MKUR-300

UHF RFID Reader

User Manual

MINERVA
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The pictures and screens shots on this document may be different to actual. .
Please thoroughly read the caution section before installing the reader.
Reasonable measures have been taken to ensure that the information included in this manual is complete and accurate.
However, Minerva reserves the right to change any specification at any time without prior notice.

◈ Cautions ◈

✓ Stop the reader in case there is smoke, strange smell and over heated.

    A. It can cause an electric shock and fire.

    B. Remove the power cable.

    C. Do not open the reader.

✓ Do not open/ modify the reader in order to repair. It can cause an electric shock and fire.

✓ Use the accurate power cable for the reader. If not, it can cause an electric shock and fire.

✓ Do not use other power adaptor.

✓ Apply the power plug properly. If not, it can cause an electric shock and fire.

Please follow the instruction below to operate the power adaptor.

    A. Make sure that there is no dust inside.

    B. Ensure that the power plug is firmly in place.

    C. Disconnect the reader from the power if the reader is not in use for a long period of time.

    D. Do not remove the power cable with wet hands.

✓ Turn off the power before connecting any communication cables or peripheral devices. It not, it can cause electric shock.

✓ Do not place any heavy objects on the reader.

✓ Do not install the reader under the circumstance of high humidity or heavy dust.

✓ Do not install the reader in an unstable environment.

✓ Use the Null-Modem cable according to the specification of DB-9Pin cable.

✓ Check the antenna port if the reader can not read the tags.

✓ This product may interfere with other electronic devices due to the transmission of ultra high radio frequency.

> ※ **Some of commands and specifications may be different depending on the software version.Some pictures may differ according to the software version.**

*This is to inform you that this manual is suitable only to manufacturers or service agents, not for users.

This device can only be installed by professional installer under grantee controller.

User is not allowed to install by themselves.

FCC Information

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 not installed and used in accordance with the instruction manual, 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.

CAUTION :

Any changes or modifications not expressly approved by the party responsible for compliance could

void the user's authority to operate this device.

FCC RF Exposure Warning:

This product complies with FCC radiation exposure limits set forth for an uncontrolled environment.
To comply with FCC RF exposure requirements, the base unit must bo installed and operated 20 cm(8 inches) or
more between the product and all person's body (excluding extremities of hands, wrist and feet).
This product may not be collocated or operated in conjunction with any other antenna or transmitter.

Contents

Chapter 1. Introduction

1.1 Operation specification

- MKUR-300 supports multi-protocols (ISO18000-6C&6B, EPC Class 1 GEN 2) to read and write tags.
- MKUR-300 supports RS-232 and TCP/IP.
- MKUR-300 supports external I/O and controls other devices through the digital I/O.
- Easy to monitor the status of reader through LED.
- Easy to control the reader through the reader's API.
- MKUR-300 provides online upgrade.
- Preferable mode can be saved by the user.
- Possible to operate the programmable multi port antennas.
- Minimize the interference of the frequency Channel. (Dense Reader Mode)
- MKUR-300 supports sensitivity setting for LBT.
- MKUR-300 supports the reader monitoring mode and measurement of RF receiving level.

1.2 Communication Specification

External Interface	Serial	230,400bps / 115,200bps / 57,600bps / 38,400bps
	Ethernet	10 BaseT(TCP/IP, UDP, ARP)
Air Protocol	Tag Air Protocol	ISO18000-6C&6B EPC Class1 GEN II

1.3 Environment Specification

Operating Temp.	-10℃ ~ 50℃
Storage Temp.	-20℃ ~ 70℃
Humidity	90% (Relative humidity)

1.4   Reader specification

Item	Specification	Remark
Model name	MKUR-300	
Air interface protocols	ISO-18000-6C&6B, EPC Class1 Gen 2	
Frequency range	902.75~927.25 MHz	FCC(US)
RF output power	Max 1W, step:1dBm	
Modulation	PR-ASK	
Antennas	Circular Patch, <5.4dBi	
Antenna cable	RP-TNC to SMA-FM, EZ-240 15Meter, -4dB loss	
Antenna connector	4 monostatic	RP-TNC
Antenna operation	Operate programmable multi-antenna ports	
DSP filter	Minimize the interference of frequency Channel (Dense Reader Mode)	
Read range	5m (depends on antenna placement and tag type)	
Channels	50 Channels	
Channel band width	500KHz@1FA	
System OS	Embedded Linux 2.4.21	
Operating program	Window 2K / XP / Vista	
User API	API for Window	
Program upgrade	Through the use of Network or RS232	
Mode Setup	Preferable mode can be saved by user	
LBT control	Supports sensitivity setting	
Power supply voltage	DC 12V ($\pm$10%)	
DC Current	MAX 2000mA	
Weight	3.5kg	
Dimensions	208 x 105 x 38 (mm)	
LAN	Connector:RJ45, Standard : IEEE802.3, 10Base T Protocol: TCP/IP	
Serial	RS-232C, Baud Rate : Max 230,400bps	
Extended I/O	4 Inputs and 8 outputs	

