FATEK®

FBs-W2C

Wi-Fi Communication Module

Category

Table

Figure

Modify Record

Version	Date	Name
V1.0.0	2019/1/24	Curtis Li
V1.0.1	2019/1/24	Edison Lin
V1.0.2	2019/1/29	Curtis Li
V1.0.3	2019/1/29	Ted Hung
V1.0.4	2019/2/13	Curtis Li
V1.0.5	2019/2/27	Curtis Li
V1.0.6	2019/5/20	Curtis Li
V1.0.7	2019/11/18	Oscar Wu

Chapter1. FBs-W2C Wi-Fi Communication Module

Product Introduction

1.1 Summary

FBs-W2C is a Wi-Fi board plugged in the PLC, which enables wireless network transmission capability. In addition, as a wireless communication module, it supports Wi-Fi Station mode (STA mode) and needs to connect to router. In order to make the W2C settings easier and more convenient, the Smart Config function is provided to allow users to easily connect to the router via the mobile app. This module breaks the traditional PLC only through wired transmission, and the use is no longer subject to the physical network route. It can make multiple PLCs establish connections through one AP at the same time. It is superior to the traditional wired way in turns of maintenance.

1.2 Product Function List

Table 1: W2C Function List

Function	Description
Wi-Fi connection	Connect with router, wireless network transmission.
FATEK Standard Communication Service	Communicate with any of the FATEK standards and communicate with devices that exist on the same local area network.
SNTP	Support SNTP
Firmware Update	Firmware update using OTA (via wireless network).
FATEK Standard Search Service	Users can use the W2C Configurator (FATEK Standard Search Service Communication Software) to search for W2C and other FATEK devices in the same local area network, check their operating status and set related configuration to control.

1.3 Product Specification

FBs-W2C supports Wi-Fi protocol IEEE 802.11 b/g/n and with frequency 2.4 GHz ~ 2.5GHz. Maximum TCP connections are up to 4.

Table 2: W2C Product Specification

Category	Item	Characteristic
Wi-Fi	Wi-Fi protocol	802.11 b/g/n
	Frequency Range	2.4 GHz ~ 2.5GHz (2400M ~ 2483.5M)
	Transmit Power	802.11 b: +20 dBm
		802.11 g: +17 dBm
		802.11 n: +14 dBm
	Receiving Sensitivity	802.11 b: –91 dBm (11 Mbps)
		802.11 g: –75 dBm (54 Mbps)
		802.11 n: –72 dBm (MCS7)
	Antenna	PCB on-board antenna
	Wi-Fi Signal Range	The quality of Wi-Fi communication depends on the level of interference in the environment. FBs-W2C proves well communicating in the range within 30M in open wide space with low interference.
Hardware	CPU	Tensilica L106 32-bit processor
	Operating Voltage	2.5V ~ 3.6V
	Operating Current	Average current: 80 mA
	Range of Operating Temperature	0°C ~ 60°C
Software	Wi-Fi Mode	Station
	Security Protocol	WPA/WPA2
	Encryption	WEP/TKIP/AES
	Firmware Update	OTA (via Network)
	Network Protocol	IPv4, TCP/UDP
	Maximum TCP Connections	4

1.4 Product Appearance

FBs-W2C Wi-Fi communication board appearance shown as **Figure 1** and **Figure 2**, simply introduce as follow:

① LINK LED: Located below the Link label, display the operational status of W2C, such as connection, disconnection and firmware update, etc. For more LED status information please refer to **1.6-LINK LED**.

② Mini Din Connector: Connector type of FBs-W2C Wi-Fi module, connect through port 0, with 4 pins and support RS232.

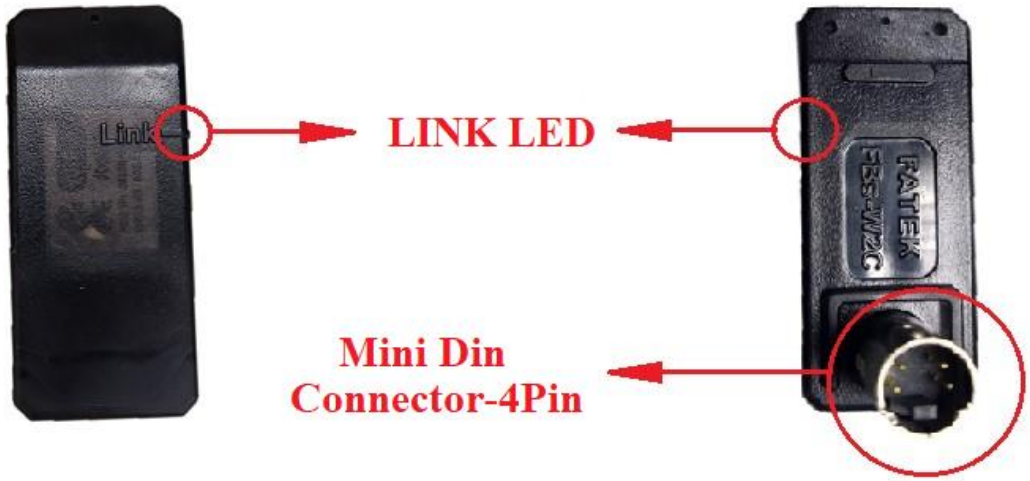


Figure 1: FBs-W2C Front and Back Appearance

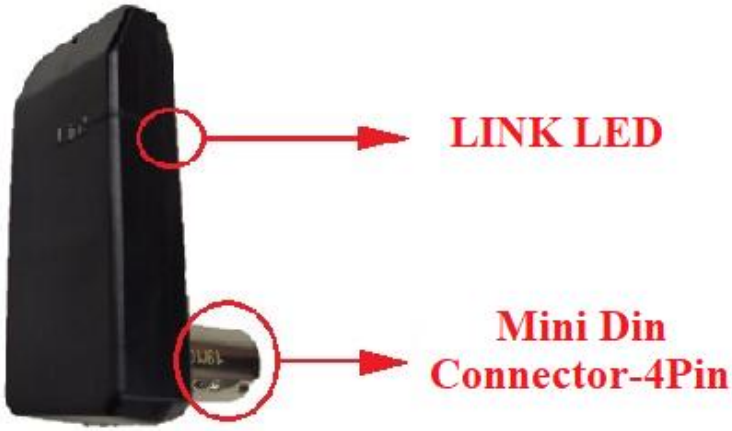


Figure 2: FBs-W2C Side Appearance

1.5 Installation

Directly plugged FBs-W2C in port 0 (port 1 for HB1 series). It can automatically detect the baud rate. After the detection, it will set the port 0 (port 1 for HB1 series) baud rate as 115200 bps.

If using HB1 series PLC, please update the firmware version of W2C to V1.3.1 or above. The baud rate of the port 1 cannot use 4800 bps. For instructions on firmware upgrade, please refer to **Chapter5 Firmware Upgrade (OTA)**.

1.6 LINK LED Status

LINK LED is in red, the LED will have different signal status depends on FBs-W2C currently state. **Table 3** shows the various signal status of LED.

Table 3: LINK LED Operation Mode

Connection Status	LINK LED
Connecting	On and off every 3 secs
Disconnected	Off
Execute Smart Config	Continuous flash
Execute OTA	Triple flash

Chapter2. Wi-Fi Connection Setting

By installing the FBs-W2C Wi-Fi communication module, the PLC can connect to the router for wireless network connection and transmission. Currently, the wireless network connection can be set in the following two ways:

- Setting through the PLC application interface.
- Setting through mobile App under Smart Config (SC) mode.

2.1 PLC Application Interface Wi-Fi Setting

According to the PLC register configuration in **Table 4**, please create two ASCII tables for SSID and Password and enter the Wi-Fi account and password you want to connect into their respective tables. As shown in **Figure 3~Figure 5**, please note that SSID and Password must be enclosed in single quotes.

After the connection is successful, the LINK LED will flash at 3s intervals (3 seconds on, 3 seconds off). If you want to reconnect or connect other router, just write any value to R904, and the W2C will reconnect according to the information of the current register.

