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Chengdu Ebyte Electronic Technology Co.,Ltd.

E103-W01-IPX_Datasheet_EN_v1.1

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1. Introduction

1.1 Feature



E103-W01-IPX is 100mW (20dBm) UART-WiFi module with competitive price. It is small-size with both IPX and embedded PCB antenna, operating at 2.4~2.4835GHz, and very easy for user to operate.

Based on ESP8266EX from Espressif, E103-W01-IPX is developed by Cdebyte engineers. With transparent transmission available, it supports AT command, server AT command. User can enjoy easy access to Internet via UART. The module are widely used in wearable electronics, home automation, home security application, health care, accessories and remote controls, smart plugs and lights, industrial internet, etc.

E103-W01-IPX supports standard IEEE802.11b/g/n protocol and complete TCP / IP protocol stack, STA/AP/STA+AP mode, SmartConfig, transparent transmission, IO control, transparent transmission on power-up, PWM output, AD detection, etc. Network connection can be achieved after a simple configuration, which saves much time for users on operation and development.

Typical Application

- √ Wireless meter reading
- √ Wireless sensing
- √ Smart home
- √ Industrial telecontrol and telemetry
- √ Intelligent building
- √ Environmental engineering
- √ Highway
- √ High voltage line monitoring
- √ Smart wearable device
- √ Weather station
- √ Intelligent robot
- √ Automatic data collection
- √ street light control

Features

- √ 210ms power-on transparent transmission, automatically connect when power-off
- √ Various baud rate
- √ Support SmartConfig configuration
- √ Support TCPServer, TCPClient, UDP
- √ Three operating mode: STATION, AP, STATION&AP
- √ Low power consumption: 14mA when receiving
- √ UART transparent transmission
- √ Various encryption method
- √ UART AT Command
- √ 4 x configurable PWM output
- √ Built-in watchdog, never crash
- √ Parameter saving when power-down
- √ 1x10-bit ADC

1.2 Basic usage

No.	Usage	Description
0	Communication between modules	Set module A to AP mode and build TCP or UDP server. Set module B to STATION mode and connect with module A. Then module B can communicate with module A via TCP or UDP Client.
1	Communication between module and Server	Wi-fi module connects to internet via wireless router, and communicate with server on the network (local area network or the Internet) via TCP client or UDP. If it needs to be connected with internet server, user need to configure the corresponding port mapping.
2	Communication between module and Client	Wi-fi module connects to internet via wireless router, and build TCP or UDP Server to listen to the connection signal. Client communicate with module by connect with its server.
Please see more details in Chapter 5		

1.3 Electrical parameter

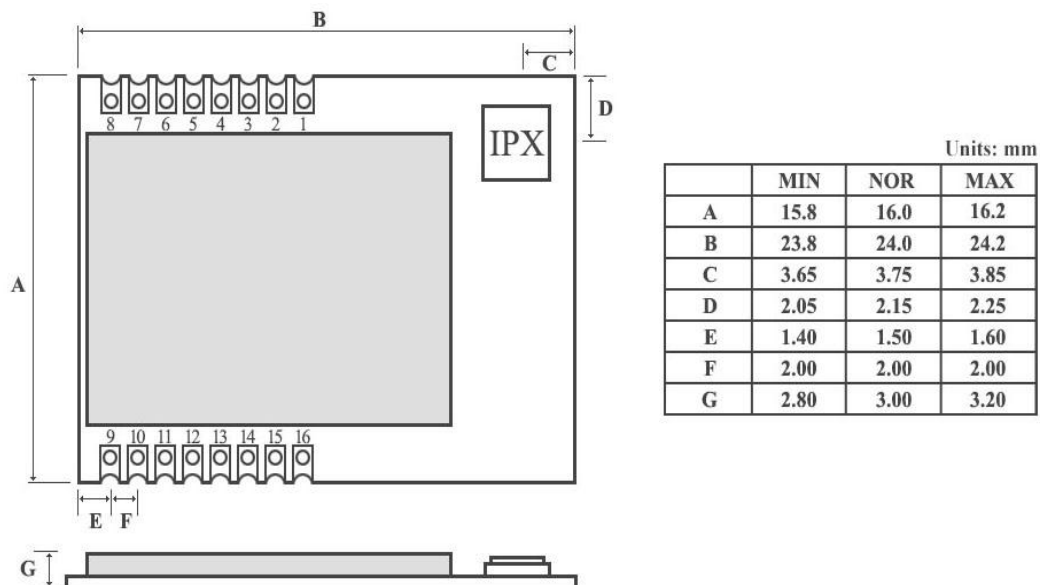
No.	Item	Parameter Details	Notes
1	RF chip	ESP8266EX	Espressif
2	Size	16 * 24 * 3mm	With PCB and IPX antenna
3	PCB	4-layer	Impedance debugging
4	Frequency Band	2.4~2.4835 GHz	-
5	Connector	2.00mm	SMD
6	Supply voltage	3.0 ~ 3.6V DC	Note: the voltage higher than 3.6V is forbidden
7	Operation Range	100m	Test condition : clear and open area & 20dBm, height:> 2m
8	Transmitting power	20dBm	100mW
9	AT support	Built-in intelligent processing	Can be read by AT command.
10	Wi-Fi version	802.11 b/g/n	-
11	Communication interface	UART	-
12	Antenna type	PCB & IPX	50Ω characteristic impedance, IPX by default
13	Operating temperature	-40 ~ +85°C	-
14	Operating humidity	10% ~ 90%	Relative humidity, no condensation
15	Storage temperature	-40 ~ +125°C	-

1.4 Electrical specification

Parameters		Condition	Min	Typical	Max	Unit
Storage Temperature Range			-40	Normal	125	°C
Maximum Soldering Temperature		IPC/JEDECJ-STD-020			260	°C
Working Voltage Value			3.0	3.3	3.6	V
I/O	V_{IL}/V_{IH}		-0.3/0.75V _{IO}	-	0.25V _{IO} /3.6	V
	V_{OL}/V_{OH}		N/0.8V _{IO}	-	0.1V _{IO} /N	
	I _{MAX}		-	-	12	mA
Electrostatic Discharge (HBM)		TAMB=25°C	-	-	2	KV
Electrostatic Discharge (CDM)		TAMB=25°C	-	-	0.5	KV

