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1. RFID Manager Connection

This demo program is mainly used for function demonstration and performance testing of the reader-writer. It also serves as example code for ModuleAPI.dll, supporting both Ethernet and serial communication.

1.1 Main Interface of the Program

Open the RFID Manager program, and its operation interface is shown in the figure:



The function menus in the upper right corner of the figure include "Tag Filter", "Inventory Statistics", "Command Debugging", "Language Switch", "Minimize", "Maximize", and "Close" respectively.

1.2 Reader-Writer Connection

1.2.1 Ethernet Connection

In Ethernet connection, the default address of the reader-writer is 192.168.1.100, the default gateway is 192.168.1.254, and the subnet mask is 255.255.255.0. The IP address of the computer

connected to the reader-writer must be in the same network segment as that of the reader-writer (for example, set the local IP to 192.168.1.11).

After correctly setting the computer's IP address, enter the cmd command in the system's "Start | Run" to enter the command operation interface, and then input `ping 192.168.1.100 -t` to check whether the network physical connection is smooth. If the connection is smooth, you can perform the Ethernet connection operation. (If the connection is not smooth, please find the device reset button and press it for 4 seconds; the status light will change color to indicate successful reset.)

The smooth Ethernet connection detection is shown in the figure:

After confirming that the IP addresses of the reader-writer and the computer are in the same network segment, click in the RFID Manager program. The IP address will be filled with the default value 192.168.1.100. Then select the corresponding antenna port. The number of antenna ports is determined by the number of antenna ports supported by the reader-writer, not by the number of antennas connected (for example, if a 4-port device has only one antenna connected, you still need to select 4 antennas).

After selecting the address and the number of antenna ports, click the green "Connect Reader-Writer" button to establish the connection. Once the reader-writer is connected correctly, you can view the device-related information.



1.2.2 Serial Port Connection

When establishing a serial port connection, you must first install the serial port driver (available at <https://ftdichip.com/drivers/d2xx-drivers/>). This applies to both scenarios of using a USB-to-serial cable and a USB-port card-issuing device. After driver installation, select the correct serial port address.

To find the serial port address, right-click the "This PC" icon on the desktop, select "Device Manager", and then check the "Ports (COM & LPT)" section in the Device Manager.



After confirming the serial port of the reader-writer, click the serial port number in the RFID Manager program. The program will automatically fill in the serial port of the first device in the

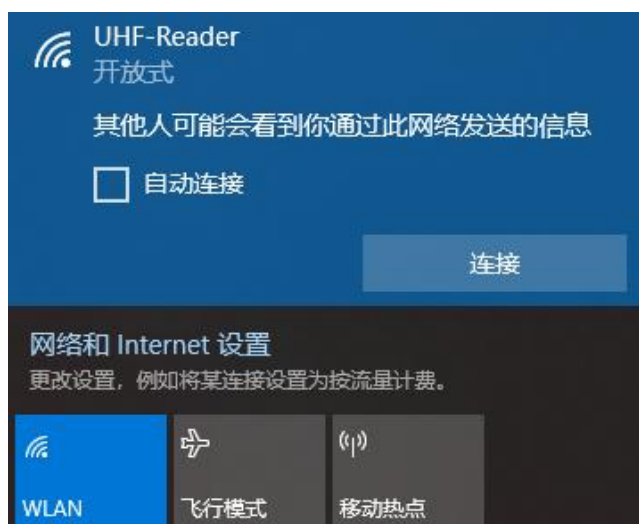
computer. If the first serial port is not that of the reader-writer, you need to modify it manually. Then select the corresponding antenna port. The number of antenna ports is determined by the number of antenna ports supported by the reader-writer, not by the number of antennas actually connected (for example, if a 4-port device has only one antenna connected, you still need to select 4 antennas).



After selecting the address and the number of antenna ports, click the green "Connect Reader-Writer" button to establish the connection. Once the reader-writer is connected correctly, you can view the device-related information.

1.2.3 WIFI Connection

For devices equipped with WIFI communication (using Huada MCU, with the mainboard software version starting with "30"), the WIFI module will automatically operate in AP mode after the device is powered on. It will emit a wireless hotspot with the SSID "UHF-Reader". This hotspot has no default password, so you can connect directly.



After connecting to the WIFI hotspot, the WIFI module will automatically assign an IP address to the host computer. Enter the device's default wireless IP address (**10.0.0.1**) in the IP address bar of the DEMO, then select the corresponding antenna port to complete the connection.



If you need the device's WIFI to access the wireless local area network (WLAN) in STA mode, you can refer to the instructions for WIFI network settings in Section 7.1.2 "Wireless Network Settings".

2. Tag Inventory

2.1 Inventory Interface

After successfully connecting the reader-writer, click "Tag Inventory" in the left menu bar to enter the inventory interface.



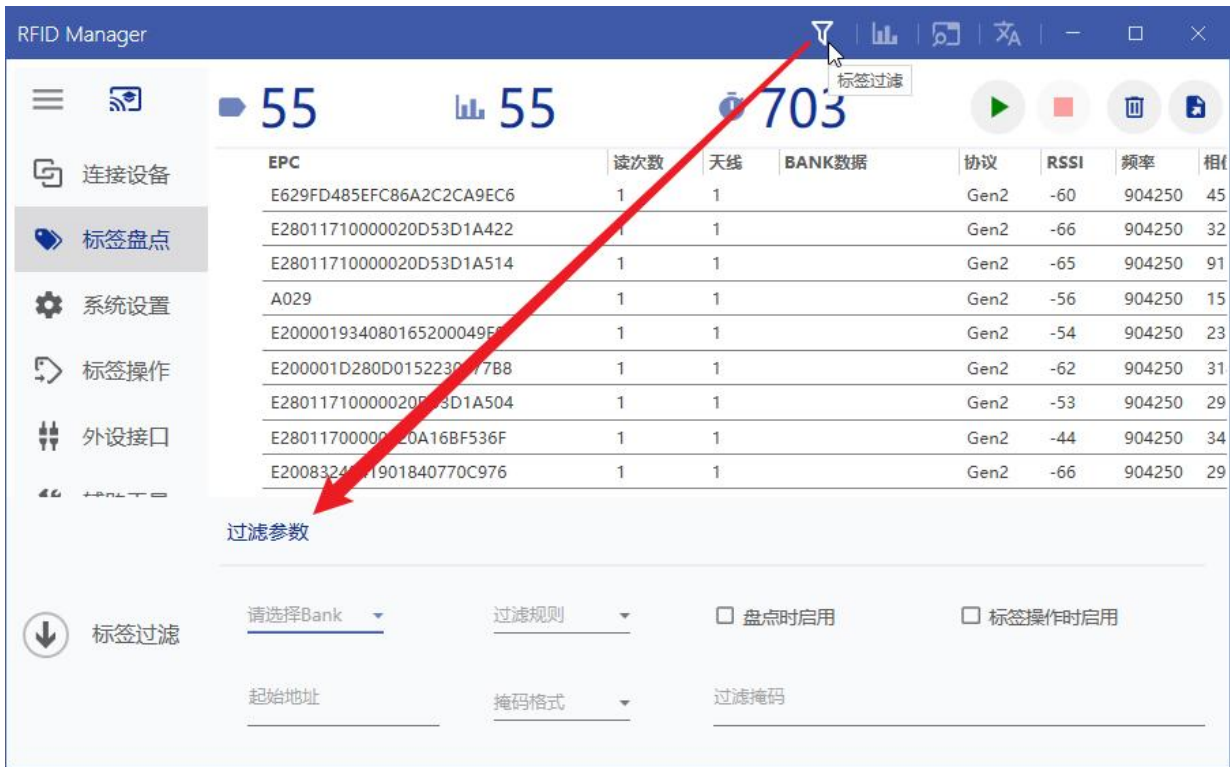
It contains 3 statistical information items and 4 operation buttons. From left to right, the statistical information includes "Number of Tags", "Tag Inventory Count", and "Time Elapsed". The operation buttons include "Start Inventory", "Stop Inventory", "Clear List", and "Export List".