1.5 Antenna Specification

Item	Specification
Model Name	MKUR-CA200R
Frequency range	902~928 MHz
3dB Beamwidth	79° MAX
Gain(dBi)	< 5.4dBi
VSWR	< 1.5
Impedance	50Ohm
Polarization	Circular(RHCP)
Dimensions	220x220x20 (mm)
Connector	SMA Female
Operating temperature	-10~50℃

1.6　　Product images

- MKUR-300 reader (Top view, front view)

- MKUR-CA200R　antenna

Chapter 2. Hardware Installation

2.1 Hardware

2.1.1   Reader I/O Panel
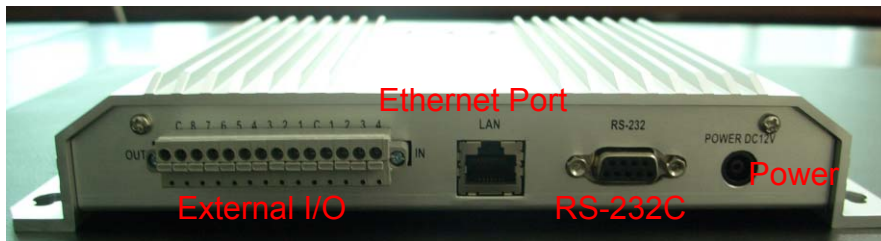
- RS-232C Port Specification

Number	Description
Pin 1	NC (Not Connected)
Pin 2	TX (Transmit Data)
Pin 3	RX (Receive Data)
Pin 4	NC (Not Connected)
Pin 5	Ground
Pin 6	NC (Not Connected)
Pin 7	Manufacture Reserved
Pin 8	Manufacture Reserved
Pin 9	NC (Not Connected)
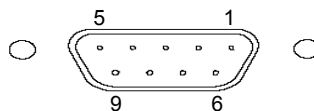
- Power Specification

Input voltage	DC 12V (±10%)	
Input current	$\geq$ 2000mA	
Ripple & Ripple noise	$\leq$ 50mVp-p	instant spike: $\leq$ 100mVp-p

● External I/O: DB-15pin Connector

Number	Description	Input/Output	Remark
O C	Common	Common	User Dependent
O 1	Output 1	Output	User Dependent
O 2	Output 2	Output	User Dependent
O 3	Output 3	Output	User Dependent
O 4	Output 4	Output	User Dependent
O 5	Output 5	Output	User Dependent
O 6	Output 6	Output	User Dependent
O 7	Output 7	Output	User Dependent
O 8	Output 8	Output	User Dependent
I C	Common	Common	User Dependent
I 1	Input 1	Input	User Dependent
I 2	Input 2	Input	User Dependent
I 3	Input 3	Input	User Dependent
I 4	Input 4	Input	User Dependent

● Antenna Port
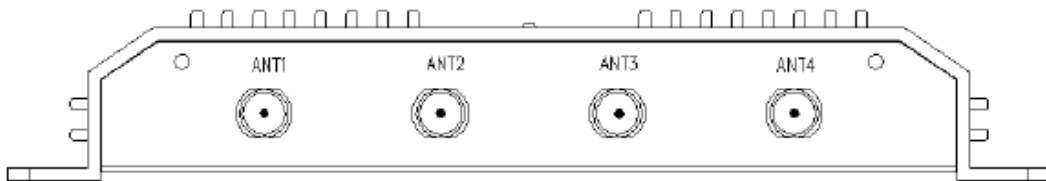
● RF specification

Item	Specification	Remark
Frequency Range	902.75~927.25MHz	
RF output power	Max 1W (≤ 30dBm)	
Modulation	PR-ASK	
Air interface protocol	ISO18000-6C&6C(EPC Class1 Gen2)	
Antenna ports	4 monostatic	
Read Range	≤ 5m (depend on reader placement and tag type)	
Antenna Gain	6dBi Below	
Channels	50 Channels	
Channel Band Width	500KHz@1FA	

2.1.2   LED Panel

- POWER (Green): It indicates the power; ON/OFF
- STATUS (Red): It flashes once the reader finishes booting and blinks faster while the reader reads the tags.
- READ (Blue): It flashes when the reader reads the tags.

2.1.3   Various types of Gen2 tags

2.2 Hardware installation

① Locate the host PC.

② Connect the reader with the RS-232C cable.

③ Connect the RS-232C cable with the host PC.

④ Connect the power adaptor to the reader..

⑤ Connect the antenna port (1) with the antenna cable.

⑥ Connect the antenna with the antenna cable.

⑦ Plug the power code.

⑧ Operate the host PC and execute the PC program (RfBag.exe).

Chapter 3. Software Installation

3.1 Check before installation

① Confirm the appropriate software.

② Confirm the host PC that connects to the network.