2. Functional description

2.1 Pin definitions



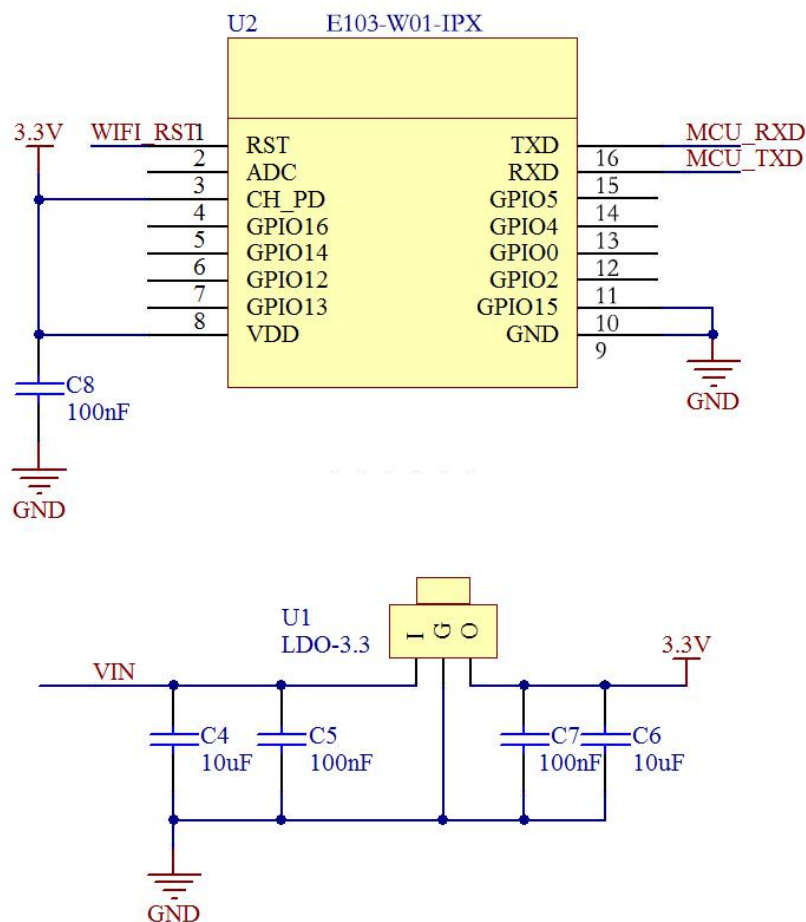
Pin	Name	Type	Function
1	RST	I	External reset signal (Low voltage level: Active)
2	ADC	I	ADC input pin
3	CH_PD	I	Module enable, need be pulled up
4	GPIO16	I	module wake up(from deep sleep state), high level effectively
5	GPIO14	IO	PWM1/GPIO14
6	GPIO12	IO	PWM0/GPIO12

7	GPIO13	IO	GPIO13			
8	VCC	-	VDC:3.0V~3.6V (above 300mA)			
9	GND	-	GND			
10	GPIO15	I	GPIO15	GPIO2★	GPIO0	Boot
11	GPIO2	I	0	1	1	Boot from FLASH
12	GPIO0	I	0	1	0	Download firmware via UART
13	GPIO4	IO	PWM2/GPIO4			
14	GPIO5	IO	PWM3/GPIO5			
15	RXD	I	UART input pin, support AT command			
16	TXD	O	UART output pin, support AT command			
★ GPIO2 is already been internal pulled up						
★ In transparent-transmission on power-up mode, GPIO2 will indicate the status of module. The module has connected a led to this pin. Users can get the status of the module by observing LED. Besides, you may connect GPIO2 to the external MCU.						
★ LED indication when module works in power-on transparent transmission mode : Intermittent double flash : cannot connect to AP access point. Intermittent single flash : connect to AP access point, but cannot connect to TCP server. Quench : connect to AP access point and TCP server.						

2.2 Power Consumption

Parameters	Min	Typical	Max	Unit
Tx802.11b,CCK11Mbps,POUT=+17dBm	-	170	-	mA
Tx802.11g,OFDM54Mbps,POUT=+15dBm	-	140	-	mA
Tx802.11n,MCS7,POUT=+13dBm	-	120	-	mA
Rx 802.11b, 1024 bytes packet length , -80dBm	-	20	-	mA
Rx 802.11g, 1024 bytes packet length, -70dBm	-	56	-	mA
Rx 802.11n, 1024 bytes packet length, -65dBm	-	56	-	mA
Modem-Sleep	-	15	-	mA
Light-Sleep	-	0.9	-	mA
Deep-Sleep	-	10	-	uA
Power Off	-	0.5	-	uA

2.3 Schematic diagram



Notes : supply voltage is 3.0V~3.6V. 300mA LDO is recommended for steady operation of module.

3. Quick Start

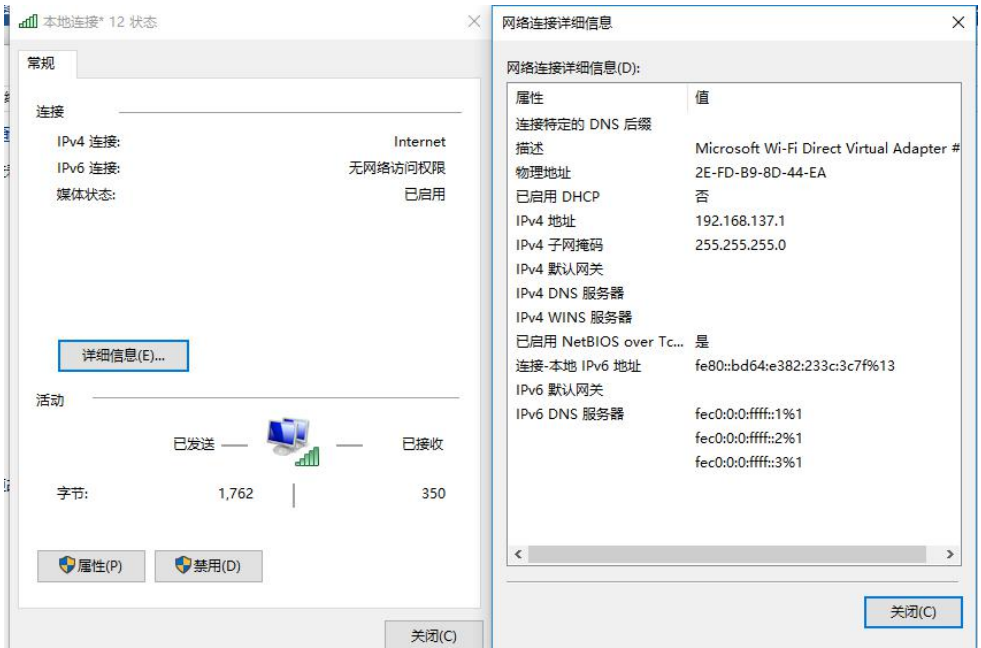
This chapter is to introduce how to achieve a variety of configuration and communication under various modes by simple configuration.

