WFM Series

Wi-Fi I/O Module with Metal Case

User's Manual





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1. Introduction

The WFM series I/O modules have WLAN connection complies with the IEEE802.11b/g standards. With the popularity of 802.11 network infrastructure, the WFM series I/O modules make an easy way to incorporate wireless connectivity into monitoring and control systems. They also support Modbus TCP protocol and the network encryption configuration, which makes perfect integration to SCADA software and offer easy and safe access for users from anytime and anywhere.

1.1 Wireless connection mode

WFM series I/O modules support AP and Ad-hoc wireless connection modes of WLAN.

1.2 Features

- RoHS Design
- Compatible with IEEE 802.11b/g standards
- Support infrastructure and ad hoc modes for wireless networks
- Support WEP, WPA and WPA2 wireless encryption
- Support Modbus TCP protocols
- Support DHCP network configuration
- Wide operating temperature range
- Built-in Watchdog

1.2.1 Features Description

The WFM I/O module offers the most comprehensive configuration to meet specific application requirements. The following list shows the features designed to simplify installation, configuration and application.

Compatible with IEEE 802.11b/g standards

WFM I/O module complied with IEEE 802.11b/g standard from 2.4~2.5GHz, and it can be used to provide up to 11Mbps for IEEE 802.11b and 54Mbps for 2.4GHz IEEE 802.11g to connect your wireless LAN.

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Support infrastructure and ad hoc modes for wireless networks

Ad hoc mode lets you create a wireless network quickly by allowing wireless nodes within range (for example, the wireless devices in a room) to communicate directly with each other without the need for a wireless access point.

Infrastructure mode is the more common network configuration where all wireless hosts (clients) connect to the wireless network via a WAP (Wireless Access Point).

Support WEP, WPA and WPA2 wireless encryption

WEP and WPA are common types of security that are used to protect wireless networks. When WEP or WPA is turned on, WFM module uses a special security key combination to allow only devices that know this key to connect to its wireless network. This applies to laptops, smart device, or any other wireless device.

Support Modbus/TCP and UDP protocols

The Modbus TCP slave function on the WFM I/O modules can be used to provide data to remote HMI/SCADA software built with Modbus TCP driver. ICP DAS also provides NAPOPC_ST DA Server for Modbus TCP to integrate WFM I/O series real-time data value with OPC client enabled software.

Built-in Multi-function I/O

Various I/O components are mixed with multiple channels in a single module, which provides the most cost effective I/O usage and enhances performance of the I/O operations.

Built-in Watchdog

Module Watchdog is a built-in hardware circuit that monitors the operating status of the module and will reset the module if a failure occurs in the hardware or the software.

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1.3 Specifications

Table 1-1: System Specifications

Modules	WFM-R14
Wi-Fi Interface	
Antenna	5 dBi (Omni-Directional)
Output Power	8 dBm @ 11Mbps
Receive Sensitivity	-83 dBm @ 11Mbps
Standard Supported	IEEE 802.11b/g
Wireless Mode	Infrastructure & Ad-hoc
Encryption	WEP, WPA and WPA2
UART Interface	
Connector	7-pin screw terminal connector(TxD, RxD, GND)
COM1	RS-232
Baud Rate (bps)	115200
Power	
Input Voltage Range	10V ~ 30V
Power Consumption	2.2W
Mechanism	
Installation	DIN-Rail
Dimensions (W x L x H)	73mm x 118mm x 111mm
Casing	Metal
Environment	
Operating Temperature	-25℃ ~ +75℃
Storage Temperature	-30℃ ~ +80℃
Humidity	10% ~ 90%

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Table 1-2: I/O Specification

Relay Output			
Channels		14	
Output Type		2 Form A Power Relays	
		12 Form C Power Relays	
Contact Rating (Resistive Load)		5A 250VAC/30VDC	
		6A 250VAC/30VDC	
Operate Time	Release Time	10ms max.	5ms max.
		8ms max.	4ms max.
Insulation Resistance		1,000MΩs at 500VDC	
Dielectric Strength		Between Coil and Contacts	3000VAC (1 min.)
		Between Open Contact	1000VAC (1 min.)
		Between Coil and Contacts	4000VAC (1 min.)
		Between Open Contact	1000VAC (1 min.)
Mechanical Endurance		2x107 times	
		1x107 times	
Electrical Endurance		1x105 times 3A 250VAC/30VDC 5x104 times 5A 250VAC/30VDC	
		1A: 6x104 times 1C: (NO)3x104 times 1C: (NC)1x104 times	

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2. Hardware

2.1 Front Panel

The WFM series IO modules front panel contains the antenna, I/O connectors and LEDs.

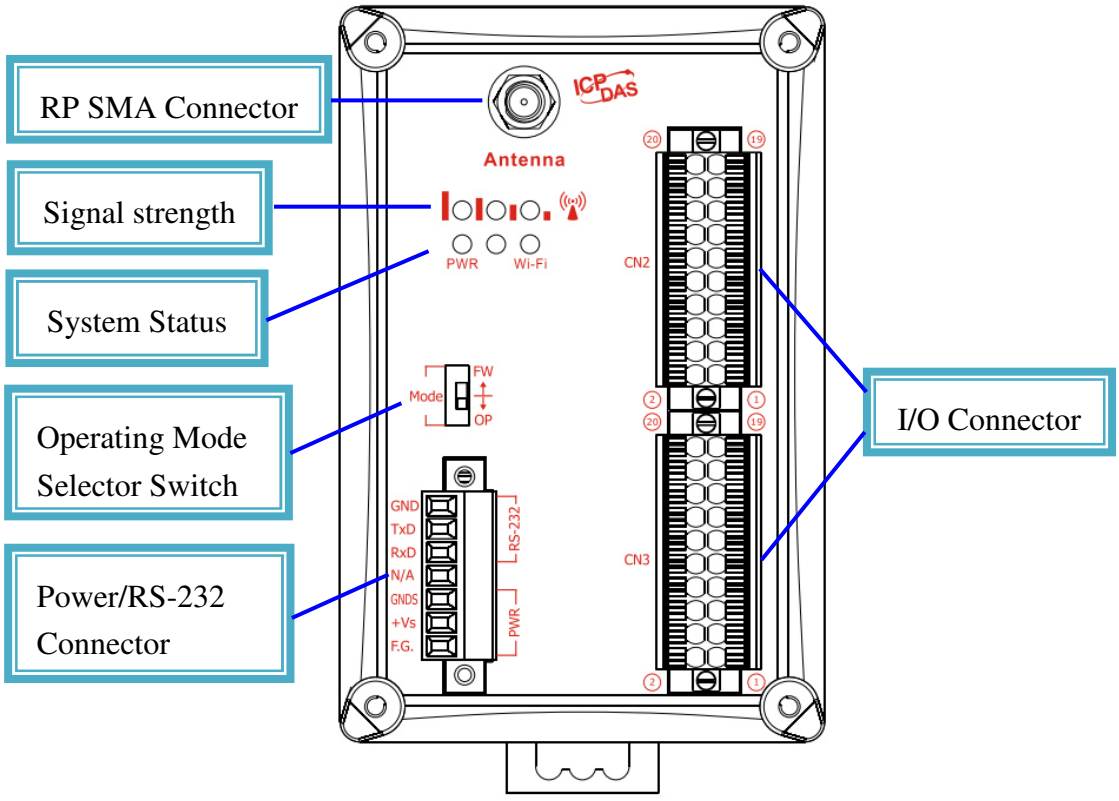


Figure 2-1: Front Panel of the WFM I/O module

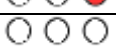
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2.1.1 **LED Indicator**

Table 2-1**:** System Status Indicator

System Status Indicator		
LED	**Module Status**	**LED Status**
PWR	Wi-Fi communication error	Blink per 100 ms
	Wi-Fi associate error	Every 1 second flashes twice per 100 ms
	Wi-Fi unable to connect error	Blink per 1000 ms
	Wi-Fi network configurations error	Every 1 second flashes three times per 100 ms
	Power failure	Off
Wi-Fi	Data transmission	Blink
	Bus Idle	Off

Table 2-2**:** Signal Strength LED Indicator

Signal Strength LED Indicator	
LED Status	**Signal strength**
	High
	Medium
	Low
	Bad or No Signal

2.1.2 **Operating Mode Selector Switch**

FW mode: Firmware update mode

Move the switch to the OP position after the upgrade is complete.

