User Manual

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RFID Reader

SST-US-URFR01A

User's Guide

ST-TSD0111-2023-v3.0

Table of Contents

Overview of UHF RFID Reader 4
Outer Image of Reader 5
Outer Image of Antenna 6
General Installation 7
1) Hardware Installation 7
2) Software Installation 8
The method of power connection 9
The method of Reader connectino with antenna 10
Outer Interface of Reader 11
1) LED Indicator 11
2) LAN 12
3) SYNC 12
4) RELAY 13
5) RS-422 13
6) RS-485 14
7) RS-232 14
8) DEBUG 15
The setting of serial communication 16
RFID Reader Setting Program 17
1) Configuration of program 18
2) Parameter Setting 18
a) Communication 18
b) Tag type setting 22
c) Setting of TID Length 23
d) Reader Configuration 24
e) Selection of modulation parameters 25
g) Anti-collision setting 25
g) Buzzer Setting 26
h) Time setting 26
i) Tag Mode Setting 26
j) Reader's Running Status Check 27
k) Update 29
l) sample RFID Tag data Format 30

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RFID Reader Specification 31
RFID Antenna Specification 32

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Overview of UHF RFID Reader

1

The RFID reader is a ISO18000-6C protocol, multi-regional Radio Frequency Identification (RFID) System that operates in the 902 ~ 928 MHz UHF band. As Shown in the following figure 1 and figure 2, the reader supports total 4 external antennas with each Tx/Rx ports separately. The reader if shipped with RFID setting program that you can use to configure and control the reader.

This product also used to transmit vehicle information to a remote server for the purpose of electronic toll collection system with RF technology. The reader reads the vehicle information from TAG ID, which is embedded in TAG, and sends this information to the remote server. The reader uses TCP/IP (Ethernet), RS-232 and RS-485 for transmitting TAG ID and receiving commands from and to the remote server. Between RS-232 and RS-485, one interface is selected for being used as communication interface and this is determined by dip switches in the MCU board. In addition, the reader has RS-422 interface to communicate with other devices, such as laser or camera, and has sync port to synchronize the operations of multi-readers. Relay interface can be used to control the switch of an outer device. The debug port is provided so that it can receive commands from user and display the status of reader. LED interface shows the status of reader and antennas.
This product uses DC-24V.

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Outer Image of Reader

2

[Figure 1] RFID Reader (SST-US-URFR01A)

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Outer Image of Antenna

3

[Figure 2] Antenna (ANBIT_RFID_915M21/10-FCC-H, ANBIT_RFID_915M21/12-US)

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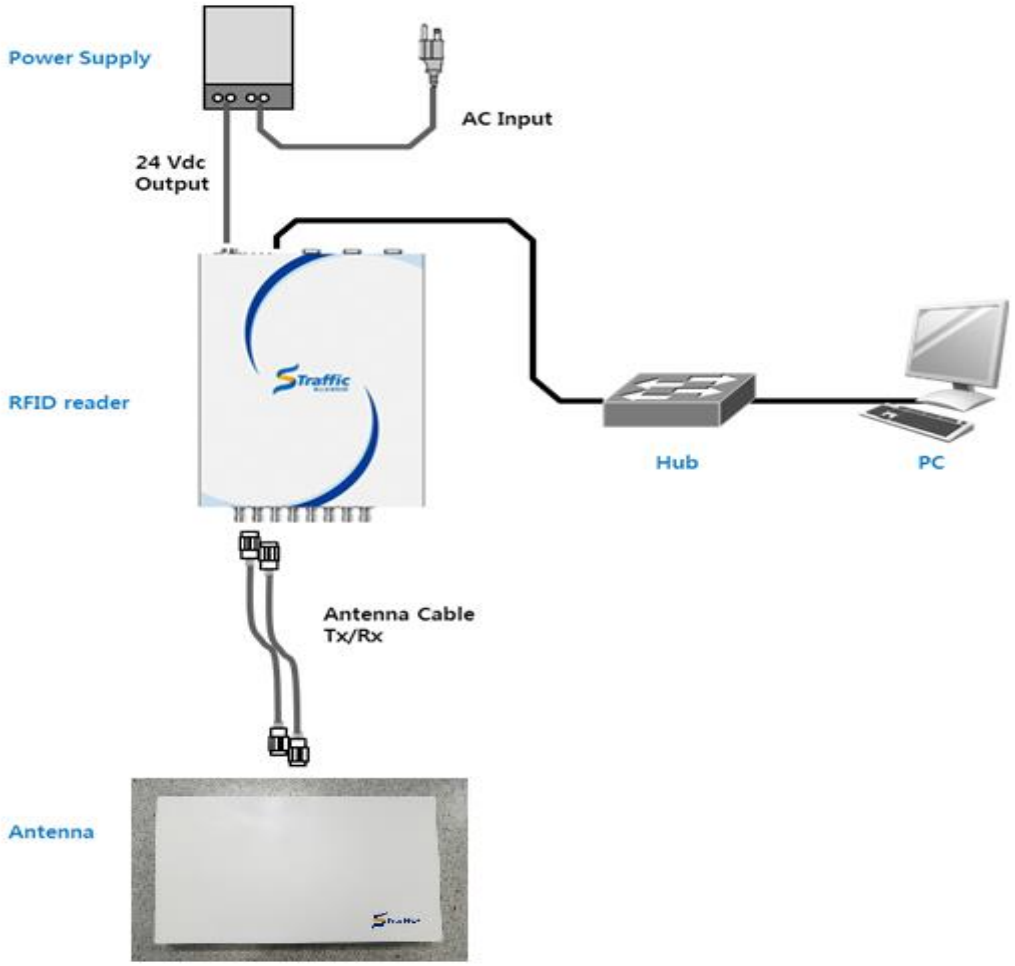
General Installation

4

1) Hardware Installation

A general electrical installation diagram is shown in the Figure 3. Connect the antenna to the antenna port, an Ethernet cable from your hub to the Ethernet port and power supply to the reader.



[Figure 3] RFID Reader Electrical Connections

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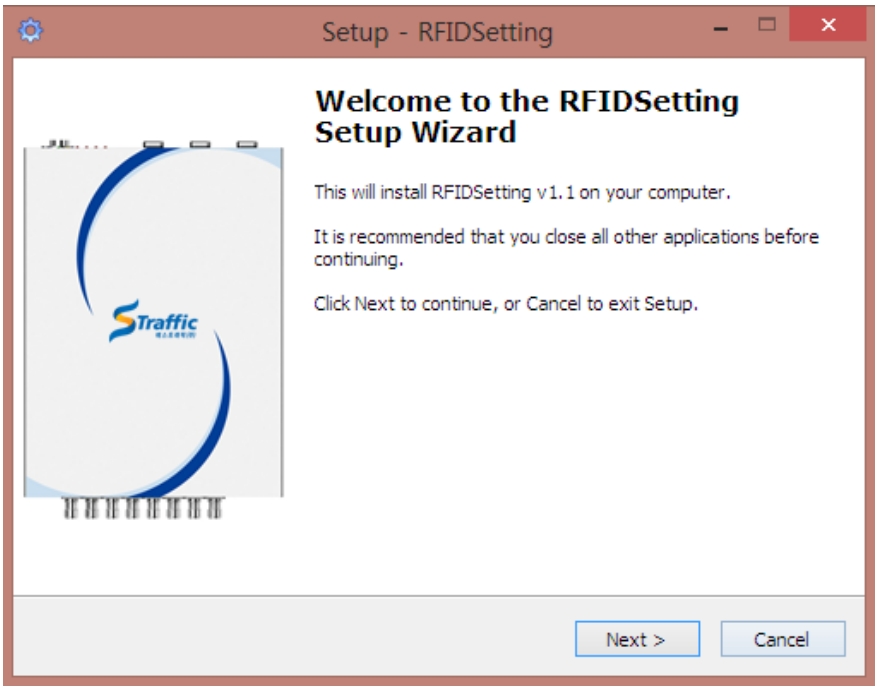
2) Software Installation

RFID Reader setting program can be used to set the configuration of a reader or measure the performance of a reader. It commits the functions through communication with a reader via Ethernet. You can use this Microsoft Windows based application to initially configure our reader as well as read and write tag data.