Table 4: PLC Register Config and Data Length Limitation

Item	PLC register config	Data Length Limitation
SSID	R850 – R868	32Bytes
Password	R869 – R903	64 Bytes
Trigger Connection	R904	

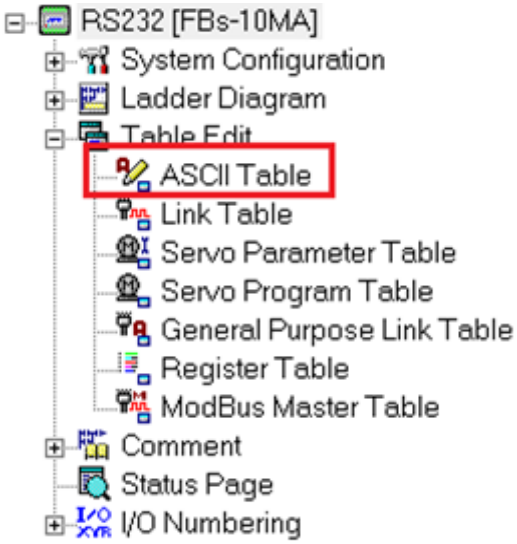


Figure 3: WinProladder ASCII Table

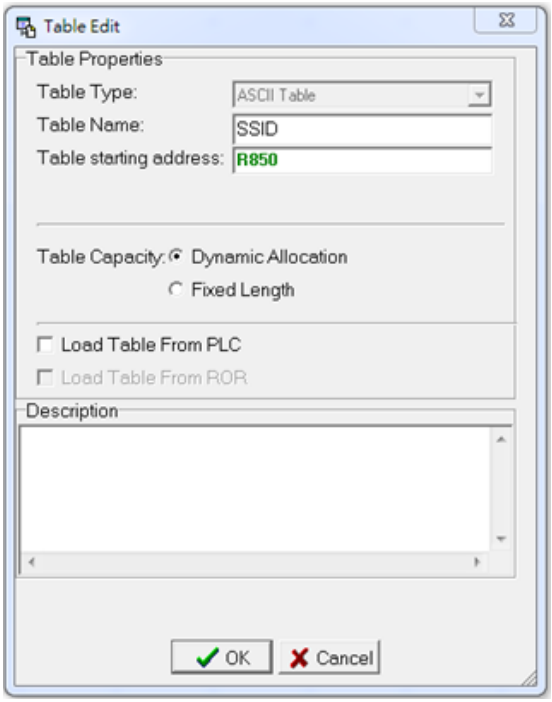


Figure 4: Build SSID ASCII table, edit table name and starting address

The starting address should match the following address:

SSID: R850~R868

Password: R869~R903

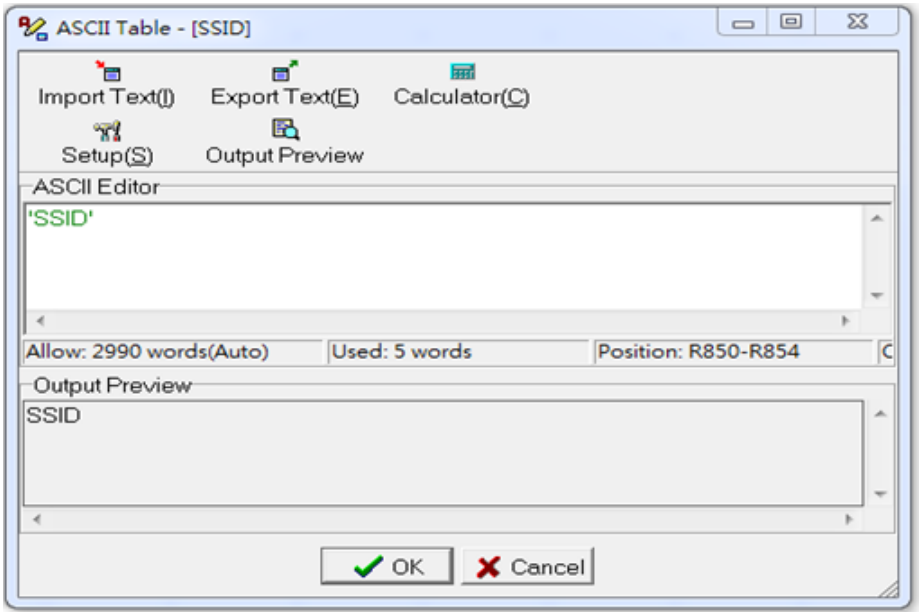


Figure 5: Enter SSID Data

2.2 Smart Config Wi-Fi Setting (SC)

For the convenience of use, the Smart Config connection method is also provided. First you need to download the mobile app - Esptouch (support in iOS / Android), as shown below. Esptouch sends the SSID and Password of the router via UDP broadcast. W2C connects according to the information received.

Figure 6: IOS – Esptouch APP

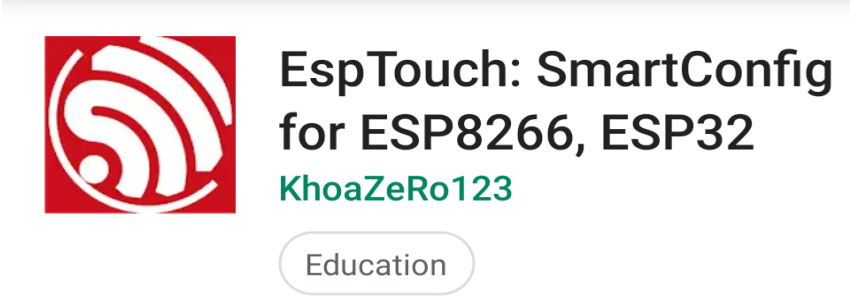


Figure 7: Android – Esptouch APP

To put the W2C into the Smart Config mode, needs to switch the W2C rapidly **3 times** in succession.
After the W2C is powered on, it must be powered off within three seconds. After repeating twice, the Smart Config mode will be enabled when the third power is turned on.
After entering the SC mode, W2C starts waiting for Esptouch broadcast information. At this time, the LED will flash continuously to indicate that the APP can start transmitting, the longest waiting time is 60 seconds.
If the connection fails after 60 seconds (such as wrong information, unstable network quality), W2C will enter the PLC application interface mode and connect through information stored in PLC before.
Since the Smart Config connection method is subject to the hardware compatibility, we provide **Appendix C-Access Point Compatibility Table** for users to choose the appropriate mobile phone for connection settings.

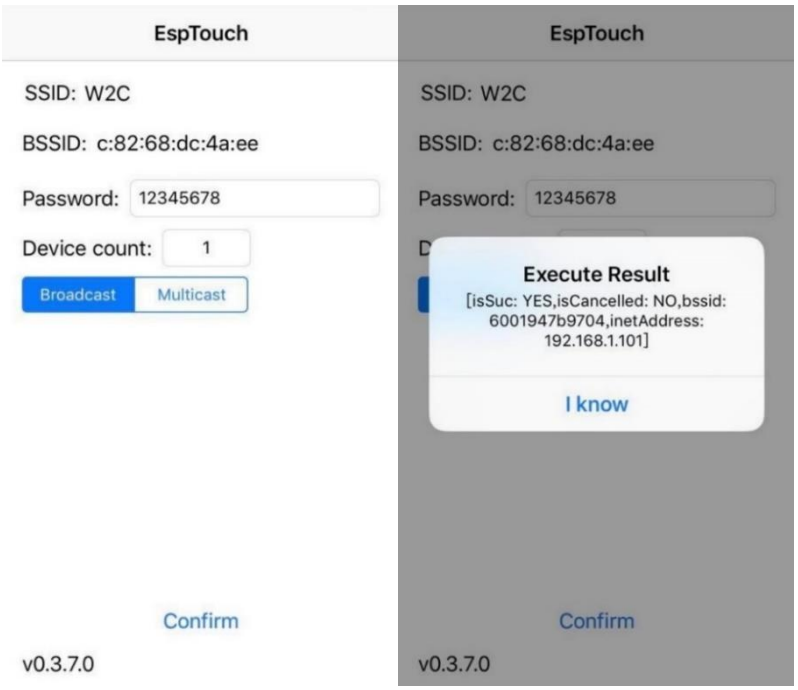


Figure 8: Esptouch operation interface, display W2C IP when connect successfully

2.3 FBs-W2C IP Searching

After the FBs-W2C is connected to the AP, the W2C IP address can be viewed in two ways (**Table 5**), and other devices can be connected to the PLC.

