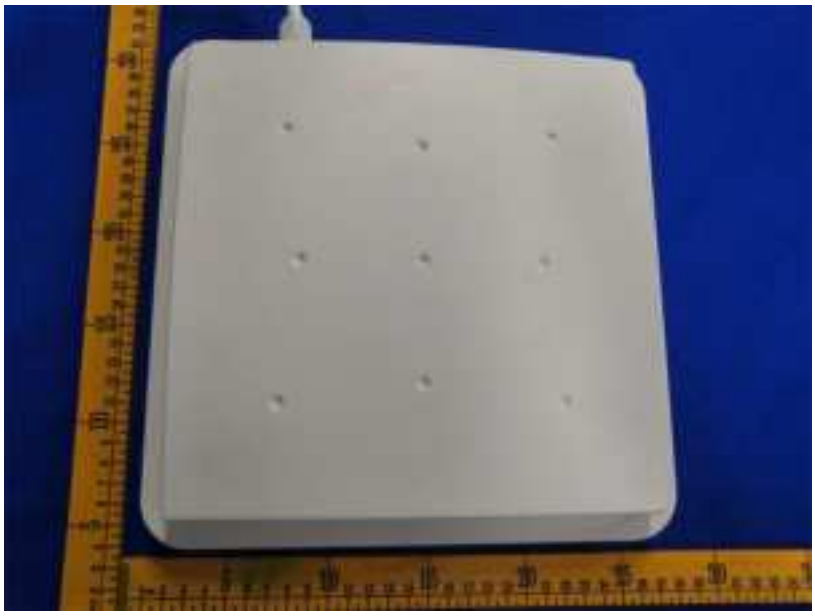
RF900I-8

User Manual

Catalogue

1. RF900I-8 View

1.1 Front View



1.2 Back View

2. RF900I-8 Configurations

2.1 Initial Use

2.1.1 Step 1: Powering the reader

Plug the **power cable** in, with the **indicator light** on and sound of a short **beep**, reader is ready.

2.1.2 Step 2: Connecting Antenna(s) to reader

Connect the antenna(s) with the antenna port:

2.1.3 Step 3: Connecting Data Line to Reader

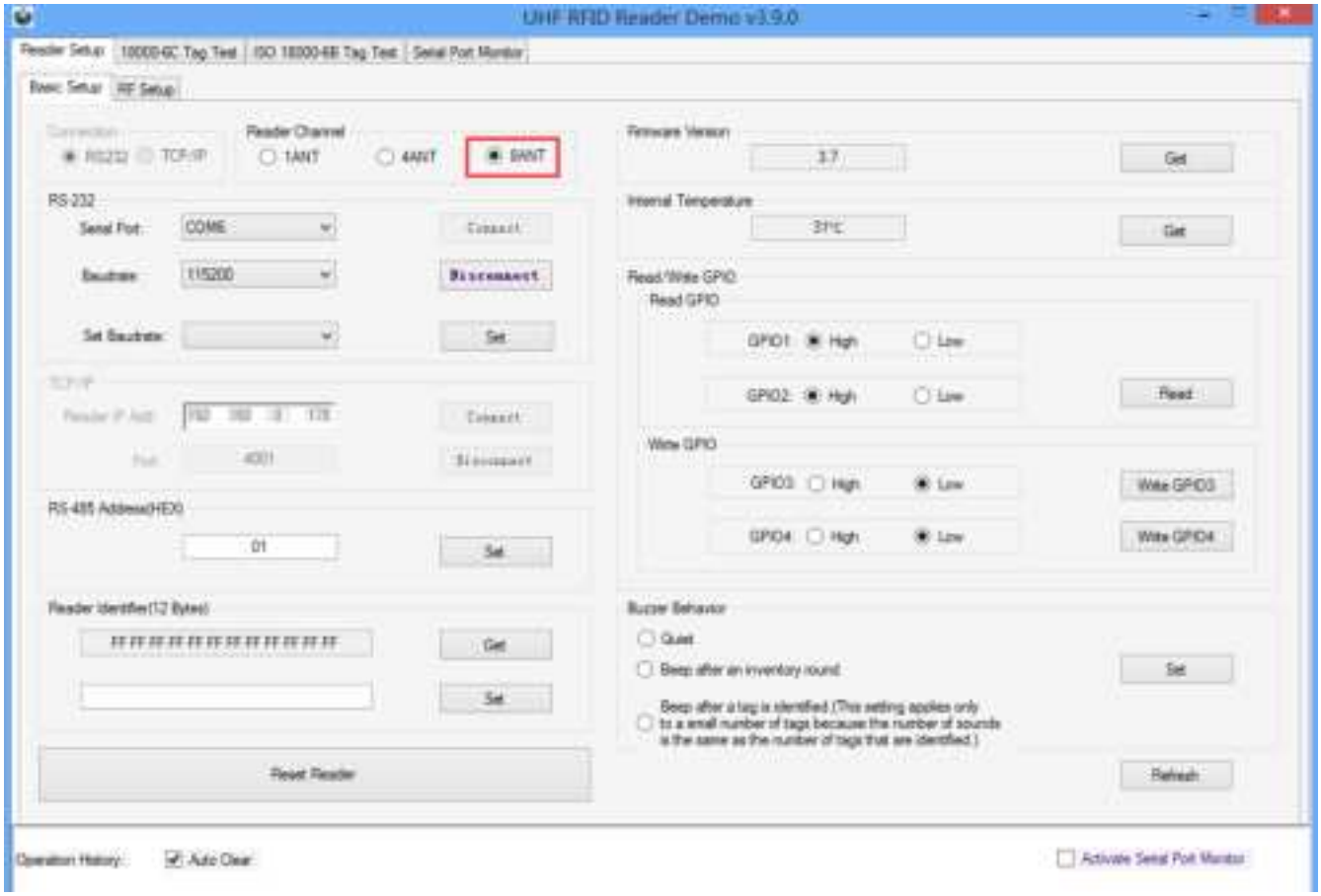
Method NO.1: You can connect the reader to your PC via RS-232 serial port:

Method NO.2: You can also connect the reader to your PC via TCP/IP:

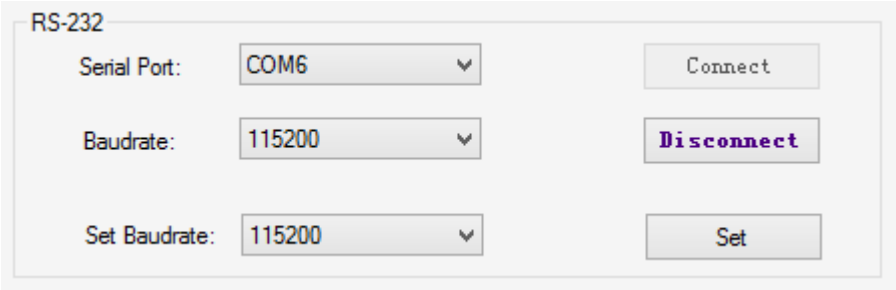
2.1.4 Step 4: Operating Reader via Demo

Put the **UHFDemo.exe**, **reader.dll**, **customControl.dll** into the same folder, and double-click **UHFDemo.exe** to run the software.

Open the software and it will shows as below:



If the reader is connected via RS232, please select "RS232" in the connection mode, select the corresponding serial port number, and select the corresponding baud rate. The default baud rate is 115200. As shown below:



Then click the "Connect " button, if the serial port is not occupied, the following information will be displayed in the **Operation History** below:

If the reader is connected via TCP/IP , you need to perform the following steps:

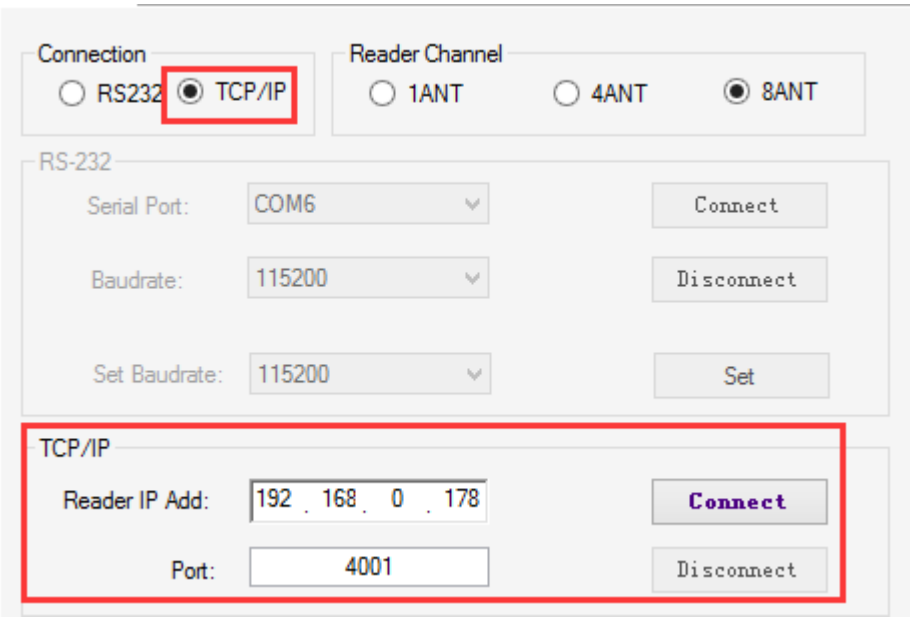
1. Make sure there is an Ethernet card in the PC.
2. Make sure that the settings of the PC and the reader are in the same network segment.