OP mode: Firmware operation mode

In the WFM module, the switch is always in the OP position. Only when updating the firmware, the switch can be moved from the OP position to the FW position.

2.1.3 **Power/Signal Connector**

Table 2-3: Power/Signal Connector

Power/Signal connector		
Pin Assignment	**Description**	
GND	RS-232	GND
RxD		RxD
TxD		TxD
N/A	Not used	
GNDS	Power GND	
+Vs	+10 ~ +30 VDC	
F.G	Frame Ground	

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2.1.4 I/O Connector

2.1.4.1 WFM-R14

Pin Assignment			CN2	Pin Assignment		
Form C	NO3	20		19	NO0	Form C
	NC3	18		17	NC0	
	COM3	16		15	COM0	
	NO4	14		13	NO1	
	NC4	12		11	NC1	
	COM4	10		9	COM1	
	NO5	8		7	NO2	
	NC5	6		5	NC2	
	COM5	4		3	COM2	
Form A	COM12	2		1	NO12	Form A

Pin Assignment			CN3	Pin Assignment		
Form C	NO9	20		19	NO6	Form C
	NC9	18		17	NC6	
	COM9	16		15	COM6	
	NO10	14		13	NO7	
	NC10	12		11	NC7	
	COM10	10		9	COM7	
	NO11	8		7	NO8	
	NC11	6		5	NC8	
	COM11	4		3	COM8	
Form A	COM13	2		1	NO13	Form A

Figure 2-2: I/O Connector of WFM-R14

2.2 Dimensions

The diagrams below provide the dimensions of the WFM I/O modules to use in defining your enclosure specifications. All dimensions are in millimeters.

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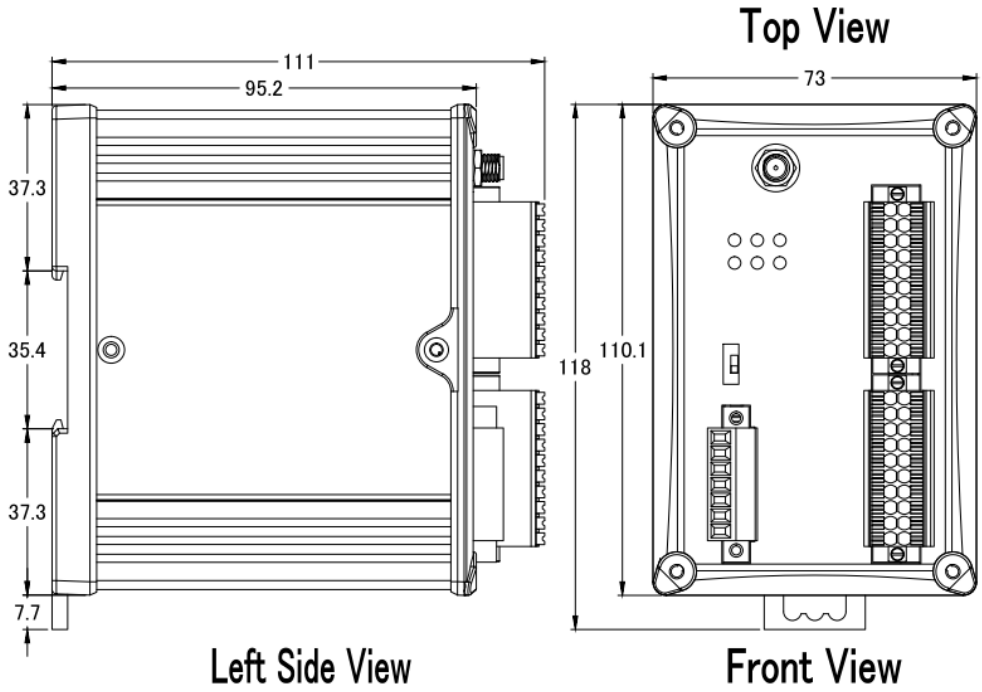


Figure 2-3: Dimension of the WFM I/O Modules

2.3 Hardware Connection

2.3.1 Power and Serial port connection

The following figures describe the Power and the COM port to a serial device via serial network.

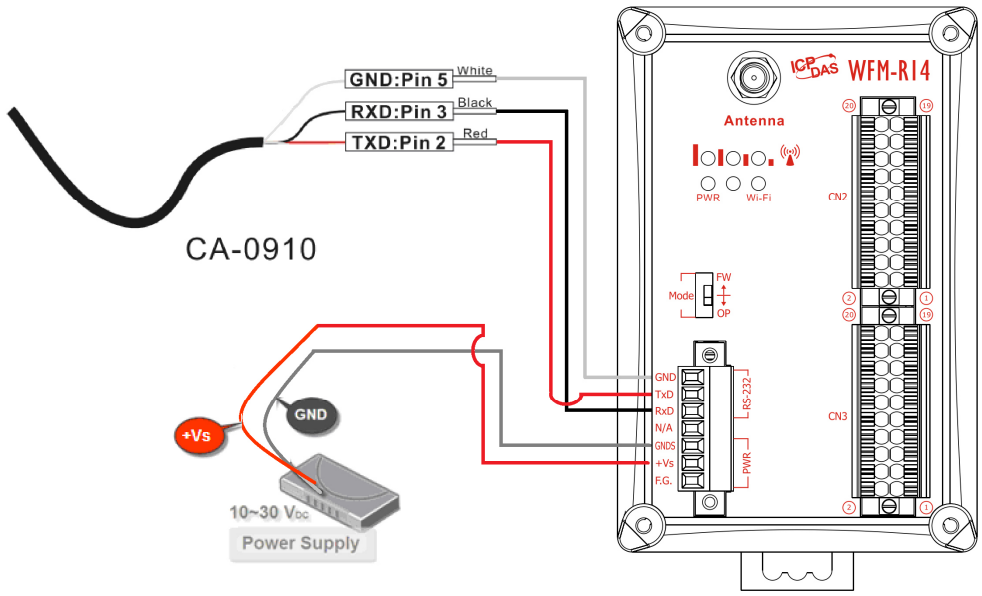


Figure 2-4: Power and Serial port wire connection

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2.3.2 I/O connection

2.3.2.1 WFM-R14

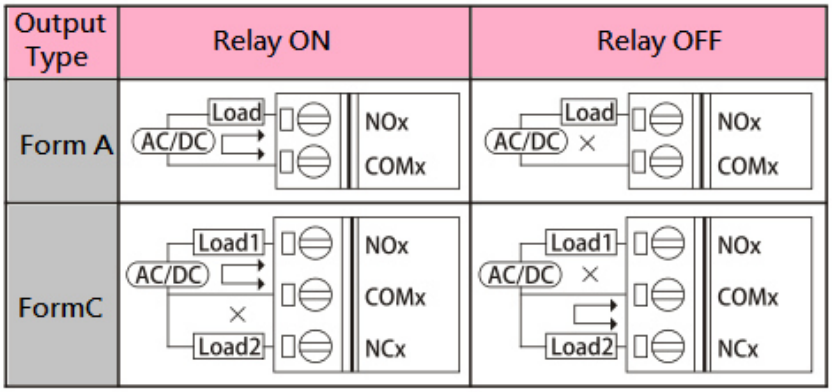


Figure 2-5**:** DO wire connection of WFM-R14

2.4 Jumper Settings

2.4.1 Watchdog Timer Settings

A watchdog timer (WDT) is a device that performs a specific operation after a certain period of time if something goes wrong and the system does not recover on its own. A watchdog timer can perform a warm boot(restarting the system) after a certain number of milliseconds.

The WFM series module supplies a jumper for users to active the watchdog timer or not. If users want to use this WDT, can open the WFM cover and use the Jumper to activate the WDT built in the module, as the Figure 2-13. Note that the default setting is active.

Table 2-4: WDT Jumper Position

Module	Jumper Number
WFM-R14	JP2

Enable (default) Disable



Figure 2-6: Watchdog timer Jumper Position

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2.5 FW / OP Dip-switch

On the top of the WFM series module, there is a dip-switch used for firmware operation or firmware update of the module. The following steps show how to use this dip-switch.

