.

2.6.1. USR-WIFI232-X Ethernet Interface Networking (As AP)

Figure 19 USR-WIFI232-X Ethernet Interface Networking (As AP)

USR-WIFI232-X module works as AP and also the center of this network. All devices' IP address in this network shall use the same network segment with USR-WIFI232-X and they can intercommunication with this method.

2.6.2. USR-WIFI232-X Ethernet Interface Networking (As STA, N-Ver)

Figure 20 USR-WIFI232-X Ethernet Interface Networking (As STA, N-Ver)

USR-WIFI232-X module works as STA (Software is N-Version), and module set as router mode. When module connect to AP, it will get wireless port IP address from AP (For example: 192.168.1.100). At the same time, module also form a subnet (Default 10.10.100.254) and all devices connected to module Ethernet interface will get assigned IP address (For example: 10.10.100.101).So as shown, PC1 at internal subnet can initiate a connection to PC2 (For USR-WIFI232-X works as router mode), but PC2 can't active initiate a connection to PC1.

2.6.3. **USR-WIFI232-X** Ethernet Interface Networking (As STA, Z-Ver)

Figure 21 USR-WIFI232-X Ethernet Interface Networking (As STA, Z-Ver)

For above networking, USR-WIFI232-X module works as STA（Firmware is Z-Version）,and module configured as bridge mode. When module connect to AP, all devices connected to module Ethernet interface will get assigned IP address from AP (For example: 192.168.1.101).For module works as bridge mode, it can be treated as a transparent device and PC1, PC2 can communicate without any limit. But in this networking, USR-WIFI232-X module needs assign a static LAN IP address (For

example: 192.168.1.10) if module also needs communication with AP or configuration through web page.

2.7. Wireless Distribution System (WDS)

USR-WIFI232-X support Wireless Distribution System (WDS) function. Through WDS, serval APs can connect each other and build a big WiFi network.

WDS network structure as following figure, the center 3 USR-WIFI232-X work as AP mode and enable WDS function; they build a big WDS network. All other USR-WIFI232-X work as STA mode and can connect with any AP in the WDS network. All modules include AP and STA are in the same local area network (LAN).

The server can connect with one AP through WiFi or Ethernet connection, then server can connect with every user device and control them as in the same local area network.

Through AT command AT+FVER=w to enable WDS function. Also WDS function can set through the web page.

Figure 22 WDS Networking Demo

2.8. Search Function for STA

When using web configuration STA Interface Setting Page, user can push “Search” button to find surrounding AP, and find a AP to associated.

2.9. Work Mode

USR-WIFI232-X modules provide Transparent transmission mode only. Transparent transmission mode achieves a plug and play serial data port, and reduces user complexity.

For a module which already finished parameters setting, it will try to connect a wireless network and server with these parameters after power up, and serial interface is also active with pre-configured parameters. Then all the data is transferred directly between serial interface and Wifi interface without any interpreted.

The parameters which need to configure include:

- **Wireless Network Parameters**
  - Wireless Network Name（SSID）
  - Security Mode
  - Encryption Key
- **TCP/UDP Linking Parameters**
  - Protocol Type
  - Link Type（Server or Client）
  - Target Port ID Number
  - Target Port IP Address
- **Serial Port Parameters**
  - Baud Rate
  - Data Bit
  - Parity (Check) Bit
  - Stop Bit
  - Hardware Flow Control
- **Work Mode Selection**
  - Transparent transmission

Transparent transmission demo as showing in the following figure, a USR-WIFI232-X module can be taken as a virtual serial line when UART interface working in transparent transmission mode. And user device will realize wireless data transmission almost without any changes.

Figure 23 USR-WIFI232-X Transparent Transmission Demo

2.10. Network Protocol

USR-WIFI232-X module supports TCP/UDP network protocol and the port parameters can be set via web accessing or AT+instruction set.

2.11. Parameters Configuration

USR-WIFI232-X module supports two methods to configuration parameters: **Web Accessing** and **AT+instruction set**.

Web accessing means users can configure parameters through built-in webpage. When USR-WIFI232-X module connected to wireless network, parameters configuration is done on a PC connected to the same wireless network. AT+instruction set configuration means user configure parameters through serial interface command. Refer to "AT+instruction set" chapter for more detail.

Notes:

USR can customized the parameters setting as customer request and ship USR-WIFI232-X modules with these parameters as factory default configuration. It will reduce user's module configuration time for mass production. Also, if user need different parameters setting for every module, USR can provide the **auto-configuration tool** to speed up the module configuration duration. Please contact USR technical interface to acquire this tool if required.

2.12. Firmware Upgrade

USR-WIFI232-X module supports firmware upgrade online; User can upgrade firmware via web access.

2.13. GPIO Function

USR-WIFI232-X module can provide maximum 7 GPIO pins, Refer to "1.2.1 Pin Definition" charter, which include 4 UART pins and 3 general use pins can be customized as GPIO pins if these functions are not required. As GPIO functional pin, user devices can read/write GPIO pins status through AT+instruction set.