1. Install RFID setting program 'RFIDSetting.exe' on your PC.



[Figure 4] RFID Setting program install screen

2. Double-click the setup program and press "Next" several times, the installation complete

3. By default, RFID reader's IP address configured 192.168.0.120. To connect the reader, change your ' PC's IP address (Server IP Address) as below.

a) IP : **192.168.0.xxx**

b) Subnet Mask : **255.255.255.0**

c) Gateway : **192.168.0.1**

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The method of power connection

5

Connect the power connector (Left of Figure5), located at the right-bottom side of a front panel, with SMPS (DC24V) power connector (Right of Figure5).

(1) Connection Power connector of Reader with connector of SMPS cable

(2) Power Cable

[Figure 5] Power Connection of RFID Reader

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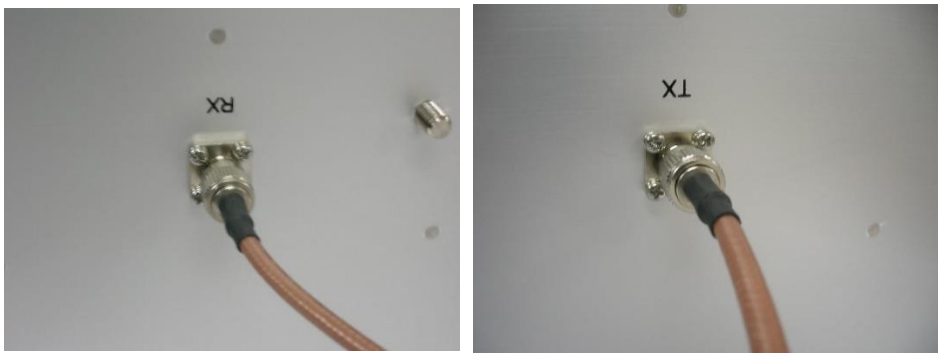
The method of Reader connection with Antenna

6

As in Figure 6 (1), Connect Rx, Tx TNC connector with Rx, Tx connector of Antenna with antenna cable. The reader has total 4 antenna connector ports and each port has Rx, Tx port separately. The Figure shows the first antenna is selected. Connect Rx connector of reader's antenna port to Rx connector in an antenna and connect Tx connector of reader's antenna port to Tx connector in an antenna. When all antennas are not selected, it is safe to connect dummy loads to unconnected antenna ports in a reader (Antenna selection is made in configuration menu of RFID setting program. If RF signal is output through unconnected antenna port, it would give a damage to a power amplifier in a reader.

(1) Antenna connector of Reader



(2) Connector of Antenna

[Figure 6] Connection of RFID Reader with Antenna

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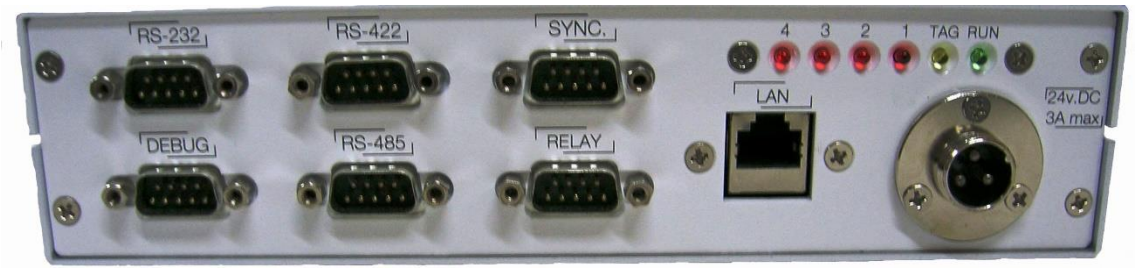
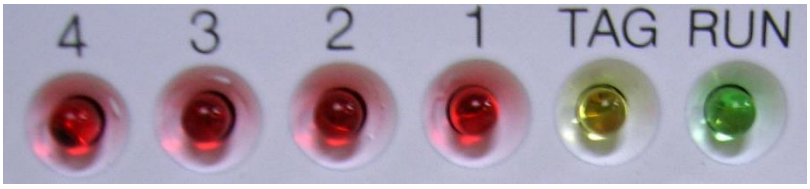
Outer Interface of Reader

7



1) LED Indicator

The reader has 6 LED indicators. The RUN LED lights as soon as power is inserted into reader and it blinks every 0.5 second after CPU is booted. TAG LED is toggled on receiving Tag ID. (Tag LED is operated only if buzzer option is selected as ON) The remaining 4 red-LEDs indicate the antenna being used. For example, if the first red-LED lights, it tells that the 1st Antenna is being used.



[Figure 7] LED Indicators

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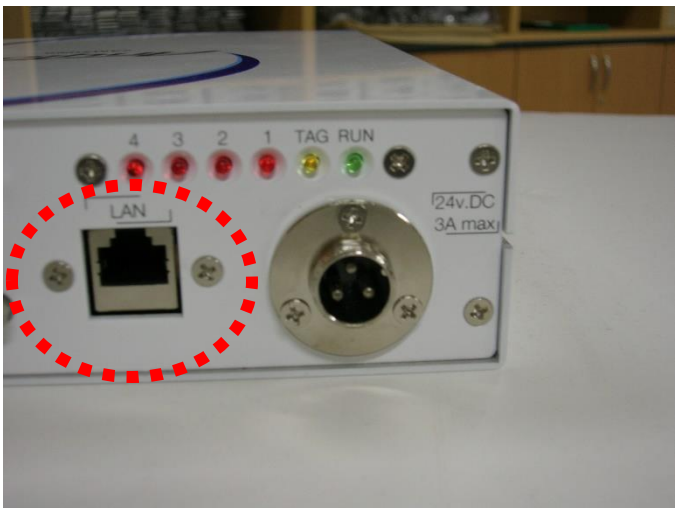
2) LAN

LAN is used for communicating with a remote server. It supports up to 100Mbps. By default, the IP address of a reader is set to 192.168.0.120.



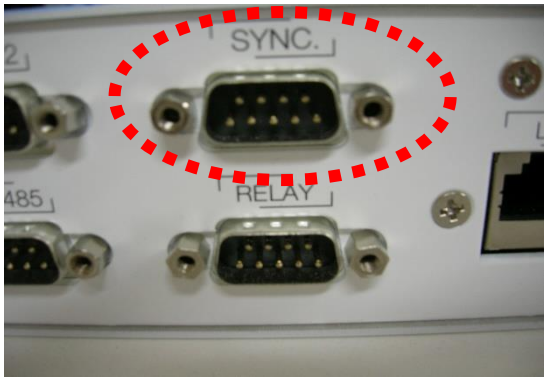
[Figure 8] LAN Port

3) SYNC

SYNC port is used to synchronize the readers in the case multi-readers occur the interference to each other. SYNC port uses the same communication method as RS-422.