Configuration software is designed for users to get a quick start of this wi-fi module. All the commands in the test are AT commands (Notes: a line break is required after each AT command).

After getting familiar with AT command, users can use Accessport to transmit AT command instead of the configuration software. Or use external MCU to connect with UART module to do AT command transmitting instead of using this development board.

Hardware :	
1	E103-W01-IPX*1
2	E103-W01-IPX development board*1
3	PC with wi-fi *1
4	Router*1 (Mobile wi-fi hotspots)
Software (download on www.cdebyte.com/en)	
1	E103-W01 configuration software
2	TCP&UDP testing tool
3	Accessport 1.3

3.1 Connected to TCP server as Client

No.	Remarks																												
1	<p>【Network connection】 :</p> <p>Computer connected to router, and the router named H60-L02(configurable for user)</p> <p>Noted the IP address as 192.168.137.1</p>  <p>The screenshot shows the Windows Network Connections window with the '本地连接* 12' (Local Connection * 12) status. The '常规' (General) tab is selected, showing the connection is 'Internet' and '无网络访问权限' (No network access). The 'IPv4 连接' (IPv4 connection) is '已启用' (Enabled). The 'IPv6 连接' (IPv6 connection) is '无网络访问权限' (No network access). The '媒体状态' (Media status) is '已启用' (Enabled). The '活动' (Activity) section shows '已发送' (Sent) as 1,762 bytes and '已接收' (Received) as 350 bytes. The '详细信息(E)...' (Details...) button is highlighted. The '网络连接详细信息' (Network Connection Details) window is open, showing the following information:</p> <table border="1"> <thead> <tr> <th>属性</th> <th>值</th> </tr> </thead> <tbody> <tr> <td>连接特定的 DNS 后缀</td> <td></td> </tr> <tr> <td>描述</td> <td>Microsoft Wi-Fi Direct Virtual Adapter #</td> </tr> <tr> <td>物理地址</td> <td>2E-FD-B9-8D-44-EA</td> </tr> <tr> <td>已启用 DHCP</td> <td>否</td> </tr> <tr> <td>IPv4 地址</td> <td>192.168.137.1</td> </tr> <tr> <td>IPv4 子网掩码</td> <td>255.255.255.0</td> </tr> <tr> <td>IPv4 默认网关</td> <td></td> </tr> <tr> <td>IPv4 DNS 服务器</td> <td></td> </tr> <tr> <td>IPv4 WINS 服务器</td> <td></td> </tr> <tr> <td>已启用 NetBIOS over Tc...</td> <td>是</td> </tr> <tr> <td>连接-本地 IPv6 地址</td> <td>fe80::bd64:e382:233c:3c7f%13</td> </tr> <tr> <td>IPv6 默认网关</td> <td></td> </tr> <tr> <td>IPv6 DNS 服务器</td> <td>fec0:0:0:ffff::1%1 fec0:0:0:ffff::2%1 fec0:0:0:ffff::3%1</td> </tr> </tbody> </table>	属性	值	连接特定的 DNS 后缀		描述	Microsoft Wi-Fi Direct Virtual Adapter #	物理地址	2E-FD-B9-8D-44-EA	已启用 DHCP	否	IPv4 地址	192.168.137.1	IPv4 子网掩码	255.255.255.0	IPv4 默认网关		IPv4 DNS 服务器		IPv4 WINS 服务器		已启用 NetBIOS over Tc...	是	连接-本地 IPv6 地址	fe80::bd64:e382:233c:3c7f%13	IPv6 默认网关		IPv6 DNS 服务器	fec0:0:0:ffff::1%1 fec0:0:0:ffff::2%1 fec0:0:0:ffff::3%1
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2

【Built TCP server】：

Open TCP&UDP test tool to build a TCP server: port6000 (configurable for user).

Click to start the server, then TCP server from PC starts to listen to port6000, and other network devices can connect and communicate with it.

上午11:430.03K/s

Debugging assistant

tcp server

udp server

tcp client

udp client

Configuration

RX :0TX :0


server starting:
192.168.137.12:6000

SEND

DISPLAYSENDCLEARMANUALDISCONNECTMATCHDELECT

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Technical Support: support@cdebyte.com












3	<p>【Module installation】 :</p> <p>Substrates VCC short jumper, GPIO0 jumper disconnected.</p> <p>Plug E103-W01 into test baseboard.</p> <p>Plug the baseboard into PC by USB connector (Please download CP1202 driver if the PC cannot recognize baseboard).</p> <p>USB port number for testing : COM30.</p> <p>AP mode is the default mode for E103-W01, which is equivalent to Wi-Fi router. Cellphone or PC can search to the wi-fi name as EBT_XXXXXX (XXXXXX is last three-byte for MAC address).</p> <p>If the MAC address for module is "1a:fe:34:ed:a6:68" , then SSID is "EBT_EDA668" .</p> <p>No password for default.</p> 
4	<p>【STATION mode configuration】 :</p> <p>Open Wi-Fi configuration software, select port number in the left corner, then the serial port open automatically.</p> <p>Serial port status changes to open now, click "STATION" button to enter configuration interface.</p> <p>The test router name as Ebyte, password is e30e31e32.</p> <p>Click "enter Sta mode" to change the mode to STATION.</p> <p>Click "connect to router" , and wait a few seconds to see the interface shown in the figure below, which means module is connected to the router successfully.</p> <p>Then user can click "IP information query" to query IP information.</p>

【TCP Client configuration】 :

Click "Client configuration" to modify the remote port as 6000(corresponding to TCP server), and modify server IP as 192.168.1.50 (refer to PC IP), then click "built connection" button.

See below figure : "CONNECT OK" means connection for TCP server is done.

At present server shows the connection is ok for device which IP address is 192.168.1.70(IP address is assigned by router).