Click "Start Inventory" to make the device start reading tags. Note that if an open-loop antenna is used, it cannot be automatically detected, and the antenna of the corresponding port needs to be manually enabled. For details, refer to "Antenna Settings" in Section 3.1. The inventory effect is shown in the following figure:

RFID Manager								
42		67		1250				
EPC	读次数	天线	BANK数据	协议	RSSI	频率	相位	
E201E20AB90A0E1C20218600	2	1		Gen2	-36	927250	9.5	
E28011C1A500006212691264	2	1		Gen2	-43	927250	70	
E28011710000020D53D1A52D	2	1		Gen2	-59	927250	31	
E28011C1A500006212680153	2	1		Gen2	-52	927250	37	
300833B2DDD9014000000000	2	1		Gen2	-49	927250	23	
E28011C1A500006212680242	2	1		Gen2	-45	927250	27	
E2000015860D015125101A1A	2	1		Gen2	-58	927250	35	
16EB	2	1		Gen2	-56	927250	29	
201705292035000000000856	1	1		Gen2	-58	902750	28	
E28011710000020D53D1A427	3	1		Gen2	-53	927250	27	
E28011700000020A16BF536F	2	1		Gen2	-57	927250	30	
E28011C1A500006212684143	1	1		Gen2	-46	902750	5.5	

2.2 Tag Filtering

If filtering function is needed during tag inventory or tag reading/writing operations, click the "Tag Filter" icon in the upper right corner. A tag parameter interface will appear at the bottom of the screen. After entering the filtering-related information, check the corresponding scenario to enable the function. Click the icon again or the downward arrow to hide the interface



The filter banks support EPCBank, TIDBank, and USERBank. The filtering rules are divided into "Match" and "Not Match". The "Match" rule means only tags related to the filter code will be read, while the "Not Match" rule means tags unrelated to the filter code will be read.

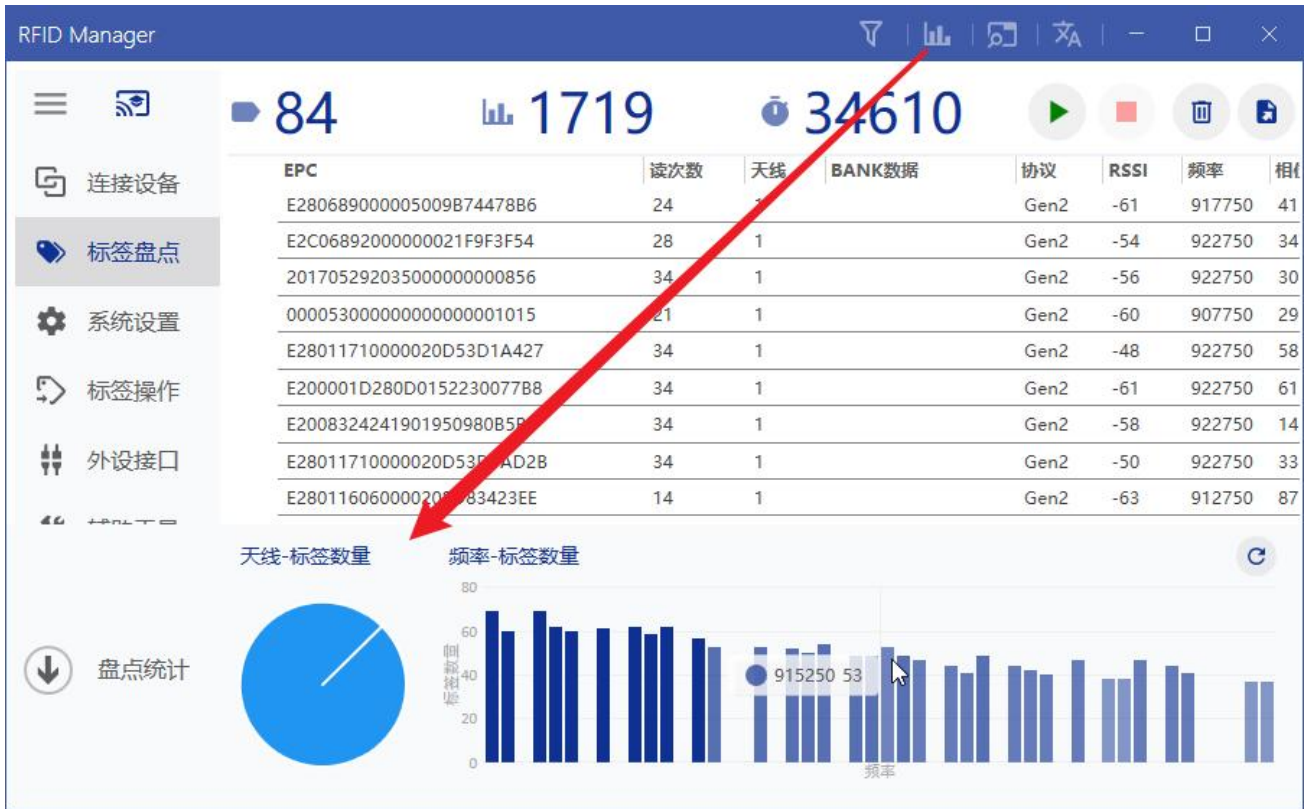
The filter formats support hexadecimal and binary. After selecting a filter bank, the filtering rule, starting address, and filter format will be filled in by default. Modify the filter parameters according to business requirements, then enter the filter mask and check "Enable during inventory" to activate the inventory filtering function. The effect of matching filtering is shown as follows:

EPC	读次数	天线	BANK数据	协议	RSSI	频率	相位
E200001D280D015225007768	1	1		Gen2	-68	904750	25
E2000015860D018525101A5B	1	1		Gen2	-67	904750	31
E200001D7507008017402D2C	1	1		Gen2	-61	904750	34
E200001D75070070174025C3	1	1		Gen2	-66	904750	30
E20081818116023324401D16	1	1		Gen2	-65	904750	29
E200001934080165200049E9	1	1		Gen2	-54	904750	61
E200001D280D0152230077B8	1	1		Gen2	-61	904750	30
E200001D750700521740180E	1	1		Gen2	-61	904750	11
E200001D750700501740180D	1	1		Gen2	-65	904750	5.6

In the above example, the first character "E" of the filter code is the first character of the EPC ID, with the starting address being 32. If you want to use another byte as the first character of the filter code (for example, "2" as the second character of the EPC ID), the starting address increases by 4 for each subsequent position. Therefore, the starting address for the filter code "2" is 36.

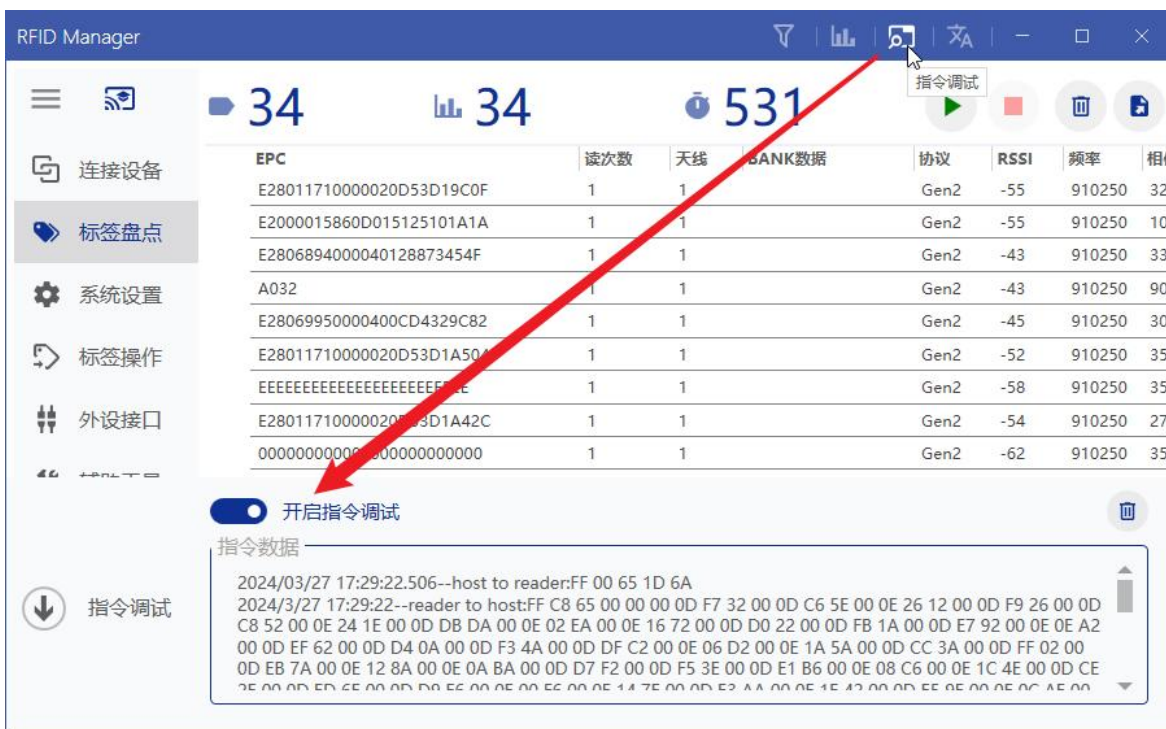
2.3 Inventory Statistics

After the reader-writer completes the inventory, click the "Inventory Statistics" icon in the upper right corner. An inventory statistics interface will appear at the bottom of the screen, which separately counts the number of reads for each antenna and each frequency point. Move the mouse over the graph to display the corresponding values. After re-conducting the inventory, you need to click the refresh icon in the upper right corner of the statistics interface to update the data.



2.4 Command Debugging

Command debugging is disabled by default. When enabled, it will record the device-related command data flow, which can serve as a reference for customers in command development.