2	Synchro.Z	X34.3	Yellow
5	Syncro.GND	X34.2	Black
3	Synchro.Y	X34.1	White
6	Synchro.A	X34.5	White
7	Synchro.B	X34.4	Red

[Table 1] DB9 pin map of SYNC port



[Figure 9] SYNC port

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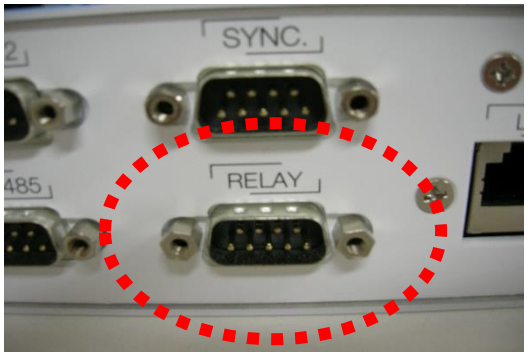
4) RELAY(Used only for debugging)



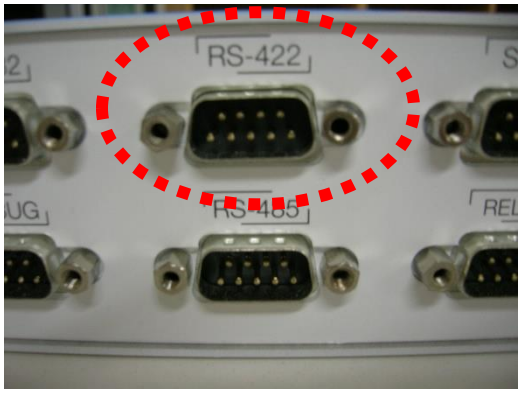
[Figure 10] RELAY port

5) RS-422

RS-422 is used to communicate with outer devices. Currently the communication speed of RS-422 of the reader is fixed to 115200 bps.

2	RS422.Z	X33.3	Yellow
5	RS422.GND	X33.2	Black
3	RS422.Y	X33.1	White
6	RS422.A	X33.6	White
8	RS422.GND	X33.5	Red
7	RS422.B	X33.4	Black

[Table 2] DB9 pin map of RS-422 Port



[Figure 11] RS-422 port

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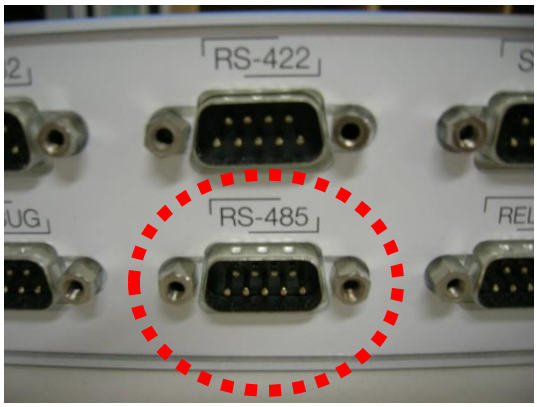
6) RS-485

RS-485 is used to communicate with outer devices or a remote server. Currently the communication speed of RS-485 of a reader is fixed to 9600bps.

7	RS485.B	X32.6	Red
8	RS485.GND	X32.5	Black
6	RS485.A	X32.4	White

[Table 3] DB9 pin map of 485 port



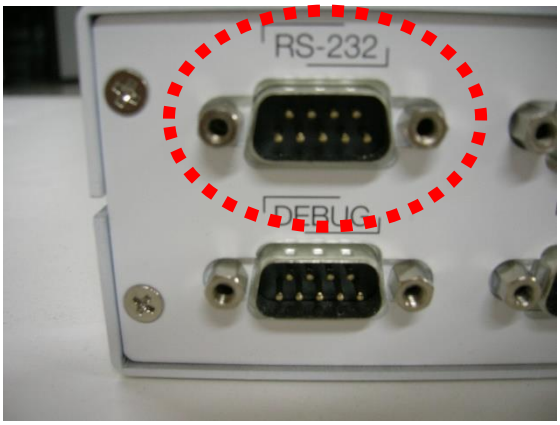
[Figure 12] RS-485 port

7) RS-232

RS-232 is used to communicate with outer devices or a remote server. Currently the communication speed of RS-232 of a reader is fixed to 9600bps.

3	RS232.TX	X32.8	White
2	RS232.RX	X32.7	Yellow
5	GND	X32.2	Black

[Table 4] DB9 pin map of RS-232 port



[Figure 13] RS-232 port

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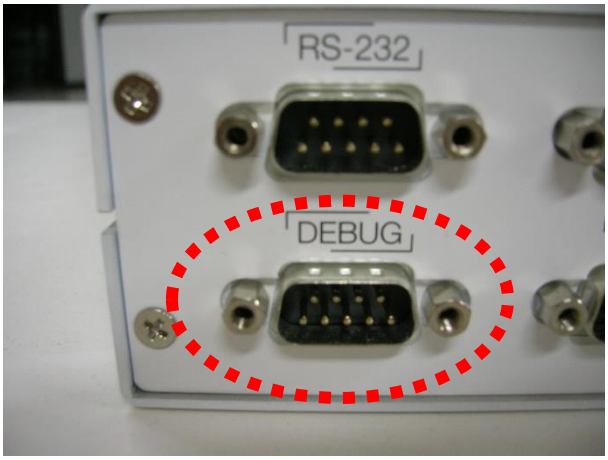
8) DEBUG

DEBUG port is used when the user want to see the status of a reader or he want to input commands to a reader. It is a console of linux device.

3	Debug.TX	X31.3	White
5	Debug.GND	X31.2	Black
2	Debug.RX	X31.1	Yellow

[Table 5] DB9 pin map of debug port



[Figure 14] DEBUG port

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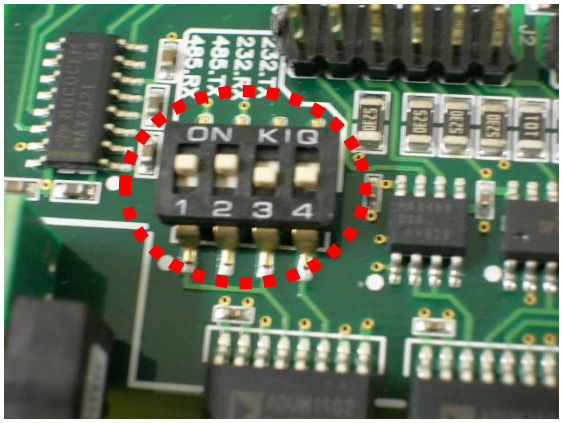
The setting of serial communication mode (DIP switch setting)

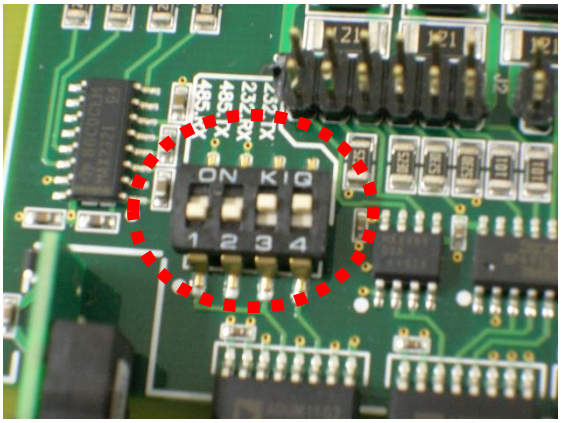
8

DIP switch is used to set the communication mode to RS-232 or RS-485. Only one mode between RS-232 and RS-485 is used. If number 1, 2 switches are ON, RS-232 mode is activated and if number 3, 4 switches are ON, RS-485 mode is activated.