2.5.1 Firmware Update Mode

Please set the dip-switch to the “FW” position as Figure 2-7, and then the WM series will work in the “Firmware Update Mode” after reset the power of the module. In this mode, users can update the firmware of the WFM module from computer’s RS-232 port via CA-0910 cable shown as Figure 2-8.

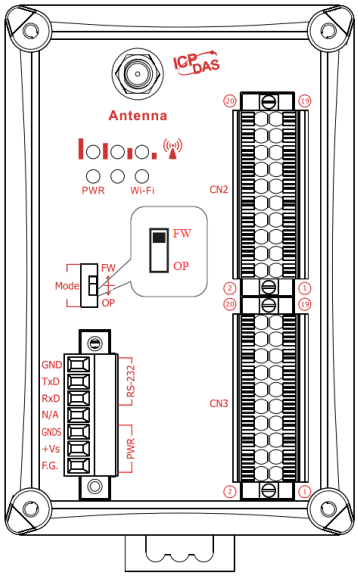


Figure 2-7**:** FW Position of Dip-Switch



Figure 2-8**:** CA-0910 Cable

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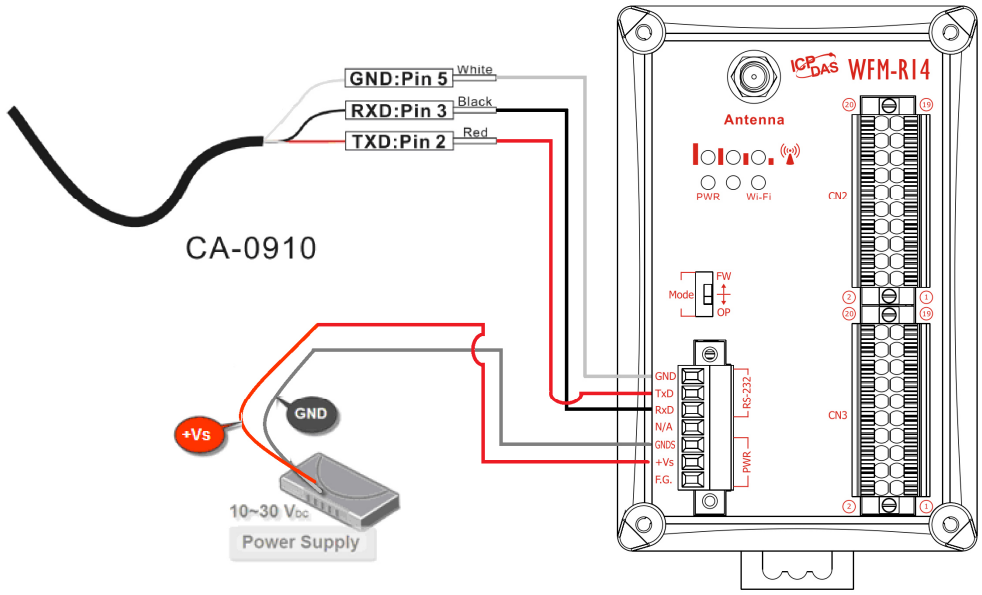


Figure 2-9**:** Downloads cable connection

Users just need to execute “Firmware_Update_Tool.exe” and follow the below steps to complete the firmware updating process.

[1] Choose “**COM**” interface and “**COM Port**”.

[2] Click “**Browser**” button to choose firmware file. (e.g. **WFMxx.fw**)

[3] Click “**Firmware Update**” button to start firmware updating process.

The result will be shown in “Firmware Update” field.

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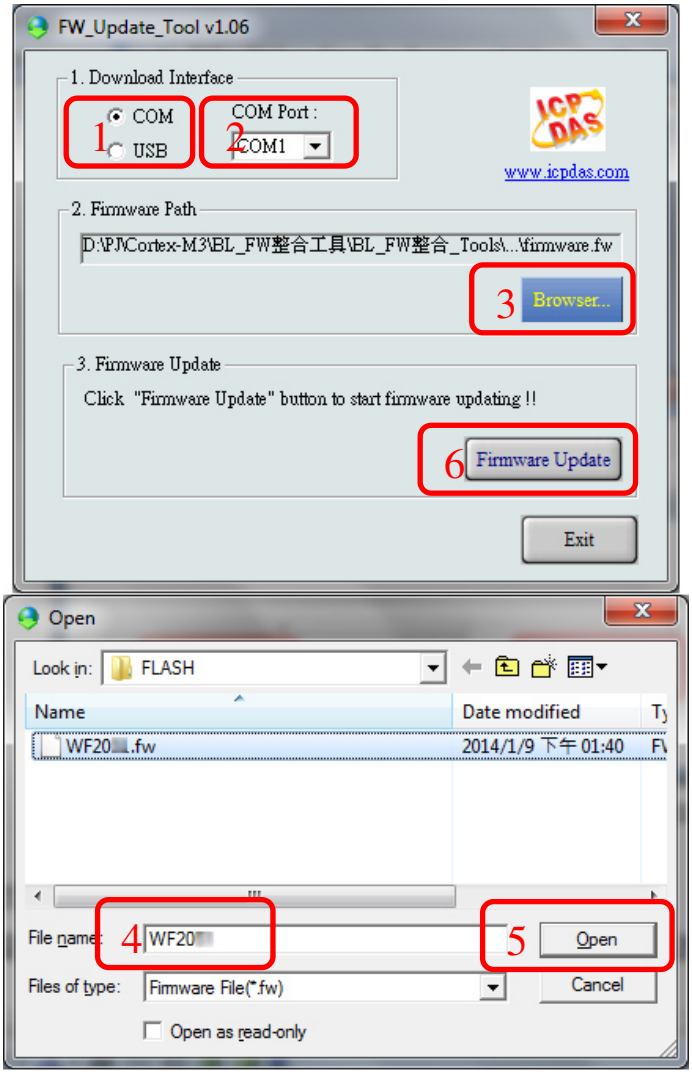


Figure 2-10**:** WFM firmware update process

The WFM firmware can be downloaded from
ftp://ftp.icpdas.com/pub/cd/usbcd/napdos/wifi/io/wfmr14/firmware

The Firmware_Update_Tool program can be downloaded from
ftp://ftp.icpdas.com/pub/cd/usbcd/napdos/wifi/io/wfmr14/software/tool/

2.5.2 Firmware Operation Mode

In the operation mode, users need to set the dip-switch to the “OP” position as Figure 2-11 and reset the power, and the WFM can run in the operation mode. In this mode, user can use the WFM series with a computer or with another WFM series module for wireless connection.

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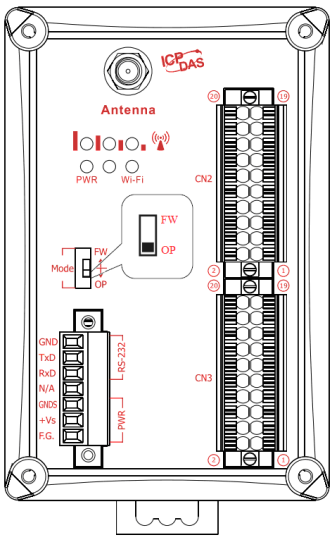


Figure 2-11: OP Position of Dip-Switch

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3. Software

The WF I/O Utility provides a simple way to test and acquire data easily and instantly for all ICP DAS WF-2000 and WFM series I/O modules without programming. WF I/O Utility can be used to configure the wireless network interface, establish a TCP connection, I/O control and I/O monitoring of WF-2000 and WFM series I/O modules.

WF I/O Utility (v2.0 or later) is a Microsoft Windows application that compatibles with Microsoft Windows XP, Vista and 7 (.NET framework 4.0 is required). You can download this program from ftp://ftp.icpdas.com/pub/cd/usbcd/napdos/wifi/io/wfmr14/software/utility/

3.1 WF I/O Utility (v2.5 or later)

The following is the main screens provided by WF I/O Utility, this utility tool can be thought as a useful tool for I/O control and monitoring on the WF-2000 and WFM series. It supplies several functions, such as UDP search, module connection and Wi-Fi configuration setting, etc.

To access the ICP DAS WF-2000 and WFM I/O module, user can double click the module listed in "Device List", and then you will see the I/O page come out. In the I/O page, it is used to access I/O data and configure parameters.