The reader as a server uses the following default settings:

IP address: 192.168.0.178

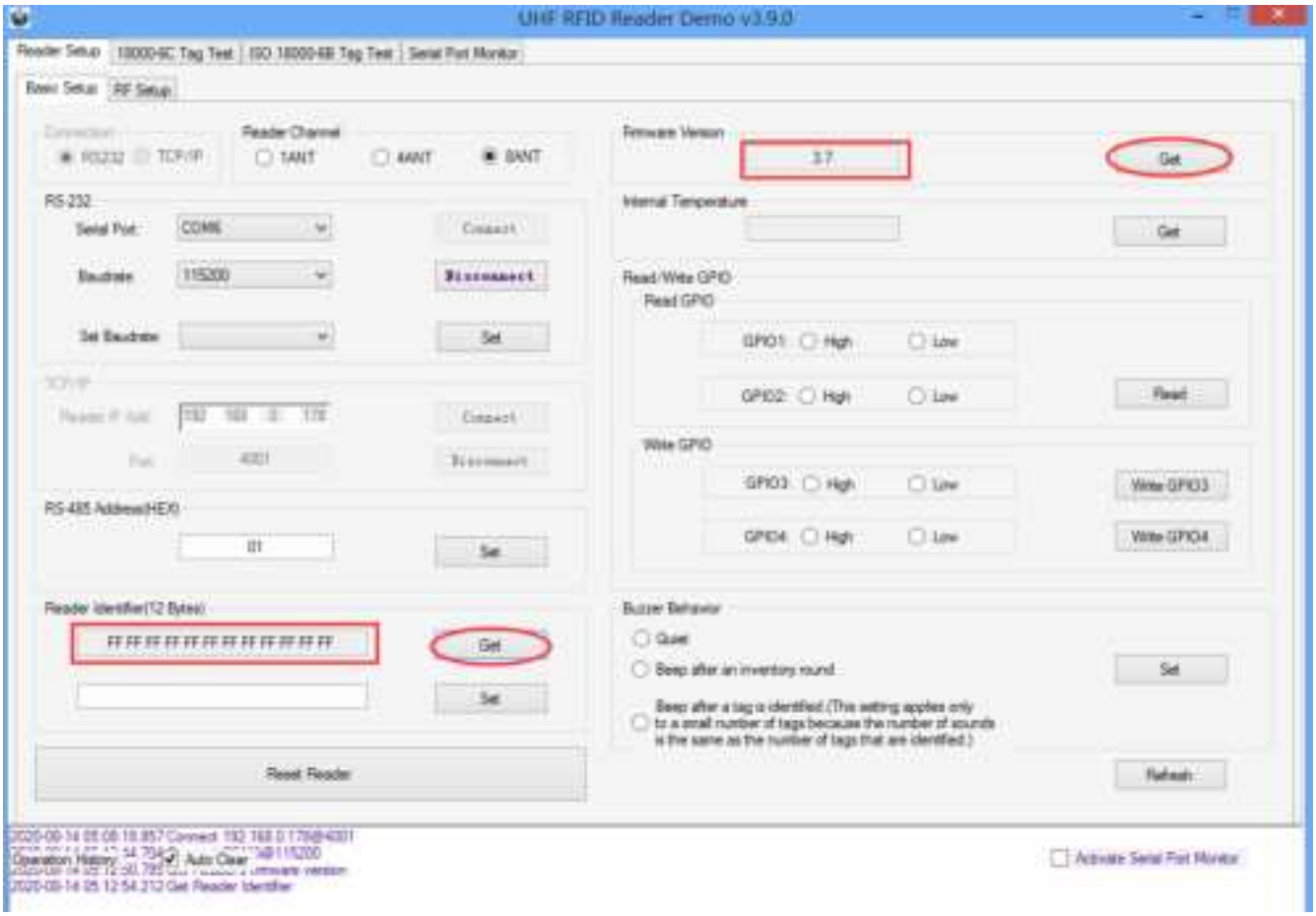
Subnet mask: 255.255.255.0
Port number: 4001
For specific TCP/IP configuration, please refer to the accompanying document: \TCP-IP configuration\USR-TCP232-ED2 network module detailed instructions-20190624.

When using the reader for the first time, please select the configuration shown in the figure below in the connection mode:



Click the "Connect "button, if the connection is successful, the following information will be displayed in the **Operation History** blow:

Next we will test the communication with the reader.
Click the button at the position shown in the oval frame in the figure below.
Click the button to read the firmware version, or click the button to read the reader identification , the interface will display the corresponding information in the rectangular frame, as shown in the following figure:



At this point, the connection between the reader and the computer has been successfully completed.

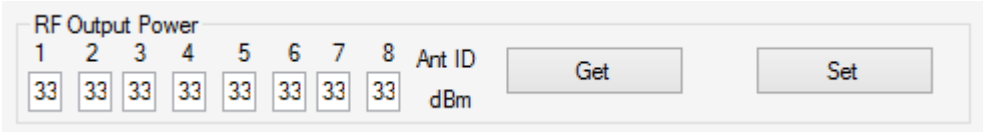
2.2 Setting RF Parameter

After successfully connecting the reader with PC, we need to set some of the most basic RF parameters, such as RF output power and RF spectrum.

RF parameter setting is in the Reader Setup->RF Setup page, as shown in the figure below:

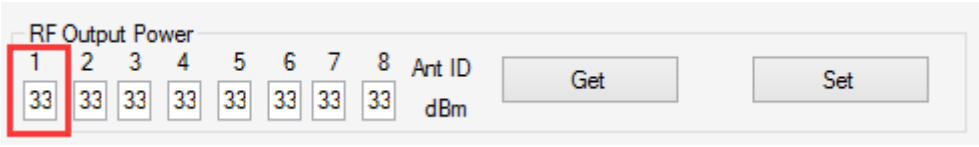
2.2.1 Setting RF Output Power

RF Output Power is the strength of RF output signal from antenna port whose unit is dBm.

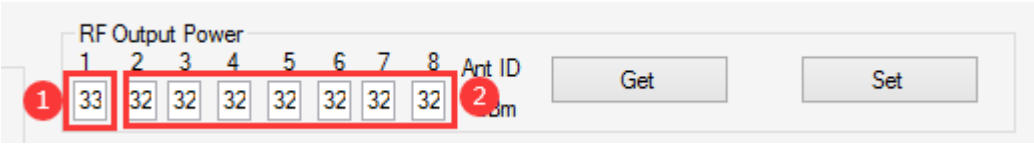


The power range is 0dBm-33dBm, in increments of 1dB. The default value is 33dBm (2W). After this value is set, it will be automatically saved in the reader and will not be lost after the reader is powered off. The default RF output power is 33dBm.

To set the output power of the 8 antenna ports at the same time, you only need to enter the required power value in port 1, and the power values of the following ports will automatically follow port 1, as shown in the following figure:



To set the output power of the 8 antenna ports independently, you need to first enter the power value you need to set in port 1, and then enter the power value you need to set in the other required setting ports, as shown in the following figure:



2.2.2 Setting RF Spectrum

In different regions, there are different requirements for the RF Spectrum. There are two ways to set the RF Spectrum of the reader.

Method 1: Use the default carrier frequency of the reader.

- Please refer to Frequency parameter tablet in Communication protocol for more information about the carrier frequency.
- Frequency range the reader supports: 865MHz-868MHz (ETSI), 902MHz -928MHz (FCC).

Set the desired carrier frequency through the drop-down box and button as shown in the figure below.

Notes:

- The start frequency and the end frequency must not exceed the scope of RF spectrum norm.
- Start frequency must be no more than end frequency.
- Set start frequency and end frequency to the same carrier frequency, the reader will work under fixed-frequency.
- When the parameter setting completes, RF carrier frequency of reader will be randomly hopping in the scope of

limited range.

- The default RF spectrum norm is FCC (902MHz-928MHz).

Method 2: Set the RF spectrum manually.

The user customizes the spectrum through three parameters: the starting frequency (unit is KHz, such as 860MHz, you need to enter 860,000), the interval between frequencies (the unit is KHz, the maximum frequency interval is 2500KHz, if you enter 2.5MHz, you need to enter 2500), the number of frequency points (Select the number of frequency points according to the input start frequency and frequency interval. The recommended maximum operating frequency range is 860MHz ~ 960MHz. When the number of frequency points is 1, work at fixed frequency according to the start frequency).

For example, if you need to customize the working frequency range from 860MHz to 960MHz, you can get the starting frequency of 860MHz, the frequency interval is 2.5MHz, and 40 frequency points are needed. Then enter the corresponding parameters as shown in the figure below. After this value is set, it will be automatically saved in the reader and will not be lost after the reader is powered off.

2.2.3 Antenna Connection Detector

The function of antenna connection detection is to check whether the antenna is connected to the port before reading and writing tags. If there is no connection, notify the user that the antenna is not connected.

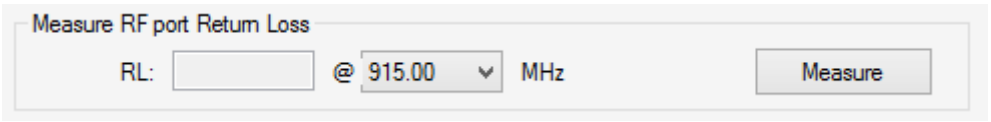
Before use, the user needs to turn on this function and view it through the interface shown in the figure below. The interface for setting this function is shown in the figure below:

The sensitivity of antenna detection is set by the user. The sensitivity of antenna detection is the return loss value (Return Loss) of the antenna port, and the unit is dB. The larger the value, the better the impedance matching requirement between the antenna and the antenna port. Generally speaking, for antennas with an antenna port standing wave VSWR $\leq$ 1.3, this threshold can be set to 3 to 6 dB. For near-field antennas, ceramic antennas or handheld terminal antennas with VSWR $\geq$ 1.3, the sensitivity can be lowered even lower. If the return loss threshold is set to 0, it means that this function is turned off, and the antenna connection status will not be detected before reading and writing tags.

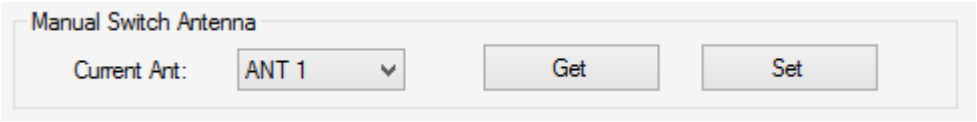
If antenna is not connected, Reader will stop to operate tags with the following screen display:

2.2.4 Measure RF Port Return Loss

Measure the return loss of the antenna port on the interface as shown in the figure below:



Before measuring, you need to set the current working antenna port. The default antenna working port is 1. When measuring the return loss of other antenna ports, you need to set the corresponding working antenna.