In addition, serial communication mode is selected though RFID setting program as the same mode as determined by DIP switches.



(1) RS-232 mode



(2) RS-485 mode

[Figure 15] DIP switch setting

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RFID Reader Setting Program

9

RFID Reader setting program can be used to measure the performance of a reader or set the configuration of a reader. It commits the functions through communication with a reader via Ethernet. As major functions, this program can set parameters used in a reader and provide interfaces for read and write functions to RFID tags. In addition, it gives the interfaces for configuration of communication environment and displaying the information of tags which a reader recognizes.

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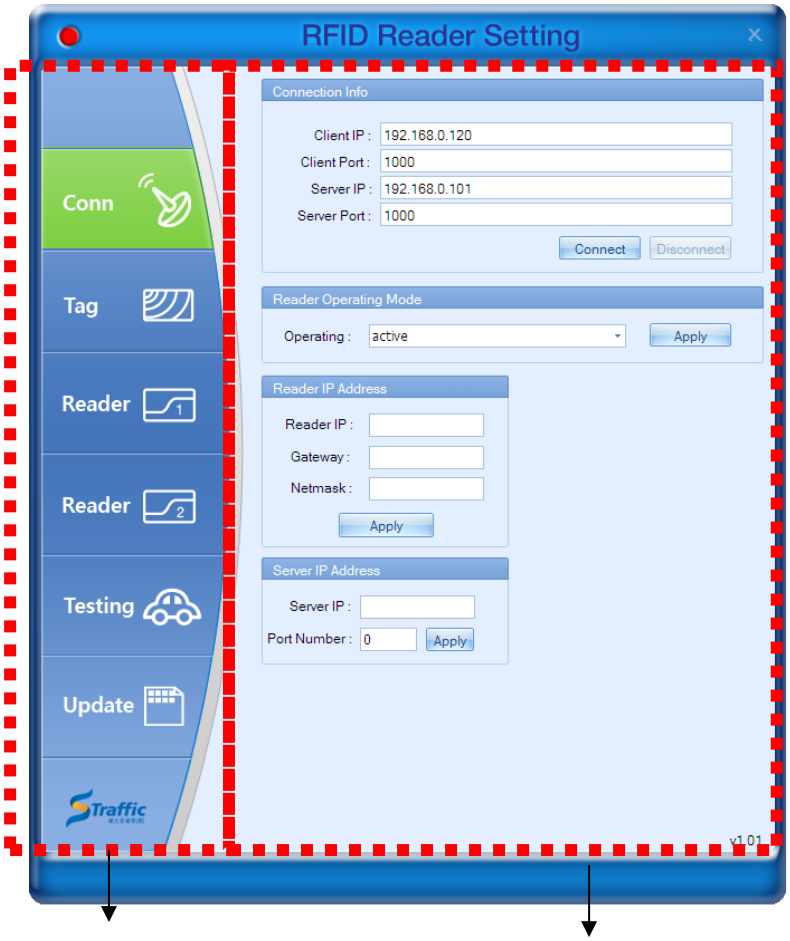
1) Configuration of program



Tabs for setting parameters Window for displaying information

[Figure 16] RFID Reader Setting Program

Setting program consists of 2 windows. Left windows is tabs for parameter setting, which contains 6 items (Connection, Tag, Reader 1, Reader 2, Testing, and Update).

Right window displays information about selected item.

2) Parameter Setting

a) Communication

Use communication item in parameter setting tabs to configure the communication environments. The communication method can be Ethernet. The selection is committed by pressing the radio button located in right side of each communication method.

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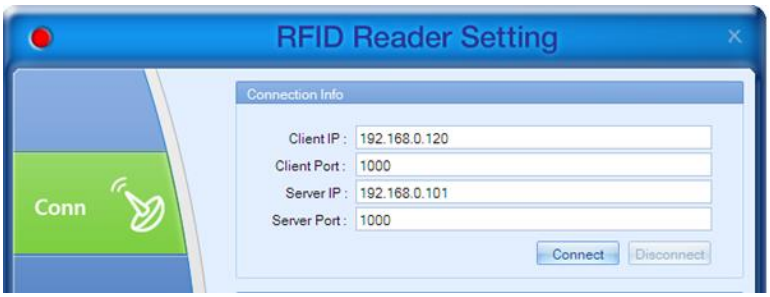
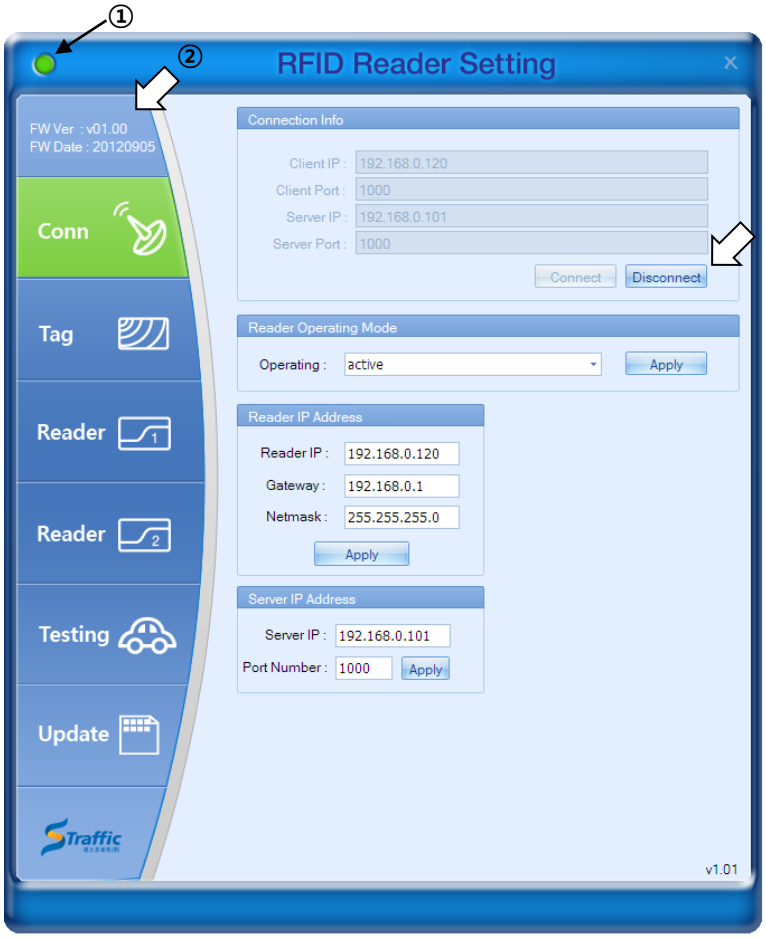


[Figure 17] Ethernet Connection

In Ethernet mode, Reader's IP address, Reader's port number, Setting Program's IP address, Setting Program's port number should be set. (Refer to Figure 17)

Default Reader's IP Address is 192.168.0.120 and the port number of TCP is fixed to 1000.