3. OPERATION GUIDELINE

3.1. Configuration via Web Accessing

When first use USR-WIFI232-X modules, user may need some configuration. User can connect to USR-WIFI232-X module's wireless interface with following default setting information and configure the module through laptop.

Table 5 USR-WIFI232-X Web Access Default Setting

Parameters	Default Setting
SSID	HF-A11_AP
IP Address	10.10.100.254
Subnet Mask	255.255.255.0
User Name	admin
Password	admin

3.1.1. Open Web Management Interface

Step 1: Connect laptop to SSID "USR-WIFI232-X_AP" of USR-WIFI232-X module via wireless LAN card;

Step 2: After wireless connection OK. Open Wen browser and access "**http://10.10.100.254**";

Step 3: Then input user name and password in the page as following and click "OK" button.

Figure 24 Open Web Management page

The USR-WIFI232-X web management page support English and Chinese language. User can select language environment at the top right corner and click "Apply" button.

The main menu include five pages: "Mode Selection"," AP Interface Setting","STA Interface Setting","Application Setting", and "Device Management"

3.1.2. Mode Selection Page

This page use to setting the wireless networking mode (AP and STA mode).

Figure 25 Mode Selection Page

3.1.3. AP Interface Setting Page

This page use to setting the parameters when USR-WIFI232-X module works as AP.

Figure 26 AP Interface Setting Page

3.1.4. STA Interface Setting Page

This page use to setting the parameters when USR-WIFI232-X module works as STA.

Such as SSID of AP which module need to connected, and also select the networking type: DHCP or static IP address.

Figure 27 STA Interface Setting Page

3.1.5. Application Setting Page

This page use to setting the parameters of serial port communication, such as UART setting and high layer network protocol setting which used support serial communication.

Figure 28 Application Setting Page

Notes:

Generally, Network protocols support three modes: **TCP Server**, **TCP Client**, **and UDP**. UDP has no server and client requirement according to standard.

Besides module working as TCP Server (IP address not required in this mode). User must set the IP address of the device which need communicate with USR-WIFI232-X module.

Also the Port ID between two sides of the communication devices must keep the same.

3.1.6. Device Management Page

This page use to manage USR-WIFI232-X module general setting, such as administrator setting, restart module button, restore factory default setting button, and update firmware through webpage.

Figure 29 Device Management Page

Notes:

Restart module button: When you setting the parameters of different web pages, you will click "Apply" button to confirm the setting, but the setting take effect only after user click the "Restart" button here, the module will re-boot up and refresh the memory information with new changes.

3.2. USR-WIFI232-X Usage Introduction

3.2.1. Software Debug Tools

In order to facilitate the use of my company, development of the serial and network debugging two-in-one test software,USR-TCP232-Test

3.2.2. Network Connection

In order to test the serial port to the WIFI network address conversion, we will module serial connected with the computer, network and computer links to WIFI.

Due to the need to have both a WIFI and serial special requirements, only a minority of the notebook computer can achieve, the user can use the desktop with a USB card, or use the notebook computer with a USB to serial line way, the author uses the desktop and WIFI card form test, desktop with serial. (Note: there USB transfer RS232 the line quality uneven, some good and some bad, in order not to waste your valuable time, look for buying a used FT232 chip scheme suggested switching line, about the price $9)

Figure 30 Connection diagram

On the serial connection, module pin leads to 3.3V TTL level, not directly connected with the computer, need to bring the bottom or users are TTL to RS232 connecting line connected to the computer, in order to facilitate the user to test the use of, we provide a variety of floor for the user to choose, here in the case of USR-WIFI232-2.

Hardware connectivity, for module power supply, the red power indicator light, wait about 6 seconds (internal LINUX system boot), Ready lights, said system startup complete, can operate, entering the next step.

3.2.3. Module Debug

As shown above, opened in PC program, set the COM export and open the serial port connection

Figure 31 "CommTools" Serial Debug Tools

Open test software USR-TCP232-Test.exe, selection of hardware attached to the computer's serial number, this is COM1, choose 57600 baud rate, such as the WIFI module serial default baud rate, open the serial port.

Network settings in TCP client mode, the server IP address input 10.10.100.254, this is WIFI module default IP address, server port number 8899, this module default monitor TCP port number, click the link to establish TCP connection,Then click the create connection.

Figure 32 "TCP UDPDbg" Tools Create Connection

Because of the USR-WIFI232-X module default support for transparent transmission mode, so now you can debug tools two-way data, all data will be wholly intact transmission to the other side of display. The testing process can be seen in module TXD and RXD indicator lights in the data through the flashing.

Figure 33 The test results show that the network and serial port

Special note: because of the RTS/CTS pin processing difference, currently available on the part of the serial debugging software for the module of the system is not available, please be sure to want to use USR-TCP232-Test we provide testing, or just RXD TXD GND connected the three line to the computer, please notice.

3.2.4. Wireless Control Application

Figure 34 Wireless Control Application

For this wireless control application, USR-WIFI232-X works as AP mode. Module's serial port connects to user device. So, control agent (Smart phone for this example) can manage and control the user device through the wireless connection with USR-WIFI232-X module.