Table 5: IP Access Method

Item	Description
Smart Config	Display on mobile APP
FATEK Standard Communication Service	Display on FATEK standard communication service software (W2C Configurator)

2.4 Wi-Fi RSSI

Wi-Fi RSSI is an indicator for measuring the strength of the signal received by the device in wireless communication. In order to monitor the connection quality of the W2C, the user can view it through the register R949 of the PLC. As shown in

Table 6, the signal strength is shown. Expressed as a negative number, the unit is dBm, the value range is 0 ~ -100, the closer to 0, the better the signal strength.

Table 6: Wi-Fi RSSI

PLC Register Config	Wi-Fi RSSI	Signal Strength
R949	>-50	Good
	-50~ -70	Normal
	-70~ -90	Bad
	<-90	No Signal

Chapter3. FATEK Standard Communication Service

PLC has wireless network communication capability by plugging FBs-W2C Wi-Fi communication module. It can communicate with objects such as WinProladder that use FATEK standard communication in the same local area network. Supporting IPv4 and TCP/UDP protocols, can up to 4 TCP connections at the same time. Default port of TCP/UDP are 500, it can be modified by PLC register, shown as **Table 7**.

Table 7: TCP/UDP Port PLC Register Config

LED	PLC register config
TCP Port	R946
UDP Port	R947

In order to ensure the successful exchange of communication data in a wireless environment, it is recommended to set the **Time out** and **Retry** as follow:

- Time out : 3 sec
- Retry : 5 times

WinProladder setting method can refer to **Figure 9**

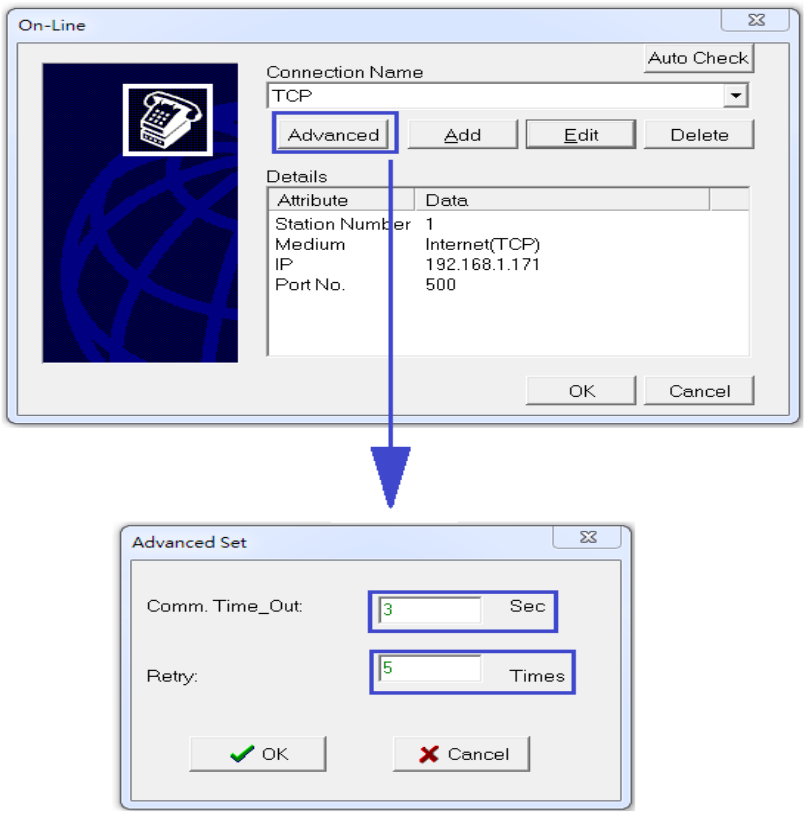


Figure 9: Communication Service setting for WinProladder

Chapter4. Simple Network Time Protocol (SNTP)

In addition to the above functions, the PLC with the FBs-W2C Wi-Fi communication module can be used to perform network time correction via the NTP Server and support two synchronization modes according to different PLC register value.

- Sync mode 1: Synchronize time back to PLC RTC.
  (For more details can refer PLC user manual 2 advanced application chapter15: RTC)
- Sync mode 2: Synchronize time back to specified PLC register.

The user can flexibly select different mode according to individual needs. The PLC register configuration of these two modes is shown in **Table 8**.

In addition, W2C will automatically perform time correction with NTP Server at the following timing, and update the time to the PLC registers.

① When W2C is **powered on**, the time of W2C and time in corresponding PLC registers according to the mode will be synchronized with NTP server.

② **Every 24 hours after powered on**, the time of W2C and time in corresponding PLC registers according to the mode will be synchronized with NTP server.

The W2C also provides the user to manually update the time to the PLC register. Simply set the value of the register R908 to 1, and the time will be updated to the corresponding register according to the selected mode.
In addition, if you want to change the time zone, you can refer to **Appendix B-Time Zone Table**. The time zone is the daylight time (if there is one in the area), input the index value of the desired area into the register R910, and then input 1 to the register to R908, the time will be updated.
If the entered index value is exceeded or not in the Appendix B table, the system default area is Taipei.

If the SNTP server needs to be changed to another server, the new URL can be written to the register and enable the corresponding PLC register to notify W2C there's a new setting needs to changed, default setting of SNTP server is " pool.ntp.org", W2C will synchronize time with SNTP server every 24 hours after powered on, the functions of SNTP and the configuration of the PLC register are shown in
Table 9.

Table 8: PLC Register Config Description

(Mode 1/Mode 2)	Description
R4128/D3953	(Second) 0-59
R4129/D3954	(Minute) 0-59
R4130/D3955	(Hour) 0-23
R4131/D3956	(Day) 1-31
R4132/D3957	(Month) 1-12
R4133/D3958	(Year) 0-99
R4134/D3959	(Week) 0-6

Table 9: SNTP Functions and PLC Register Configuration

PLC register	SNTP function
R907	After setting the SNTP server URL, notify W2C to update the Server URL.
R908	Synchronize time back to PLC register immediately.
R909	Synchronize time back to PLC mode: 1: mode 1 0: mode 2
R910	Setting location index For example: Taipei area set to 86
R911-R942	Setting SNTP server URL For example: time.google.com

Chapter5. Firmware Upgrade (OTA)

OTA is a function to update the W2C firmware through the cloud. W2C will check the version information in the "w2c_info" file on the cloud to determine whether it needs to be updated. If a new version is found, the PLC corresponding register will be set to 1, means users can update new firmware for the W2C.

W2C will check the latest version on the cloud when it connects to AP and every morning 00:01.

When the user wants to update the firmware, W2C will check whether the cloud has a new version. If there is, the W2C will immediately update the firmware of the OTA. If it is not found, it will go to the cloud to check the version information again. The result will be checked. Decide whether to allow updates.

When updating the firmware, LINK LED will flash three times per second then off one second, PLC register configuration description as **Table 10**.

Table 10: OTA Register Configuration Description

PLC register	Description
R905	Result for the version check of W2C 0: No newer version 1: Can update to newer version
R906	After setting value > 0, W2C will decide whether the update is needed.

Chapter6. FATEK Standard Searching Service

W2C Configurator is a communication software provided by FATEK standard searching service. Users can use this software to search for W2C devices in the same local network to check their execution status and set related configuration if needed.

6.1 Window Layout

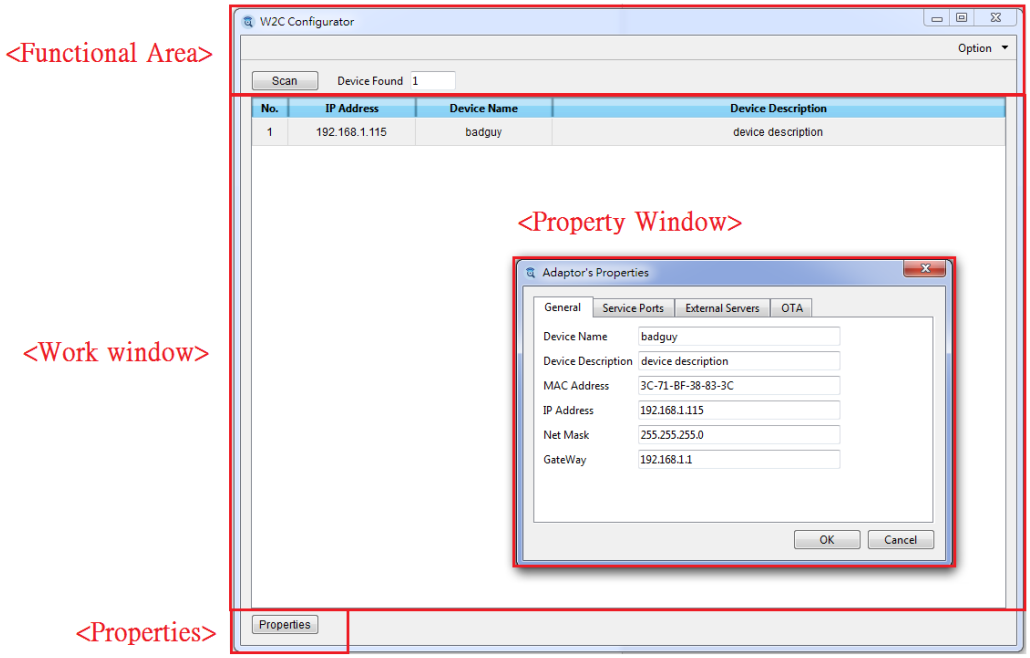


Figure 10: W2C Configurator Window Layout

6.2 Functional Area and Properties

The functional area provides the user to scan the W2C devices in the same local area network, also provides related settings. When press the properties button, the properties window will pop up to display more detailed information of scanned device. **Table 11** shows the functions in these areas, and more details are introduced in later sections.