In the actual application environment, the working status of the environment in front of the antenna can be preliminarily determined by reading the return loss value of each frequency point of the current working antenna. The larger the return loss value, the smaller the electromagnetic wave reflection in front of the antenna. If the measured return loss of the antenna product port is less than or equal to 10dB, it indicates that the electromagnetic wave reflection in front of the antenna is too large. At this time, it is necessary to reduce the RF output power or adjust the antenna installation position. The return loss of the antenna port and VSWR are two different expressions of the same concept. The corresponding relationship is shown in the following table:

Return loss of antenna port (dB)	Standing wave ratio (VSWR) of antenna port
40	1.02
26	1.11
20	1.22
18	1.29
15	1.43
10	1.92

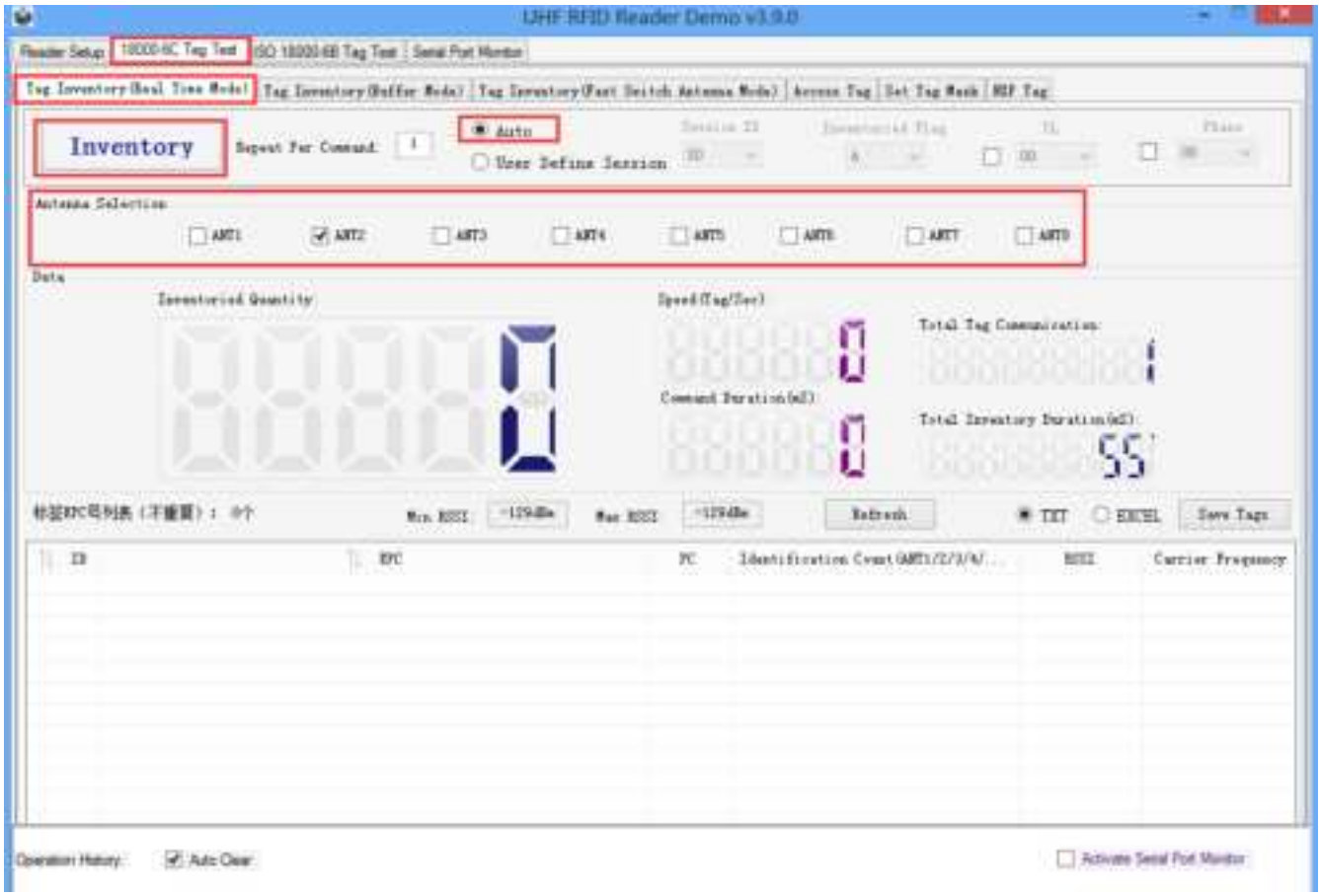
2.3 ISO-18000-6C tag inventory

After correctly connecting the reader and setting the RF parameters, you can read and write tags.
Inventory tags, that is, recognizes the EPC code of multiple tags at the same time.This is the core funtion of UHF RFID Reader and one of the standards to judge a reader's performance.

2.3.1 Real Time Mode

The most commonly used mode is the real-time mode, which means uploading immediately after reading the EPC number of the tag. The user can get the EPC number of the tag as soon as possible.
The advantage of the real-time mode is that the multi-tag recognition performance is good, the response is fast, and the user can get the tag data in the first time without delay. And RSSI (tag signal strength indicator), frequency

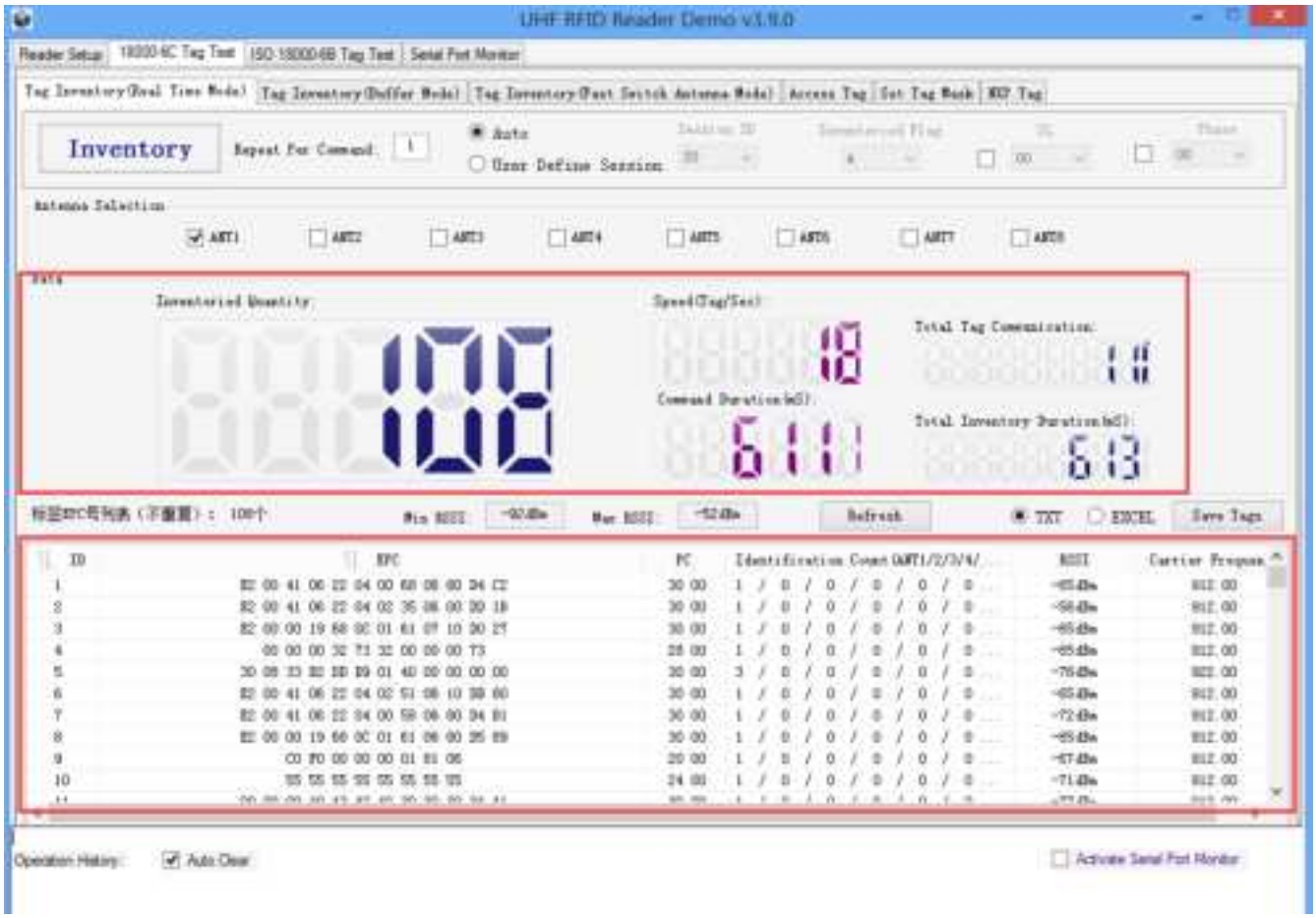
parameter (carrier frequency when the tag is read) also change in real time. But it will generate a lot of data. The reader adopts a dual-CPU architecture. Two different chips are responsible for reading tags and transmitting tag data. Reading tags and transmitting tag data are parallel, without interfering with each other, and not occupying each other's time, so users do not need to worry Data transmission will reduce the read performance of multiple tags. Therefore, the multi-tag recognition performance in real-time mode is the best.



Inventory tags in real-time mode.

Click Tag Inventory (Real time mode) page to switch the software interface to real time mode. Manually tick the connected antenna. Then set the number of cycles for each command. The meaning of this parameter is the number of repeated executions of the inventory command. For example, if it is set to 1, each inventory command executes an anti-collision algorithm. Set to 2, then each inventory command will execute the anti-collision algorithm twice, and so on. The default setting is 1 (the bottom layer of the reader does not support setting other values).