3.2.5. Remote Management Application

Figure 35 Remote Management Application

For this remote management application, USR-WIFI232-X works as STA mode and connects to Internet through wireless AP. Module configured as TCP Client and communicates with remote TCP server at Internet. Module's serial port connects to user device.

So, user device's data or sampling information can send to remote TCP server for storage or processing. Also remote TCP server can send command to control and manage the user device through the wireless network.

3.2.6. Transparent Serial Port Application

For this transparent serial port application, two USR-WIFI232-X modules connect as below figures to build up a transparent serial port connection.

Figure 36 Transparent Serial Port Application

For left side USR-WIFI232-X module, configured as AP mode and use default SSID and IP address, network protocol configured as TCP/Server mode, and protocol port ID: 8899.

For right side USR-WIFI232-X module, configured as STA mode and setting the same SSID （"HF-A11_AP" for this example）with left side USR-WIFI232-X module, enable DHCP network and network protocol configured as TCP/Client mode, protocol port ID: 8899. Target IP address part setting the same IP address with left side USR-WIFI232-X module ("10.10.100.254" for this example).

When right side USR-WIFI232-X boot up, it will find wireless AP (SSID：HF-A11_AP for this example) and open TCP/Client network protocol to connect with left side module's TCP/Server. All these operation will be automatic and after finished, the two user devices connected to USR-WIFI232-X module through serial port can communicate each other and think the connection between them is fully transparent.

3.2.7. Wireless Data Acquisition Card Application

For this wireless data acquisition card application, one PC works as data server and every data acquisition card connects with a USR-WIFI232-X module to support wireless connection function.

Figure 37 Wireless Data Acquisition Card Application

As above figure, one USR-WIFI232-X configured as AP mode and all others configured as STA mode. All USR-WIFI232-X which configured as STA and data server PC wireless connected to USR-WIFI232-X which configured as AP to make up a wires network.

Data server PC open TCP/Server protocol and all USR-WIFI232-X modules open TCP/Client protocol. All data acquisition cards' data and sampling information can be transmitted to data server PC for operation.

4. AT+INSTRUCTION INTRODUCTION

4.1. Configuration Mode

When USR-WIFI232-X power up, it will default works as transparent transmission mode, then user can switch to configuration mode by serial port command. USR-WIFI232-X UART default parameters setting as below figure,

Uart Setting	
Baudrate	57600
Data Bits	8
Parity	None
Stop	1
CTSRTS	Disable

Figure 38 USR-WIFI232-X Default UART Port Parameters

In configuration mode, user can setting the module through AT+ instruction set, which cover all web page setting function.

4.1.1. Switch to Configuration Mode

Two steps to finish switching from transparent transmission mode to configuration mode.

- **UART input "+++", after module receive "+++", and feedback "a" as confirmation.**
- **UART input "a", after module receive "a" and feedback "+ok" to go into AT+ instruction set configuration mode.**

Figure 39 Switch to Configuration Mode

Notes:

1. When user input "+++" (No "Enter" key required), the UART port will display feedback information "a", and not display input information"+++" as above UART display.

2. Any other input or wro ng step to UART port will cause the module still works as original mode (transparent transmission).

4.2. AT+ Instruction Set Overview

User can input AT+ Instruction through hyper terminal or other serial debug terminal, also can program the AT+ Instruction to script. User can also input “AT+H” to list all AT+ Instruction and description to start.

Figure 40 ”AT+H” Instruction for Help

4.2.1. Instruction Syntax Format

AT+Instruction protocol is based on the instruction of ASCII command style, the description of syntax format as follow.

- **Format Description**
  - **< >**: Means the parts must be included
  - **[ ]**: Means the optional part

- **Command Message**

AT+<CMD>[op][para-1,para-2,para-3,para-4…]<CR>

- AT+: Prefix of command message;
- CMD: Command string;
- [op]: Symbol of command operator,
  - “=” : The command requires parameters input;
  - “NULL”: Query the current command parameters setting;
- [para-n]: Parameters input for setting if required;

- <CR>：”Enter” Key, it’s 0x0a or 0x0d in ASCII;

Notes: When input AT+Instruction, “AT+<CMD>” character will display capital letter automatic and other parts will not change as you input.

➢ **Response Message**

+<RSP>[op] [para-1,para-2,para-3,para-4…]<CR><LF><CR><LF>

- +: Prefix of response message;
- RSP: Response string;
  - “ok” : Success
  - “ERR”: Failure
- [op] : =
- [para-n]: Parameters if query command or Error code when error happened;
- <CR>: ASCII 0x0d;
- <LF>: ASCIII 0x0a;

➢ **Error Code**

Table 6 Error Code Description USR-WIFI232-X Web Access Default Setting

Error Code	Description
-1	Invalid Command Format
-2	Invalid Command
-3	Invalid Operation Symbol
-4	Invalid Parameter
-5	Operation Not Permitted