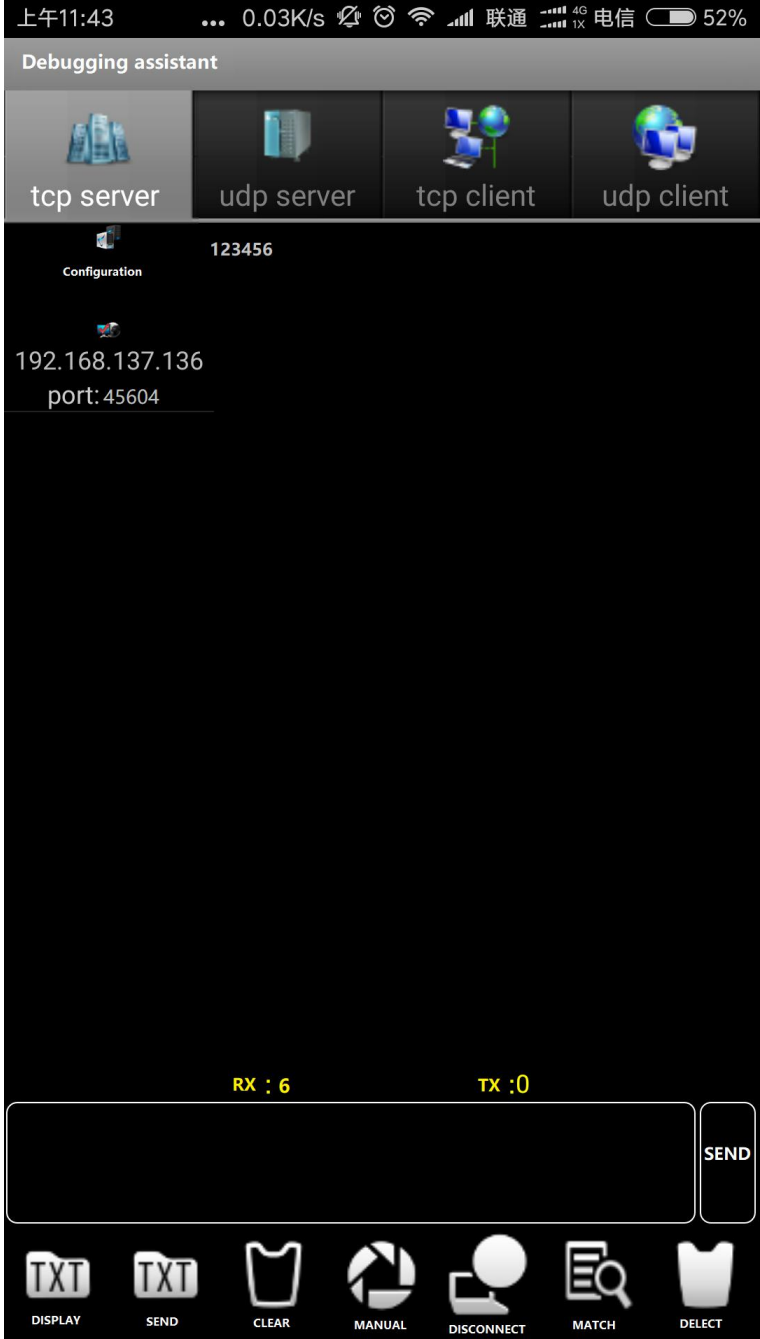
	<div><div>上午11:430.03K/s 联通 4G 电信 52%</div><div>Debugging assistant</div><div><div>tcp server</div><div>udp server</div><div>tcp client</div><div>udp client</div></div><div><div>Configuration</div><div>192.168.137.136</div><div>port: 45604</div></div><div><div>RX : 0TX : 0</div><div><div></div><div>SEND</div></div></div><div><div>DISPLAY</div><div>SEND</div><div>CLEAR</div><div>MANUAL</div><div>DISCONNECT</div><div>MATCH</div><div>DELECT</div></div></div>
6	<div><div>【Transmitting】 :</div><div>Use AT+CIPSEND command to transmit data, first send AT+CIPSEND=6 to specify the length of 6 bytes.</div></div>



After ">" symbol shows, transmit data "123456", user can see the TCP server receive data "123456".

Data communication completed.



	
7	<p>【Transparent transmission】 :</p> <p>After the configuration, module can transmit data to TCP server directly without AT protocol.</p> <p>Configuration : click "enter transparent transmission mode" (AT+CIPMODE=1) after connected to server, then input AT+CIPSEND to enter transparent transmission mode.</p>