2.5 Language Switching

The RFID Manager program comes with two language packs: "Chinese" and "English", with Chinese as the default. You can also add custom language packs (custom language packs must be created in the same format as the program's built-in language packs). Place the custom language pack in the "Lang" folder under the root directory of the RFID Manager program, then restart the program to apply it.



3.RFID Manager System Settings

3.1 Antenna Settings

The antenna settings interface displays the status of antennas corresponding to the ports detected by the device. Closed-loop antennas will be automatically detected and enabled as connected, while open-loop antennas and ports without connected antennas cannot be identified, thus showing a disconnected status and requiring manual checking to enable.

(1) Obtain: Click the "Obtain" button above to get parameters including antenna "reading power", "writing power", and "connection status".

(2) Set: Double-click the "reading power" or "writing power" of an antenna to edit the power, or modify the power of all antennas in the "Global Settings" at the bottom. Check the antennas to be enabled, click the "Set" button above, and a prompt indicating successful parameter setting will appear.

(3) Permanent Save: Parameters such as "reading power" and "writing power" can be saved permanently. After successful saving, the power saved permanently will be used for the next connection after power-off.



passwords but only one access password can be entered here, only the locked data in the Reserved Area of tags with the correct password can be read. It should also be noted that for the EPC Area, TID Area, and User Area, no access password is required for read operations, regardless of whether they are locked. Providing an incorrect access password will instead prevent data from being read.

3.2.2 Fast Mode

Working modes are mainly divided into Normal Mode (Synchronous Inventory/Cache Mode) and Fast Mode (Asynchronous Inventory/Real-Time Mode). The E-series modules enable Fast Mode by default. In Normal Mode, the inventory cycle and inventory interval together form a working cycle, and this parameter is only valid in non-Fast Mode. The inventory cycle refers to the reading duration within one working cycle, and the inventory interval refers to the rest time within one working cycle.

Fast Mode is divided into "Fast Mode (Standard)", "Fast Mode - Read Distance Priority", "Fast Mode - Read Count Priority", and "Ex10 Fast Mode". When "Fast Mode (Standard)" is selected, you can configure common inventory parameters as needed. Other modes are customized based on application scenarios, so common parameters cannot be modified for them.

"Fast Mode - Read Distance Priority" defaults to using the profile with the highest sensitivity, which is suitable for long-distance testing of a small number of tags.

"Fast Mode - Read Count Priority" defaults to using the profile with the highest reverse link frequency and sets the Target to A-B, which is suitable for scenarios where a small number of tags need to be read multiple times.

"Ex10 Fast Mode" is an intelligent algorithm mode. Its working parameters are automatically switched and configured based on the tag reading status, which is suitable for multi-tag scenarios.



3.2.3 Common Inventory Parameters

Common parameters are Gen2 protocol parameters, including Gen2Session, Profile, Gen2 Target, and Gen2 Q Value. The "Permanent Save" button in the inventory settings can only save these four parameters. Among them, the parameters corresponding to different RF-MODEs for the Profile parameter are as follows:

RF_MODE ID	Forward Link Modulation	Tari (us)	BLF (KHz)	Reverse Link Modulation	Receive Sensitivity Minimum ¹ (dBm)			Read Rate ² (tags/s)
					E710	E510	E310	
103	DSB-ASK	6.25	640	FM0	-64.0	N/A	N/A	>1000
11	PR-ASK	7.5	640	FM0	-64.1	N/A	N/A	>1000
120	DSB-ASK	6.25	640	Miller M=2	-70.3	-65.2	N/A	>600
1	PR-ASK	7.5	640	Miller M=2	-70.4	-65.4	N/A	>600

15	PR-ASK	7.5	640	Miller M=4	-76.2	-70.2	N/A	>450
345	PR-ASK	7.5	640	Miller M=4	-76.4	-71.2	-63	>350
12	PR-ASK	15	320	Miller M=2	-76.6	-71.4	-63	>350
3	PR-ASK	20	320	Miller M=2	-76.1	-71.4	-63	>300
5	PR-ASK	20	320	Miller M=4	-81.5	-75.5	-66.7	>200
7	PR-ASK	20	250	Miller M=4	-81.4	-76	-68	>150
13	PR-ASK	20	160	Miller M=8	-87.4	-80	-73.4	>70

3.2.4 Auto-Stop Inventory

The program supports configuring auto-stop conditions for inventory tests. The inventory interface will automatically stop inventory when the specified conditions are met. Currently, you can configure the specified stop time, stop tag quantity, number of cycle tests, and stop interval for each cycle. When both stop time and stop tag quantity are configured, the program will stop when either of the conditions is met.

Note: After modifying the parameters in the inventory settings, you need to click the "Set" button above; otherwise, the settings will not take effect.

For example, to set the program to stop after reading for 2 seconds, or stop after reading 110 tags, repeat the test 5 times, with a 3-second interval between each stop, you can configure as follows:



After the inventory is completed, the program will pop up statistical results. Moving the mouse to the corresponding position in the statistics interface allows you to view specific statistical data, including the percentage of full reads of the number of tags and the specific quantity of each read.



3.2.5 Card Reading-Driven Buzzer

For devices with a built-in buzzer on the mainboard, you can configure the buzzer to be driven during card reading for prompt purposes, and the driving frequency can be customized.

The on-board buzzer is set to GPO5 by default. If you need to test driving other GPO ports during card reading, you can change the driving IO port to the corresponding port.



3.3 Network Settings

The IP Settings section is mainly used to modify the device's IP address, subnet mask, and gateway. When setting the IP information, please note that the IP address, subnet mask, and gateway must correspond to each other; otherwise, the settings will not be applied.

After saving the IP settings, the reader-writer will restart, and you need to reconnect to it (using the modified IP address as the connection address).



3.4 Advanced Settings

3.4.1 Special Parameters

Frequency Hopping Mode: Only valid for devices with R2000 modules; this parameter is invalid for E-series devices.

Antenna Dwell Time: The maximum working duration (in ms) for a single antenna. In Fast Mode, if an antenna does not read a tag, it will switch to the next antenna immediately. In non-Fast Mode, it will switch after reaching the maximum duration.

Gen2 Writing Mode: The program provides two modes: "Word Write" and "Block Write", with "Word Write" as the default. Some early tags do not support "Word Write", so you need to manually change the writing mode to "Block Write".

3.4.2 Tag Data Cache Settings

During daily inventory, when encountering tags in the EPC system, the program provides three ways to distinguish tags: "Antenna number as unique identification", "Bank data as unique identification", and "Record maximum RSSI". The default is "Bank data as unique identification", and multiple options can be selected.

3.4.3 Frequency Regulation Rules

Due to different frequency band regulation rules in various countries and regions around the world, it is necessary to select an appropriate frequency band to match the reader-writer's frequency band. In the regional settings, you can set different regions, such as North America, Japan, Europe, China, etc. First, click "Obtain" to get the current regional settings. Select the region and click "Set" to complete the frequency band selection. In the frequency hopping table, clicking "Obtain" will display the currently selected frequency points; you can also change the selected frequency points and click "Set" to complete the frequency point selection. The region and frequency points can be "permanently saved".

4. Tag Operations

Tag operations support five functions: "Read Bank", "Write Bank", "Write EPC", "Lock Tag", and "Destroy Tag". Before performing tag operations, it is recommended to reduce the reader-writer's power to avoid cross-reading and cross-writing. You can also filter the tags to be operated on as needed; for details, refer to Section 2.2.

4.1 Read Tag



Taking the above figure as an example, in the operation type of common parameters, select "Read

Bank", then select the antenna for reading the tag. In the read/write operation parameters, choose the bank to be read, enter the starting address and the number of blocks to read, and finally click "Execute" in the upper right corner. If the reading is successful, the read tag information will be displayed in the operation results below.

If you need to read the Reservebank and the tag has been locked, you must enter the access password to read it successfully.

4.2 Write Tag



Taking the above figure as an example, in the operation type of common parameters, select "Write Bank", then select the antenna for writing to the tag. In the read/write operation parameters, choose the bank to be written to (TID cannot be written to), enter the starting address, and input the data to be written to the tag below. Click the "Execute" button. If the bank to be written is temporarily locked, you must enter the correct access password to write successfully.

※ Note: When the length of EPC data to be written is less than the default 96 bits, the effects of selecting "Write Bank" and "Write EPC" are different. "Write EPC" will modify the PC value in EPC according to the data length when writing data, so the read length will be the written data length.

If "Write Bank" is selected, only the data in the specified number of blocks will be modified, and the complete data will be displayed during inventory.

4.3 Lock Tag

Lock operations are divided into three types: "Unlock", "Temporary Lock", and "Permanent Lock". Tags with permanent locks cannot be unlocked or have their data modified even with an access password.

When the Reservebank is locked, an access password must be provided for reading. When other areas are locked, reading can be done without a password, but an access password is required for writing operations. (Both Access Password and Kill Password belong to Reservebank.)