4.2.2. AT+ Instruction Set

Table 7 AT+ Instruction Set List

Instruction	Description
<null>	NULL
E	Open/Close show back function
ENTM	Set module into transparent transmission mode
NETP	Set/Query network protocol parameters
UART	Set/Query serial port parameters
UARTF	Open/Close UART auto-frame function
UARTFT	Set/Query UART auto-frame trigger time
UARTFL	Set/Query UART auto-frame trigger length
TMODE	Set/Query data transmission mode (transparent transmission or agreement transmission)
WMODE	Set/Query WIFI work mode (AP or STA)
WSKEY	Set/Query WIFI security parameters as STA
WSSSID	Set/Query WIFI target AP SSID parameters as STA
WSLK	Query WiFi link status as STA
WEBU	Set/Query WEB page login parameters

	(User Name and Password)
WAP	Set/Query WIFI parameters as AP
WAKEY	Set/Query WIFI security parameters as AP
MSLP	Set modules into power save mode.(Turn OFF WiFi)
WSCAN	Seek AP when module works as STA mode
TCPLK	Query if TCP link already build-up
TCPDIS	Open/Cose TCP (Only TCP Client available)
WANN	Set/Query WAN setting, only effective as STA mode
LANN	Set/Query LAN setting, only effective as AP mode
DHCPGW	Set/Query DHCP gateway address
TCPTO	Set/Query TCP timeout
MAXSK	Set/Query maxima TCP connection
TCPB	Open/Close TCPB function
TCPPTB	Set/Query TCPB port number
TCPADDB	Set/Query TCPB server address
TCPTOB	Set/Query TCPB time out time
TCPLKB	Query TCPB link status
EPHY	Open/Close ETH interface
RELD	Restore to factory default setting
Z	Re-start module
MID	Query module ID information
VER	Query module software version information
H	Help

Notes: USR-WIFI232-X module can works as AP or STA, user have to use different AT+ Instruction to set WiFi parameters when module works as AP or STA mode.

4.2.2.1. AT+E

- Function: Open/Close show back function;
- Format:

AT+E<CR>
+ok<CR>< LF ><CR>< LF >

When USR-WIFI232-X module firstly switch from transparent transmission to configuration mode, show back status is open, input “AT+E” to close show back function, input“AT+E” again to open show back function.

4.2.2.2. AT+ENTM

- Function: Set module into transparent transmission mode;
- Format:

AT+ENTM<CR>
+ok<CR>< LF ><CR>< LF >

When operate this command, module switch from configuration mode to transparent transmission mode.

4.2.2.3. AT+NETP

- Function: Set/Query network protocol parameters;
- Format:
  - Query Operation

AT+NETP<CR>

+ok=<protocol,CS,port,IP><CR>< LF ><CR>< LF >

  - Set Operation

AT+NETP=<protocol,CS,port,IP><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - protocol:
    - TCP
    - UDP
  - CS: Network mode:
    - SERVER
    - CLIENT
  - Port: protocol port ID: Decimal digit and less than 65535
  - IP: Server's IP address when module set as client

After USR-WIFI232-X module boots up again, the setting will be effective.

4.2.2.4. AT+UART

- Function: Set/Query serial port parameters;
- Format:
  - Query Operation

AT+UART<CR>

+ok=<baudrate,data_bits,stop_bit,parity,flowctrl><CR>< LF ><CR>< LF >

  - Set Operation

AT+UART=<baudrate,data_bits,stop_bit,parity><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - baudrate:
    - 50,75,110,134,150,200,300,600,1200,1800,2400,4800,9600,19200,38400,57600,115200,230400,345600,460800
  - data_bits:
    - 5,6,7,8
  - stop_bits:
    - 1,2
  - parity:
    - NONE,EVEN,ODD,MARK,SPACE
  - flowctrl：hardware flow control (CTSRTS)
    - NFC: No flow control
    - FC: flow control

After USR-WIFI232-X module boots up again, the setting will be effective.

4.2.2.5. AT+ UARTF

- Function: Open/Close UART auto-frame function;
- Format:
  - Query Operation

AT+ UARTF<CR>

+ok=<para><CR>< LF ><CR>< LF >

  - Set Operation

AT+ UARTF=<para ><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - para:
    - disable - Close auto-frame function;
    - enable - Open auto-frame function;

4.2.2.6. AT+ UARTFT

- Function: Set/Query UART auto-frame trigger time;
- Format:
  - Query Operation

AT+ UARTFT<CR>

+ok=<time><CR>< LF ><CR>< LF >

  - Set Operation

AT+ UARTFT=<time ><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - time: Range 100 ~10000; Unit: ms. Auto-frame trigger time

4.2.2.7. AT+ UARTFL

- Function: Set/Query UART auto-frame trigger length;
- Format:
  - Query Operation

AT+ UARTFL<CR>

+ok=<len><CR>< LF ><CR>< LF >

  - Set Operation

AT+ UARTFL=<len ><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - len: Range 64 ~4096; Unit: byte. Auto-frame trigger length;

4.2.2.8. AT+TMODE

- Function: Set/Query data transmission mode;
- Format:
  - Query Operation

AT+TMODE<CR>

+ok=<tmode><CR>< LF ><CR>< LF >

- Set Operation

AT+ TMODE=<tmode><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - tmode: Data transmission mode
    - Through: Transparent transmission
    - Agreement: Agreement transmission

After USR-WIFI232-X module boots up again, the setting will be effective.