3.1.1 Main Screen

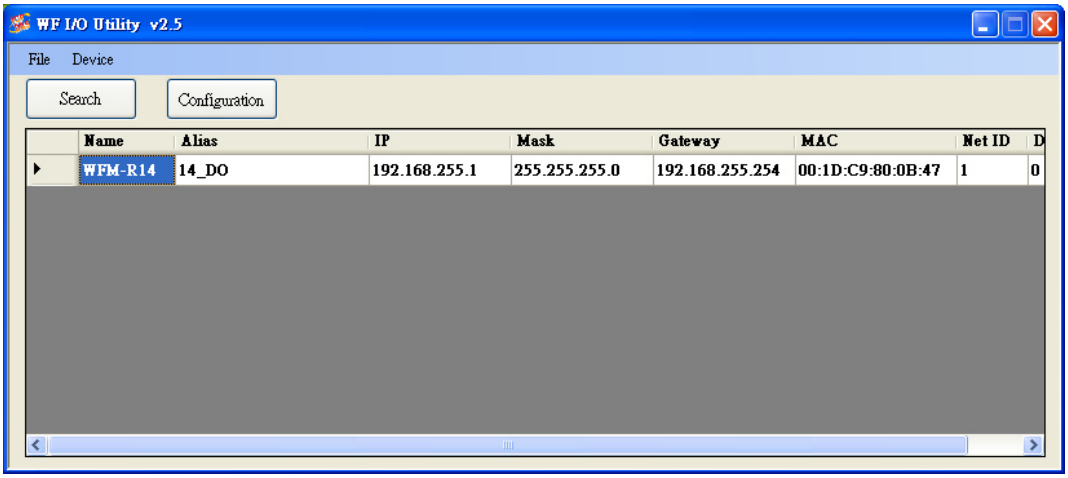


Figure 3-1: WF I/O Utility (v2.5 or later) main screen

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Menu Function:

[1] **File**

- Exit
  Press this button to exit WF I/O Utility.

[2] **Device**

- Search
  This function can search all of WF-2000 and WFM devices that support UDP communication.

- Configuration
  This function can enter the basic wireless configuration interface, as shown in Figure 3-2.

[3] **Search List**

Search list provides each item that scans from UDP and display the related information about the device, includes host name, alias name, IP address, Mask, Gateway, MAC address, Modbus Net ID and its DHCP state.

3.1.2 Configuration Screen

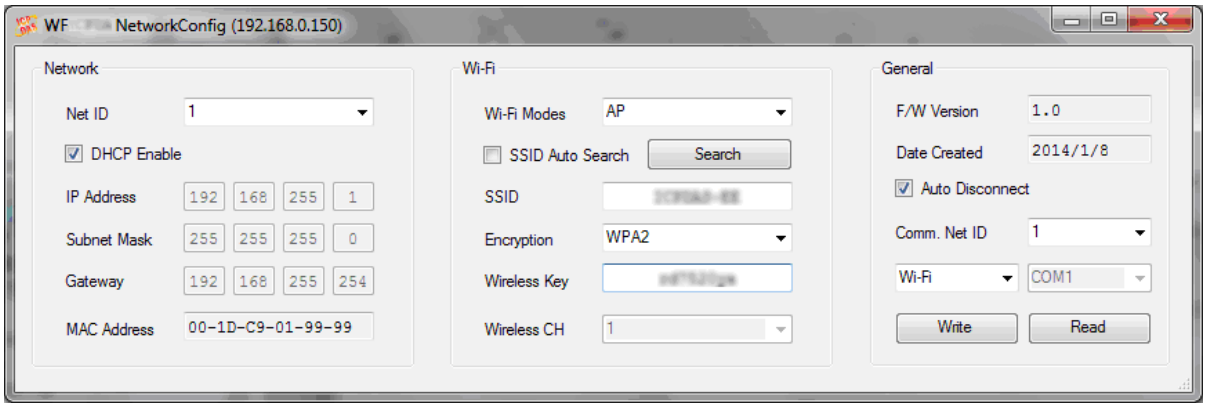


Figure 3-2**:** WF I/O Utility (v2.5 or later) configuration screen

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[1] Network

- Net ID

  The Unit Identifier in Modbus TCP/IP application data unit. (Range:1~247, Default:1)

- DHCP Enable

  If a DHCP server is present on the network, the WF-2000 and WFM modules will automatically obtain the network settings from the DHCP server when the DHCP function is enabled. (Ad Hoc mode don't support DHCP configuration)

- IP Address

  WF-2000 / WFM IP setting (Default:192.168.255.1)

- Subnet Mask

  WF-2000 / WFM Net Mask setting (Default: 255.255.255.0)

- Gateway

  WF-2000 / WFM Gateway setting (Default: 192.168.255.254)

- MAC Address

  Display WF-2000 / WFM MAC Address

[2] Wi-Fi

- SSID Auto Search

  Auto search the broadcast SSID in the air, and list SSID names in the drop-down menu.
  (It must establish a Wi-Fi connection first, and communicate with Wi-Fi Interface)

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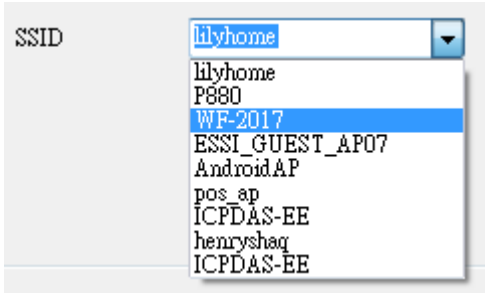


Figure 3-3: Auto search SSID list

■ Wi-Fi Configuration

Table 3-1: AP Mode

Wi-Fi Mode	AP：Use the wireless access point way for connection and transmission. (Must have Wi-Fi AP)
SSID	Service Set Identifier: Connected devices must be with the same SSID, SSID length must not exceed 20 characters.
Wireless CH	0~11：Wi-Fi transmission channel setting, connected devices must with the same channel. (In AP mode AUTO mode, the Wireless channel can be automatically selected)
Encryption	NONE / WEP64 / WEP128 / WPA / WPA2: Encryption of Wi-Fi, connected devices must with the same encryption.
Wireless Key	Key of Encryption，connected devices must with the same Key. WEP-64 ：Key length must be 10 characters. WEP-128：Key length must be 26 characters. WPA ：Key length must between 8~64 characters. WPA2 ：Key length must between 8~64 characters. Characters of key should be in range of: [0 ~ 9] or [A ~ F] or [a ~ f].

Table 3-2: AD-Hoc

Wi-Fi Mode	Ad-Hoc：Use Ad-Hoc connectivity with another WF-2000 series or Wi-Fi devices to create AD-hoc wireless network.
SSID	Service Set Identifier: Connected devices must be with the same SSID, SSID length must not exceed 20 characters.
WLCH	1~11：Wi-Fi transmission channel setting, connected devices must with the same channel.
Encryption	NONE / WEP64 / WEP128: Encryption of Wi-Fi, connected devices must with the same encryption. Not Support WPA、WPA2 encryption in Ad-Hoc mode。
Wireless Key	Key of Encryption，connected devices must with the same Key. WEP-64 ：Key length must be 10 characters. WEP-128：Key length must be 26 characters. Characters of key should be in range of: [0 ~ 9] or [A ~ F] or [a ~ f].

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[3] General

- F/W Version

  Display the firmware version of the WF-2000 and WFM I/O module

- Date created

  Display the date created of the WF-2000 and WFM I/O module

- Auto Disconnect

  Once the connection is established, if there is no data exchange within 60 sec the socket will be closed automatically when the this function is enabled

- Communication Net ID

  Modbus Net ID of WF-2000 and WFM module

- Parameter Transmission Interface

  The parameter transmission interface, that provides Wi-Fi and RS-232 interface for connection.

- Write Parameter

  It allows users to upload the parameters to WF-2000 and WFM series

- Read Parameter

  It allows users to download the parameters form WF-2000 and WFM series.

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3.1.3 Data Acquisition Screen

In the I/O page of the DI and DO, the real-time value and module configuration can be read or written in this page. The detail of all items in this form will be introduced in this section.