Taking locking EPCbank as an example, the following steps are required:① Modify the Access Password of Reservebank. The default access password of the tag is "00000000", so it needs to be modified before use. This step requires using "Write Bank". The access password is part of the reserved area data, with a starting address of 2 and 2 blocks. Here, we will change it to "88888888".



② After modifying the tag's access password, you can perform the tag locking operation. First, change the operation type to "Tag Lock", select the antenna and enter the modified access password.

Then, in the lock operation parameters, select the lock target as "EPCbank" and the lock type as "Temporary Lock". Finally, click "Execute" to complete the locking operation.



To unlock a temporarily locked tag, you only need to follow the same operation steps. Finally, change the lock type to "Unlock" and re-execute the operation to complete the unlocking.

4.4 Destroy Tag

Once a tag is destroyed, it can no longer be read and cannot be recovered. Therefore, use this function with caution. The destruction operation steps are as follows: ① Modify the Kill Password of the Reservebank. The default kill password of the tag is "00000000", so it needs to be modified before use. This step requires using "Write Bank". The kill password is part of the reserved area data, with a starting address of 0 and 2 blocks. Here, we will also change it to "88888888".



② After modifying the kill password, change the operation type to "Destroy Tag", select the antenna, enter the kill password, and then click "Execute" to complete the destruction operation.



5. Peripheral Interfaces

GPI (General Purpose Input) and GPO (General Purpose Output) are general-purpose input and output interfaces.

For GPI input ports, users can only obtain (read) their status.

For GPO output ports, users can set (configure) their status by themselves.



6. Firmware Upgrade

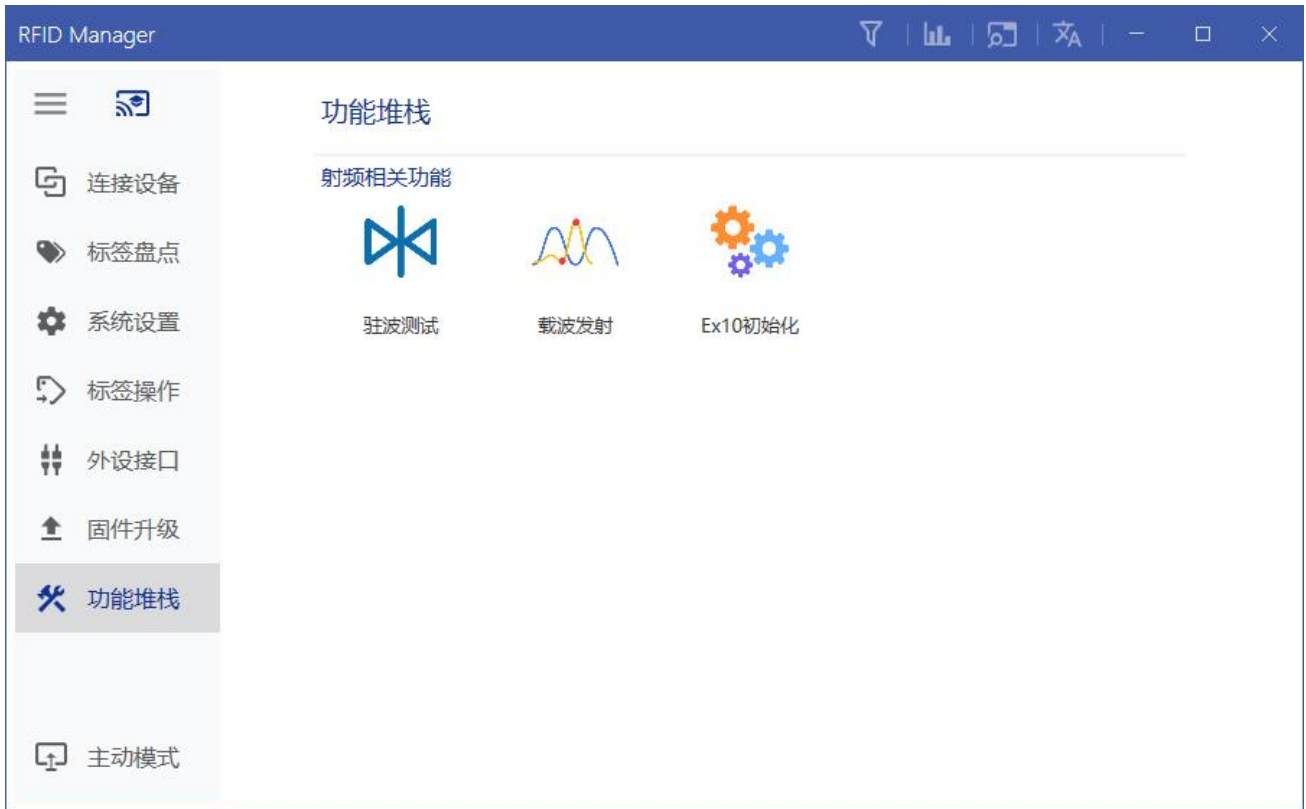
Before upgrading the firmware, please ensure the validity of the firmware file. There are two types of firmware: module firmware and communication board firmware. Module firmware usually has a ".bin" suffix, while communication board firmware usually has a ".slfw" suffix.

Enter the serial port or network port address, click "Preview" to select the firmware file, then click "Upgrade" and wait for the upgrade progress to complete. When a success prompt appears, you need to disconnect the power supply and reconnect it.



7. Function Stack

The function stack integrates various functional application and scenario application modules of the device. After the device is connected, users can enter the function stack to select corresponding functions for operation, testing, and other actions.

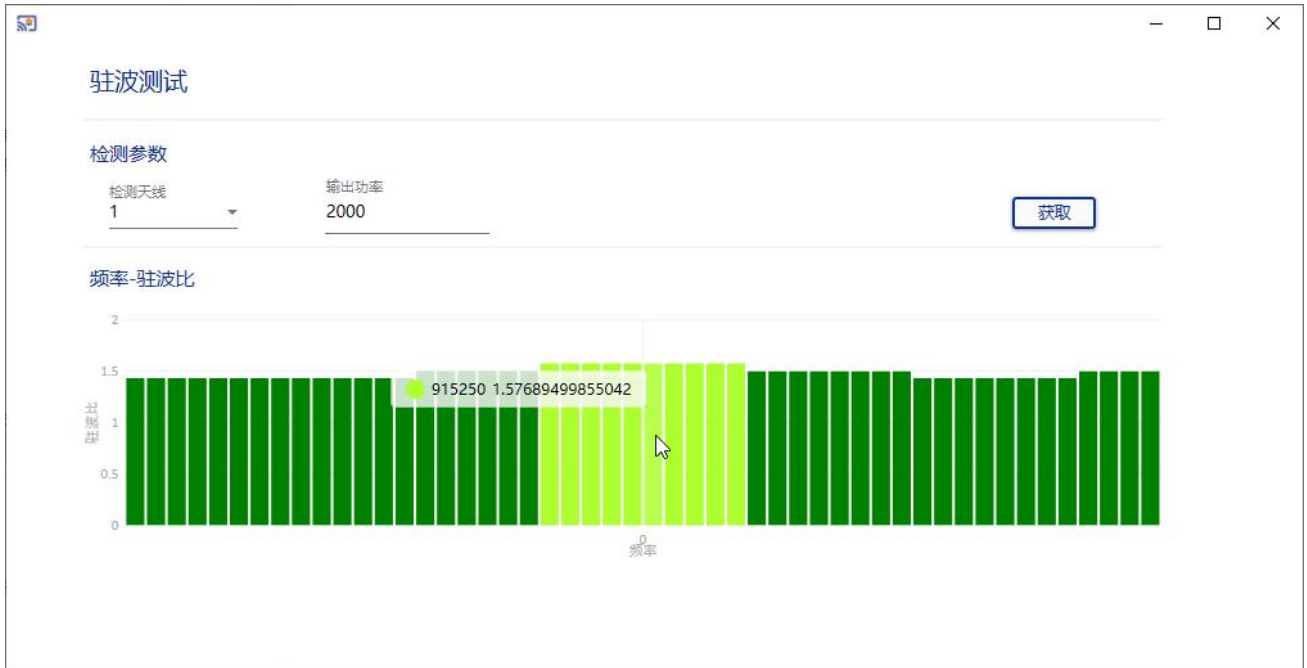


7.1 RF-Related Functions

7.1.1 VSWR Detection

Enter the antenna number and the test power (currently, the internally fixed detection power of E-series modules is 2000), then click the "Obtain" button; the result will be displayed below.

VSWR (Voltage Standing Wave Ratio) testing can detect antenna performance. A VSWR value of 1–1.5 indicates good performance, 1.5–2 indicates average performance, and above 2 indicates poor performance.



7.1.2 Carrier Transmission

Carrier transmission is mainly used in laboratories, certification institutions, etc. It requires the device to transmit fixed-frequency carrier waves/modulated waves for relevant indicator detection. Here, you can set the transmission port, power, and frequency point.