4.2.2.9. AT+WMODE

- Function: Set/Query WIFI work mode;
- Format:
  - Query Operation

AT+WMODE<CR>

+ok=<mode><CR>< LF ><CR>< LF >

  - Set Operation

AT+ WMODE=<mode><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - mode:WIFI work mode
    - AP
    - STA

After USR-WIFI232-X module boots up again, the setting will be effective.

4.2.2.10. AT+WSKEY

- Function: Set/Query WIFI security parameters as STA;
- Format:
  - Query Operation

AT+WSKEY<CR>

+ok=<auth,encry,key><CR>< LF ><CR>< LF >

  - Set Operation

AT+ WSKEY=< auth,encry,key><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - auth: Authentication mode
    - OPEN
    - SHARED
    - WPAPSK
  - encry:Encryption algorithm
    - NONE: When “auth=OPEN”, effective
    - WEP: When “auth=OPEN” or “SHARED”, effective
    - TKIP: When ”auth= WPAPSK”, effective
    - AES: When “auth= WPAPSK”, effective

- key: password, ASCII code, shall less than 64 bit and greater than 8bit

This Instruction only effective for USR-WIFI232-X works as STA. After USR-WIFI232-X module boots up again, the setting will be effective. But user can set this command when module configured as AP.

4.2.2.11. AT+WSSSID

- Function: Set/Query WIFI target AP SSID parameters as STA.
- Format:
  - Query Operation

AT+WSSSID<CR>

+ok=<ap's ssid><CR>< LF ><CR>< LF >

  - Set Operation

AT+ WSSSID=<ap's ssid ><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - ap's ssid: AP's SSID

This Instruction only effective for USR-WIFI232-X works as STA. After USR-WIFI232-X module boots up again, the setting will be effective. But user can set this command when module configured as AP.

4.2.2.12. AT+ WSLK

- Function: Query WiFi link status as STA
- Format:
  - Query Operation

AT+ WSLK<CR>

+ok=<ret><CR>< LF ><CR>< LF >

- Parameters:
  - ret
    - "Disconnected", if no WiFi connection;
    - "AP' SSID（AP's MAC"）, if WiFi connection available;
    - "RF Off", if WiFi OFF;

This Instruction only effective for USR-WIFI232-X works as STA. After USR-WIFI232-X module boots up again, the setting will be effective. But user can set this command when module configured as AP.

4.2.2.13. AT+WEBU

- Function: Set/Query WEB page login parameters;
- Format:
  - Query Operation

AT+WEBU<CR>

+ok=<usr,password><CR>< LF ><CR>< LF >

  - Set Operation

AT+ WEBU=< usr,password ><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - usr: User name for WEB page access;
  - password：Password for WEB page access;

4.2.2.14. AT+WAP

- Function: Set/Query WIFI parameters as AP;
- Format:
  - Query Operation

AT+WAP<CR>

+ok=<wifi_mode,ssid,channel><CR>< LF ><CR>< LF >

  - Set Operation

AT+ WAP=<wifi_mode,ssid,channel><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - wifi_mode: WiFi protocols
    - 11BG
    - 11B
    - 11G
    - 11BGN
    - 11N
  - ssid: SSID when module works as AP;
  - channel: WIFI channel selection
    - AUTO
    - CH1~CH11

This Instruction only effective for USR-WIFI232-X works as AP. After USR-WIFI232-X module boots up again, the setting will be effective. But user can set this command when module configured as STA.

4.2.2.15. AT+WAKEY

- Function: Set/Query WIFI security parameters as AP;
- Format:
  - Query Operation

AT+WAKEY<CR>

+ok=<auth,encry,key><CR>< LF ><CR>< LF >

  - Set Operation

AT+ WAKEY=< auth,encry,key><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - auth: Authentication mode
    - OPEN
    - SHARED
    - WPAPSK
  - encry:Encryption algorithm
    - NONE: When “auth=OPEN”, effective;
    - WEP: When “auth=OPEN”, effective or “SHARED”, effective;
    - TKIP: When “auth=WPAPSK”, effective;
    - AES:When “auth=WPAPSK”, effective;
    - TKIPAES:When “auth=WPAPSK”, effective;

- key: password, ASCII code, shall less than 64 bit and greater than 8bit;

This Instruction only effective for USR-WIFI232-X works as AP. After USR-WIFI232-X module boots up again, the setting will be effective. But user can set this command when module configured as STA.

4.2.2.16. AT+MSLP

- Function: Set modules into power save mode.(Turn OFF WiFi);
- Format:
  - Query Operation

AT+ MSLP <CR>

+ok=<sta.><CR>< LF ><CR>< LF >

  - Set Operation

AT+ MSLP=<on/off><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - When Query,sta reply if the module in sleep mode;
    - On - Module not in sleep mode (WiFi ON);
    - Off - Module in sleep mode(WiFi OFF);
  - When Set,
    - Off - Set module to sleep mode (WiFi OFF);
    - On - Set module to normal mode (WiFi ON);

When module go into sleep mode, user can input “AT+MSLP=on” to re-start the module and module go into transparent transmission mode.