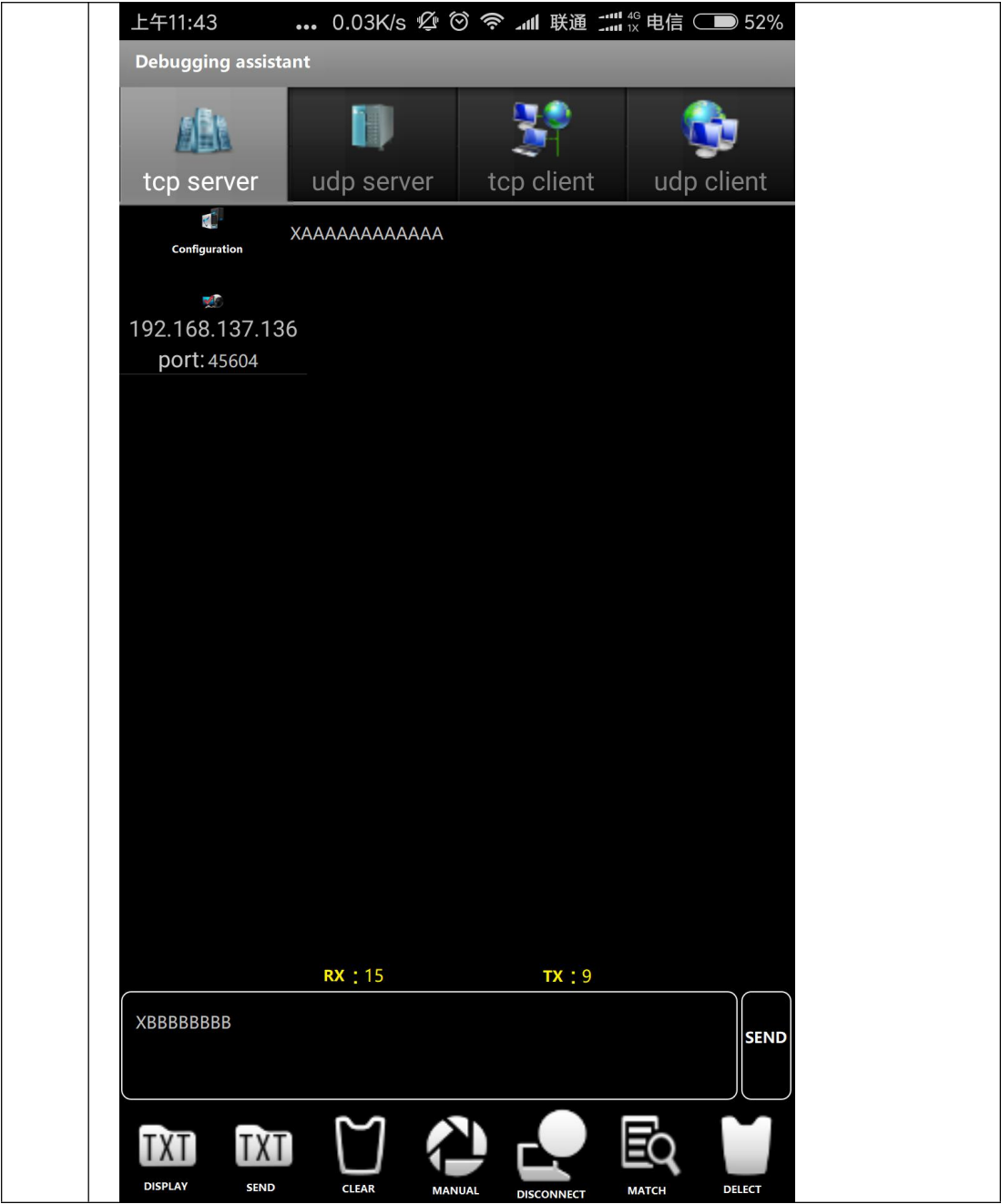


Notes: module no longer receive AT command, transmit the data from UART to server directly.

If user continue to transmit data AT+CIPSEND, module will treat AT+CIPSEND as data and transmit it to TCP server directly.

Data sent by server is also output directly from the module.





8

【Transparent transmission on power-up】 :

Advantage: save the complicated operation steps for user, once the configuration for transparent transmission on power-up is done, transparent transmission can be achieved on power-up.

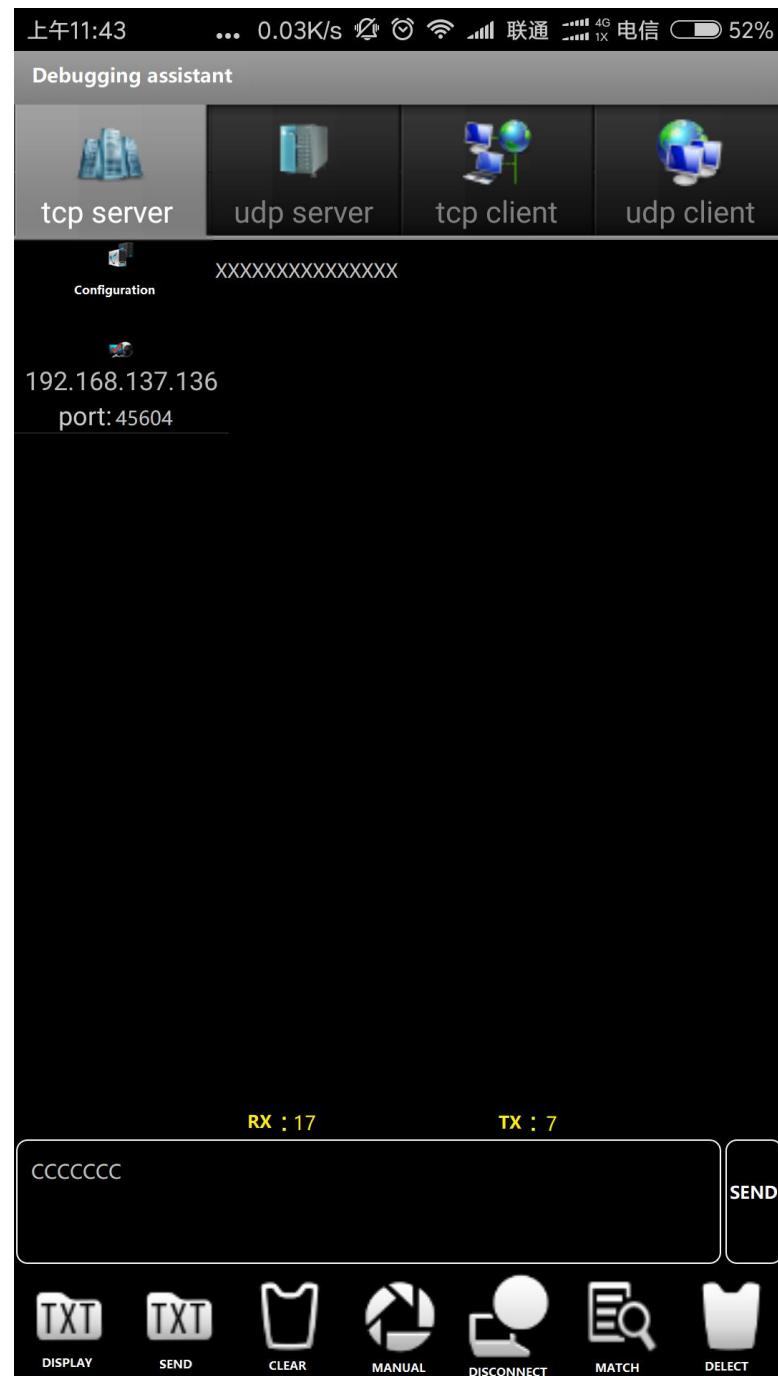
After using this function, user only need to configure the connection between router and TCP once.

When module re-start or re-power, it will connect with router automatically, then connect with specified TCP server automatically. User only need to wait the completion of TCP connection (wi-fi indicator goes out), then transmit data directly.

Click "transparent transmission on power-up" and input corresponding wi-fi name and password, then click "wi-fi", see below interface means configuration is down.

Input server IP address, port number, and choose TCP mode, then click "transparent transmission on power-up", see below interface means configuration is done.






Wi-Fi indicator(GPIO2) specification :

Intermittent double flash : cannot connect to AP access point.

Intermittent single flash : connect to AP access point, but cannot connect to TCP server.

Quench : connect to AP access point and TCP server.

It only needs 210ms for E103-W01-IPX to connect to internet.