Table 11: W2C Configurator, Function Area and Properties introduction

Function	Description
Scan	Searching for the W2C devices in the same local network.
Device Found	Record the number of scanned devices.
Option	Includes Select Network, Scan Setting, Language and About for viewing the software version.
Properties	Press the button to display the scanned device properties.

6.2.1 Scan

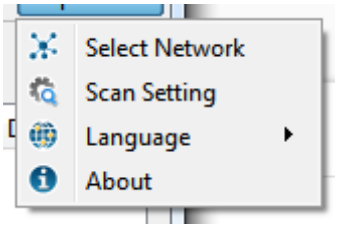
Searching for W2C devices in the same local network.

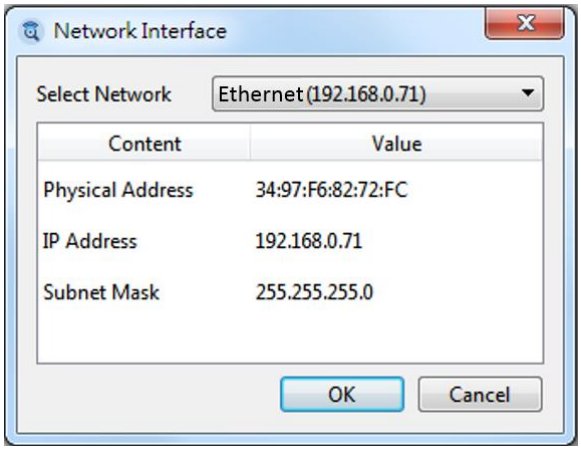
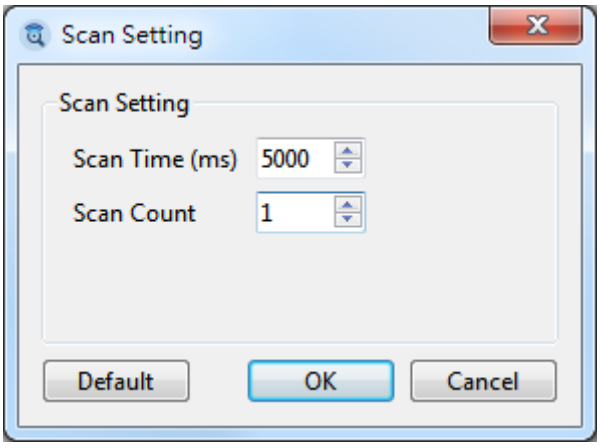
6.2.2 Device Found

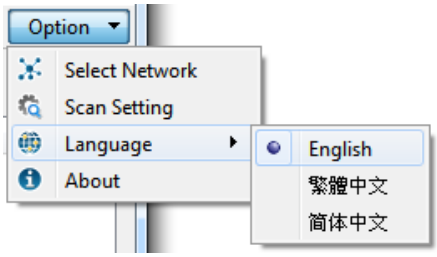
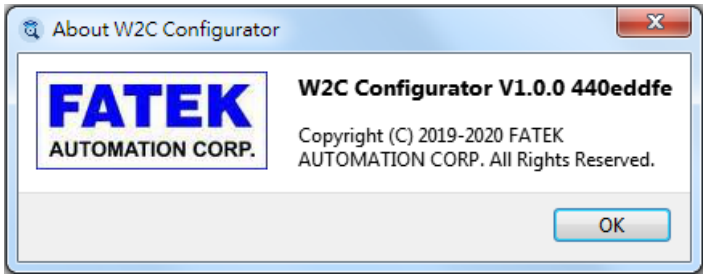
Record the number of scanned W2C devices.

6.2.3 Option

Provide users to select scanning network, scan setting, language and W2C configurator information.



Function	Description
Select Network	You can select any network interface as the local network to be scanned, and the IP address, MAC address, and subnet mask of selected network interface are displayed in the window. 
Scan Setting	Can decease or increase the scanning time depends on the situation, scan count can also be adjusted, default scan time is 5000ms and scan count is 1 time. 

Language	Provide English, Traditional Chinese and Simplified Chinese for users. 
About	Display W2C Configurator version. 

6.2.4 Properties

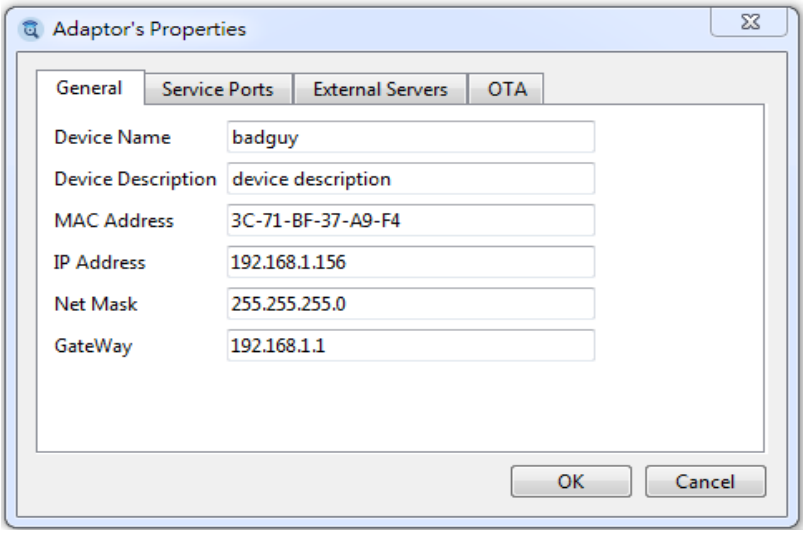
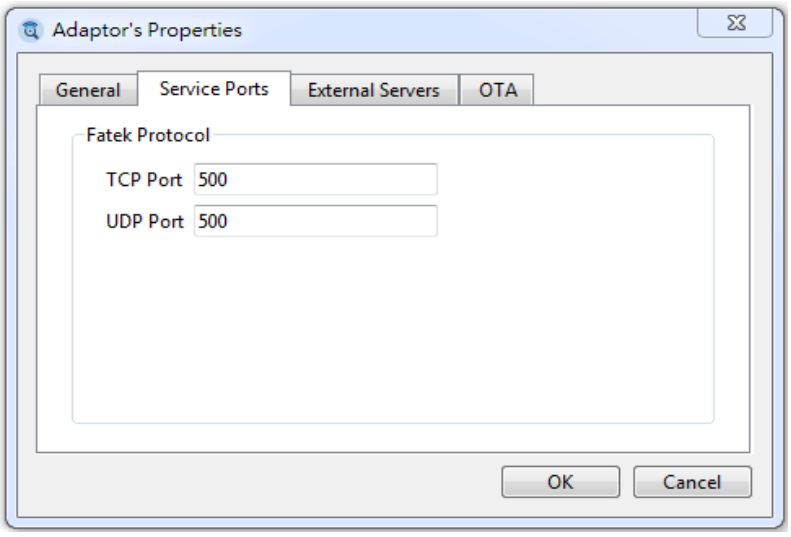
Displays the properties window of the W2C devices found in the same local area network.

6.3 Work Area

Displays the W2C device scanned in the same local area network and indicates the IP address, device name, and device description of the device.