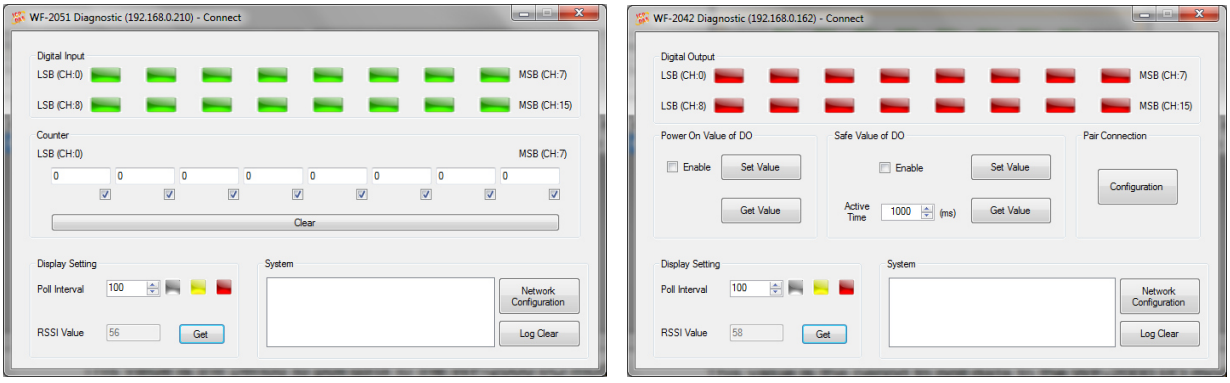


Figure 3-4**:** WF I/O Utility (v2.5 or later) DI/DO Data Monitor screen

- Digital Input Monitor Region

  The digital input value can be read in this region.

- Counter Monitor Region

  The counter value can be read or reset in this region.

- Digital Output Monitor Region

  The digital output value can be read and write in this region.

- Power On Value of DO

  The power on value of DO can be Set and Get in this region. It is loaded into the DO under 3 conditions: power on, reset by Module Watchdog, reset by reset command.

  Enable: Enabled or disable this function.
  Set Value: Set the current output status as Power On Value.

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Get Value: Get the current configuration of Power On Value.

- Safe Value of DO

  The safe value of DO can be Set and Get in this region. When the communication timeout occurs, the "Safe Value" is loaded into the DO.

  Enable: Enabled or disable this function.
  Set Value: Set the current output status as Safe Value.
  Get Value: Get the current configuration of Safe Value.
  Active Time (ms): This function is active when the communication timeout reach this setting.

- Polling Interval

  This value is the period to poll data to the WF-2000 and WFM I/O module.
  Note: The valid value is 100 ~ 5000 ms.

- RSSI

  This area will display the signal strength information by RSSI value and LED indicator when press the "Get" button.

Table 3-3**:** Signal Strength Information Display Table

Signal Strength LED Indicator		
LED Status	**RSSI value**	**Signal strength**
	1 ~ 40	High
	41 ~ 60	Medium
	61 ~ 80	Low
	0	Bad or No Signal

- System

  This area will display information for the system connection.

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■ Pair Connection

This pair connection function is a particular feature of WF-2000 and WFM that can enable a pair of DI-to-DO via Modbus/TCP. With pair connection function enabled, WF-2000 and WFM modules can poll the status of remote input devices using the Modbus/TCP protocol and then continuously write to its output channels in the background.

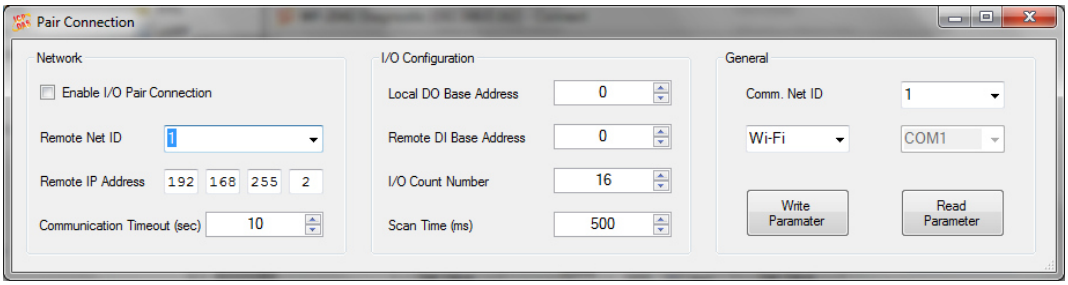


Figure 3-5: Pair connection configuration screen

Enable I/O Pair Connection: Enable/Disable I/O pair connection.

Remote Net ID: Modbus Net ID of remote device.

Remote IP Address: IP address of remote input device.

Communication Timeout (sec): The period of which the WF-2000 and WFM series is waiting for a response from the remote DI device.

Local DO Base Address: DO base address of local DO register will be mapped to remote DI device.

Remote DI Base Address: DI base address of Remote DI device that will be mapped to local DO register.

I/O Count Number: I/O count mapped from the base address.

Scan Time (ms): The frequency with the remote input device will be polled.

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4. Application Notes

Users can use a computer to communicate with the WF-2000 and WFM devices in the application. It can complete the purpose of I/O control to wireless network by this way.

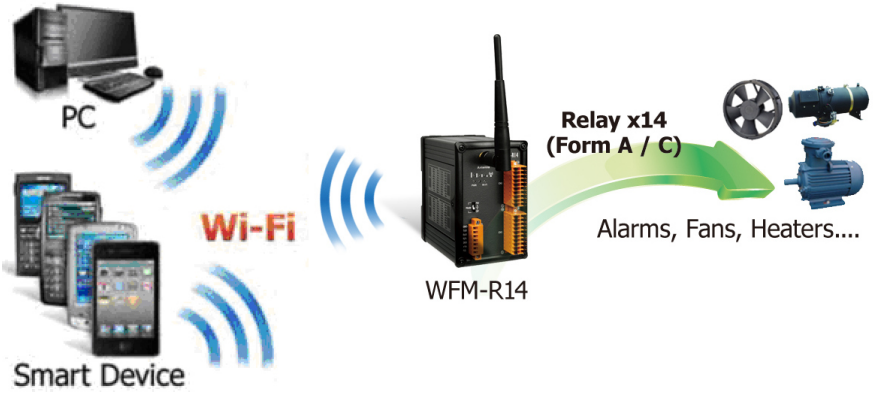


Figure 4-1**:** WFM-R14 + Laptop application architecture

4.1 Hardware Installation

Before use, associated hardware configuration, the steps described as follows：

Step 1: Checking the WF-2000 and WFM series firmware operation mode

It needs to set the DIP switch to the "OP" position (operating mode), as resetting the power, WF-2000 and WFM series will be in the operation mode.

Step 2: Serial port connection

WF-2000 and WFM series supports RS-232 serial communication. The circuit configuration is as shown in Figure 2-4.

If you do not need parameter setting, this step can be omitted.

Step 3: Power connection

Connect the power supply to WF-2000 and WFM series' power terminator, as shown in Figure 2-4.

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4.2 WF-2000 and WFM series Configuration

4.2.1 **WF-2000 and WFM Series Wireless Network Configuration**

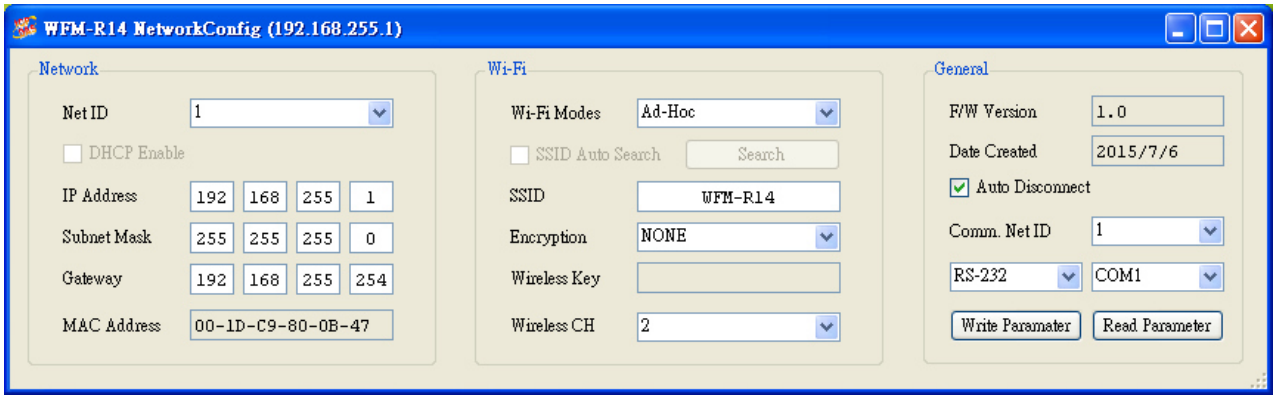


Figure 4-2**:** Configuration Interface

01、Net ID ：The Unit Identifier in Modbus TCP/IP application data unit. This case is set as "1" in Figure 4-2.