	 <table data-bbox="585 546 1115 591"><tr><th colspan="2">Marker 1</th><th colspan="4">Measurement (Between Markers (M2 - M1))</th><th colspan="2">Marker 2</th></tr><tr><td>Sample Number:</td><td>7917</td><td colspan="4">Δt = 00.209968 s</td><td colspan="2">10023</td></tr><tr><td>Timestamp:</td><td>16.55.18.432225</td><td>Min:</td><td>Average:</td><td>Max:</td><td>Delta:</td><td>16.55.10.647193</td></tr><tr><td>Trace Value:</td><td>31.4778 mAdc</td><td>748.602 μAdc</td><td>66.9979 mAdc</td><td>237.339 mAdc</td><td>37.2296 mAdc</td><td>68.7064 mAdc</td></tr></table>	Marker 1		Measurement (Between Markers (M2 - M1))				Marker 2		Sample Number:	7917	Δt = 00.209968 s				10023		Timestamp:	16.55.18.432225	Min:	Average:	Max:	Delta:	16.55.10.647193	Trace Value:	31.4778 mAdc	748.602 μAdc	66.9979 mAdc	237.339 mAdc	37.2296 mAdc	68.7064 mAdc
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9	<p>【Exit transparent transmission】：</p> <p>Send “+++” to exit transparent transmission mode and re-enter AT mode.</p> <p>After exiting transparent transmission mode, user can use AT command to exit transparent transmission on power-up mode. See below,</p> <p>Click “exit transparent transmission” (send “+++” without line break) to enter AT command mode.</p> <p>Click “turn off transparent transmission” to see below interface.</p> <p>After the configuration, module will not works at transparent transmission mode automatically after rebooting.</p>																														



3.2 Build TCP SERVER to connect to PC as PA

No	Remarks
1	<p>In factory mode, module' s IP address is 192.168.4.1 when act as AP.</p> <p>Check network status of PC, see below information means the connection between PC and module is ok.</p> <p>AT command can be used to restore the factory state if user ever changed module' s parameter.</p>
2	<p>【模块建议 TCP 服务器】：</p> <p>Make sure PC is connected to the modules, then click "server settings" button.</p> <p>Click "open multiple connections" (exiting transparent transmission mode is necessary) first, then</p>

click "built server" to see below information.



【PC connected with TCP server of module to transmit data】 :

PC uses TCP&UDP test tool to build TCP server, target IP:192.168.4.1, port : 1001.

Click "connect" button, then the module should output as shown below: "0, CONNECT" (0 means connection ID), indicating that clients (up to 5) are connected to the module.

PC transmits data, module outputs "+IPD,0,15:XXXXXXX" (+IPD : command 0:connection ID 15 : data package length XXXXXX : data)

Specified connection ID is necessary during transmitting : AT+CIPSEND=0,10 means transmitting 10-byte data to connection 0.

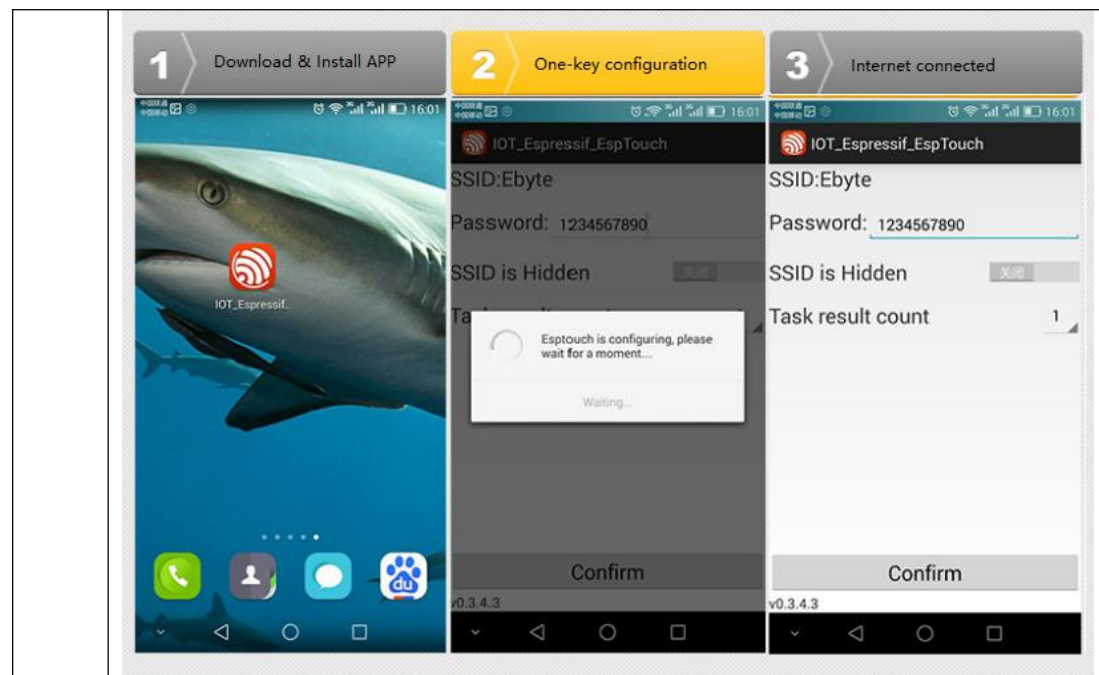


3



3.3 Usage of Smart Config

No.	Remark
1	<p>Smart Config enable user to use phone APP to configure module and connected with network with fast-speed.</p> <p>When module works at STATION mode, send “AT+CWSTARTSMART” to enter Smart Config mode , then the configuration for module can be done by cellphone.</p> <p>User only need to start EspTouchAPP (download from Expressif systems) on cellphone, then input router password on the APP to make connection between module and router.</p> <div data-bbox="352 1305 1326 2007"></div>



3.4 Usage of PWM

Steps	
E103-W01 supports 4 channel PWM output, can be configured through the AT instruction to fast PWM cycle (1~10ms) and duty cycle, Steps: enter "peripheral control option" to configure parameters:	
1	Period range 1000~10000 corresponds to 1ms~10ms
2	Adjustment for duty cycle value Range of 0~222222 corresponding to 0ms~10ms (high level time ≈ value*45ns)
3	Channel number range 1~4 indicates the number of currently enabled PWM channels, increasing from PWM0, for example channel number is equal to 2, then PWM0 and PWM1 are enabled(channel number cannot be changed after the first transmission)
Notes	
1	The actual duty cycle = adjustment value for duty cycle *45ns/ cycle The following figure shows the cycle for opening four channel is 10ms, the duty cycle is 50% for PWM.
2	Calling PWM command once again to modify the duty cycle.
Click "PWM output" after parameter-setting (AT+EBPWM=4, 10000, 111111, 111111, 111111, 111111). (Please refer to the AT chapter for AT command)	
Click "PWM output" one more time after parameter-setting to modify PWM output. But channel number cannot be changed after the first setting. Channel number after modifying other parameters must keep the same as the first set, otherwise the error is returned.	
Notes: PWM channel cannot be closed after opening. It can be reset by reset command or re-power.	