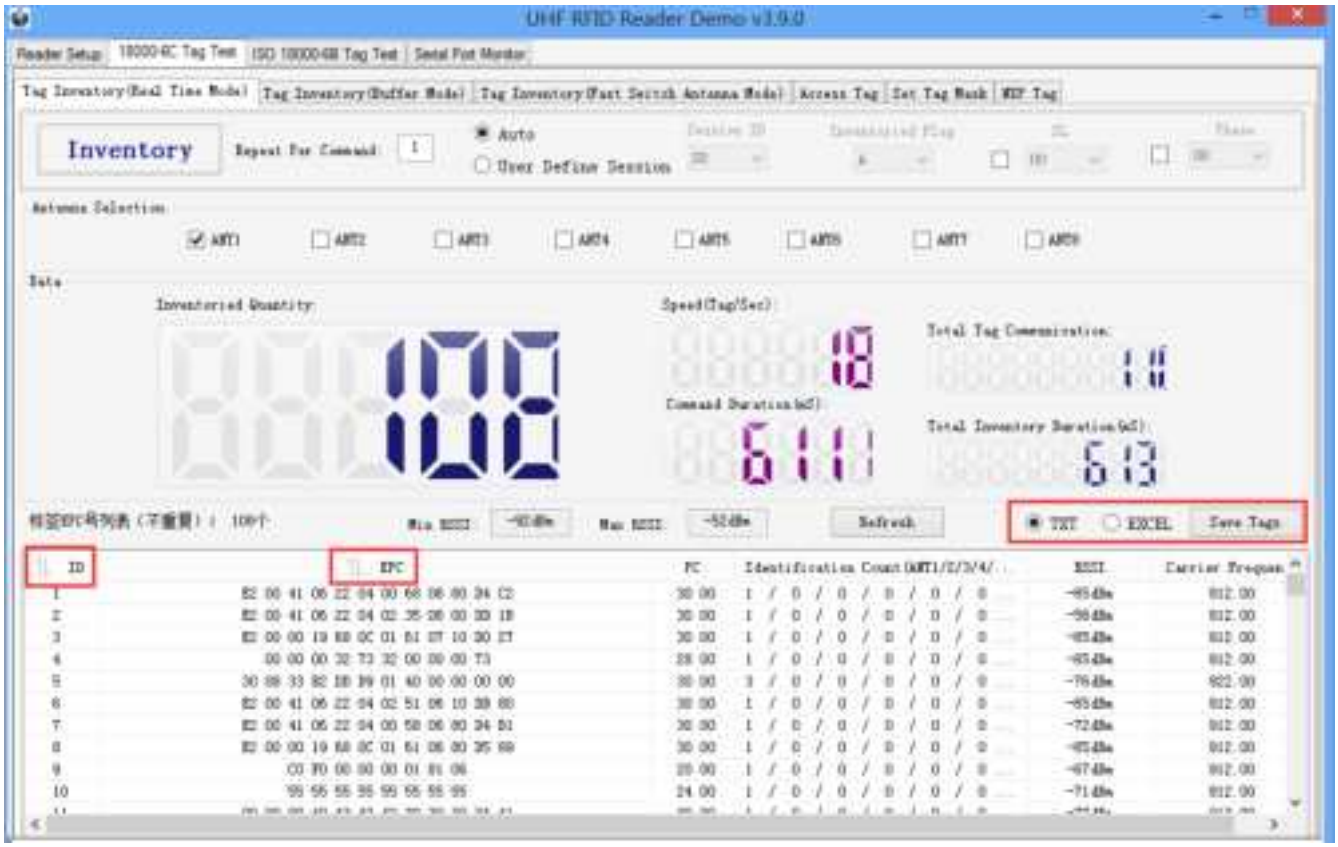
Next, click the "Inventory" button and read the EPC number of the tag. We can see that the EPC data of the tag is immediately uploaded and updated in real time. If you do not click the "Stop" button, the reader will keep real-time inventory tags, as shown in the following figure:



The meaning of the data display is as follows:

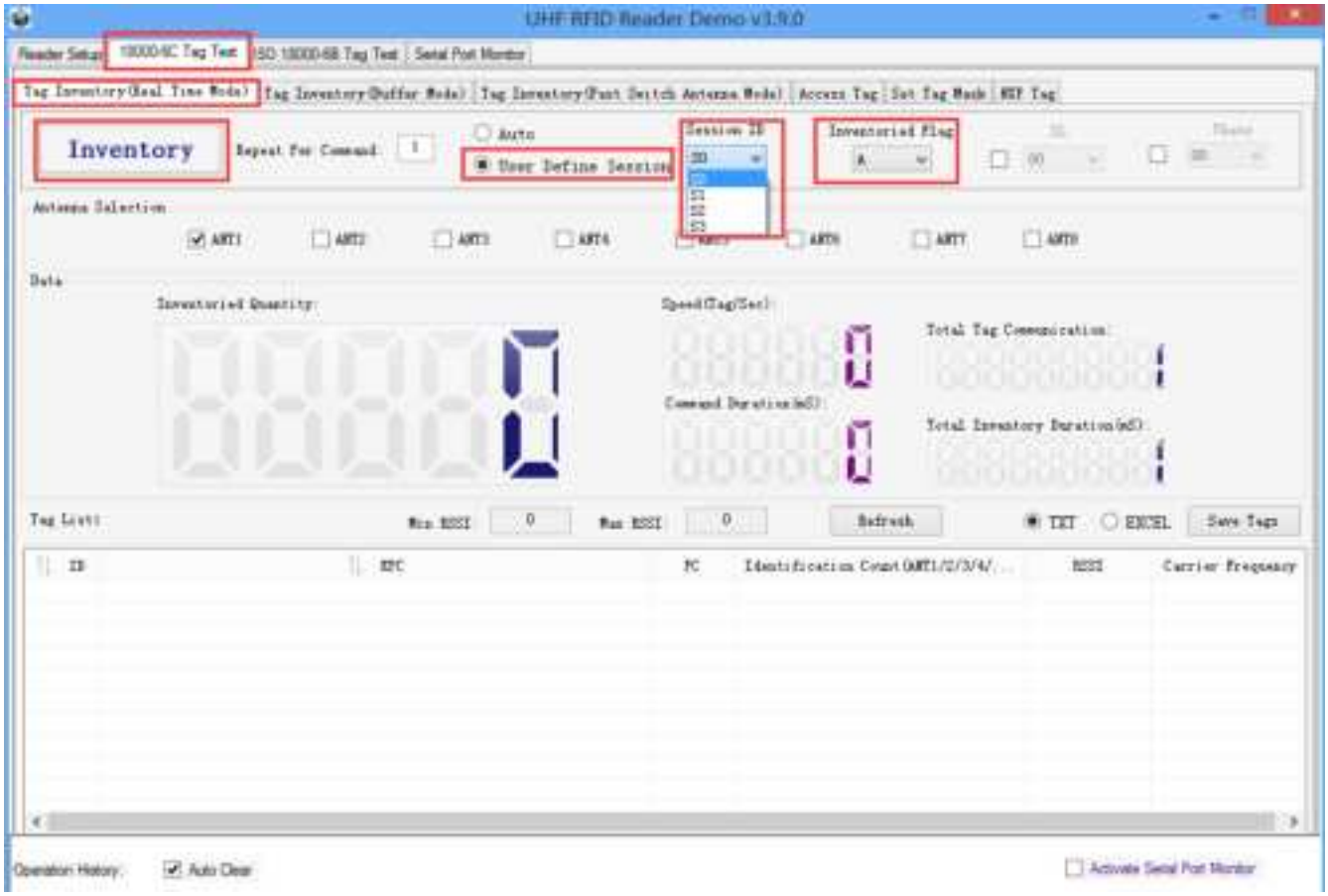
Inventoried Quantity	Total number of inventory tags since click on **Inventory Tag**.
Speed	Speed of identification Tag, unit: piece / sec
Total Tag Communication	Total return EPC data of tags (Including repeated data)
Command Duration	Time of each Inventory Command takes, unit: ms
Total Inventory Duration	Total elapsed time since click on **Inventory Tag**, unit: ms.
ID	The serial number of data.
EPC	EPC number of tag.
PC	Protocol Control word of tag.
Identification Count	Times of tag identified.
RSSI	The signal strength when tag was identified at the last time.
Carrier Frequency	Carrier Frequency of tag which is identified at the last time.

It is convenient for users to analyze the inventory data, and can choose to save the inventory data such as the tag EPC number in TXT or EXCEL, as shown in the figure below.



2.3.2 Users define Session ID & Inventorying Parameter of Inventoried Flag

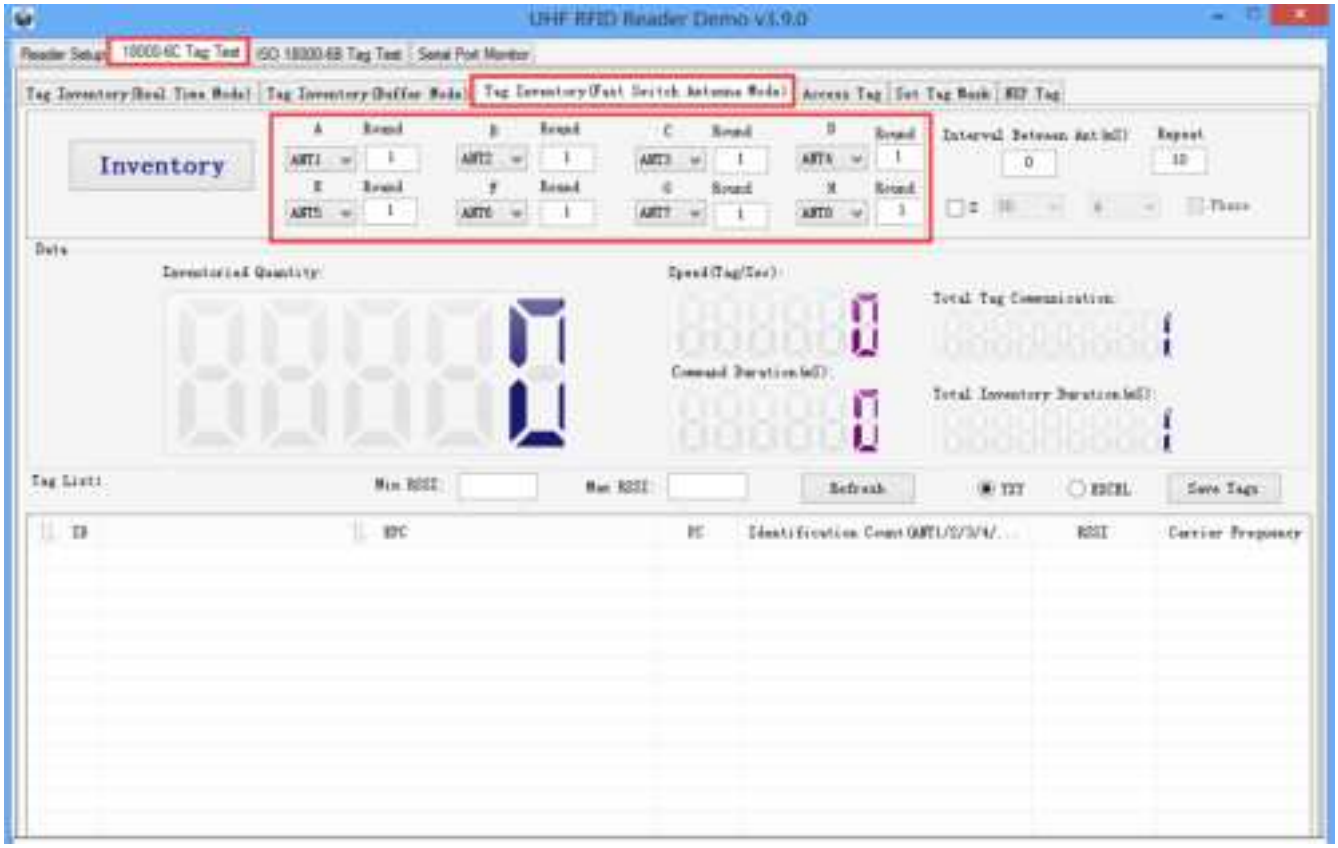
According to the user-defined Session ID and Inventoried Flag parameters to inventory, the reader can inventory according to the user-defined session parameters (four types of session S0, S1, S2, S3) and the inventoried flag (two inventoried flags A, B) parameters .