6.4 Properties Window

Display the detailed information of the selected W2C device. Displayed items includes General, Service Ports, External Servers, and OTA. The access property of these information items, please refer to **Table 12** .

Function	Description
General	Display device name, device description and IP address, etc. Users can modify Device Name and Device Description to differentiate multiple devices. 
Service Ports	Display the TCP/UDP Port of the device, default TCP/UDP Port are 500. 
External Servers	SNTP server setting, it's able to view the time of W2C and can change the URL of NTP server for network time correction. In addition, you can also select the desired time zone and

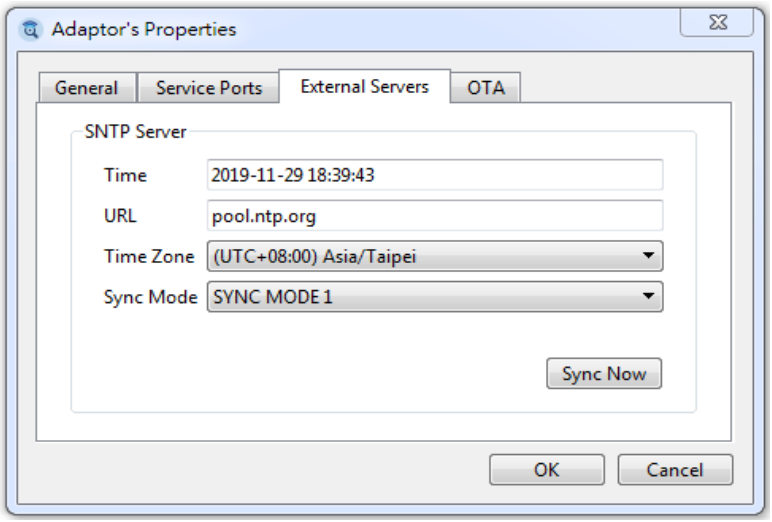
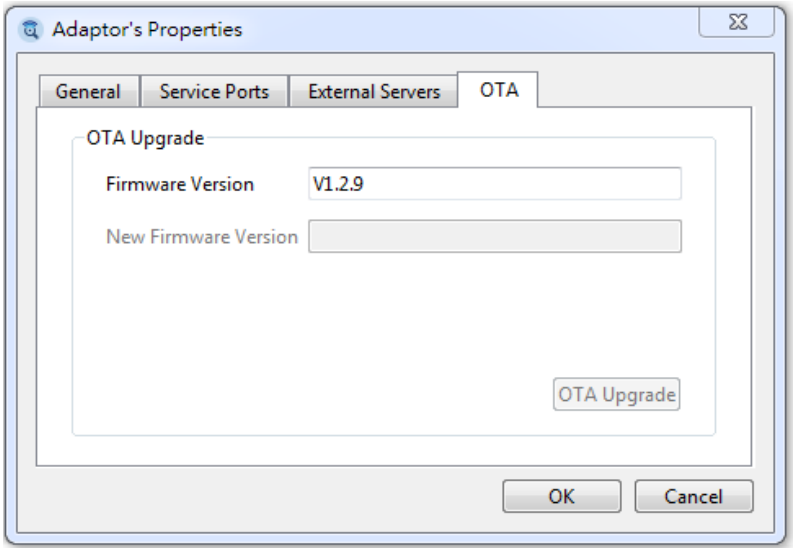
	synchronization mode to directly update the time to the corresponding PLC register. It is important to note that the device must be rescanned after synchronization, so the time field will be displayed as the updated time. Default value of the NTP Server URL: pool.ntp.org 
OTA	Display current firmware version of W2C. if there is newer firmware available for updating, then it is displayed in New Firmware Version field, user can upgrade by pressing button OTA Upgrade. 

Table 12: W2C Configurator Properties Window

Item		R/W	Note
General	Device Name	RW	
	Device Description	RW	
	MAC Address	RO	
	IP Address	RO	
	Subnet Mask	RO	
	Gateway	RO	
Service Ports	TCP Port	RW	
	UDP Port	RW	
External Servers	Time	RO	
	URL	RW	
	Time Zone	RW	
	Sync Mode	RW	
OTA	Firmware Version	RO	Current version of W2C.
	New Firmware Version	RO	W2C updatable version, it is not displayed if the current version is the latest.

Appendix A PLC Register Configuration Table

Category	Item	PLC register config	Mode	Data Length Limitation	Note
AP connection	SSID	R850 – R868	RW	32 B	
	Password	R869 – R903	RW	64B	
	Trigger connection	R904	RW		Trigger when is not 0.
OTA	Firmware has new version	R905	RO		If is 1 means there is new version can update.
	Update firmware	R906	RW	2B	Trigger when is not 0. After triggered, OTA will update firmware under W2C permission.
SNTP	SNTP trigger	R907	RW	2B	Trigger when is not 0. After triggered, update the server URL setting that is om the PLC to W2C.
	SYNC NOW	R908	RW	2B	Trigger when is not 0. After triggered, synchronize W2C time to PLC D3953~D3959.
	SYNC MODE	R909	RW	2B	Synchronize time back to PLC mode.
	TIMEZONE NUMBER	R910	RW	2B	Setting time zone index.
	SNTP URL	R911 – R945	RW	64B	Setting SNTP server URL.

	SYNC MODE 1	R4128 – R4134 M1952	RO		Synchronize mode 1, directly synchronize the time on W2C to RTC on the PLC.
	SYNC MODE 2	D3953 – D3959	RO		Synchronize mode 2, synchronize the time on W2C to PLC register.
TCP	TCP Port	R946	RW	2B	Trigger when is not 0. Change port number.
UDP	UDP Port	R947	RW	2B	Trigger when is not 0. Change port number.
System Command	System Reset	R948	RW		Trigger when is not 0.
Wi-fi Signal Strength	RSSI	R949	R		Current Wifi signal quality.

Appendix B Time Zone Table

Country	Index	Country	Index
(UTC+14:00)Pacific/Kiritimati	1	(UTC+01:00)Europe/Stockholm	257
(UTC+13:00)Pacific/Apia	2	(UTC+01:00)Europe/Tiran	258
(UTC+13:00)Pacific/Enderbury	3	(UTC+01:00)Europe/Vaduz	259
(UTC+13:00)Pacific/Fakaofo	4	(UTC+01:00)Europe/Vatican	260
(UTC+13:00)Pacific/Tongatapu	5	(UTC+01:00)Europe/Vienna	261
(UTC+12:45)Pacific/Chatham	6	(UTC+01:00)Europe/Warsaw	262
(UTC+12:00)Antarctica/McMurdo	7	(UTC+01:00)Europe/Zagreb	263
(UTC+12:00)Antarctica/South_Pole	8	(UTC+01:00)Europe/Zurich	264
(UTC+12:00)Pacific/Auckland	9	(UTC+01:00)Poland	265
(UTC+12:00)Asia/Anadyr	10	(UTC+01:00)Africa/Windhoek	266
(UTC+12:00)Asia/Kamchatka	11	(UTC+00:00)Africa/Abidjan	267
(UTC+12:00)Pacific/Funafuti	12	(UTC+00:00)Africa/Accra	268
(UTC+12:00)Pacific/Kwajalein	13	(UTC+00:00)Africa/Bamako	269
(UTC+12:00)Pacific/Majuro	14	(UTC+00:00)Africa/Banjul	270
(UTC+12:00)Pacific/Nauru	15	(UTC+00:00)Africa/Bissau	271
(UTC+12:00)Pacific/Tarawa	16	(UTC+00:00)Africa/Conakr	272
(UTC+12:00)Pacific/Wake	17	(UTC+00:00)Africa/Dakar	273
(UTC+12:00)Pacific/Wallis	18	(UTC+00:00)Africa/Freetow	274
(UTC+12:00)Pacific/Fiji	19	(UTC+00:00)Africa/Lome	275
(UTC+11:00)Antarctica/Macquarie	20	(UTC+00:00)Africa/Monrovia	276
(UTC+11:00)Asia/Magadan	21	(UTC+00:00)Africa/Nouakchott	277