3.5 Usage of GPIO

No.	Remark
1	E103-W01 provide 5 GPIO interfaces:GPIO4\GPIO5\GPIO12\GPIO13\GPIO14 , and GPIO4\GPIO5\GPIO12\GPIO14 and PWM pin cannot use at the same time. For example, when PWM pin is operating, the GPIO is inoperable.
2	User can do pin' s status-setting (AT+EBIOSET) and obtain pin' s status (AT+EBIOGET) by using AT command.
3	Click "PIN_State_Set" to set pin' s status; Click "PIN_State_Get" to get pin' s status.



3.6 Usage of ADC

No.	Remark
1	E103-W01 provides one ADC with 10-byte precision, with which 0.0V ~ 1.0V voltage can be detected.
2	User can get current ADC value by AT command (AT+EBADC), then obtain the real voltage by calculation.
3	Input voltage=ADC value/1024 For example ADC value is 45, so the really voltage is equal to $45/1024=0.044V$.



3.7 Modify UART baud rate

No.	Remark
1	E103-W01 module supports 10 standard UART baud rate. The user must not set the baud rate out of the effective range, or there will be an issue when debugging . If so, please reload the firmware or contact us for help.
2	User can modify UART baud rate by sending AT+UART command. For example: AT+UART=115200,8,1,0,0
3	See below for more information;
Supporting baud rate	9600
	19200
	38400
	57600
	115200(default)
	230400
	256000
	460800
	921600
Parity	NONE (default)
	EVEN
	ODD
Data length	5-bit
	6-bit
	7-bit
	8-bit(default)
Stop bit	1-bit(default)
	2-bit

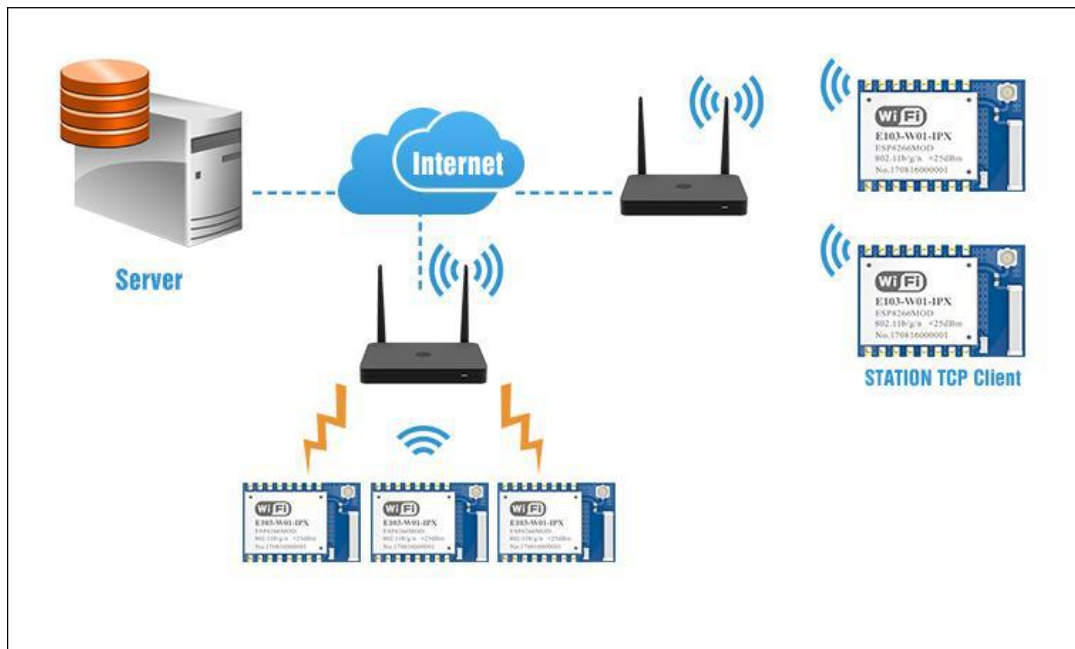
4. Specification for networking

4.1 Wi-fi role

No.	Remark
1	E103-W01 supports AP mode (router) and STATION mode (wi-fi equipment). At most 3 wi-fi devices can be supported when module works at AP mode.
2	E103-W01 including TCP Server、TCP Client and UDP as Socket. At most 5 sockets can be connected when module works at TCP Server mode. Based on TCP connection mechanism, if long time connection is needed, please use TCP heartbeat bag.

4.2 Networking model

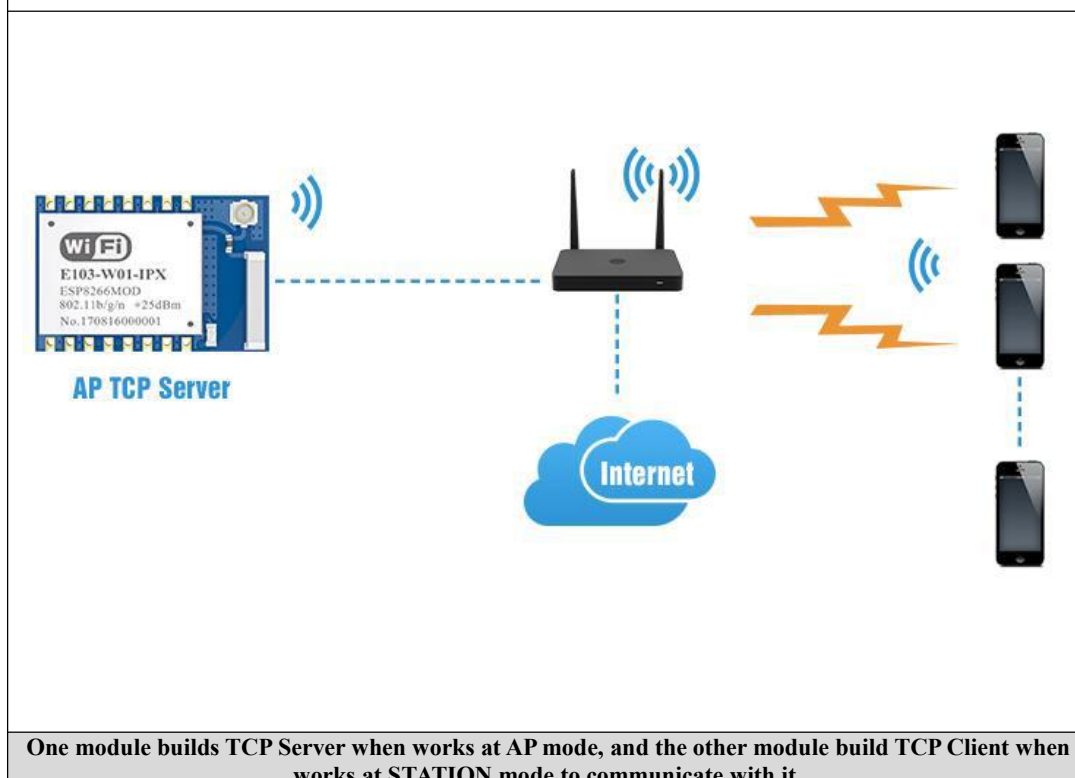
Module builds TCP Client to connect with remote server when works at STATION mode(classic)
Can be used for home LOT, meter-reading, real-time monitoring etc. Module can communicate with network server for real-time data. User can operate module by real-time communication.