2.3.3 Fast Switching Antenna to Inventory Tags

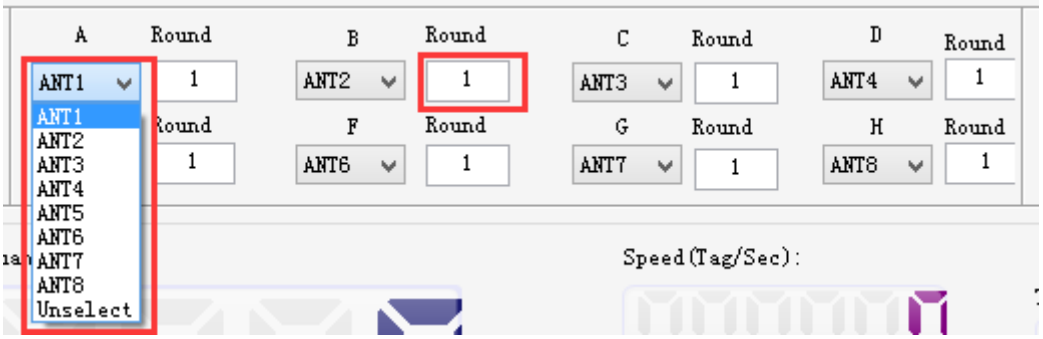
In the operation of standard inventory tags (real time mode, each antenna needs to be commanded to set the corresponding working antenna before inventory), a single antenna inventory requires at least 200 milliseconds. Only after the inventory is completed, the reader can respond to new commands.
However, in many practical application environments, it is unacceptable to switch the antenna after 200 milliseconds. At this time, the function of quickly switching the antenna of the inventory tag needs to be used.

Use cmd_name_fast_switch_ant_inventory command (see R2000 module serial interface communication protocol V4.0).
With this command, users do not need to send antenna switching commands, so it is faster and more efficient. On one antenna, the time consumed to read one or two tags is only about 50 milliseconds. Please refer to R2000 module serial interface communication protocol V4.0 for the specific usage of this command.
We can see the effect of fast 8-antenna inventory tag in the demo program.
Switch the demo program to the fast 8-antenna inventory interface, as shown in the figure below:



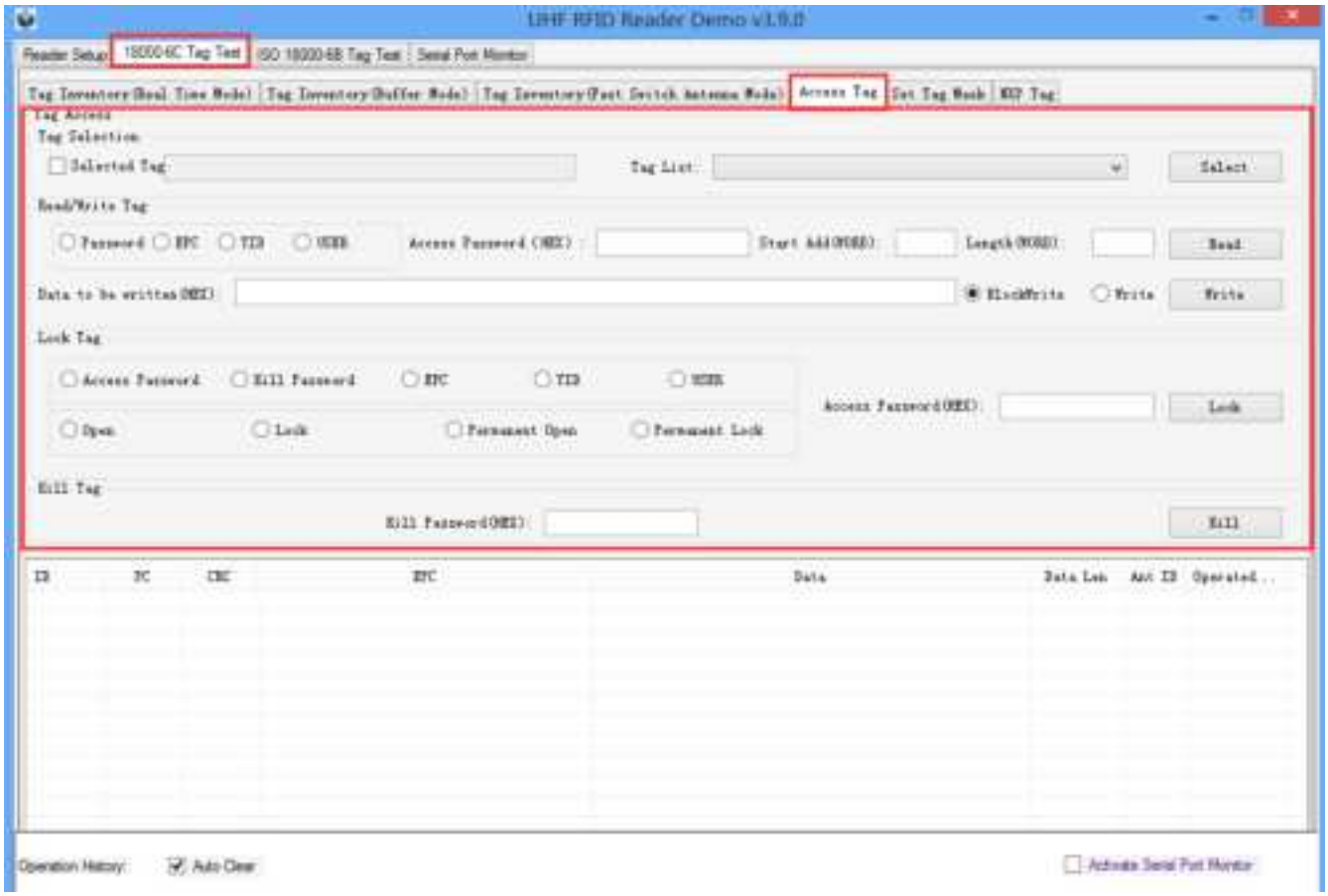
The working time of each antenna can be set independently. The number of round 1 means that the working time of the antenna is 50ms, and the number of round*50ms is the working time of the antenna. Set the appropriate number of round according to the number of tags in front of the antenna. The default number of round is 1.

The sequence of antenna switching and whether to select the antenna inventory can be set as shown in the figure below.



2.4 Accessing ISO-18000-6C Tag

Click the "Access Tag" selection box to enter the access tag interface, as shown below:



The following will introduce how to access tags one by one.