02、IP Address ：Set the local WF-2000 series' IP. Here set to "192.168.255.1".

03、Subnet Mask ：Net Mask settings. Here set to "255. 255. 255.0".

04、Gateway ：Gateway settings. Here set to "192.168.255.254".

05、Wi-Fi Mode ：Wireless network connection mode settings. Here set to "Ad-Hoc" mode. (If the mode is "AP" mode, wireless AP devices is needed.)

06、SSID ：Service set identifier. Here set to "WFM-R14".

07、Wireless Key: Wireless encryption Key. Here does not have the setting.

08、Wireless CH ：Wi-Fi connection channel settings. Here set to "2".

09、Encryption : Encryption mode setting. Here set "NONE" (without encryption).

10、Upload parameters : After completing the settings above, select the "RS-232" interface, communication "Net ID" and "COM Num". Press "Write Parameter" button to upload the parameters.

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4.2.2 **PC Connection Configuration**

01、TCP/IP Setting ：

a. Open Network connections and entry the properties setting of wireless network connections.

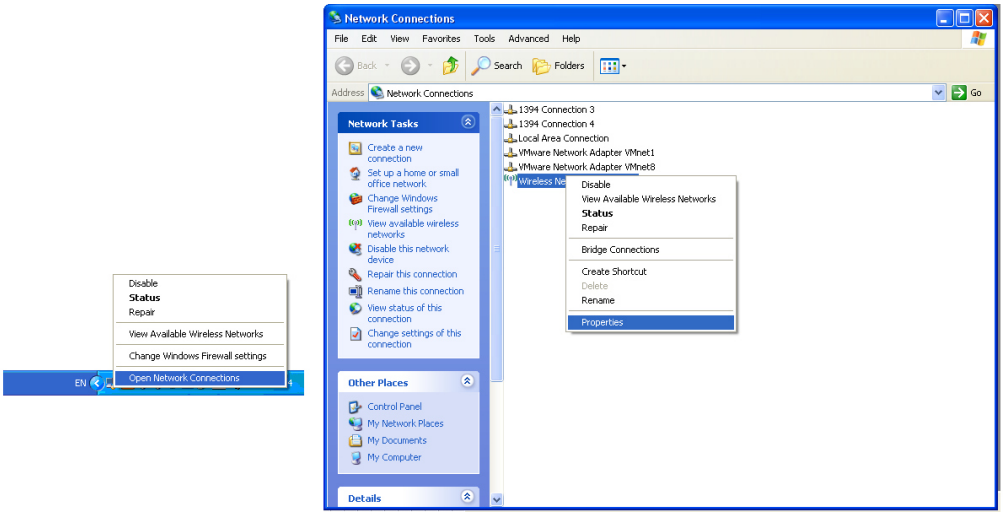


Figure 4-3**:** Properties setting of wireless network connections

b. Select the Internet Protocol (TCP/IP) and press the "Properties" button.

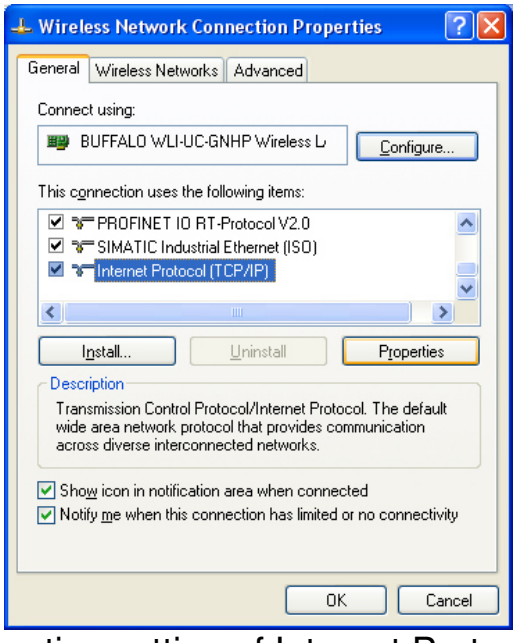


Figure 4-4**:** Properties setting of Internet Protocol (TCP/IP)

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c. Click the "Use the following IP address" and entry the **IP address** as "192.168.255.10", **Subnet mask** as "255.255.255. 0". Finally, press "OK" button.

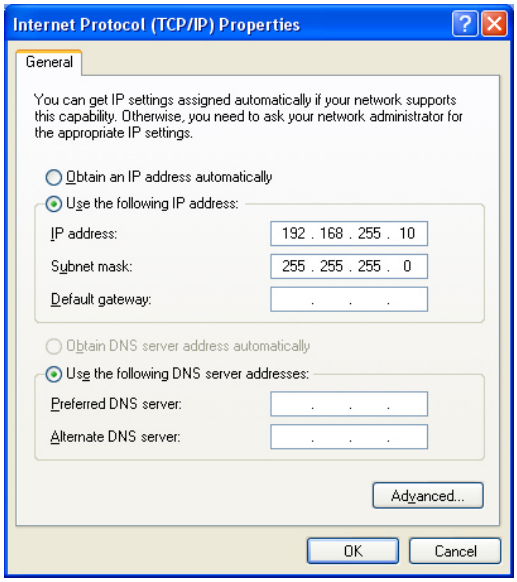


Figure 4-5**:** IP address setting interface

02、Wireless network connection ：

a. View available wireless networks and you can see the "WFxxx" wireless network in the list.
b. Select the "WFxxx" and press the "Connect" button.

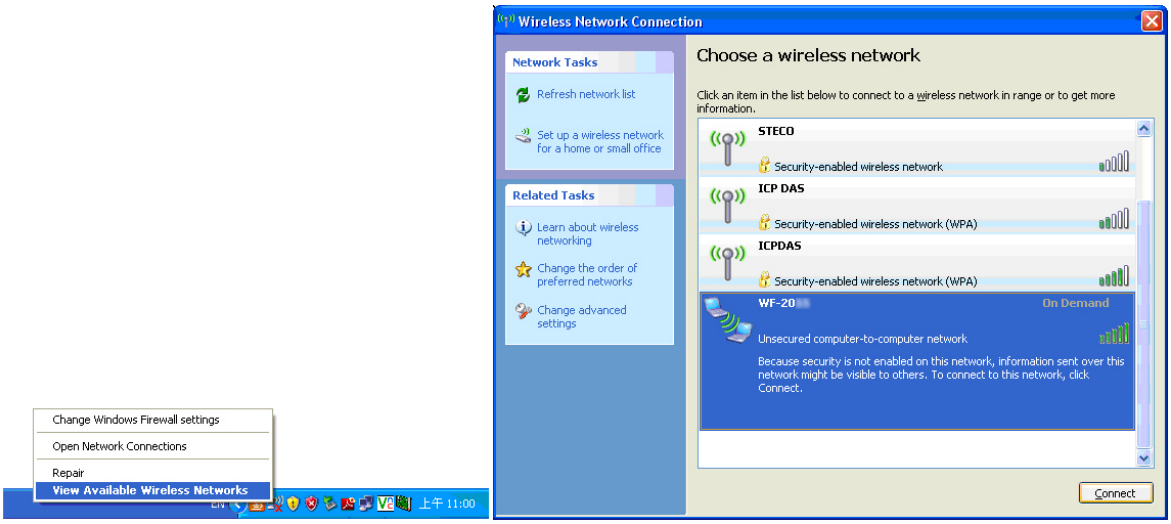


Figure 4-6**:** Wireless network connection

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c. Press the "Connect Anyway" button for the next step.



Figure 4-7**:** Connection confirm interface

d. After waiting for a while, there will appear connection success screen.