7.1.3 Ex10 Initialization

The Ex10 initialization function is only applicable to devices with Impinj E-series chips, and the configuration parameters require hardware support to execute. It is mainly used to modify the default working frequency band of the device.

First, click "Obtain" to get the current configuration of the module, then modify the relevant parameters and click "Set". After successful execution, the device needs to be powered off and on again for the settings to take effect.

It is not recommended for customers to use this function without authorization; it is advisable to

confirm with our technical staff before performing the operation.



8. Active Mode (Hualong MCU Devices)

Active Mode mainly supports customers to configure the device to work automatically after power-on. It can realize complex operations such as trigger work through the GPIO port in combination with some peripherals. This mode is divided into two major configuration items: static parameter configuration and operation parameter configuration.

※ It should be particularly noted that once the device is configured in active upload mode, the demo cannot be connected directly. You need to switch the mode to passive mode in the operation parameter configuration, or erase the current active mode before using the demo for connection.

8.1 Static Parameter Configuration

Static parameter configuration is the global configuration of the device mainboard. Therefore, regardless of whether the device works in active mode or passive mode, the static parameter configuration will take effect. Some functions in the static parameter configuration overlap with the system settings of the DEMO program. After the device runs, the parameters in the static parameter configuration shall prevail finally.

Enter the device IP or serial port number in the address bar (the serial port number needs to include the baud rate, e.g., COM3:115200), and click the "Obtain" button to view the current parameters of the device.

The static parameter configuration includes common parameter configuration, advanced parameter configuration, and inventory & tag operation parameter configuration.

In the common parameter configuration, you can modify Ethernet-related settings, select Gen2 protocol parameters, and adjust the value of RF parameters.

In the advanced parameter configuration, it mainly involves the setting of some Gen2 protocol parameters, GPO initial status, RF parameters, tag data, serial port parameters, and application initialization parameters.

8.1.1 Ethernet Settings

In this item, you can modify the IP information of the device's wired network card, and its function is consistent with the network settings in Section 3.3. In addition, it adds support for configuring the device's DHCP automatic IP assignment mode and modifying the MAC address (only applicable to devices with no fixed legal MAC address at the factory; devices with a legal MAC address written at the factory cannot be modified).



8.1.2 Wireless Network Settings

Only Hualong MCU devices equipped with WIFI communication can display this item after clicking "Obtain". The device defaults to AP mode, with the wireless network card IP address being 10.0.0.1. The host computer can communicate with the device by connecting to the hotspot with the SSID "UHF-Reader".

The default IP address and SSID can be modified, and a connection password can also be added

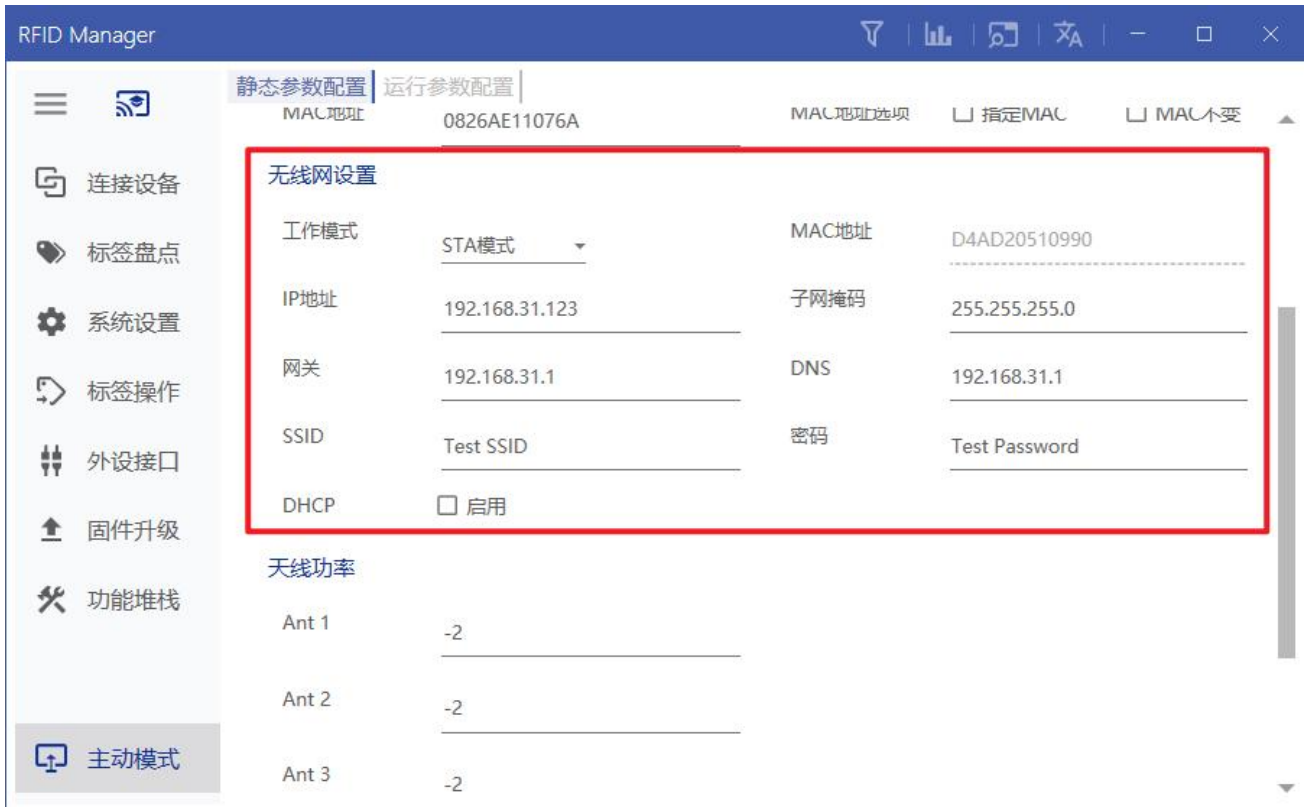
to the hotspot.



When the device needs to connect to another wireless network, change the working mode to "STA Mode". Fill in the SSID and connection password of the local area network as needed; it is recommended to assign a static IP directly for quick device association.

The device only supports connecting to 2.4G wireless networks. After filling in the configuration parameters, click "Set", then power off and restart the device to wait for network access.

The host computer connects to the same hotspot, uses the ping command to check the device's network access status. After a successful ping, use the test program to connect to the device via WIFI for testing.



8.1.3 4G Mobile Network Settings

For devices equipped with 4G communication, relevant mobile network parameters will be displayed in the static parameter configuration after clicking "Obtain". However, the 4G module is only activated in the active working mode—in passive mode, relevant parameters cannot be obtained, the network status will show "Unknown", and the IMEI code will not be displayed either.

After configuring 4G active upload, restart the device to connect to the network. The network status will then show "Connected", along with the IMEI code and signal strength (25–31 indicates good signal, 20–25 indicates average signal, and below 20 indicates poor signal).

APN parameters are mainly used for dial-up configuration in dedicated networks. Configure the parameters according to the corresponding requirements.



8.1.4 Bluetooth Settings

For devices equipped with Bluetooth communication, relevant Bluetooth parameters will be displayed in the static parameter configuration after clicking "Obtain".

The default Bluetooth name is "UHF-Reader", which supports custom modification. The MAC address cannot be modified. The Bluetooth pairing standard and custom pairing password can be configured as needed, and the function is disabled by default.



8.1.5 RF Parameters

RF parameters are used to configure the read/write power of the device. The default parameter "-2" indicates that the module's default power is used. You can also enter a specific power value (e.g., 3300 represents 33 dBm).



8.1.6 Advanced Parameters

Advanced parameters support configuring deeper-level parameters or logic of the device. Modifications here are generally unnecessary under normal circumstances.

1) GPO Initial State

This allows modifying the default level state of the GPO port after the device is powered on.

"0" indicates the default low level after power-on.

"1" indicates the default high level output after power-on.



2) Tag Data Cache Settings

Antenna Number as Unique Identifier: By default, the program aggregates data using EPC ID as the differentiating item. When the same tag is read by different antennas, it will be merged into one record. The data uploaded at the end of the upload cycle only includes the total number of reads and the ID of the last antenna that read the tag. If you need to record data of the tag read by each antenna, check this option—so that readings of the same tag by different antennas will be recorded and uploaded separately.

Bank Data as Unique Identifier: For the same reason as above, after enabling additional data reading for other bank data, if EPC IDs are the same, they will be counted as one record and only the last read data will be uploaded. After checking this option, records will be separated and uploaded based on differences in the additionally read bank data.

Record Maximum RSSI Value: By default, the program uploads the last recorded RSSI value of the tag in each upload cycle. After checking this option, it will upload the maximum RSSI value of the tag recorded within the upload cycle.