2.4.1Read tags

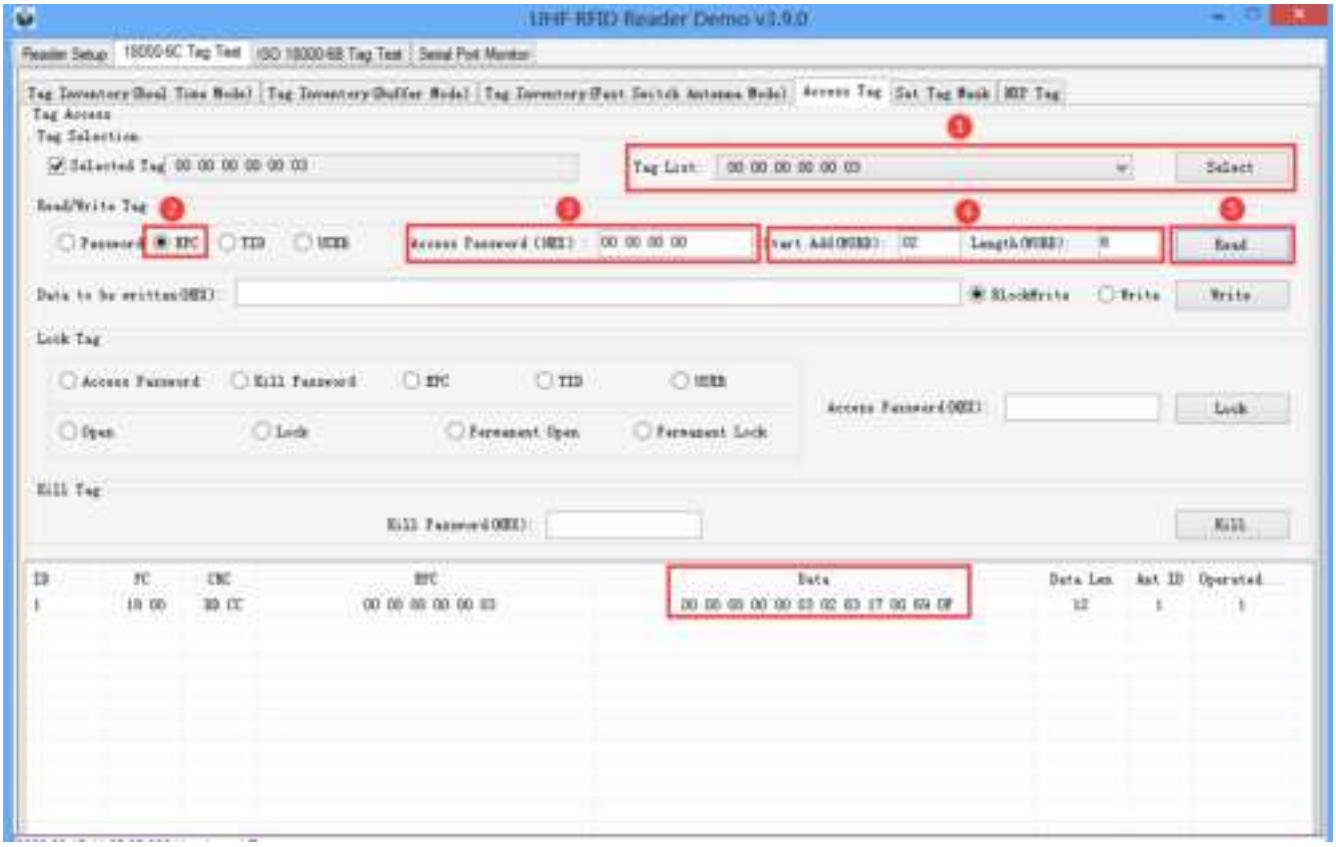
The parameters for reading tags are entered in the interface shown in the figure below:

Three parameters need to be input to read tags: select the tag storage area to be read, start address and data length.
Note: The units of the start address and data length here are both WORD, which is a double byte of 16 bits. After setting the parameters, click the “Read” button.
It should be noted that the input parameters must meet the tag specifications, otherwise an error message will appear.

The specific read tag operation is shown in the figure below:
(1) Select the tag that needs to be operated (read in the real-time inventory interface, and all the read tags will be displayed in the drop-down list), and click the "Selected " button on the right.
(2) Select the storage area that needs to operate the tag. In the example, select the EPC storage area.
(3) Enter the access password, the default is 00 00 00 00.
(4) Enter the starting address and data length. The upper four bytes of the EPC storage area are two bytes of CRC and two bytes of PC, so the starting address of the EPC number is 02 (unit word, Start reading after the upper four bytes).

Data length input 6 (unit word, read 12 bytes).

(5) Click "Read " to read the contents of the corresponding storage area of the tag and display it in the data column of the list box.



As many tags are manipulated, how many pieces of data will be displayed in the list.

2.4.2 Write tags

The interface of the tag writing operation and the reading operation are in the same area. The difference is that the writing operation also needs to provide information such as access password and writing data.

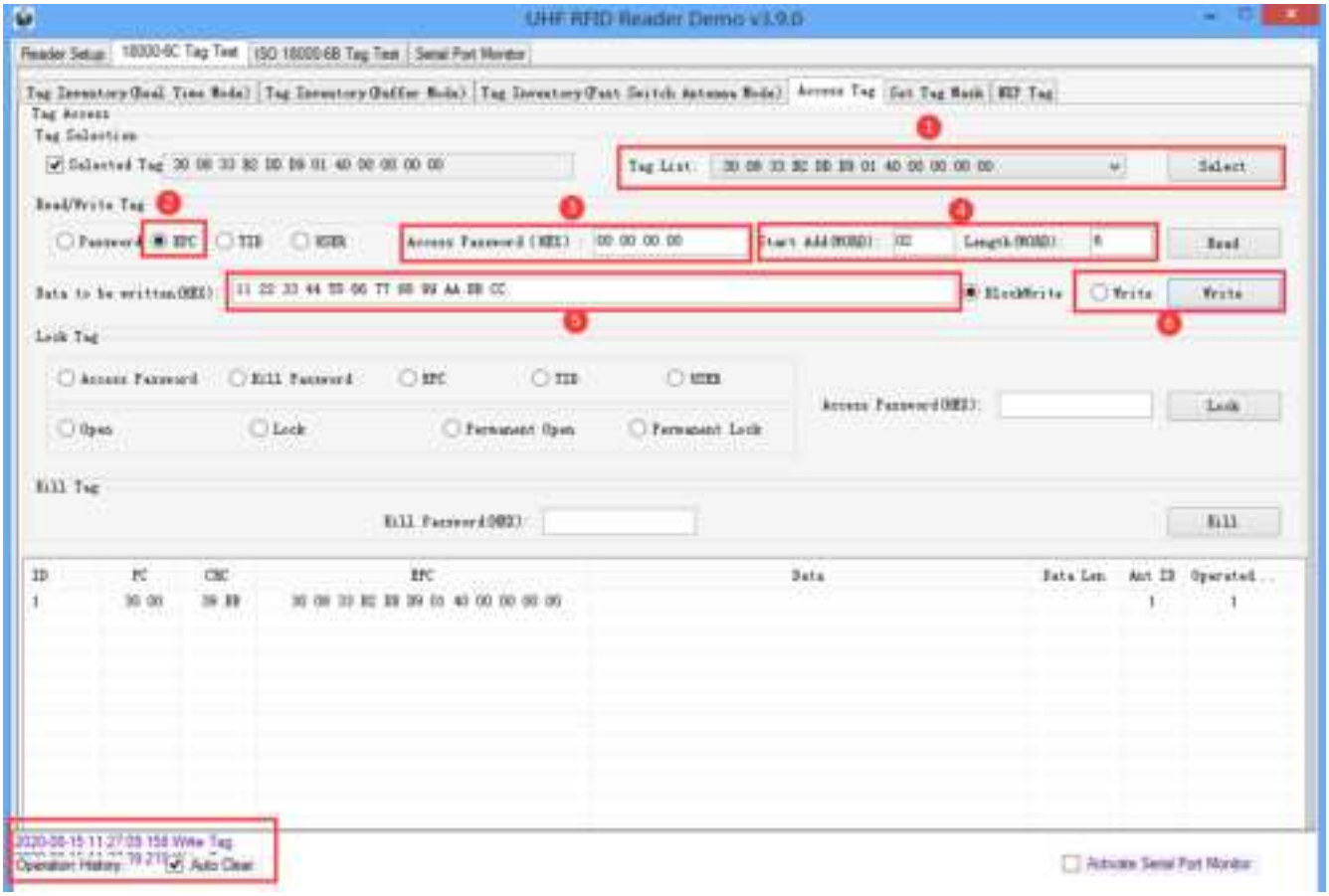
The password area is the part of the password (password) in the tag storage area. Including kill password and access password. Both the kill password and the access password are 4 bytes. Among them: the address of the inactivation password is 00H～03H (in bytes); the address of the access password is 04H～07H (in bytes).

The specific tag writing operation is shown below:

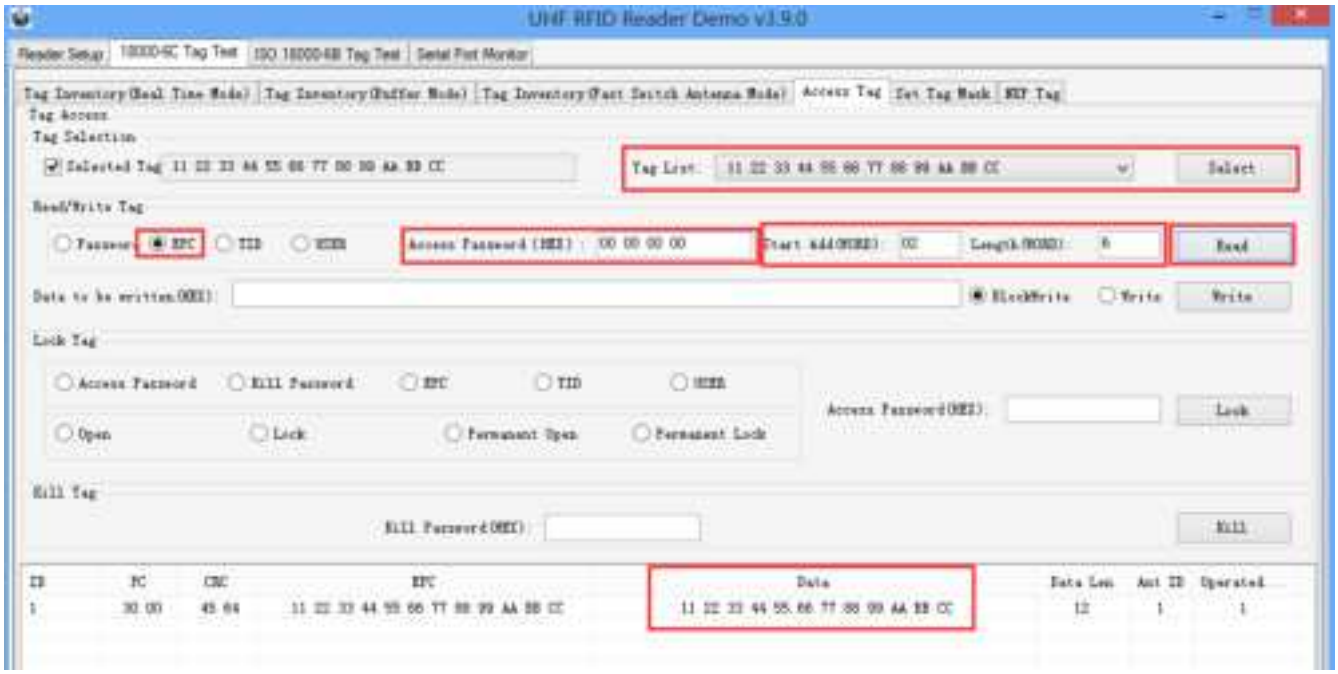
(1) Select the tag that needs to be operated (read in the real-time inventory interface, and all the read tags will be displayed in the drop-down list), and click the "Select" button on the right.