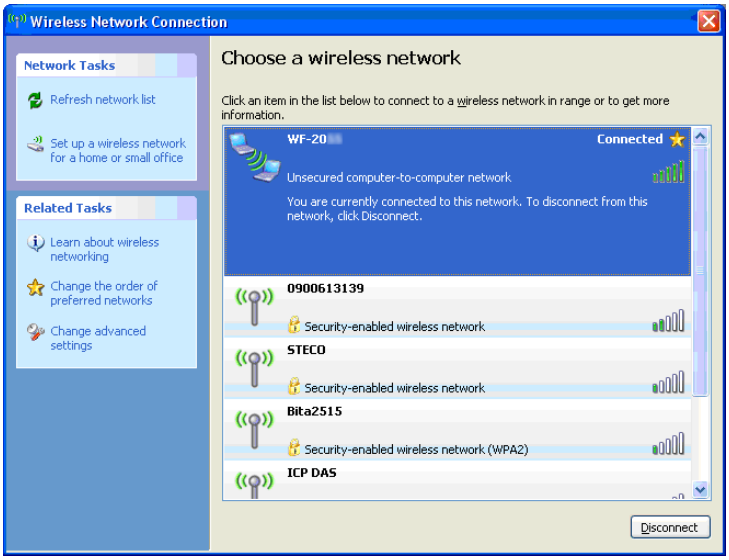


Figure 4-8**:** Connection successful interface

4.2.3 **Access I/O data**

01、**Connection with WF I/O utility (v2.5 or later)**

a. Open WF I/O utility and click the "Search" button, search list will provide each item that scan from UDP Port.
b. To access the WF I/O module user can double click the module listed in "Device List".

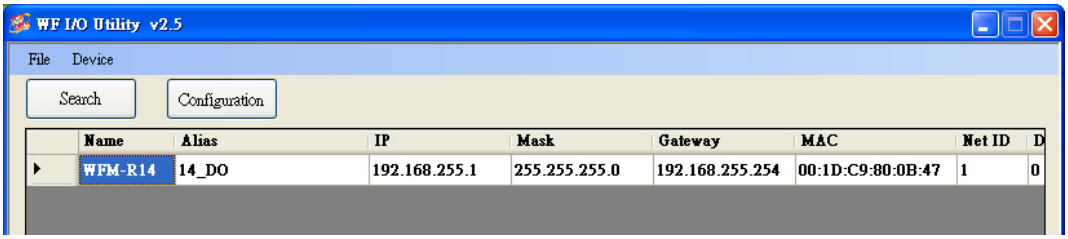


Figure 4-9**:** WF I/O search list

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c. Then you will see the I/O page come out. In the I/O page, it is used to access I/O data and configure parameters.

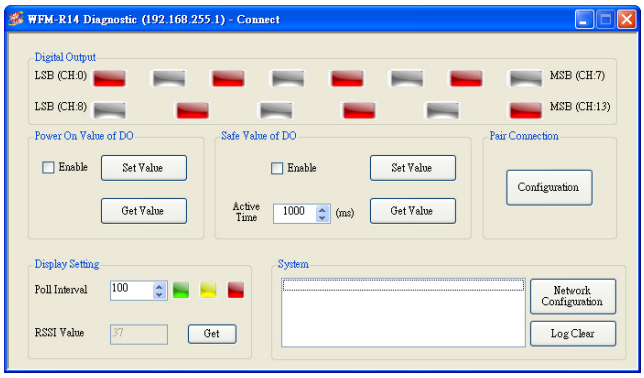


Figure 4-10**:** I/O page interface

02、**Connection with Modbus TCP utility**

a. Open Modbus TCP utility and key in the IP address as "192.168.255.1", Port as "502". Finally, click the "Connect" button.

b. If the network settings are correct, this will immediately establish a connection.

c. Use the function code "0x01", and set the Reference Number as "0x00", Bit Count as "0x0E" to get the 14 CHs DO value.

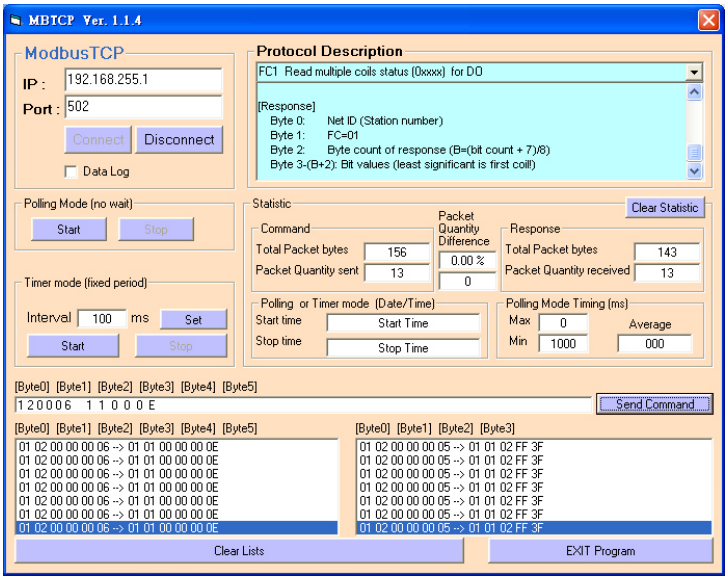


Figure 4-11**:** Read multiple coils status for DO

d. Use the function code "0x0F", and set the Reference Number as "0x00", Bit Count as "0x0E", Byte Count as "0x02" to force multiple coils for 14 CHs DO.

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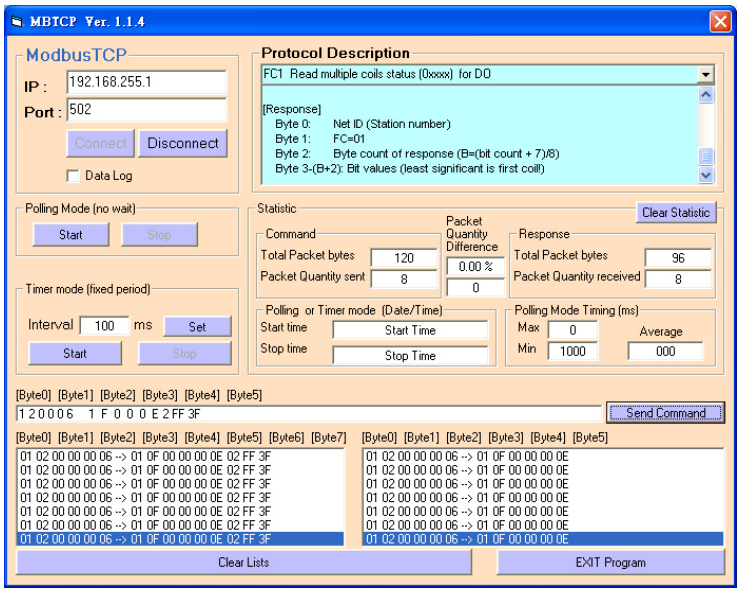


Figure 4-12**:** Force multiple coils for DO

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5. Modbus Applications

The WF-2000 is a Modbus device that allows you to access terminals data via Wi-Fi and communicates using a master-slave technique in which only one device (the master) can initiate transactions (called queries). The other devices (slaves) respond by supplying the requested data to the master, or by taking the action requested in the query.

Most SCADA Supervisor Control And Data Acquisition and HMI software can easily integrate serial devices via the Modbus protocol, such as Citect, ICONICS, iFIX, InduSoft, Intouch, Entivity Studio, Entivity Live, Entivity VLC, Trace Mode, Wizcon, Wonderware, etc.

5.1 What is Modbus TCP/IP?

Modbus is a communication protocol developed by Modicon in 1979.

Different versions of Modbus used today include Modbus RTU (based on serial communication like RS485 and RS232), Modbus ASCII and Modbus TCP, which is the Modbus RTU protocol embedded into TCP packets.

Modbus TCP is an internet protocol. The protocol embeds a Modbus frame into a TCP frame so that a connection oriented approach is obtained thereby making it reliable. The master query's the slave and the slave responds with the reply. The protocol is open and hence highly scalable.

5.2 Protocol Description

The Modbus protocol defines a simple protocol data unit independent of the underlying communication layers. The mapping of Modbus protocol on network can introduce some additional fields on the application data unit.