3) RF Parameters

Working Frequency Band: Options include full band (840MHz~960MHz), North America (902MHz~928MHz), China (902MHz~925MHz), and Europe (865MHz~867MHz). The default is North American band. Fixed-frequency settings are supported here: enter specific frequency points within the supported range, separated by underscores. For example, to make the device work solely at 902750KHz, 915250KHz, and 927250KHz, enter "902750_915250_927250" in the frequency hopping table.

Frequency Hopping Mode: This is a function supported by some older R2000 modules; current E-series modules no longer support it, so it generally does not need to be filled in.

Single Antenna Dwell Time: This setting forces antenna polling switching by defining the dwell time. The default dwell time is 200ms, so the reading duration should be greater than (antenna dwell time × number of enabled antennas).



4) RS232 and RS485 Serial Port Parameters

Serial port parameters mainly include those required for the Modbus protocol and common serial port configuration parameters. RS485 communication uses the standard Modbus protocol.

Baud Rate: A parameter that measures the transmission rate. The device's default baud rate is 115200.

Data Bits: A parameter that measures the actual number of data bits in communication. The setting depends on the information to be transmitted. For example, the standard ASCII code ranges from 0 to 127 (7 bits), and the extended ASCII code ranges from 0 to 255 (8 bits). The default parameter is 8 bits.

Stop Bits: Used to indicate the last bit of a single packet. Typical values are 1, 1.5, and 2 bits; the default here is 2 bits. Stop bits not only indicate the end of transmission but also provide an opportunity for the computer to correct clock synchronization.

Parity Bit: A simple error detection method in serial communication, with four error detection modes: Even, Odd, Mark, and Space. It is also possible to have no parity bit. For Even and Odd parity, the serial port sets a parity bit (the bit after the data bits) to a value that ensures the transmitted data has an even or odd number of logical high bits.



5) Application Initialization Parameters

USB Initial Type: The USB port of the reader-writer can be configured into two modes: Virtual Serial Port + HID (HID+CDC) and Virtual Keyboard + HID (HID+Keyboard). The default mode is HID+CDC, and modification is generally unnecessary.

Maximum Tag Length: The reader-writer has an internal cache for storing tags, so a maximum

length must be set for each tag data, mainly the total number of bytes of EPC plus data read from a specific bank. A smaller value allows more tags to be cached, while a larger value reduces the cacheable quantity. Typically, 400–1000 tags can be stored. To increase the number of offline stored tags, you can set this value more precisely based on your actual EPC length and whether additional bank data is read.

Event Queue Length: This primarily applies to tag entry events. In active mode, if the tag entry event is enabled, the reader-writer will immediately upload a newly read tag to meet real-time application needs. However, since the reader-writer continues operating during uploads, it must cache such tags. This parameter specifies the maximum number of such tags that can be cached.

8.1.7 Inventory and Tag Parameter Settings

1) GEN2 Parameters

Session: Optional values are Session0, Session1, Session2, and Session3.

For single-antenna readers: Session1 works best for a large number of tags (over 20) with slow movement; Session0 is optimal for a small number of tags (fewer than 20) with fast movement.

For multi-antenna readers: Session1 is most effective for a large number of tags (over 30) with slow movement; Session0 performs best for a small number of tags (fewer than 30) with fast movement.

Session2 and Session3 are parameters with opposite states, used for reading tags only once, and are rarely used.

Target: Sets the tag marking type after the reader-writer reads a tag. Selecting an appropriate marking type based on tag quantity and usage can improve tag recognition rates. Four marking types are available: A, B, A-B, and B-A. The latter two types switch from A to B and from B to A over time, respectively.

Gen2 Q Value: Generally set to automatic. For a very small number of tags, you can specify the Q value to improve efficiency. The general rule is: 2 raised to the power of Q equals the number of tags.

Profile: Corresponds to encoding and modulation parameters of the Gen2 air interface. Valid values include: -1, 0, 1, 2, 3, 16, 17, 18, 19, 20, 21, 101, 103, 105, 107, 111, 112, 113, 115. Not all readers support all values; -1 indicates no specific value is assigned, determined by the RFID module, and is the default. For parameters corresponding to different profiles, refer to Section 3.2.3 "Description of Common Inventory Parameters.



2) Inventory Parameters

Inventory Cycle Parameters: The "read duration" in the inventory cycle refers to the length of time for each inventory operation, in milliseconds, with a default value of 150 ms, which is suitable for a small number of tags. The "read interval" parameter indicates the dormancy time between each inventory operation, with a default value of 10 ms. To speed up reading, this value can be reduced, with a minimum of 0. The "inventory mode" parameter is not currently in use; it is reserved for future use and does not require setting.

Working Antennas: In active mode, the device automatically detects the VSWR of port antennas to determine the antenna connection status, and by default, enables antennas with normal detection results. If you need to specify individual antennas to work, you can configure them here. Antenna port numbers are separated by commas; for example, to enable only antennas 1 and 3, enter "1,3".



3) Tag Access Operation Parameters

Tag access operations include reading, writing, locking, and destroying tags. This parameter is mainly used to set a maximum operation duration for these operations in Modbus mode.

If the operation is completed within this duration, data will be returned to the client immediately.

If the operation remains unfinished for an extended period, a failure message will be returned once the set duration is exceeded.



4) Additional Data

For detailed descriptions, refer to Section 3.2.1 for explanations of additional data, as well as usage methods and examples of multiple BANKS.

5) Tag Filtering

For detailed descriptions, refer to Section 2.2 for explanations of tag filtering.

8.2 Operation Parameter Configuration

Operation parameter configuration is for configuring the functional parameters of the device in active upload mode. First, enter the device's IP address or serial port address (the baud rate must be included, e.g., com3:115200) to obtain the current parameters and working status.



When the device is in active mode, it can be restored to passive mode via "Erase" or "Switch":

After "Erase", the device will fully revert to passive mode. Reconfiguring active mode requires resetting relevant parameters.

"Switch" only temporarily switches the device to passive mode (facilitating DEMO connection and testing). The device will restore the original active mode configuration and retain related parameters after switching back.

8.2.1 TCP Protocol (Ethernet/WIFI/4G) Active Upload

Since data in the device's active upload mode is uploaded periodically, a fixed upload cycle time needs to be configured. Supported communication methods for TCP protocol active upload include Ethernet, WIFI, and 4G.

In the mandatory parameters:

First, enter the data sorting cycle (i.e., data upload cycle).

Select the corresponding communication method (Ethernet/WIFI/4G) in the hardware interface according to requirements.

Select "TCP" in the pop-up drop-down window.

Finally, enter the IP address and port of the upload server in the TCP parameters.



※ Before configuring the server address and port, it is recommended to first test whether the server can normally ping the device's IP or other IPs on the same network as the device to ensure network connectivity. If the server does not receive data after configuration, you can also check whether the corresponding port permissions of the server are open.

Before selecting WIFI communication for TCP protocol active upload, you should first configure the WIFI working mode in the static parameter configuration with reference to Section 7.1.2, to ensure wireless network connectivity between the device and the server.

After configuring the device for TCP active upload, you can install a network debugging assistant on the server side and use it to monitor whether data is uploaded to the corresponding port



8.2.2 HTTP Protocol (Ethernet/WIFI/4G) Active Upload

Communication methods supporting HTTP/HTTPS protocol active upload include Ethernet, WIFI, and 4G.

In the mandatory parameters:

First, enter the data sorting cycle (i.e., data upload cycle).

Select the corresponding communication method (Ethernet/WIFI/4G) in the hardware interface according to requirements.

Select "HTTP" in the pop-up drop-down window.

Finally, enter the upload URL address in the HTTP parameters.

For convenient testing, we provide a local test program. You can first upload data to the local

system via HTTP/HTTPS protocol to test the function. The download link is: <https://v2.fangcloud.com/share/8456d84a68372e0d3721efca04>. The configuration method is to fill in the server URL as `http://Local IP:12345/reader`. If using HTTPS, the port number is 22345. For example, configure it as `http://192.168.1.11:12345/reader` here.