Press connect button for communicating with a reader. When the connection is completed, the communication status indicator located in left-top side of the program will change green color from red color (①) and FW version and FW data information will be displayed. (②)



[Figure 18] Communication status indicator

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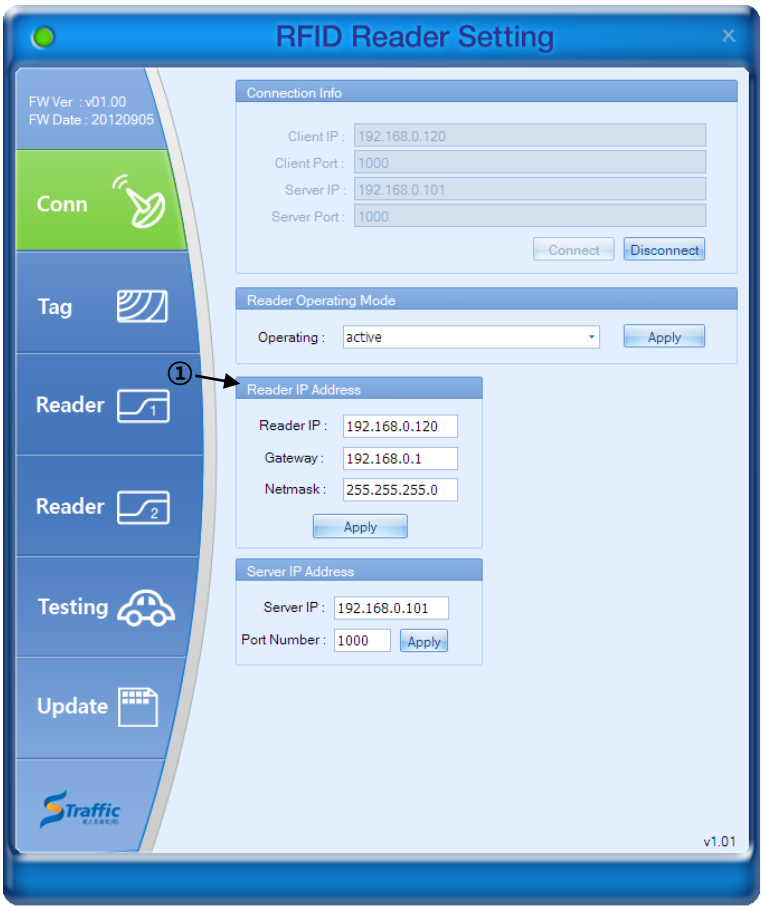
If you want to change Reader's IP address, fill in the Reader IP, Netmask, Gateway Information (①) and select Apply Button. (Refer to Figure 19)

Then Reader Starts to Reboot. Reconnect the reader after 30 seconds.



[Figure 19] Reader IP Setting

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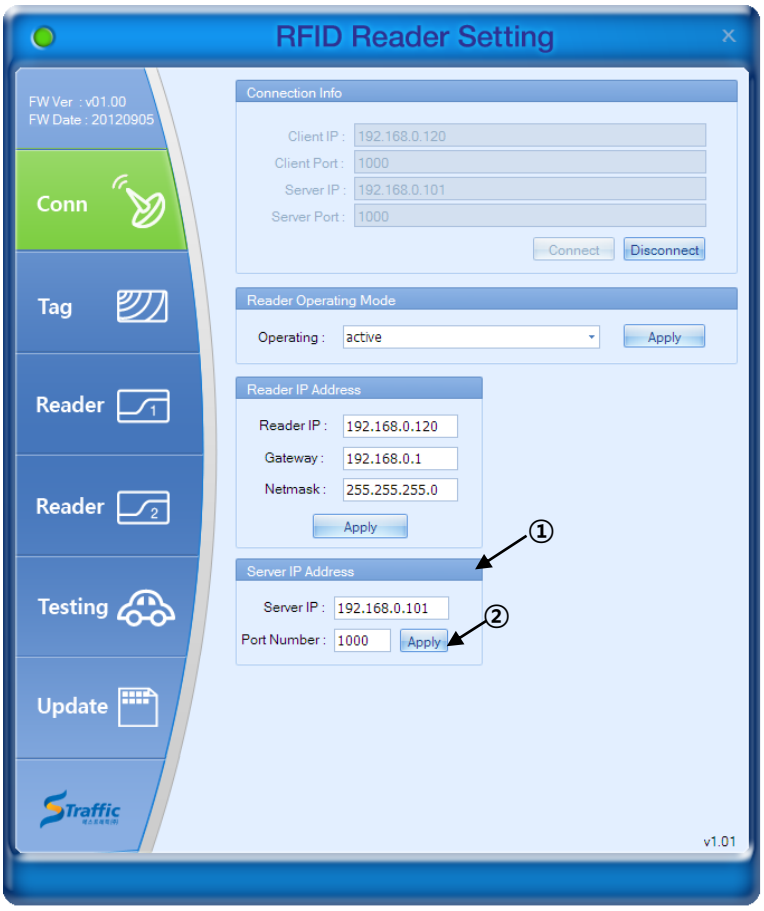
By default reader sends recognized tag information to server IP 192.168.0.101.

If you want to change server IP address fill in the Server IP(①) and select Apply Button(②) (Refer to Figure 20). Then Reader Starts to Reboot. Reconnect the reader after 30 seconds.



[Figure 20] Server IP Setting

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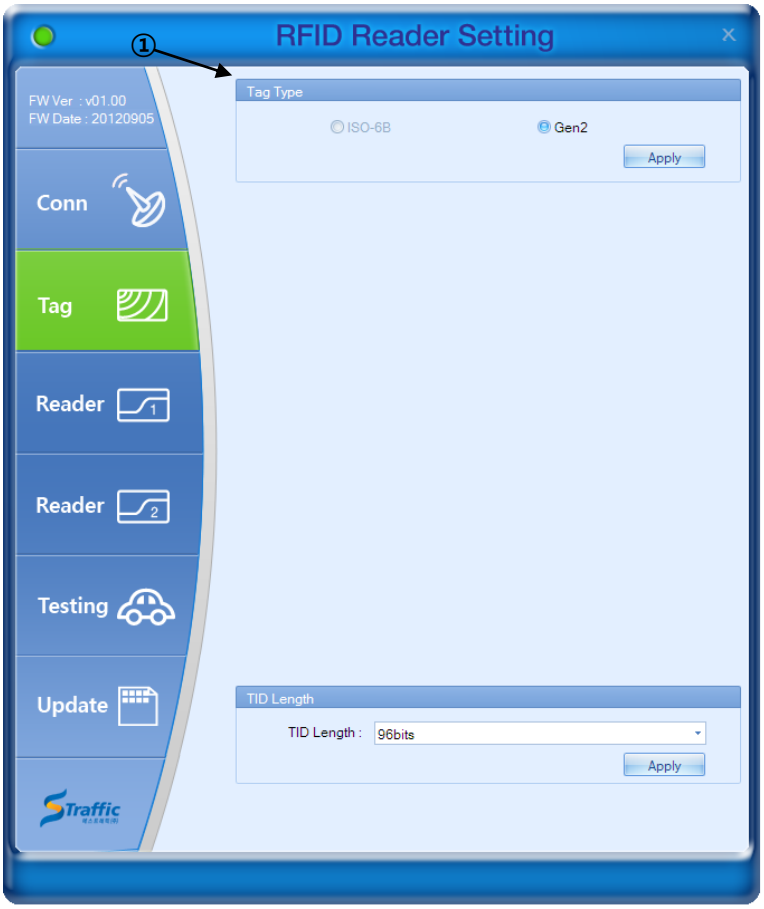
b) Tag type setting