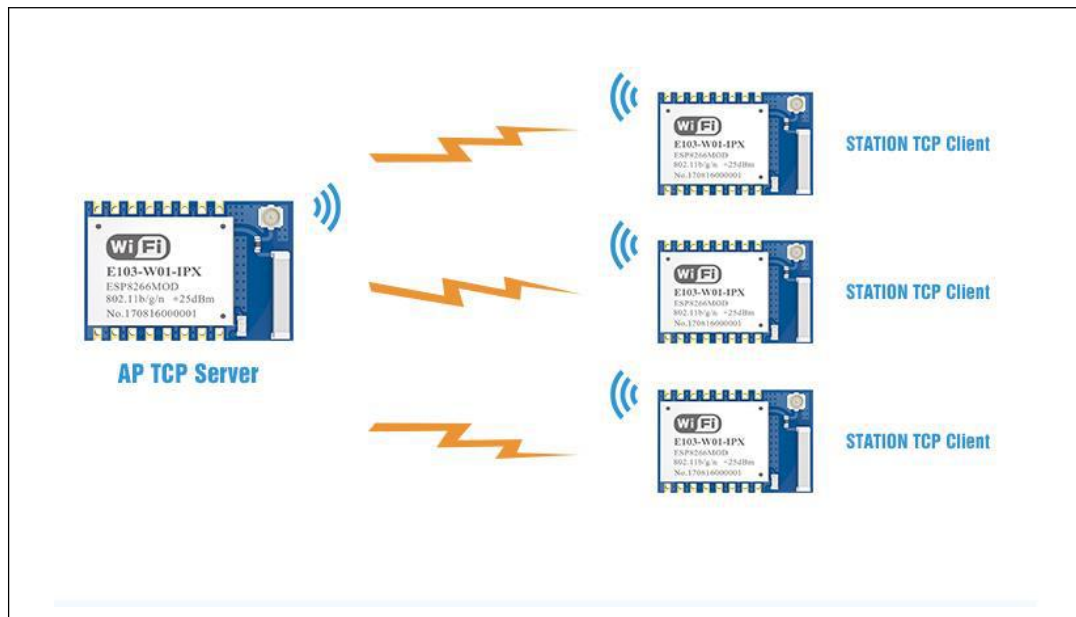
Module build TCP Client to connect with wi-fi device when works at STATION mode

The same as type one, only difference is module build TCP server instead of TCP Client when works at STATION mode.

At most 5 remote devices can be connected when module connects with network



One module builds TCP Server when works at AP mode, and the other module build TCP Client when works at STATION mode to communicate with it.



5. AT command

Only list some special AT command for your reference, more AT command please refer to the official datasheet.		
1	AT+EBPWM-PWM configuration	
	T+EBPWM=<channel_num>,<period>,<duty0>[,<duty1>][,<duty2>][,<duty3>]	Parameter specification : channel_num : channel number period : cycle(1000~10000 corresponding to 1~10ms) duty0~duty3 : PWM0~PWM3 Duty cycle setting (high level time=duty*45ns) Duty number should keep the same with channel number. Response : First transmission response : PWM Start! Non-first transmission response : OK Error response : ERROR
	Example : Set PWM0 duty cycle to 25%, while set PWM1 duty cycle to 10ms AT+EBPWM=2,10000,55555,111111	
	Notes : PWM cannot be closed after booting, and channel number cannot be modified.	
2	AT+EBIOGET to get IO input status	
	AT+EBIOGET=<gpio_num>	Parameter specification : gpio_num : GPIO number, 4,5,12,13 and 14 are available. Response : 0 or 1 OK
	Example : AT+EBIOGET=4	
	Notes : The pins which could been used to be the PWM output, is not suitable for this command.	
3	AT+EBIOSET to configure IO output status	
	AT+EBIOSET=<gpio_num> , <value>	Parameter specification : gpio_num : GPIO number, 4,5,12,13 and 14 are

		available. Value: Pin status can be configure to 0,1 Response : OK
	Example : AT+EBIOSET=4 , 1	
	Notes : The pins which could been used to be the PWM output, is not suitable for this command.	
4	AT+EBADC to get ADC value	
	AT+EBADC	Parameter specification : Range of input voltage : DC 0.0V~1.0V Response : 45 (real voltage=45/1024) OK
	Example : AT+EBADC	
5	AT+EBSTATE register GPIO13 as Wi-Fi indicator	
	AT+EBSTATE=<en>	Parameter specification : en: Setting to 1 indicates set GPIO13 as wi-fi status indicator. Setting to 0 indicates cancel for set GPIO13 as wi-fi status indicator. Response : OK
	Example : AT+EBSTATE=1	
	Notes : After setting GPIO13 as wi-fi indicator, the IO operation is forbidden.	

6. Customization

★Please contact us for customization.

★Ebyte has established profound cooperation with various well-known enterprises.



7. About us



Chengdu Ebyte Electronic Technology Co., Ltd. (Ebyte) is specialized in wireless solutions and products.

- ◆We research and develop various products with diversified firmware;
- ◆Our catalogue covers WiFi, Bluetooth, Zigbee, PKE, wireless data transceivers & etc.;
- ◆With about one hundred staffs, we have won tens of thousands customers and sold millions of products;
- ◆Our products are being applied in over 30 countries and regions globally;
- ◆We have obtained ISO9001 QMS and ISO14001 EMS certifications;
- ◆We have obtained various of patents and software copyrights, and have acquired FCC, CE, RoHs & etc.