After the settings are completed, the device will restart automatically. At this point, run the `tag_server` test program to check the data upload status:

```

{ ep: 'E2801170000021793778DD4', bd: '', at: 1, rc: 4 },
{ ep: 'AAAAAAAABBBBBBBBCCCCCCC', bd: '', at: 1, rc: 1 } ]
{ reader_name: '0826ae1107ad',
  event_type: 'tag_read',
  event_data:
  [ { ep: '00000000000000000556225', bd: '', at: 1, rc: 5 },
    { ep: 'E200001D75070070174025C3', bd: '', at: 1, rc: 1 },
    { ep: 'E2806894000050196EF39449', bd: '', at: 1, rc: 5 },
    { ep: '000000002158051105144002', bd: '', at: 1, rc: 1 },
    { ep: '000000000000000000000280', bd: '', at: 1, rc: 3 },
    { ep: 'E280116060000208F7884A2A', bd: '', at: 1, rc: 2 },
    { ep: 'E20047160E306821AD730109', bd: '', at: 1, rc: 3 },
    { ep: 'E280116060000208F7884CAA', bd: '', at: 1, rc: 6 },
    { ep: 'AAAAAAAABBBBBBBB5555025', bd: '', at: 1, rc: 1 },
    { ep: '2547', bd: '', at: 1, rc: 2 },
    { ep: '201705292035000000000856', bd: '', at: 1, rc: 1 },
    { ep: 'E2000015860D0077252017E7', bd: '', at: 1, rc: 2 },
    { ep: 'A0D8', bd: '', at: 1, rc: 1 },
    { ep: 'FC8068900004009B74470B6', bd: '', at: 1, rc: 3 },
    { ep: 'E20047159F306821A683010F', bd: '', at: 1, rc: 1 },
    { ep: 'E200001D7507008017402D2C', bd: '', at: 1, rc: 3 },
    { ep: 'E28011710000020D53D19C1A', bd: '', at: 1, rc: 1 },
    { ep: 'E200001D7310011718405ADA', bd: '', at: 1, rc: 2 },
    { ep: 'EEEEEEEEEEEEEEEEEEEE', bd: '', at: 1, rc: 2 },
    { ep: 'E20081818116023324401D16', bd: '', at: 1, rc: 1 },
    { ep: 'E2801160600000000000028', bd: '', at: 1, rc: 1 },
    { ep: 'E28011710000020D53D1A422', bd: '', at: 1, rc: 1 },
    { ep: 'E200001D750700521740180E', bd: '', at: 1, rc: 1 },
    { ep: 'E20000171517011328000572', bd: '', at: 1, rc: 1 } ] ]

```

8.2.3 MQTT Protocol (Ethernet/WIFI/4G) Active Upload

Communication methods supporting MQTT protocol active upload include Ethernet, WIFI, and 4G.

In the mandatory parameters:

First, enter the data sorting cycle (i.e., data upload cycle).

Select the corresponding communication method (Ethernet/WIFI/4G) in the hardware interface according to requirements.

Select "MQTT" in the pop-up drop-down window.

Finally, enter the relevant information in the MQTT parameters.

Taking local testing as an example, before configuring MQTT-related parameters, you need to deploy a test environment. First, install two pieces of software to build the environment:

Download link for MQTXX software: <https://mqttx.app/zh>

Download link for Mosquitto virtual server: <https://mosquitto.org/download/>

Install Mosquitto to create the environment, and modify some parameters in the configuration file after installation:

Open the mosquitto.conf file in text mode. First, modify the server's listening port: find the keyword listener port-number and change it to listener 1883 (indicating the listening port number is 1883). Remove the # at the beginning of the parameter code.

Second, modify the login permission: set allow_anonymous false (where false means login with

username and password is required; set to true for anonymous login).

Third, set the username and password: change `#password_file` to `password_file` `pwfile.example` to specify the path of the account password file (the default is `pwfile.example` in the root directory).

Fourth, create a login username and password: in the installation path, press Shift, right-click, select "Open PowerShell window here", and enter the following command: `./mosquitto_passwd -c pwfile.example admin`. You will be prompted to enter the password twice (set the password as needed).

Finally, start the Mosquitto server: in the installation path, press Shift, right-click, select "Open PowerShell window here", and enter `./mosquitto -c.\mosquitto.conf -v`. The server environment is now set up.

Next, configure the device's MQTT parameters:

Local test host address: Enter the IP address of the current computer.

Port number: Refers to the port number used by the MQTT broker, which is the previously configured 1883.

Publish topic: When the reader-writer needs to upload tag information to the server, it must be associated with a topic. This topic is a string and can be customized.

Publish QOS: There are three levels. A higher number means higher reliability of reception by the server, but it may also increase the server load.

Broadcast subscription topic: If you want to send messages to the reader-writer, the message must also be associated with a topic. The reader-writer can be pre-bound to this topic so that it can receive the message.

Broadcast subscription QOS: There are three levels. A higher number means higher reliability of message reception, but it may also increase the server load.

Unicast subscription topic: The reader-writer can be bound to multiple receiving topics. The current reader-writer supports binding two receiving topics, named "broadcast subscription topic" and "unicast subscription topic" respectively.

Unicast subscription QOS: There are three levels. A higher number means higher reliability of message reception, but it may also increase the server load.

Keepalive time: The interval at which the reader-writer sends keep-alive messages to the server.

Username: If the server is configured with username and password verification, this item must be configured on the reader-writer side.

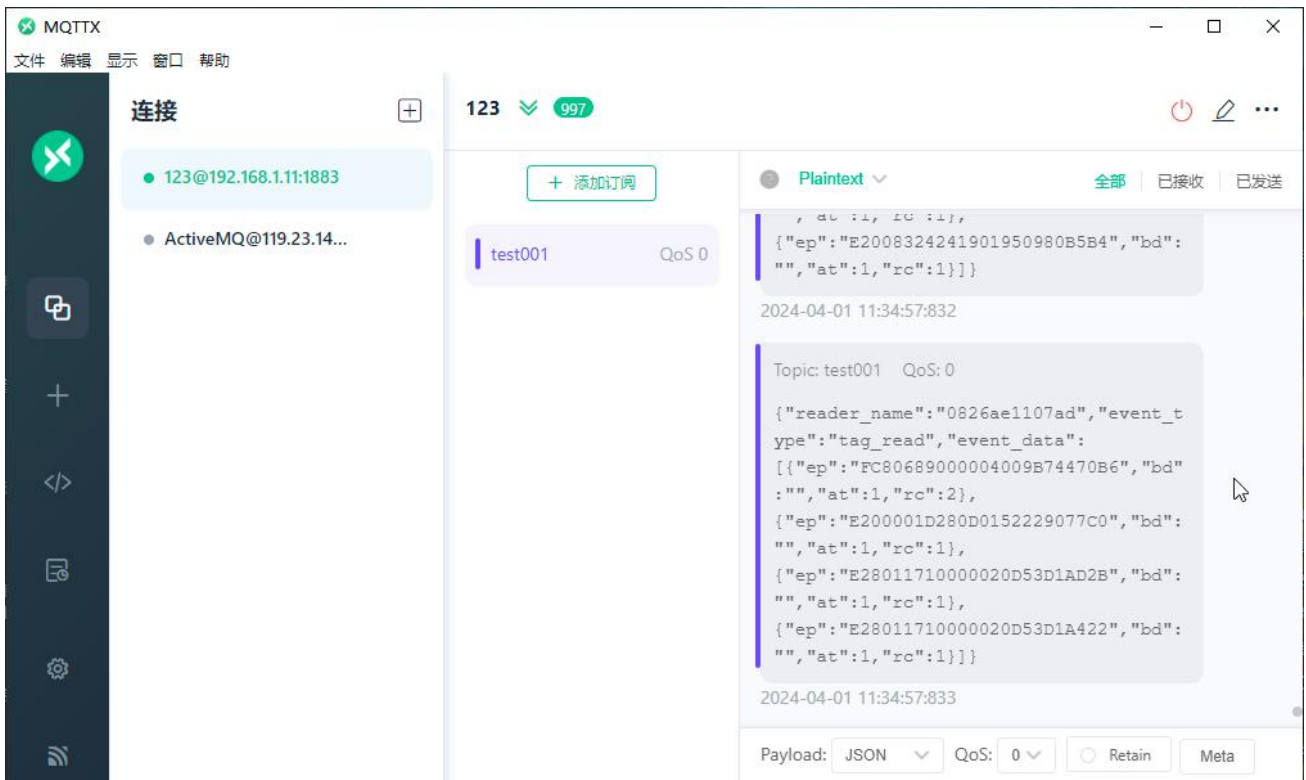
Password: If the server is configured with username and password verification, this item must be configured on the reader-writer side.

TLS one-way authentication: If the server is configured to communicate through an SSL/TLS secure TCP channel, select "Enable"; otherwise, select "Disable".

After configuring the parameters, click "Set" and the device will restart. You can see that data upload starts in the mosquitto service:

```
PS D:\Program Files\mosquitto> .\mosquitto -c.\mosquitto.conf -v
1711941780: mosquitto version 2.0.15 starting
1711941780: Config loaded from .\mosquitto.conf.
1711941780: Opening ipv6 listen socket on port 1883.
1711941780: Opening ipv4 listen socket on port 1883.
1711941780: mosquitto version 2.0.15 running
1711941899: New connection from 192.168.1.100:49152 on port 1883.
1711941899: New client connected from 192.168.1.100:49152 as 0826ae1107ad (p2, c1, k60).
1711941899: No will message specified.
1711941899: Sending CONNACK to 0826ae1107ad (0, 0)
1711941899: Received SUBSCRIBE from 0826ae1107ad
1711941899:     test002 (QoS 0)
1711941899: 0826ae1107ad 0 test002
1711941899: Sending SUBACK to 0826ae1107ad
1711941900: Received PUBLISH from 0826ae1107ad (d0, q0, r0, m0, 'test001', ... (71 bytes))
1711941902: Received PUBLISH from 0826ae1107ad (d0, q0, r0, m0, 'test001', ... (1416 bytes))
1711941902: Received PUBLISH from 0826ae1107ad (d0, q0, r0, m0, 'test001', ... (1417 bytes))
1711941902: Received PUBLISH from 0826ae1107ad (d0, q0, r0, m0, 'test001', ... (721 bytes))
1711941904: Received PUBLISH from 0826ae1107ad (d0, q0, r0, m0, 'test001', ... (1445 bytes))
1711941904: Received PUBLISH from 0826ae1107ad (d0, q0, r0, m0, 'test001', ... (1453 bytes))
1711941904: Received PUBLISH from 0826ae1107ad (d0, q0, r0, m0, 'test001', ... (333 bytes))
```

Then open the MQTTX test software and connect to the local IP address 192.168.1.11 with the port number 1883. After a successful connection, add a subscription to the topic "test001" (the one published by the reader-writer) to receive data:



8.2.4 Serial Communication Active Upload

The device supports configuring RS232 or RS484 serial ports for active upload. The serial active upload mode only supports one-to-one communication and does not allow multiple devices to upload data to the same serial port simultaneously.