Now, RFID Reader supports only GEN2 type tag. (Refer to Figure 21)



[Figure 21] Tag type setting

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c) Setting of TID Length

To determine the length of TAG ID, which is read from GEN2 tag, use the TID Length(①) Select item of Tag tabs. The length can be 64bits or 96bits. (Refer to Figure 22)

[Figure 22] Setting of TID Length

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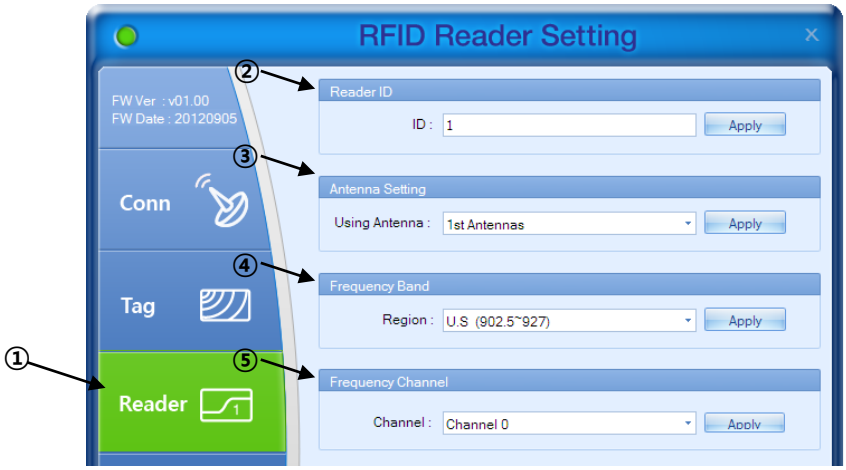
d) Reader Configuration



[Figure 23] Setting of Reader Configuration

To configure the parameters of a reader, use configuration items in Reader 1 tabs(①) (Refer to Figure 20).

1. Selecting Reader ID (②)

After writing ID in the edit box right to the ID item, press Apply button. Up to 2 digits is permitted as ID.

2. Antenna Configuration (③)

RFID Reader supports up to 4 antennas. Therefore you can choose which antenna is used. You can select to use 4antennas, 3antennas, 2antennas or 1st antenna, 2nd antenna, 3rd antenna, 4th antenna with antenna combo box. After selecting which antenna is used, if you press Apply button, the antenna configuration is completed.

3. Selection of Frequency Range (④)

To select frequency range of a reader, use a combo-box of Frequency item. The selectable frequency ranges are KOREA, Europe and U.S. After selecting the frequency range in combo-box, press Apply button.

4. Selection of Frequency Channel (⑤)

To select frequency channel of a reader, use a combo-box of Frequency channel item. The selectable

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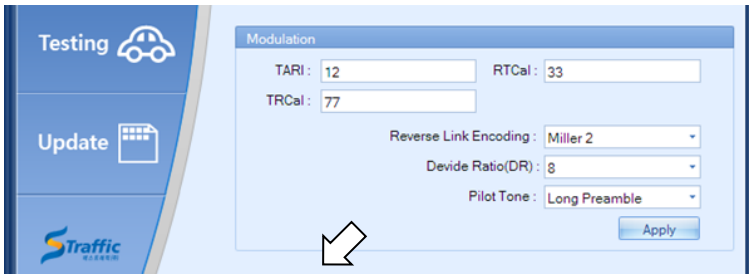
frequency channels will automatically listed according to Frequency Range what you selected. After selecting the frequency channel in combo-box, press Apply button.

[CAUTION] However, if the frequency range is selected in the U.S., whichever channel is selected will operate as pseudo-random hopping across the entire frequency channel.

e) Selection of modulation parameters

Modulation parameters can be set in reader1 tab (Refer to Figure 25). The modulation tab is only used when TAG type is GEN2. Configurable parameters of modulation are TARI, RTCal, TRCal, Reverse link encoding method, Divide ratio (DR), and pilot tone. TARI, RTCal, TRCal value is set by the micro second. Reverse link encoding method can be FM0, Miller2, Miller4, Miller8, but now the reader supports only Miller2 encoding. Divide ratio cab be set with 8 or 64/3. Pilot tone determines which preamble is used, short preamble or long preamble. By default, TARI is set to 12micro seconds, RTCal is set to 33mirco seconds, TRCal is set to 77micro seconds, Reverse link encoding is set to Miller 2, Divide ratio is set to 8 and Pilot tone is set to long preamble.

[CAUTION] Except of a special case, do not change default modulation parameters.

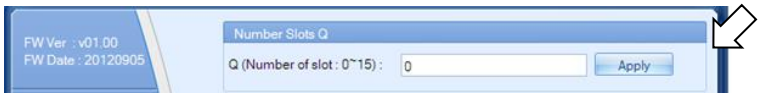


[Figure 25] Selection of modulation parameters

f) Anti-collision setting

When GEN2 protocol is used, anti-collision function is permitted using Q value in Query message which can be set Reader 2 item in parameter setting tabs of setting program. (Refer to Figure 26)

Using the Q value, GEN2 tag generates random number for choosing slot in which it sends its TAG ID. After RFID reader transmits Query message, it sends (2^Q-1) Query Repeat messages. If TAG receives the message, it decreases its slot number by 1 and if the slot number reaches to 0, the TAG responds to the message by transmitting it TAG ID. Q value can be set from 0 to 15. Value of 0 means that anti-collision function is disabled.



[Figure 26] anti-collision setting

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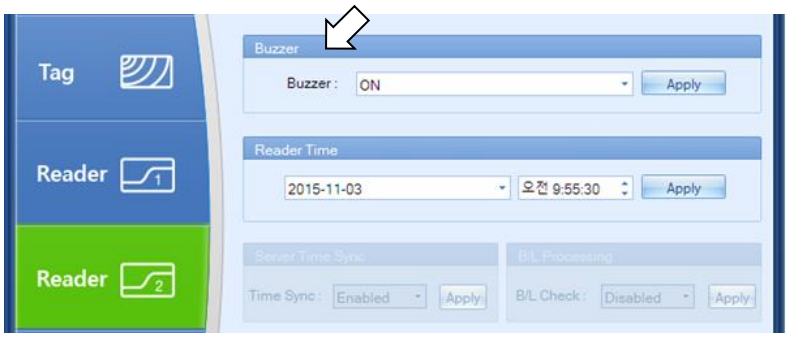
g) Buzzer Setting

In order to make the buzzer ring when a reader receives a TAG ID, you can set Buzzer item in Reader2 tab of parameter configuration tabs. (Refer to Figure 28)

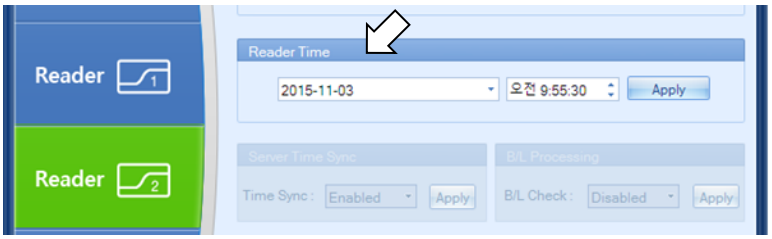
If you want to ring the buzzer on receiving the tag id, you can select ON in combo button, and if you want the buzzer to remain silently, you can select OFF in combo button. Then press apply button



[Figure 28] Buzzer Setting

h) Time setting

To change the clock time of a RFID reader, use Reader's Date and Time Setting item of Reader 2 tabs. Year, Month, Day, Hour, Minute and Second can be set. (Refer to Figure 29)



[Figure 29] Setting of Clock time

i) Tag Mode Setting

In GEN2 Tag, 2 types of IDs exist, which are UII and TID. To determine which ID is received, use Test Mode Setting item of test tabs.