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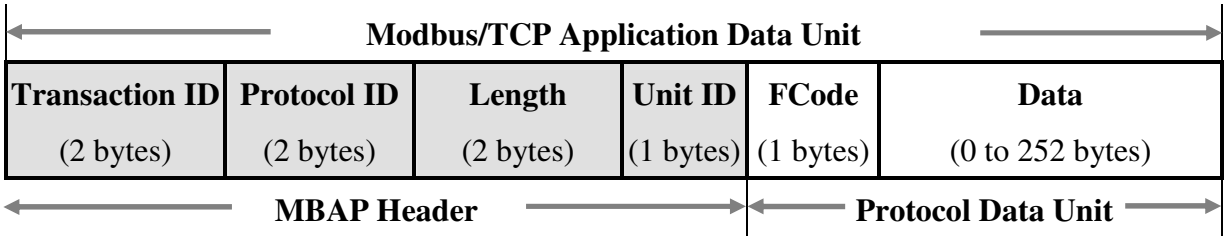


Figure 5-1**:** Modbus/TCP Application Data Unit

5.2.1 **MBAP**

The Modbus/TCP extension includes 7 additional bytes to the original Modbus protocol, which allows for transport over the TCP/IP layers.

A dedicated header is used on TCP/IP to identify the Modbus Application Data Unit. It is called the MBAP Header (MODBUS Application Protocol Header). The MBAP Header consists of 7 bytes of information:

Table 5-1: MODBUS Application Protocol Header

Fields	Length	Description
Transaction Identifier	2 bytes	Identification of Request/Response transaction – Copied from request to response
Protocol Identifier	2 bytes	0 = Modbus protocol
Length	2 bytes	Number of following bytes - Includes the Unit Identifier
Unit Identifier	1 byte	Identification of remote slave

5.2.2 **Function Code**

The function code field of a Modbus data unit is coded in one byte. Valid codes are in the range of 1 ... 255 decimal (the range 128 - 255 is reserved and used or exception responses). When a Modbus request is sent from a Modbus Client to a Server device the function code field tells the Server what kind of action to perform.

The Modbus/TCP feature of WF-2000 series module supports 7 function codes, which allows the reading and writing of data contents of

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registers.

Table 5-2: Supports Function Codes of WF-2000 series

Function Code	Descriptions
01 (0x01)	Read Coil Status
02 (0x02)	Read Input Status
03 (0x03)	Read Holding Registers
04 (0x04)	Read Input Registers
05 (0x05)	Force Single Coil
15 (0x0F)	Force Multiple Coils
16 (0x10)	Preset Multiple Registers

Any other function code request will be returned with an error response indicating the function code is not supported, as well as a request for too much data or data at a register address that not present.

5.2.3 **Data**

The data field of Modbus request sent from a client to server devices contains additional information that the server uses to take the action defined by the function code. This can include items like discrete and register addresses, the quantity of items to be handled, and the count of actual data bytes in the field.

The data field may be nonexistent (of zero length) in certain kinds of requests; in this case the server does not require any additional information. The function code alone specifies the action.

5.2.4 **Response**

If no error occurs related to the Modbus function requested in a properly received Modbus PDU (Protocol Data Unit) the data field of a Modbus response from a server to a client contains the data requested. If an error related to the Modbus function requested occurs, the field

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contains an exception code that the server application can use to determine the next action to be taken.

For example a client can read the ON/OFF states of a group of digital input or output or it can read/write the data contents of a group of registers.

When the server responds to the client, it uses the function code field to indicate either a normal response or that some kind of error occurred (called an exception response). For a normal response, the server simply echoes to the request the original function code.

For an exception response, the server returns a code that is equivalent to the original function code from the request PDU with its most significant bit set to logic 1.

5.2.5 **Data Encoding**

Modbus uses a “big-endian” representation for address and data items. This means that when a numerical quantity larger than single byte is transmitted, the most significant byte (MSB, also called the high-order byte) is send first. The following sub-topics describe the different byte of encoding and show how the data is encoded as it is within the Modbus/TCP packet.

5.2.5.1 Binary

A binary item is represented as a single bit within a data word. All binary is packed into 16-bits data words, which are accessed using function code 01 and 02. Therefore, a single register contains 16 bits of binary data, each having a specific meaning.

Table 5-3: A single register contains 16 bits of binary data

Value	1st	2nd
0xAA55 (1010101001010101)	0xAA (10101010)	0x55 (01010101)

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5.2.5.2 16-bits Word

A 16-bits word item is transmitted with the most significant byte first. Function code 03 and 04 read 16-bits items at a time; therefore, each of these data items will fit within one register that is read.

Table 5-4: A 16-bits word item

Value	1st	2nd
0x1234	0x12	0x34

5.3 Address Mapping

5.3.1 **WFM-R14 I/O Address Mapping**

Table 5-5: (0xxxx) DO address

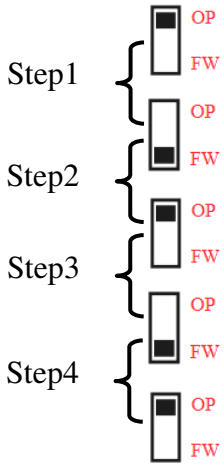
Begin Address	Points	Descriptions	Range	Access Type
00001 (0x00)	1~14	Digital Output	0=OFF, 1=ON	R/W

Table 5-6: (4xxxx) AO address

Begin Address	Points	Descriptions	Range	Access Type
40248 (0xF7)	1	Reset System	1= Reset System 247= Restore to Factory Default Settings	W

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6.Troubleshooting

Item	Problem Description	Solution
1	Power Failure (PWR LED Off)	1. Please return to the ICP DAS for inspection and repair
2	WLAN connection can not be established	1. Make sure that the service set identifier device (SSID) settings are the same. 2. Make sure Wi-Fi transmission Channel settings are the same. 3. Make sure encryption is set, encryption keys are the same way 4. Make sure antenna is connected 5. Please confirm whether there are barriers on the scene. That could result in poor signal quality.
3	TCP connection can not be established	1. Make sure WLAN connection is established successfully 2. Make sure the network configuration is good (TCP / IP Port, Local IP, Net Mask)
4	How to restore factory default  	1. Power on the WF-2000 and WFM series I/O module 2. Change the Dip-Switch position of the WF-2000 and WFM series and to complete the following steps in 5 seconds. Step1. From “OP” to “FW” position. Step2. From “FW” to “OP” position. Step3. From “OP” to “FW” position. Step4. From “FW” to “OP” position. 3. When the correct implementation of the above steps, the Signal Strength LEDs and PWR/Wi-Fi LEDS of the WF-2000 and WFM series should be turn on, and that should be turn off after 500 ms later. 4. Reset the power the WF-2000 and WFM series would back to factory defaults.

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Item	Problem Description	Solution
5	Cannot execute WF I/O Utility(v2.5 or later) with the message like the following Figure 6-1	Because the ICP DAS WF I/O Utility(v2.5 or later) requires .NET Framework v4.0,this program will automatically detect the .NET Framework v4.0 installed as well or not. Users can install .NET Framework v4.0 in the following website. Microsoft .NET Framework 4 (Web Installer) http://www.microsoft.com/en-us/download/details.aspx?id=17851 Microsoft .NET Framework 4 (Standalone Installer) http://www.microsoft.com/en-us/download/details.aspx?id=17718

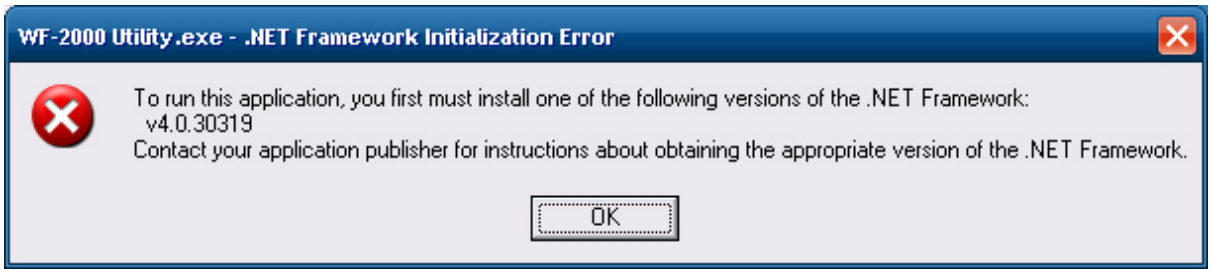


Figure 6-1: .NET Framework Initialization Error

● Technical Support

If you have problems about using the WF-2000 and WFM series I/O module, please contact ICP DAS Product Support.
Email: service@icpdas.com

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