In the operation parameter configuration, you only need to set the upload cycle and the corresponding hardware interface. For detailed serial port parameters, refer to the fourth item in Section 7.1.4 regarding serial port configuration instructions.

8.2.5 Wiegand Communication Active Upload

Devices with a Wiegand communication interface can be configured for Wiegand active upload. Currently supported Wiegand protocols include three types: 26, 34, and 66.

The output format can be set to either "high byte first" or "low byte first". The pulse width, pulse interval, and data output interval can all be customized according to requirements.



8.2.6 HID Mode Upload

Currently, the HID mode only has basic function implementation and has not been optimized for specific application scenarios. To prevent reading redundant tags and repeated uploads when swiping cards in HID mode, you can modify parameters based on actual results:

First, adjust parameters on the static parameter configuration interface. For example, select Session1 mode to reduce the recognition frequency, and lower the power to avoid misreading other tags.

After the static parameters are set successfully, enter the operation parameter interface for configuration: select "HID Keyboard" as the hardware interface, then wait for the keyboard to reinitialize.

After initialization, the device will upload tag EPC data via the USB port by default, and the read tags will be input into the text box through the virtual keyboard. The system input method must be switched to English; otherwise, garbled characters may appear.

8.2.7 Bluetooth Active Upload

Motherboards with optional Bluetooth communication can also use Bluetooth as the communication interface for active upload. In the operation parameters, simply configure the normal

data cycle and select "Bluetooth" as the hardware interface.

8.2.8 Advanced Parameters

It is important to note that in most cases, the GPI trigger state of our device is "0" for high level and "1" for low level, while the GPO state is the opposite: "1" for high level and "0" for low level.

1) GPI Trigger Operation

This mode controls the working mode of GPI in the reader-writer's GPIO. It receives signals via GPI to control the reader-writer for operations such as inventory. Currently, 4 modes are supported for configuration; refer to the mode description text for the function of each mode, select the appropriate mode based on usage, and check the enable button.

In event subscription, you can subscribe to GPI trigger messages and upload them synchronously.

For example, if a device has infrared sensors connected to both GPI1 and GPI2, and you want to start card reading when either sensor is triggered and stop card reading when the other is triggered, you can configure it as follows:



GPI Trigger Configuration GPI State Setting:

For GPI State 1, we set GPI0 as the trigger. Change the state of GPI1 from "1" to "0" and check "Enable"; GPI2 is in the default non-trigger state and can remain disabled.

For GPI State 2, do the opposite: enable GPI2 as the trigger state "0", and leave GPI1 in the default non-trigger state (disabled).

Trigger Mode: Select the last option: start triggering with GPI State 1 or GPI State 2, and stop triggering with the other GPI State. Note that one GPI state can configure the status of all GPI ports, not just a single GPI port.

Duration/Inversion Duration: This configures the continuous working duration after triggering, preventing repeated start/stop caused by unstable signal of the trigger GPI port.

Direction Configuration: After checking "GPI Change" in the subscribed events, the device will report GPI state changes and direction values (0 and 1). For example:

In a typical scenario, if the channel gate host is installed on the left, infrared triggers 1→2 indicate entry, and 2→1 indicate exit.

If the host can only be installed on the right (triggers 2→1 for entry and 1→2 for exit), and the channel gate is pre-installed (making on-site wiring modification difficult), you can configure the direction as "Forward" or "Reverse". Selecting "Reverse" will automatically invert the reported GPI state, eliminating the need for the client's upper computer to develop two sets of logic.

2) GPO Trigger on Tag Read

Basic GPO Trigger Setting: The GPO trigger works similarly—it is triggered after a tag is read. You can select the trigger duration and high/low level as needed (Note: The internal power supply of the reader-writer is 12V). After selecting the duration, check the corresponding GPO to enable it.

Buzzer Trigger Configuration: For devices with a buzzer attached to the board, you can separately configure GPO5 to trigger the buzzer (to make a sound when a tag is read). Change the

state to "1" to indicate triggering and outputting a high level.

This translation clarifies the logical relationship between GPI/GPO states and triggers, as well as scenario-based configurations like direction inversion. If you need to translate more device configuration content, feel free to send it over. Would you like me to organize a GPI/GPO Trigger Configuration Comparison Table that summarizes trigger conditions, applicable scenarios, and key parameters for both, making it easier to quickly compare and configure.



3) Tag JSON Format

The tag JSON format is used in active mode. When uploading tag information via HTTP/HTTPS or MQTT, you can specify the specific information items of the tag to be included in the data.

For the format type:

For ARM7 devices, select the default "new protocol".

The "old format" only needs to be configured to maintain compatibility with programs developed for previous ARM9-based devices, ensuring the communication protocol remains unchanged.



4) Advanced Options for Data Upload

The advanced options for data upload are designed to reduce data transmission volume and improve efficiency, and their default settings are generally recommended. Configuration is supported for special scenarios, with the following options available:

Client Acknowledgment: During active upload via TCP protocol, you can choose whether new data is uploaded only after receiving an acknowledgment from the client. If not selected, unacknowledged data will be resent. The default setting is no client acknowledgment required.

Reply Timeout: When acknowledgment is required (for active upload via TCP or HTTP), if no acknowledgment is received within the specified time, the data will be resent.

Binary Message CRC: Uploaded messages undergo CRC verification. This function is enabled by default.

Old Data Cleanup Time: After a communication error is resolved and communication is restored, there may be old invalid data. This setting specifies the waiting time to receive and discard such old data. The default setting is recommended.

Tag Entry Duplication: After enabling the "Tag Entry" function, new tag entry data is reported only once per cycle by default. Select Enable if you need repeated reporting of newly entered tags.

Event Subscription: Refers to the data items included in actively uploaded data. Tag data and heartbeat are enabled by default.

GPI Change: Reports the status of all GPI ports when GPI parameters change.

Empty Data: Uploads a message with no tag data at the end of a cycle (even if no tags are read), facilitating device status monitoring.

Tag Entry: Reports newly identified tags immediately during the upload cycle (by default, tags are reported uniformly at the end of the cycle). After checking this option, a tag is reported once

when first read and again at the end of the cycle. If "Tag Data" in events is unchecked, the tag is reported only once (when first read).

Time Synchronization: Requires the server to respond to time synchronization requests. The reader-writer has no internal timekeeping and must obtain time information from the server.

Reader-Writer Logical Name: The default logical name is the device's MAC address (modifiable). This name helps distinguish devices during active upload.

Heartbeat Interval: 10 seconds by default (customizable).

Send Buffer Length: The buffer must accommodate all data from the application process (i.e., the length of one message). The valid range is 1500–8192 bytes, with a default of 1580 bytes. Modification is not recommended.

Network Timeout Restart Time: If the device fails to reconnect to the server within the specified time after disconnection, it will restart automatically. A default value of "0" indicates 60 minutes.

Inventory Exception Restart Time: If the device reports internal errors due to exceptions (preventing normal inventory) and fails to recover within the specified time during active upload, it will restart automatically. A default value of "0" indicates 60 minutes.

Initial State Inventory: Configures the default state of the device after power-on in active upload mode. The current default is immediate inventory after power-on.

Remote Command Reply: Remote control commands can be sent via the communication link during active upload. By default, the device does not need to reply after responding to a command.

Custom Parameters: Custom ASCII strings are supported for specific customer needs (e.g., buzzer activation when reading a tag):

Example: #OnReadGpoAct__1_1_2000_2_0_2000_3_1_2000_4_0_2000#This string means: When a tag is read, set GPO1 to 1 (for 2000ms), GPO2 to 0 (for 2000ms), GPO3 to 1 (for 2000ms), and GPO4 to 0 (for 2000ms).

For single GPO control (e.g., GPO2): Use the parameter #OnReadGpoAct__2_1_2000#. The three values "2_1_2000" represent GPO number, target state, and duration (in ms).