4.2.2.17. AT+WSCAN

- Function: Seek AP when module works as STA mode;
- Format:

AT+ WSCAN<CR>

+ok=<ap_site><CR>< LF ><CR>< LF >

- Parameters:
  - ap_site: AP searched;

4.2.2.18. AT+ TCPLK

- Function: Query if TCP link already build-up;
- Format:

AT+ TCPLK<CR>

+ok=<sta><CR>< LF ><CR>< LF >

- Parameters:
  - sta.: if module already setup TCP link;
    - on: TCP link setup;
    - off: TCP link not setup;

4.2.2.19. AT + TCPDIS

- Function: Open/Cose TCP (Only TCP Client available);
- Format:
  - Query Operation

AT+TCPDIS<CR>

+ok=<sta><CR>< LF ><CR>< LF >

- Set Operation

AT+ TCPDIS=<on/off><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - sta.: set/query TCP link status;
    - on: TCP link available; When setting “on”, module will connect to TCP server right away.
    - off: TCP link not available; when setting “off”, module will disconnect with TCP server and not connect again.

4.2.2.20. AT+ WANN

- Function: Set/Query WAN setting, only effective as STA mode;
- Format:
  - Query Operation

AT+WANN<CR>

+ok=<mode,address,mask,gateway><CR>< LF ><CR>< LF >

- Set Operation

AT+ WANN=< mode,address,mask,gateway ><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - mode: IP setting for WAN port
    - static: Static IP
    - DHCP: Dynamic IP
  - address: WAN port IP address;
  - mask: WAN port subnet mask;
  - gateway: WAN port gateway address;

This Instruction only effective for USR-WIFI232-X works as STA. After USR-WIFI232-X module boots up again, the setting will be effective. But user can set this command when module configured as AP.

4.2.2.21. AT+ LANN

- Function: Set/Query LAN setting, only effective as AP mode;
- Format:
  - Query Operation

AT+LANN<CR>

+ok=<address,mask ><CR>< LF ><CR>< LF >

- Set Operation

AT+ LANN=<address,mask ><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - address: LAN port IP address;
  - mask: LAN port subnet mask;

This Instruction only effective for USR-WIFI232-X works as AP. After USR-WIFI232-X module boots up again, the setting will be effective. But user can set this command when module configured as STA.

4.2.2.22. AT+ DHCPGW

- Function: Set/Query DHCP gateway address;
- Format:
  - Query Operation

AT+ DHCPGW<CR>

+ok=<address><CR>< LF ><CR>< LF >

  - Set Operation

AT+ DHCPGW=<address ><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - address: DHCP gate address;

4.2.2.23. AT+ TCPTO

- Function: Set/Query TCP timeout;
- Format:
  - Query Operation

AT+ TCPTO<CR>

+ok=<time><CR>< LF ><CR>< LF >

  - Set Operation

AT+ TCPTO=<time ><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - time: TCP timeout time.
    - <= 600, (600s);
    - >=0, (0 means no timeout);
    - Default, 300s;

4.2.2.24. AT+ MAXSK

- Function: Set/Query maxima TCP connection;
- Format:
  - Query Operation

AT+ MAXSK<CR>

+ok=<num><CR>< LF ><CR>< LF >

  - Set Operation

AT+ MAXSK =<num ><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - num: 1~32, default 32. maxima TCP connection;

When configure as TCP/Server, USR-WIFI232-X support maxima 32 TCP connections. If not require so much connection, user can resetting this parameters.

4.2.2.25. AT+TCPB

- Function: Open/Close TCPB function;
- Format:
  - Query Operation

AT+TCPB<CR>

+ok=<sta><CR>< LF ><CR>< LF >

  - Set Operation

AT+ TCPB=<on/off><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - sta: TCPB enable status
    - on, TCPB enable
    - off, TCPB disable

After USR-WIFI232-X module boots up again, the setting will be effective.

4.2.2.26. AT+TCPPTB

- Function: Set/Query TCPB port number;
- Format:
  - Query Operation

AT+TCPPTB<CR>

+ok=<port>><CR>< LF ><CR>< LF >

  - Set Operation

AT+ TCPB=<port><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - port: decimal ,<65535

After USR-WIFI232-X module boots up again, the setting will be effective.

4.2.2.27. AT+TCPADDB

- Function: Set/Query TCPB server address;
- Format:
  - Query Operation

AT+TCPADDB<CR>

+ok=<add><CR>< LF ><CR>< LF >

  - Set Operation

AT+ TCPADDB=<add><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - add: TCPB server address, can be IP address or url.

After USR-WIFI232-X module boots up again, the setting will be effective

4.2.2.28. AT+TCPTOB

- Function: Set/Query TCPB time out time;
- Format:
  - Query Operation

AT+TCPTOB<CR>

+ok=<time><CR>< LF ><CR>< LF >

  - Set Operation

AT+ TCPTOB=<time><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - time: TCPB time out time, <=600 (600s), >=0 (No time out), default 300

After USR-WIFI232-X module boots up again, the setting will be effective.