(2) Select the storage area that needs to operate the tag. In the example, select the EPC storage area.

(3) Enter the access password, the default is 00 00 00 00.
(4) Enter the starting address and data length. The upper four bytes of the EPC storage area are two bytes of CRC and two bytes of PC, so the starting address of the EPC number is 02 (unit word, Start reading after the upper four bytes). Data length input 6 (unit word, write 12 bytes).
(5) Enter the data to be written in the "Data to be written (HEX)", such as "112233445566778899AABBCC", 12 bytes.
(6) Click the "Write" button to write the content that needs to be written into the corresponding storage area of the tag and display it in the data column of the list box.



How many tags are successfully operated, how many pieces of data will be displayed in the list. Unlike reading tags, there is no content in the data column in the figure above. The user can read the same area of the tag again to verify that the data is written correctly. As shown below:



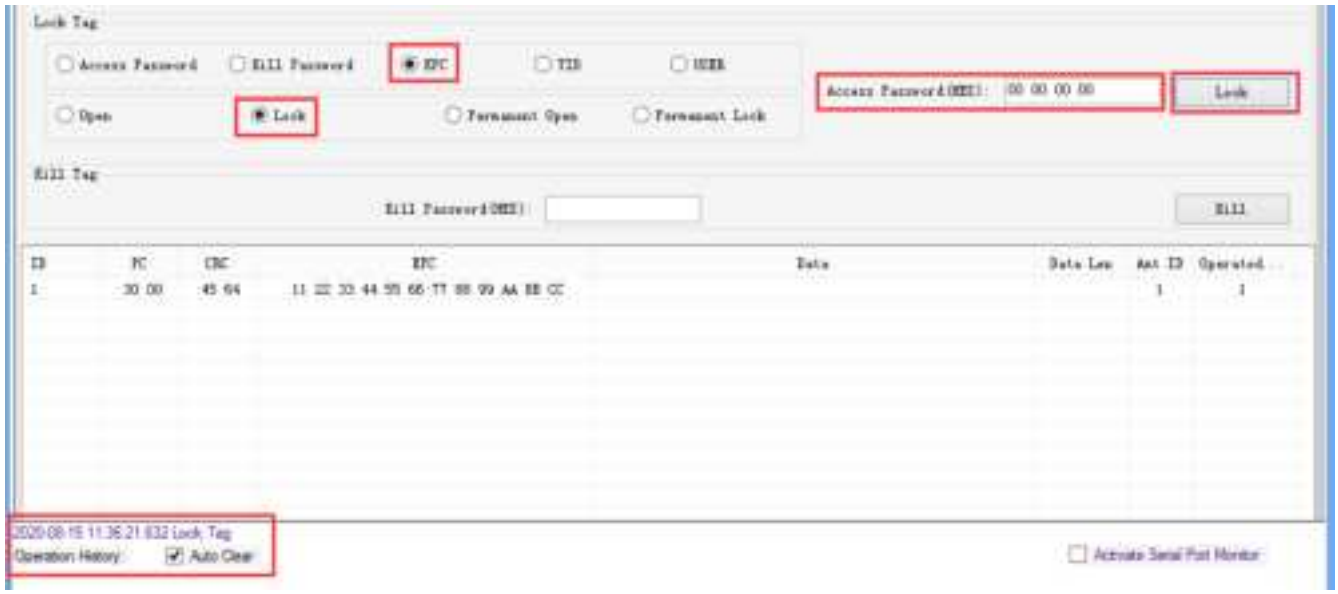
Note that the maximum write length at one time is 32 Words (64 bytes, 512bits).

2.4.3 Lock Tags

The operation interface of the lock tag is shown in the figure below:

The lock tag must provide an access password to proceed.

After the operation is successful, the following information will be returned:



Similarly, how many tags are operated, how many pieces of data will be displayed in the list.

2.4.4 Kill Tags

The operation interface of the kill tag is shown in the figure below:

The killing tag must provide an kill password, and the kill password cannot be 00 00 00 00. Therefore, to kill a tag, you must first modify the content of the kill password in the password area through the write tag command.

After the tag is successfully killed, the following information will be returned:

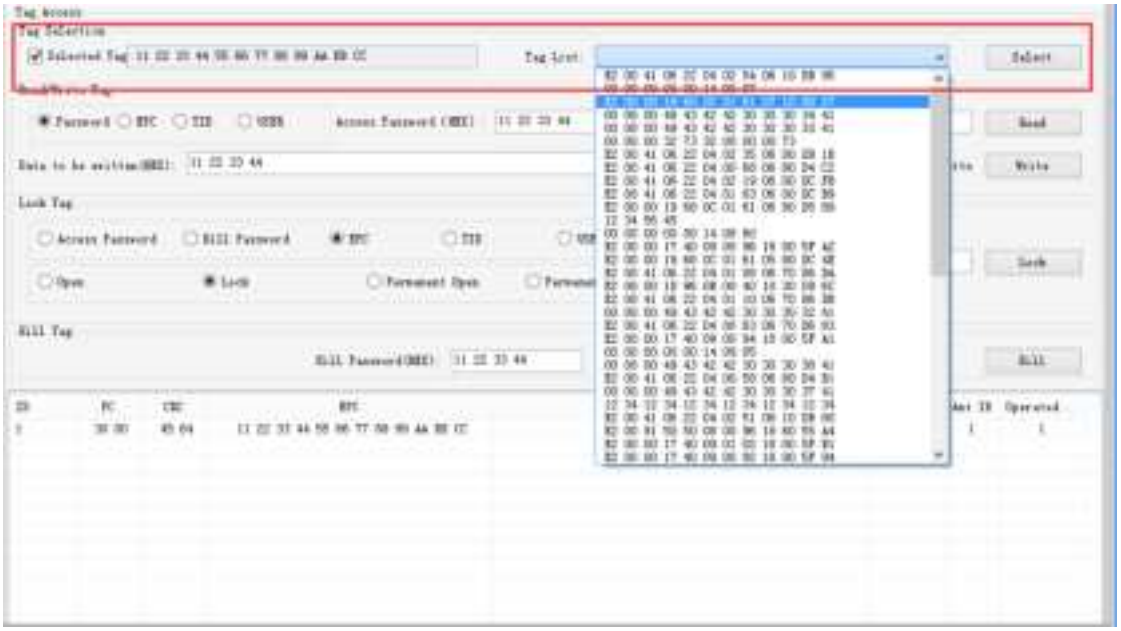
Like all operations of accessing tags, how many tags are killed, how many pieces of data are displayed in the list.

2.4.5 Tag Selection

In many cases, we hope that no matter how many tags there are in the radio frequency area, only one tag with a known EPC number can be accessed. At this time, the tag function (EPC matching function) of the selected operation needs to be used.

In the accompanying demo software, taking the real-time inventory mode as an example, the operation is as follows:

- First, use real-time inventory mode to inventory tags, and get all EPC numbers.
- Then go to the interface of access label and select the EPC number to be matched. As shown below:



After the selection is completed, click the "Select" button, and the following figure will be shown after successful operation:

We see that the " Selected Tag" checkbox on the left has been ticked, and the selected EPC number appears in the text box on the left.

Next, all tag access operations will only be performed on tags with this EPC number.

If you want to cancel the matching of EPC, just uncheck the checkbox of the selected tag. As shown below:

2.4.6 Error Display Might Be Returned

Errors occur if wrong operations done:

◆Inventory success, access failure:

There are two steps to get access to tags: firstly, tag inventory; secondly, access tags. Picture above shows the inventory is successful, but we can't access to tags.

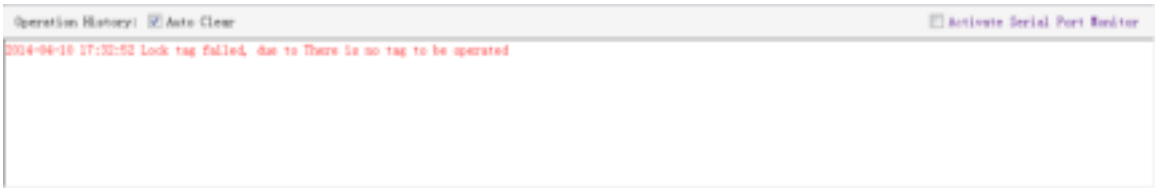
Two reasons why:

1. Parameters incorrect: for example, zones (password/ EPC/ TID/ User) to be read do not exist.
2. Tags beyond the area that the radio frequency electromagnetic field cover: distance when accessing to tags is about 60%-70% of tag inventory; in this case, please proceed the tag closer to antenna.

◆Wrong password:

Reason why: wrong password is set.

◆No tags to be operated：



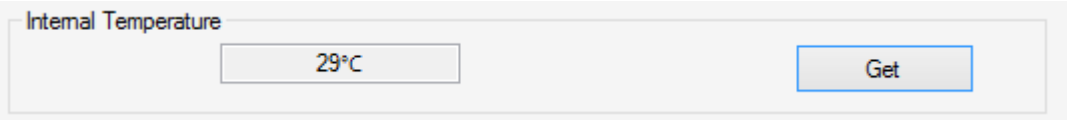
The above prompt will appear if there are no tags available for operation in the radio frequency area.
For the meaning of other returned information, users can refer to the document: **R2000 module serial interface communication protocol V4.0.**
Every time the UID of the tag is successfully read, the buzzer will beep once. If the buzzer beeps slightly longer, it means that the reader has activated the anti-collision function and recognized multiple tags at the same time.

2.5 Other Settings

2.5.1Operating Temperature Monitoring

When the reader is used continuously at high intensity, heat will be generated. The user can monitor the internal working temperature of the reader through the built-in temperature sensor to avoid overheating (the working temperature exceeds 65 degrees Celsius). If the temperature is too hot, you can stop reading and writing tags for a period of time.