With Comb-box right to Mode item, UII Read, TID Read, Entrance Tollgate or Exit Tollgate can be selected. UII Read Mode is for receiving UII only and TID Read mode is for receiving UII and TID. Entrance Tollgate Mode and Exit Tollgate Mode is used for writing and reading User data in User Data memory area as functions of entrance and exit of toll gate system.

Text, Location, Car Lane of User Data item contains the information of toll gate.

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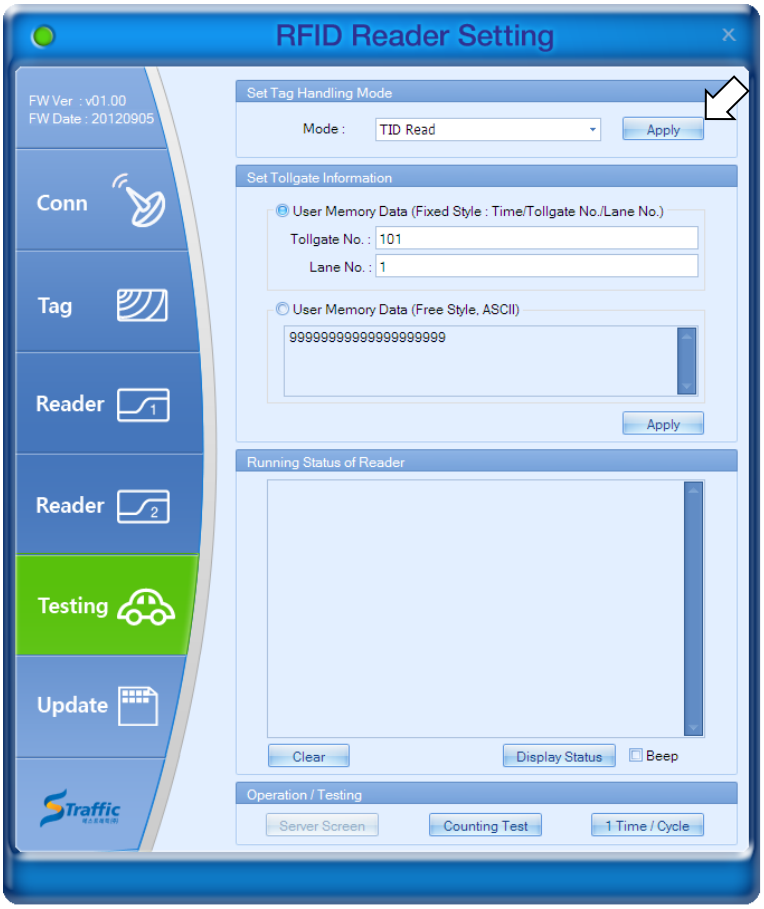
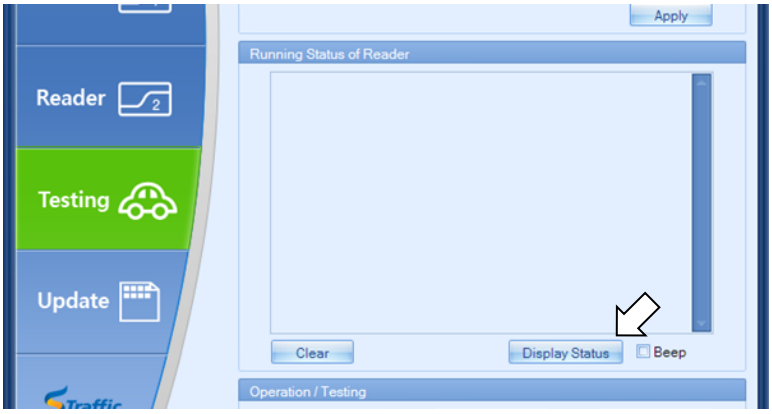


[Figure 30] Setting of Read mode of a Tag and Writing User Data

j) Reader's Running Status Check

Reader's Running Status Check item of test tabs shows if TAG ID is received or not. (Refer to Figure 31) If Display Status button is pressed, star(*) mark is displayed in edit box when TAG ID is received. C indicates the CRC error. To stop displaying indicator, press Stop Display Status button.



[Figure 31] Indicator of TAG ID

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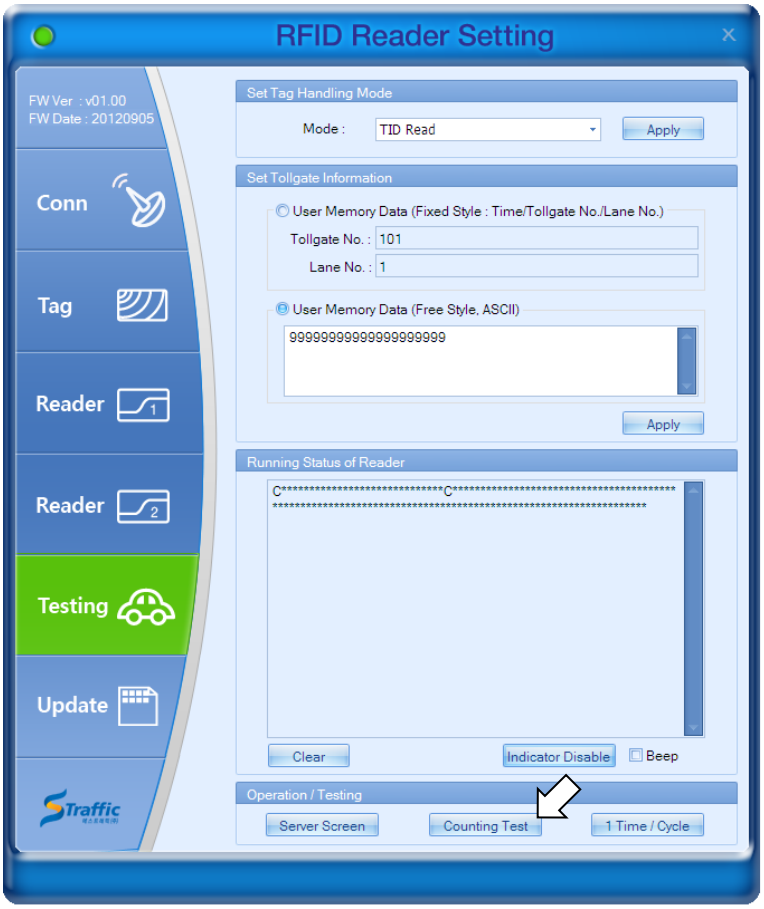
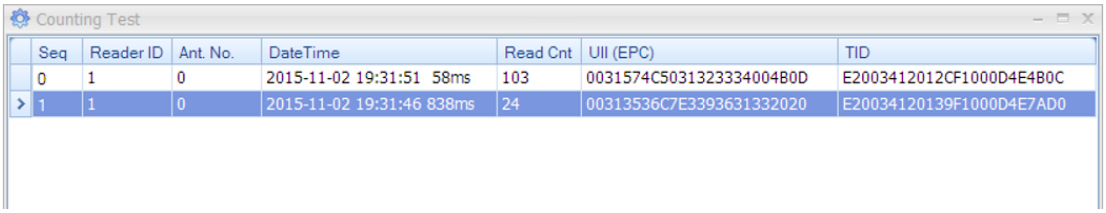


[Figure 32] Reading of TAG Data

If you click Counting Test button, you can show pop up window to display detailed information what the reader received. Reader Id, UII, TID information and some other useful information will be shown. (Figure 33).