4.2.2.29. AT+TCPLKB

- Function: Query TCPB link status;
- Format:

AT+TCPCKB<CR>

+ok=<sta><CR>< LF ><CR>< LF >

- Parameters:
  - sta: TCPB link status
    - on, TCPB link OK
    - off, TCPB link not available

4.2.2.30. AT+EPHY

- Function: Open/Close ETH interface;
- Format:
  - Set Operation

AT+ EPHY=<on/off><CR>

+ok<CR>< LF ><CR>< LF >

- Parameters:
  - On/off
    - Off: Close Ethernet port function;
    - On: Open Ethernet port function;

If you want to keep the Ethernet port open,please use the AT+FEPHY=on.

Close module's Ethernet port function can reduce the power consumption. The default setting for USR-WIFI232-X is close Ethernet port function.

4.2.2.31. AT+FUDLX

- Function:Open/Close RS485
- Format:

AT+FUDLX=<on/off><CR>

+ok<CR>< LF ><CR>< LF >

Enable or prohibit 485 control functions, the 485 control pin RTS

4.2.2.32. AT+RELD

- Function: Restore to factory default setting;
- Format:

AT+ RELD<CR>

+ok=rebooting…<CR>< LF ><CR>< LF >

This command restores the module to factory default setting, and then re-starts the module.

4.2.2.33. AT+Z

- Function: Re-start module;
- Format:

AT+ Z<CR>

4.2.2.34. AT+MID

- Function: Query module ID information;
- Format:
  - Query Operation

AT+MID<CR>

+ok=<module_id><CR>< LF ><CR>< LF >

- Parameters:
  - module_id: Module ID information;
    - A11-yymmddnnnn "yymmdd" date; "nnnn" serial number;

4.2.2.35. AT+VER

- Function: Query module software version information;
- Format:
  - Query Operation

AT+VER<CR>

+ok=<ver><CR>< LF ><CR>< LF >

- Parameters:
  - ver: Module software version information;

4.2.2.36. AT+H

- Function: Help;
- Format:
  - Query Operation

AT+H<CR>

+ok=<command help><CR>< LF ><CR>< LF >

- Parameters:
  - command help: command introduction;

5. PACKAGE INFORMATION

5.1 Shipping Information

TRAY

Size:450*255*34 mm

BOX

Size:450*250*80 mm

CARTON

Figure 41 Shipping Information

Note:

1 tray = 5*20pcs = 100 pcs

1 box = 2 trays = 2 * 100 pcs = 200pcs

1 carton = 4 boxes = 4 * 200 pcs = 800pcs

APPENDIX A: QUESTIONS AND ANSWERS

Q1: How to configure transparent serial port application (TCP protocol) with two WIFI modules?

- Network structure as below figure:
  - Module 1# Setting:
    - Works as AP mode; *--See "Mode Selection Page"*
    - LAN IP address: 10.10.100.254; *--See "AP Interface Setting Page"*
    - Network Protocal:TCP/Server, Port ID: 8899; *-- See "Application Setting Page"* (Module default setting);
  - Module 2# Setting:
    - Works as STA mode; --See "Mode Selection Page"
    - WAN connection type: DHCP or Static IP (For this example:10.10.100.100) *--See "STA Interface Setting Page"*
    - Network Protocal:TCP/Client, Port ID: 8899; Application IP address: Module 1#'s LAN IP address (10.10.100.254); *-- See "Application Setting Page"*
    - **Notes:** When module 2# works as STA mode, module's WiFi interface works as WAN port. Module's WAN IP address and LAN IP address shall be setting different segment. So, module 2#'s LAN IP address must change to other segment; (For this sample, we change to 10.10.99.254); *--See "AP Interface Setting Page"*

Figure 1. Configure Transparent Serial Port Connection (TCP)

Q2: Where to Set WIFI Module LAN IP and WAN IP through Web Page?

- USR-WIFI232-X Wireless LAN IP address setting see "AP Interface Setting Page" as below Figure,

Figure 2. Module LAN IP Setting

- USR-WIFI232-X Wireless WAN IP address setting see "STA Interface Setting Page" as below Figure, User can set WAN connection type to DHCP and STATIC IP.

Figure 3. Module WAN IP Setting

Q3: How to configure transparent serial port application (UDP protocol) with two WIFI modules?

- Network structure as below figure:
  - Module 1# Setting:
    - Works as AP mode; *--See "Mode Selection Page"*
    - LAN IP address: 10.10.100.254; *--See "AP Interface Setting Page"*
    - Network Protocal:UDP, Port ID: 8899; Application IP address:10.10.100.100; *-- See "Application Setting Page"*
  - Module 2# Setting:
    - Works as STA mode; --See "Mode Selection Page"
    - WAN connection type: Static IP (10.10.100.100) *--See "STA Interface Setting Page"*
    - Network Protocal:UDP, Port ID: 8899; Application IP address: Module 1#'s LAN IP address (10.10.100.254); *-- See "Application Setting Page"*
    - LAN IP address: 10.10.99.254 (Different net segment with WAN port) *--See "AP Interface Setting Page"*

Figure 4. Configure Transparent Serial Port Connection (UDP)

Q4: Where to set USR-WIFI232-X module network protocol (TCP/UDP)?