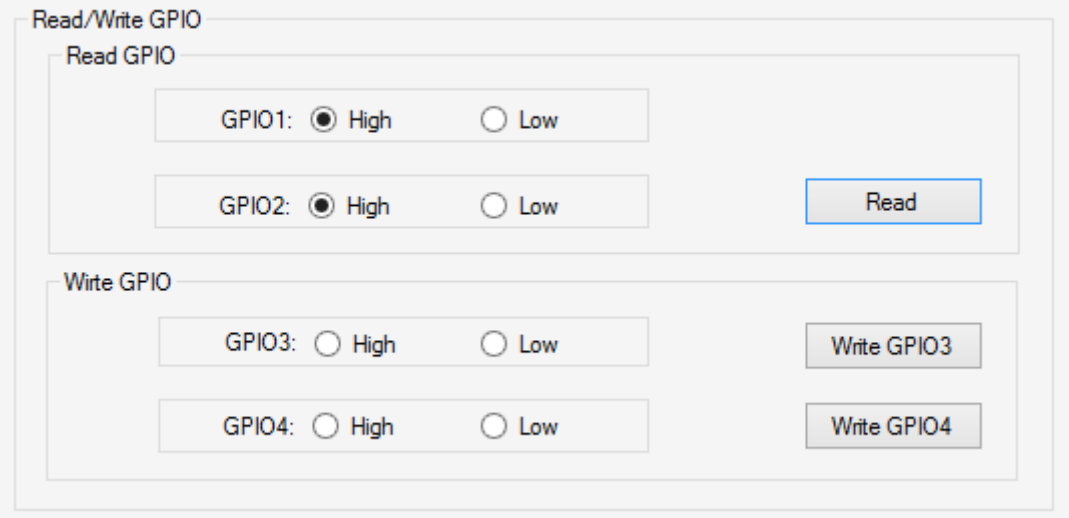
The operation interface for monitoring temperature is as follows:



2.5.2 Set GPIO Level

GPIO is the general-purpose input and output interface. It provides users with the function of triggering and controlling each other between peripheral devices and readers. This reader provides two optically isolated inputs (GPIO1 and GPIO2) and two relay outputs (GPIO3 and GPIO4).

The operation interface is shown in the below:

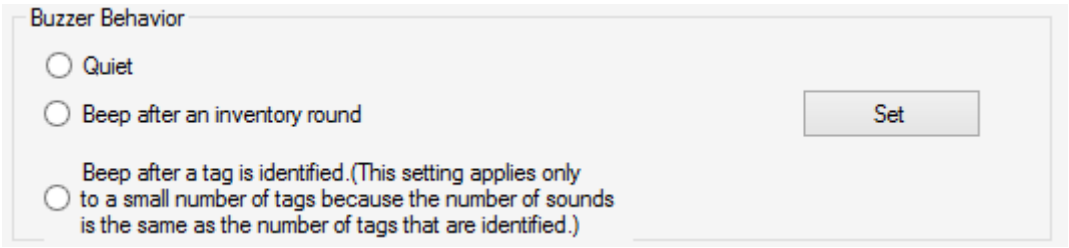


Users can read and write GPIO through serial commands in their own applications.

2.5.3 Setting Buzzer Status

The buzzer provides users with sound information about the status of the reader.
The user can turn off the buzzer, or set it to sound once every time the tag is inventoried.
It can also be set to beep every time a tag is read, but this will reduce the efficiency of multi-tag recognition. This function is more used to test tags or readers.

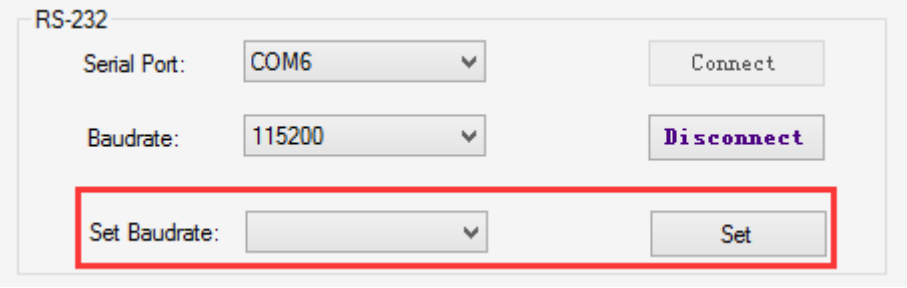
The operation interface is as follows:



It should be noted that the buzzer sound after successful power-on self-test is not controlled by this setting.
After the setting is completed, the state of the buzzer will be kept in the FLASH inside the reader and will not be lost after power off.

2.5.4 Changing The Serial Communication Baud Rate

Users can change the communication rate of the serial port by themselves. The reader supports two baud rates of 38400bps and 115200bps. The default is 115200bps.
The user can set the baud rate through the following interface:



After the setting is successful, the new baud rate will be saved in the FLASH inside the reader, and will not be lost after the reader power off, restart the reader to make the setting effective. At this time, it must communicate with the reader at the new baud rate.

caution:

- If the interface used by the user is a TCP/IP interface, then the TCP/IP module must be changed to the corresponding serial port rate. For specific operations, please refer to the TCP/IP interface configuration document attached with the reader.
- Inventory tags in real-time mode will generate a lot of data, please try to use 115200bps baud rate.

3 Develop your own RFID Application

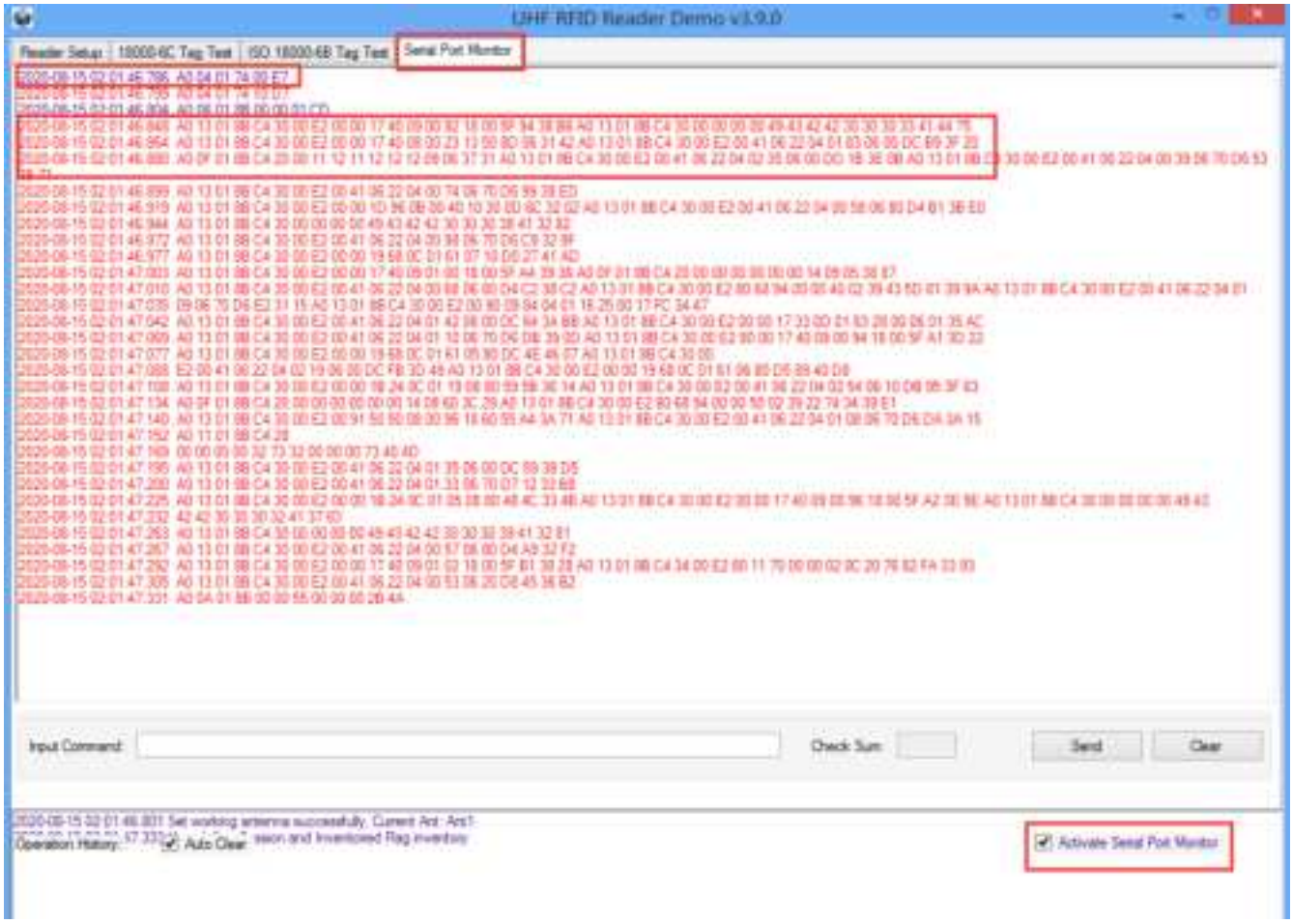
Users can operate most of the functions of the reader through the demonstration program, but in the actual application environment, it is necessary to develop their own programs.

The accompanying document: R2000 module serial interface communication protocol V4.0.doc provides a complete interface for operating the reader.

This interface is based on serial communication, so no matter the user's physical interface is RS232 or TCP/IP, the reader will follow the definition of this interface.

The demonstration program provides an important function, which is the transmission record of the serial port. The user can compare the communication protocol document with the actual serial port data during the operation of the demonstration program to quickly grasp the content of the communication protocol.

After checking the Open serial port monitoring check box in the lower right corner, all upstream and downstream serial port data will be recorded, as shown in the figure below (after opening the serial port monitoring, the response speed of the software will become slower, so you should usually close the serial port monitoring.):



The purple-blue information is the data sent by the PC to the reader, and the red information is the data returned by the reader to the PC.

The function of manually sending data can be used by users to debug serial commands, and it has the function of automatically calculating the checksum.

In addition, the attached document also includes the complete source code of this demo program (based on the C# language development of the .Net platform) for user reference, so that applications based on this reader can be developed at the fastest speed.

FCC Warning

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any inte rference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interferenceto radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-Reorient or relocate the receiving antenna.

•Increase the separation between the equipment and receiver.

•Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

•Consult the dealer or an experienced radio/TV technician for help.

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.