Seq	Reader ID	Ant. No.	DateTime	Read Cnt	UII (EPC)	TID
0	1	0	2015-11-02 19:31:51 58ms	103	0031574C5031323334004B0D	E2003412012CF1000D4E4B0C
1	1	0	2015-11-02 19:31:46 838ms	24	00313536C7E3393631332020	E20034120139F1000D4E7AD0

[Figure 33] Counting Test screen

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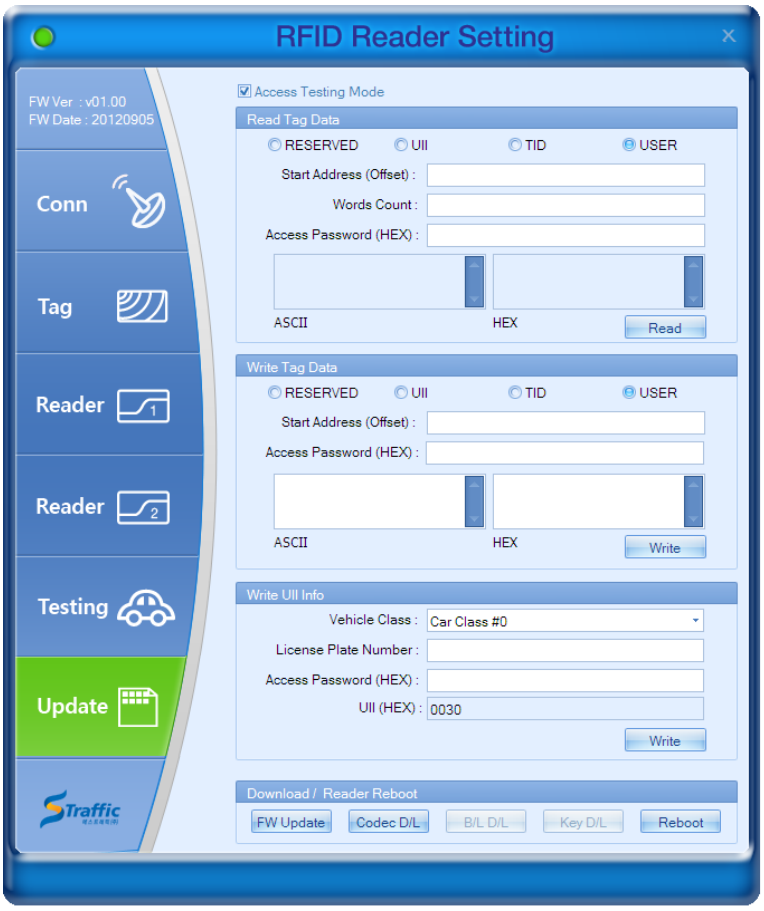
k) Update

By default, this menu is disabled. Only for test, you can use these functions with checking Access Testing Mode check box. (Figure 34). You also use Download/Reader Reboot buttons.



[Figure 34] Update menu (enabled)

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l) sample RFID Tag data Format

[EPC Code]

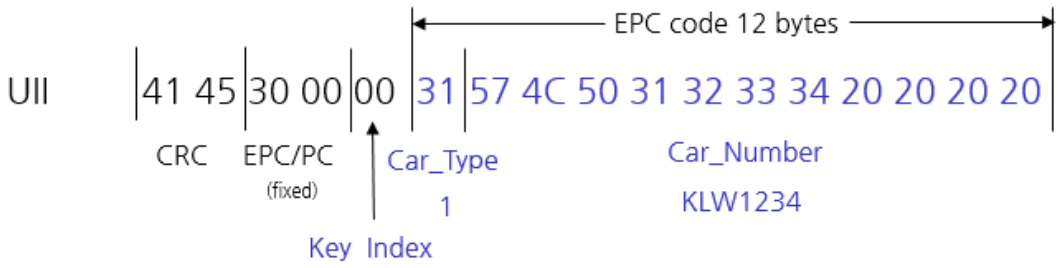
CRC-16 1 Word	EPC / PC (1 word)	EPC Code (variable PC Value Dependent)
A4 6E	30 00	00 04 05 07 77 88 88 96 00 23 45

30 → 0011 0000, 0000 0000(b)

* 00110(b) → 6(d) → 6 X 2(word) = 12 byte
* EPC Code Length is 12 byte → 96 bit

UII 414530000031574C5031323334202020

TID E200341202CF1000D4E4B0C



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RFID Reader Specification

10

Items	Specification and Fucntions
Main Board	• 32bit ARM CPU • 64M RAM • 256M NAND Flash
Operating Frequency	• US : 902 ~ 928 MHz(FHSS)
RF Output Power	≤ 24.5dBm
Channel Spacing	• US : 500 KHz
Recognition Distance	< 10m
Indicators	• LED : RUN, Tag, Ant1, Ant2, Ant3, Ant4 • Beep
Protocols	• ISO 18000-6C (EPC Class1 Gen2)
Communication Interfaces	RS-232 or RS-485, RS-422, 100M LAN, Synchronization Port
IO	• GPIO(1 digital input lines) • Relay
Operating Temperature	-20~ 70℃
Operating Humidity	0 ~ 90%
Operating Voltage	24 V DC
Power Consumption	17W
Power Adaptor	INPUT : 100~240 VAC, 50/60Hz, 0.9 A OUTPUT: 24 VDC, 1.5 A
Size	275 x 220 x 55 mm

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RFID Antenna Specification 11

Items	Specification and Functions
Model	ANBIT_RFID_915M21/12-US(10.99dBi) ANBIT_RFID_915M21/10-FCC-H(10.82dBi)
Frequency Range	902 ~ 928 MHz
Polarization	Circular, Linear
Impedance	50 Ω
Beam Width	El : 68 Degrees, AZ : 39 Degrees
Size	650 x 460 x 60 (mm)
Connector	TNC Female

FCC Compliance Statement

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 interference received, including interference that may cause undesired operation.

CAUTION: This equipment complies its antenna must not be co-located or operation in conjunction with any other antenna or transmitter.

This equipment complies with FCC RF exposure requirements set forth in an uncontrolled environment and can be used without any restriction.

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

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Modifications: Any modifications made to this device that are not approved by **Straffic Co., Ltd.** may void the authority granted to the user by the FCC to operate this equipment.

A minimum separation distance of **20 cm** must be maintained between the antenna and the person for this appliance to satisfy the RF exposure requirements.

Address :

338, Pangyo-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea

Tel : 031-601-3500

Manufacturer Address :

88-11, Jangjincheon-gil, Ilsandong-gu, Goyang-si, Gyeonggi-do, Republic of Korea

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