- USR-WIFI232-X network protocol setting see "Application Setting Page" as below Figure,
  - Protocol: TCP Server
    - Only Port ID required: 8899 (Default)

Figure 5. Module Network Protocols: TCP/Server

  - Protocol: TCP Client
    - Application IP address required: it's target TCP server 's IP address;
    - Port ID required: 8899 (Default)

Figure 6. Module Network Protocol: TCP/Client

  - Protocol: UDP
    - No Server/Client selection required;
    - Application IP address required: it's target device 's IP address;
    - Port ID required: 8899 (Default)

Net Setting	
Mode	Client
Protocol	UDP
Port	8899
IP Address	10.10.10.100

Figure 7. Module Network Protocol: UDP

Q5: How to configure transparent serial port application: Two WIFI modules all configured as STA and connection through AP?

- Network structure as below figure:
  - Module 1# Setting: (We use USR-WIFI232-X as AP for this example)
    - Works as AP mode and all default setting;
  - Module 2# Setting:
    - Works as STA mode; --See "Mode Selection Page"
    - WAN connection type: Static IP: 10.10.100.100; *--See "STA Interface Setting Page"*
    - Network Protocal:TCP/Server, Port ID: 8899; *-- See "Application Setting Page"*
    - LAN IP address: 10.10.99.254 (Different net segment with WAN port); *--See "AP Interface Setting Page"*
  - Module 3# Setting:
    - Works as STA mode; --See "Mode Selection Page"
    - WAN connection type: Static IP: 10.10.100.101; *--See "STA Interface Setting Page"*
    - Network Protocal:TCP/Client, Port ID: 8899; Application IP address: Module 2#'s WAN IP address (10.10.100.100); *-- See "Application Setting Page"*
    - LAN IP address: 10.10.98.254 (Different net segment with WAN port); *--See "AP Interface Setting Page"*

Figure 8. Two USR-WIFI232-X Modules Connection Through AP

Q6: How to avoid IP address confliction when apply USR-WIFI232-X module?

- The following address allocation method can avoid the IP address confliction for dynamic and static IP address mixed application.
  - Module dynamic IP address range from 100 to 200 for last IP address segment.
    - Such as default IP: 10.10.100.254. When module works as AP, the IP address module can allocate to STA is from 10.10.100.100 to 10.10.100.200;
  - So, if user needs to set static IP for dedicated STA internal network, the available IP address range can start from 10.10.100.1 to 10.10.100.99.

Q7: PC works as server, all WIFI modules works as data acquisition card and connect with PC, how to configure this application?

- Network structure as below figure: Three USR-WIFI232-X module setup 3 TCP links with PC server. Module 1# works as AP and all devices connect to module 1# through WiFi interface;
  - PC Setting:
    - IP address: 10.10.100.100;
    - Network Protocal:TCP/Server, Port ID: 8899;
  - Module 1# Setting:
    - Works as AP mode;
    - LAN IP address: 10.10.100.254;
    - Network Protocal:TCP/Client, Port ID: 8899; Application IP address:10.10.100.100;
  - Module 2# Setting:
    - Works as STA mode;
    - WAN connection type: Static IP: 10.10.100.101;
    - Network Protocal:TCP/Client, Port ID: 8899; Application IP address:10.10.100.100;
    - LAN IP address: 10.10.99.254 (Different net segment with WAN port);
  - Module 3# Setting:
    - Works as STA mode;
    - WAN connection type: Static IP: 10.10.100.102;
    - Network Protocal:TCP/Client, Port ID: 8899; Application IP address:10.10.100.100;
    - LAN IP address: 10.10.98.254 (Different net segment with WAN port);

Figure 9. Wireless Data Acquisition Card Setting

APPENDIX B: EVB REFERENCE DESIGN

APPENDIX C: EXTERNAL POWER SHUTDOWN MODE REFERENCE DESIGN

USR-WIFI232-X- V4.3

Embedded WiFi Module User Manual

Overview of Characteristic

- Support IEEE802.11b/g/n Wireless Standards
- Support TCP/IP/UDP Network Protocols
- Support UART/GPIO/Ethernet Data Interface
- Support Work As STA/AP/AP+STA Mode
- Support Router/Bridge Mode Networking
- Support Internal/External Antenna Option
- Support Transparent Transmission Mode
- Support AT+ Instruction Set for Configuration
- Support Friendly Web Configuration Page
- Support Palmodic Signal
- Support UART Port Auto-Frame Function
- Single +3.3V Power Supply
- Small Size: 25 x 40mm
- FCC/CE Certificated

Remarks: This module is applicable to USR-WIFI232-A/B/C/D and its derivatives,for USR-WIFI232-2/610/L/G and the series of different, please refer to the corresponding document..

APPENDIX E: CONTACT INFORMATION

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END OF DOCUMENT