(UTC+11:00)Asia/Sakhalin	22	(UTC+00:00)Africa/Ouagadougou	278
(UTC+11:00)Asia/Srednekolymsk	23	(UTC+00:00)Africa/Sao_Tome	279
(UTC+11:00)Pacific/Bougainville	24	(UTC+00:00)Africa/Timbuktu	280
(UTC+11:00)Pacific/Efate	25	(UTC+00:00)America/Danmarkshavn	281
(UTC+11:00)Pacific/Guadalcanal	26	(UTC+00:00)Atlantic/Reykjavik	282
(UTC+11:00)Pacific/Kosrae	27	(UTC+00:00)Atlantic/St_Helen	283
(UTC+11:00)Pacific/Norfolk	28	(UTC+00:00)Africa/Casablanca	284
(UTC+11:00)Pacific/Noumea	29	(UTC+00:00)Africa/El_Aaiun	285
(UTC+11:00)Pacific/Pohnpei	30	(UTC+00:00)Antarctica/Troll	286
(UTC+11:00)Pacific/Ponape	31	(UTC+00:00)Atlantic/Canary	287
(UTC+10:30)Australia/LHI	32	(UTC+00:00)Atlantic/Faeroe	288
(UTC+10:30)Australia/Lord_Howe	33	(UTC+00:00)Atlantic/Faroe	289
(UTC+10:00)Antarctica/DumontDUrville	34	(UTC+00:00)Atlantic/Madeira	290
(UTC+10:00)Asia/Ust-Nera	35	(UTC+00:00)Europe/Lisbon	291
(UTC+10:00)Asia/Vladivostok	36	(UTC+00:00)Portugal	292
(UTC+10:00)Pacific/Chuuk	37	(UTC+00:00)Europe/Belfast	293
(UTC+10:00)Pacific/Port_Moresby	38	(UTC+00:00)Europe/Guernsey	294
(UTC+10:00)Pacific/Truk	39	(UTC+00:00)Europe/Isle_of_Man	295
(UTC+10:00)Pacific/Yap	40	(UTC+00:00)Europe/Jersey	296
(UTC+10:00)Australia/ACT	41	(UTC+00:00)Europe/London	297
(UTC+10:00)Australia/Canberra	42	(UTC+00:00)Europe/Dublin	298
(UTC+10:00)Australia/Currie	43	(UTC+00:00)UTC	299
(UTC+10:00)Australia/Hobar	44	(UTC-01:00)America/Scoresbysund	300
(UTC+10:00)Australia/Melbourne	45	(UTC-01:00)Atlantic/Azores	301

(UTC+10:00)Australia/NSW	46	(UTC-01:00)Atlantic/Cape_Verde	302
(UTC+10:00)Australia/Sydney	47	(UTC-02:00)America/Noronha	303
(UTC+10:00)Australia/Tasmania	48	(UTC-02:00)Brazil/DeNoronha	304
(UTC+10:00)Australia/Victoria	49	(UTC-02:00)Atlantic/South_Georgia	305
(UTC+10:00)Australia/Brisbane	50	(UTC-03:00)America/Araguaina	306
(UTC+10:00)Australia/Lindeman	51	(UTC-03:00)America/Bahia	307
(UTC+10:00)Australia/Queensland	52	(UTC-03:00)America/Belem	308
(UTC+10:00)Pacific/Guam	53	(UTC-03:00)America/Fortaleza	309
(UTC+10:00)Pacific/Saipan	54	(UTC-03:00)America/Maceio	310
(UTC+09:30)Australia/Adelaide	55	(UTC-03:00)America/Recife	311
(UTC+09:30)Australia/Broken_Hill	56	(UTC-03:00)America/Santarem	312
(UTC+09:30)Australia/South	57	(UTC-03:00)America/Argentina/Buenos_Aires	313
(UTC+09:30)Australia/Yancowinna	58	(UTC-03:00)America/Argentina/Catamarca	314
(UTC+09:30)Australia/Darwin	59	(UTC-03:00)America/Argentina/ComodRivadavia	315
(UTC+09:30)Australia/North	60	(UTC-03:00)America/Argentina/Cordoba	316
(UTC+09:00)Asia/Chita	61	(UTC-03:00)America/Argentina/Jujuy	317
(UTC+09:00)Asia/Khandyga	62	(UTC-03:00)America/Argentina/La_Rioja	318
(UTC+09:00)Asia/Yakutsk	63	(UTC-03:00)America/Argentina/Mendoza	319
(UTC+09:00)Asia/Dili	64	(UTC-03:00)America/Argentina/Rio_Gallego	320
(UTC+09:00)Pacific/Palau	65	(UTC-03:00)America/Argentina/Salta	321
(UTC+09:00)Asia/Jayapura	66	(UTC-03:00)America/Argentina/San_Juan	322

(UTC+09:00)Asia/Seoul	67	(UTC-03:00)America/Argentina/ San_Lui	323
(UTC+09:00)Asia/Tokyo	68	(UTC-03:00)America/Argentina/ Tucuman	324
(UTC+08:45)Australia/Eucla	69	(UTC-03:00)America/Argentina/ Ushuaia	325
(UTC+08:30)Asia/Pyongyang	70	(UTC-03:00)America/Buenos_Aires	326
(UTC+08:00)Asia/Brunei	71	(UTC-03:00)America/Catamarca	327
(UTC+08:00)Asia/Choibalsan	72	(UTC-03:00)America/Jujuy	328
(UTC+08:00)Asia/Irkutsk	73	(UTC-03:00)America/Mendoz	329
(UTC+08:00)Asia/Kuala_Lumpur	74	(UTC-03:00)America/Rosario	330
(UTC+08:00)Asia/Kuching	75	(UTC-03:00)America/Cayenne	331
(UTC+08:00)Asia/Manila	76	(UTC-03:00)America/Montevideo	332
(UTC+08:00)Asia/Singapore	77	(UTC-03:00)America/Paramarib	333
(UTC+08:00)Asia/Ulaanbaatar	78	(UTC-03:00)America/Punta_Arenas	334
(UTC+08:00)Asia/Ulan_Bator	79	(UTC-03:00)America/Santiago	335
(UTC+08:00)Asia/Chongqing	80	(UTC-03:00)Antarctica/Palme	336
(UTC+08:00)Asia/Chungking	81	(UTC-03:00)Chile/Continental	337
(UTC+08:00)Asia/Harbin	82	(UTC-03:00)Antarctica/Rothera	338
(UTC+08:00)Asia/Macao	83	(UTC-03:00)Atlantic/Stanley	339
(UTC+08:00)Asia/Macau	84	(UTC-03:00)America/Miquelon	340
(UTC+08:00)Asia/Shanghai	85	(UTC-03:00)America/Sao_Paulo	341
(UTC+08:00)Asia/Taipei	86	(UTC-03:00)Brazil/East	342
(UTC+08:00)Asia/Hong_Kong	87	(UTC-03:30)America/St_Johns	343
(UTC+08:00)Asia/Makassar	88	(UTC-03:30)Canada/Newfoundland	344
(UTC+08:00)Asia/Ujung_Pandang	89	(UTC-04:00)America/Anguilla	345

(UTC+08:00)Australia/Perth	90	(UTC-04:00)America/Antigua	346
(UTC+08:00)Australia/West	91	(UTC-04:00)America/Aruba	347
(UTC+07:00)Antarctica/Davis	92	(UTC-04:00)America/Barbados	348
(UTC+07:00)Asia/Bangkok	93	(UTC-04:00)America/Blanc-Sablon	349
(UTC+07:00)Asia/Ho_Chi_Minh	94	(UTC-04:00)America/Curacao	350
(UTC+07:00)Asia/Phnom_Penh	95	(UTC-04:00)America/Dominica	351
(UTC+07:00)Asia/Saigon	96	(UTC-04:00)America/Grand_Turk	352
(UTC+07:00)Asia/Vientiane	97	(UTC-04:00)America/Grenada	353
(UTC+07:00)Asia/Barnaul	98	(UTC-04:00)America/Guadeloupe	354
(UTC+07:00)Asia/Hovd	99	(UTC-04:00)America/Kralendijk	355
(UTC+07:00)Asia/Krasnoyarsk	100	(UTC-04:00)America/Lower_Princes	356
(UTC+07:00)Asia/Novokuznetsk	101	(UTC-04:00)America/Marigot	357
(UTC+07:00)Indian/Christmas	102	(UTC-04:00)America/Martinique	358
(UTC+07:00)Asia/Jakarta	103	(UTC-04:00)America/Montserra	359
(UTC+07:00)Asia/Pontianak	104	(UTC-04:00)America/Port_of_Spain	360
(UTC+06:30)Asia/Rangoon	105	(UTC-04:00)America/Puerto_Rico	361
(UTC+06:30)Asia/Yangon	106	(UTC-04:00)America/Santo_Domingo	362
(UTC+06:30)Indian/Cocos	107	(UTC-04:00)America/St_Barthelemy	363
(UTC+06:00)Antarctica/Vostok	108	(UTC-04:00)America/St_Kitts	364
(UTC+06:00)Asia/Almaty	109	(UTC-04:00)America/St_Lucia	365
(UTC+06:00)Asia/Bishkek	110	(UTC-04:00)America/St_Thomas	366
(UTC+06:00)Asia/Dacca	111	(UTC-04:00)America/St_Vincent	367
(UTC+06:00)Asia/Dhaka	112	(UTC-04:00)America/Tortola	368
(UTC+06:00)Asia/Kashgar	113	(UTC-04:00)America/Virgin	369

(UTC+06:00)Asia/Urumqi	**114**	**(UTC-04:00)America/Asuncion**	**370**
(UTC+06:00)Asia/Omsk	**115**	**(UTC-04:00)America/Boa_Vista**	**371**
(UTC+06:00)Asia/Qyzylorda	**116**	**(UTC-04:00)America/Manaus**	**372**
(UTC+06:00)Asia/Thimbu	**117**	**(UTC-04:00)America/Porto_Velho**	**373**
(UTC+06:00)Asia/Thimphu	**118**	**(UTC-04:00)Brazil/West**	**374**
(UTC+06:00)Indian/Chagos	**119**	**(UTC-04:00)America/Guyana**	**375**
(UTC+06:00)Asia/Novosibirsk	**120**	**(UTC-04:00)America/La_Paz**	**376**
(UTC+06:00)Asia/Tomsk	**121**	**(UTC-04:00)America/Caracas**	**377**
(UTC+05:45)Asia/Kathmandu	**122**	**(UTC-04:00)America/Campo_Grande**	**378**
(UTC+05:45)Asia/Katmandu	**123**	**(UTC-04:00)America/Cuiaba**	**379**
(UTC+05:30)Asia/Calcutta	**124**	**(UTC-04:00)America/Glace_Bay**	**380**
(UTC+05:30)Asia/Colombo	**125**	**(UTC-04:00)America/Goose_Bay**	**381**
(UTC+05:30)Asia/Kolkata	**126**	**(UTC-04:00)America/Halifax**	**382**
(UTC+05:00)Antarctica/Mawson	**127**	**(UTC-04:00)America/Moncton**	**383**
(UTC+05:00)Asia/Aqtau	**128**	**(UTC-04:00)America/Thule**	**384**
(UTC+05:00)Asia/Aqtobe	**129**	**(UTC-04:00)Atlantic/Bermuda**	**385**
(UTC+05:00)Asia/Ashgabat	**130**	**(UTC-04:00)Canada/Atlantic**	**386**
(UTC+05:00)Asia/Ashkhabad	**131**	**(UTC-05:00)America/Atikokan**	**387**
(UTC+05:00)Asia/Atyrau	**132**	**(UTC-05:00)America/Cancun**	**388**
(UTC+05:00)Asia/Dushanbe	**133**	**(UTC-05:00)America/Cayman**	**389**
(UTC+05:00)Asia/Oral	**134**	**(UTC-05:00)America/Coral_Harbour**	**390**
(UTC+05:00)Asia/Samarkand	**135**	**(UTC-05:00)America/Jamaica**	**391**
(UTC+05:00)Asia/Tashkent	**136**	**(UTC-05:00)America/Panama**	**392**
(UTC+05:00)Asia/Yekaterinburg	**137**	**(UTC-05:00)America/Bogota**	**393**

(UTC+05:00)Indian/Kerguelen	138	(UTC-05:00)America/Eirunepe	394
(UTC+05:00)Indian/Maldives	139	(UTC-05:00)America/Porto_Acr	395
(UTC+05:00)Asia/Karachi	140	(UTC-05:00)America/Rio_Branco	396
(UTC+04:30)Asia/Kabul	141	(UTC-05:00)Brazil/Acre	397
(UTC+04:00)Asia/Baku	142	(UTC-05:00)America/Guayaquil	398
(UTC+04:00)Asia/Dubai	143	(UTC-05:00)America/Lima	399
(UTC+04:00)Asia/Muscat	144	(UTC-05:00)America/Detroit	400
(UTC+04:00)Asia/Tbilisi	145	(UTC-05:00)America/Fort_Wayne	401
(UTC+04:00)Asia/Yerevan	146	(UTC-05:00)America/Indiana/ Indianapolis	402
(UTC+04:00)Europe/Astrakhan	147	(UTC-05:00)America/Indiana/Marengo	403
(UTC+04:00)Europe/Samara	148	(UTC-05:00)America/Indiana/ Petersburg	404
(UTC+04:00)Europe/Ulyanovsk	149	(UTC-05:00)America/Indiana/Vevay	405
(UTC+04:00)Indian/Mahe	150	(UTC-05:00)America/Indiana/Vincennes	406
(UTC+04:00)Indian/Mauritius	151	(UTC-05:00)America/Indiana/Winamac	407
(UTC+04:00)Indian/Reunion	152	(UTC-05:00)America/Indianapoli	408
(UTC+03:30)Asia/Tehran	153	(UTC-05:00)America/Iqaluit	409
(UTC+03:00)Asia/Famagusta	154	(UTC-05:00)America/Kentucky/Louisville	410
(UTC+03:00)Asia/Istanbul	155	(UTC-05:00)America/Kentucky/Monticello	411
(UTC+03:00)Europe/Istanbul	156	(UTC-05:00)America/Louisville	412
(UTC+03:00)Europe/Kirov	157	(UTC-05:00)America/Montreal	413
(UTC+03:00)Europe/Minsk	158	(UTC-05:00)America/Nassau	414
(UTC+03:00)Europe/Saratov	159	(UTC-05:00)America/New_York	415

(UTC+03:00)Europe/Volgograd	160	(UTC-05:00)America/Nipigon	416
(UTC+03:00)Africa/Addis_Ababa	161	(UTC-05:00)America/Pangnirtun	417
(UTC+03:00)Africa/Asmara	162	(UTC-05:00)America/Port-au-Prince	418
(UTC+03:00)Africa/Asmera	163	(UTC-05:00)America/Thunder_Bay	419
(UTC+03:00)Africa/Dar_es_Salaam	164	(UTC-05:00)America/Toronto	420
(UTC+03:00)Africa/Djibouti	165	(UTC-05:00)Canada/Eastern	421
(UTC+03:00)Africa/Juba	166	(UTC-05:00)US/Eastern	422
(UTC+03:00)Africa/Kampala	167	(UTC-05:00)US/East-Indiana	423
(UTC+03:00)Africa/Khartoum	168	(UTC-05:00)US/Michigan	424
(UTC+03:00)Africa/Mogadishu	169	(UTC-05:00)America/Havana	425
(UTC+03:00)Africa/Nairobi	170	(UTC-06:00)America/Bahia_Banderas	426
(UTC+03:00)Indian/Antananarivo	171	(UTC-06:00)America/Merida	427
(UTC+03:00)Indian/Comoro	172	(UTC-06:00)America/Mexico_City	428
(UTC+03:00)Indian/Mayotte	173	(UTC-06:00)America/Monterrey	429
(UTC+03:00)Antarctica/Syowa	174	(UTC-06:00)Mexico/General	430
(UTC+03:00)Asia/Aden	175	(UTC-06:00)America/Belize	431
(UTC+03:00)Asia/Baghdad	176	(UTC-06:00)America/Costa_Rica	432
(UTC+03:00)Asia/Bahrain	177	(UTC-06:00)America/El_Salvador	433
(UTC+03:00)Asia/Kuwait	178	(UTC-06:00)America/Guatemala	434
(UTC+03:00)Asia/Qatar	179	(UTC-06:00)America/Managua	435
(UTC+03:00)Asia/Riyadh	180	(UTC-06:00)America/Regina	436
(UTC+03:00)Europe/Moscow	181	(UTC-06:00)America/Swift_Current	437
(UTC+03:00)Europe/Simferopol	182	(UTC-06:00)America/Tegucigalpa	438
(UTC+02:00)Africa/Blantyre	183	(UTC-06:00)Canada/East-Saskatchewan	439

(UTC+02:00)Africa/Bujumbura	184	(UTC-06:00)Canada/Saskatchewan	440
(UTC+02:00)Africa/Gaborone	185	(UTC-06:00)America/Chicago	441
(UTC+02:00)Africa/Harare	186	(UTC-06:00)America/Indiana/Knox	442
(UTC+02:00)Africa/Kigali	187	(UTC-06:00)America/Indiana/Tell_City	443
(UTC+02:00)Africa/Lubumbashi	188	(UTC-06:00)America/Knox_IN	444
(UTC+02:00)Africa/Lusak	189	(UTC-06:00)America/Matamoros	445
(UTC+02:00)Africa/Maputo	190	(UTC-06:00)America/Menominee	446
(UTC+02:00)Africa/Cairo	191	(UTC-06:00)America/North_Dakota/Beulah	447
(UTC+02:00)Africa/Tripoli	192	(UTC-06:00)America/North_Dakota/Center	448
(UTC+02:00)Europe/Kaliningrad	193	(UTC-06:00)America/North_Dakota/New_Salem	449
(UTC+02:00)Africa/Johannesburg	194	(UTC-06:00)America/Rainy_River	450
(UTC+02:00)Africa/Maseru	195	(UTC-06:00)America/Rankin_Inlet	451
(UTC+02:00)Africa/Mbabane	196	(UTC-06:00)America/Resolute	452
(UTC+02:00)Asia/Amman	197	(UTC-06:00)America/Winnipeg	453
(UTC+02:00)Asia/Beirut	198	(UTC-06:00)Canada/Central	454
(UTC+02:00)Asia/Damascus	199	(UTC-06:00)US/Central	455
(UTC+02:00)Asia/Gaza	200	(UTC-06:00)US/Indiana-Starke	456
(UTC+02:00)Asia/Hebron	201	(UTC-06:00)Pacific/Galapagos	457
(UTC+02:00)Asia/Nicosia	202	(UTC-07:00)America/Boise	458
(UTC+02:00)Europe/Athens	203	(UTC-07:00)America/Cambridge_Bay	459
(UTC+02:00)Europe/Bucharest	204	(UTC-07:00)America/Denver	460
(UTC+02:00)Europe/Helsinki	205	(UTC-07:00)America/Edmonton	461
(UTC+02:00)Europe/Kiev	206	(UTC-07:00)America/Inuvik	462

(UTC+02:00)Europe/Mariehamn	207	(UTC-07:00)America/Ojinag	463
(UTC+02:00)Europe/Nicosia	208	(UTC-07:00)America/Shiprock	464
(UTC+02:00)Europe/Riga	209	(UTC-07:00)America/Yellowknife	465
(UTC+02:00)Europe/Sofia	210	(UTC-07:00)Canada/Mountain	466
(UTC+02:00)Europe/Tallinn	211	(UTC-07:00)US/Mountain	467
(UTC+02:00)Europe/Uzhgorod	212	(UTC-07:00)America/Chihuahua	468
(UTC+02:00)Europe/Vilnius	213	(UTC-07:00)America/Mazatlan	469
(UTC+02:00)Europe/Zaporozhye	214	(UTC-07:00)Mexico/BajaSur	470
(UTC+02:00)Turkey	215	(UTC-07:00)America/Creston	471
(UTC+02:00)Europe/Chisinau	216	(UTC-07:00)America/Dawson_Creek	472
(UTC+02:00)Europe/Tiraspol	217	(UTC-07:00)America/Fort_Nelson	473
(UTC+01:00)Africa/Algier	218	(UTC-07:00)America/Hermosillo	474
(UTC+01:00)Africa/Tunis	219	(UTC-07:00)America/Phoenix	475
(UTC+01:00)Africa/Bangui	220	(UTC-07:00)US/Arizona	476
(UTC+01:00)Africa/Brazzaville	221	(UTC-08:00)America/Dawson	477
(UTC+01:00)Africa/Douala	222	(UTC-08:00)America/Ensenada	478
(UTC+01:00)Africa/Kinshasa	223	(UTC-08:00)America/Los_Angeles	479
(UTC+01:00)Africa/Lagos	224	(UTC-08:00)America/Santa_Isabel	480
(UTC+01:00)Africa/Libreville	225	(UTC-08:00)America/Tijuana	481
(UTC+01:00)Africa/Luanda	226	(UTC-08:00)America/Vancouve	482
(UTC+01:00)Africa/Malabo	227	(UTC-08:00)America/Whitehorse	483
(UTC+01:00)Africa/Ndjamena	228	(UTC-08:00)Canada/Pacific	484
(UTC+01:00)Africa/Niamey	229	(UTC-08:00)Canada/Yukon	485
(UTC+01:00)Africa/Porto-Novo	230	(UTC-08:00)Mexico/BajaNorte	486

(UTC+01:00)Africa/Ceuta	231	(UTC-08:00)US/Pacific	487
(UTC+01:00)Arctic/Longyearbyen	232	(UTC-08:00)US/Pacific-New	488
(UTC+01:00)Atlantic/Jan_Mayen	233	(UTC-08:00)Pacific/Pitcairn	489
(UTC+01:00)Europe/Amsterdam	234	(UTC-09:00)America/Anchorage	490
(UTC+01:00)Europe/Andorra	235	(UTC-09:00)America/Juneau	491
(UTC+01:00)Europe/Belgrade	236	(UTC-09:00)America/Metlakatla	492
(UTC+01:00)Europe/Berlin	237	(UTC-09:00)America/Nome	493
(UTC+01:00)Europe/Bratislava	238	(UTC-09:00)America/Sitka	494
(UTC+01:00)Europe/Brussels	239	(UTC-09:00)America/Yakutat	495
(UTC+01:00)Europe/Budapest	240	(UTC-09:00)US/Alaska	496
(UTC+01:00)Europe/Busingen	241	(UTC-09:00)Pacific/Gambier	497
(UTC+01:00)Europe/Copenhagen	242	(UTC-09:30)Pacific/Marquesas	498
(UTC+01:00)Europe/Gibraltar	243	(UTC-10:00)America/Adak	499
(UTC+01:00)Europe/Ljubljana	244	(UTC-10:00)America/Atka	500
(UTC+01:00)Europe/Luxembourg	245	(UTC-10:00)US/Aleutian	501
(UTC+01:00)Europe/Madrid	246	(UTC-10:00)Pacific/Honolulu	502
(UTC+01:00)Europe/Malta	247	(UTC-10:00)Pacific/Johnston	503
(UTC+01:00)Europe/Monaco	248	(UTC-10:00)US/Hawaii	504
(UTC+01:00)Europe/Oslo	249	(UTC-10:00)Pacific/Rarotonga	505
(UTC+01:00)Europe/Paris	250	(UTC-10:00)Pacific/Tahiti	506
(UTC+01:00)Europe/Podgorica	251	(UTC-11:00)Pacific/Midwa	507
(UTC+01:00)Europe/Prague	252	(UTC-11:00)Pacific/Pago_Pago	508
(UTC+01:00)Europe/Rome	253	(UTC-11:00)Pacific/Samoa	509
(UTC+01:00)Europe/San_Marino	254	(UTC-11:00)US/Samoa	510

(UTC+01:00)Europe/Sarajevo	**255**	**(UTC-11:00)Pacific/Niue**	**511**
(UTC+01:00)Europe/Skopje	**256**	**(UTC+02:00)Israel**	**512**

Appendix C Access Point Compatibility Table

AP Brand	Mobile Phone Brand						
	Apple iPhone 7	ASUS ZenFone 4	HTC U12 life	Huawei Mate 20X	Mi A2	Redmi note7	Samsung Galaxy S10+
ASUS Blue Cave AC2600	○	△	○	✕	✕	○	○
Belkin G54/N150	○	○	○	○	○	○	○
D-Link DIR-615	○	△	○	○	○	○	○
Linksys WRT1900ACS	○	✕	✕	✕	✕	✕	○
NETGEAR N300 WNR2000	○	○	○	○	○	○	○
Tenda N301	○	○	○	○	○	○	○
TP-Link TL-WR940N	○	○	○	○	○	○	○
TP-Link WR841N	○	○	○	○	○	△	○
WAVLINK ARK N300	○	○	○	○	○	○	○

This table shows the success rate of Smart Config connection setting for the connection of each brands of mobile phones and routers.

○ : High (80%-100%) Compatible
△ : Possible (40%-60%) Possibly Work
✕ : Low (0%-20%) Incompatible