3.2 Software installation

① Copy the software into the host PC (E.g.. Copy the MKUR-300 folder onto D:)
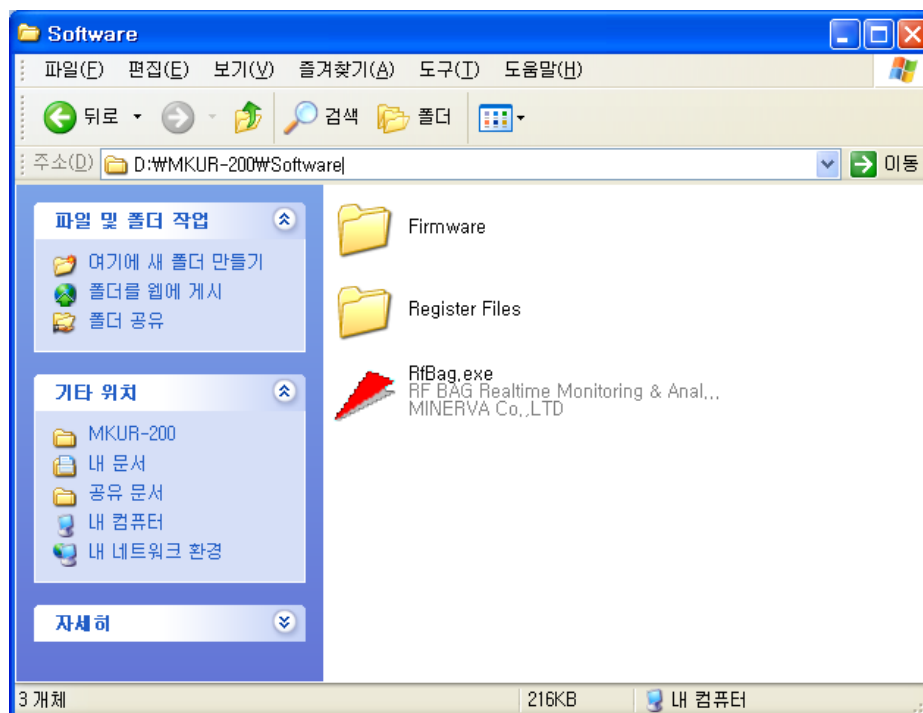
※ **Firmware folder**: It includes .bin file in order to upgrade a firmware.

Register file folder: It includes .rgs file in order to set a registry

RfBag.exe: It is the executable PC program.

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② When you execute the RfBag.exe, you can see the Main Menu window as follows.

Chapter 4. Software Operation

There are two ways to operate the MKUR-300 UHF Reader. One is to operate the reader with directly received input and the other is the Machine-to-Machine(MtoM) mode, in other words, to operate automatically by the connected host or software which has been programmed in the middleware. In order to operate in MtoM mode, you need the program that is developed with the appropriate protocol which is discussed in chapter 6 and 7.

The reader can be controlled using binary protocols (See chapter 7) for the provided program. It can also be controlled as the terminal form which is delivered in text format, while the reader connects through serial or TCP/ IP. User inputs commands directly to the keyboard (See chapter 6,Reader String Protocol).

In this chapter, it describes how to control the reader by the program that uses binary protocols and also discusses how the user reads and writes the tags.

4.1 Execute the Rfbag (PC Application Program)

① Turn the reader on while connects to the antenna(s).

> ※ It takes approximately 20~30 seconds for booting the reader. (The status LED blinks when the booting finishes)

② Execute a (PC Application Program)
RfBag

4.2 Connect the host PC with the reader through RS232C

> ※ **NOTICE: Check a serial connection of the Reader**
> You need to choose the protocol type in the serial communication method that operates only one channel. The factory default setting will be the binary protocol which can be used.
> But if you have changed the serial protocol mode to string, it can only work with the terminal method. Therefore, check the next chapter for the serial connection.

①   Connect the RS232C cable to the reader.

②   In the Main Menu, choose the Option from Help or configuration, the Configuration window opens.

config.
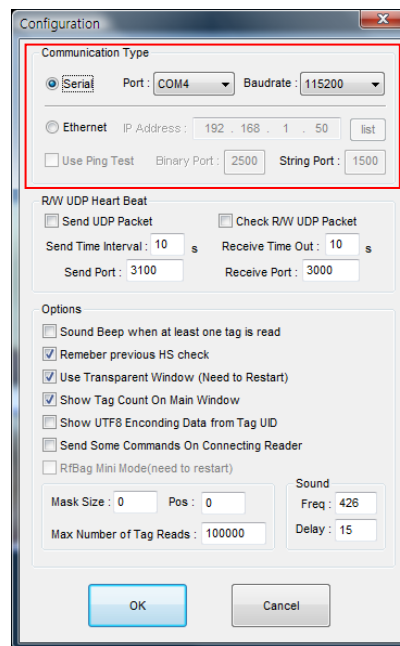
③   Choose the Serial from Communication Type.

④   Select the host PC's communication port. (ex. COM1, COM2….)

> ※ **How to check the host PC's communication port**
>
>   Right click on My computer → Select Properties → Systems Properties → Hardware → Device Manager → Ports (COM/ LPT)

⑤   Select   115200 bps for Baudrate and then click OK.   OK

⑥   In the Main Window, click connect button.   connect   It will connect the reader to the host PC.

⑦   If you want to check the connectivity between the reader and the host PC, click the Info button. The Information of Internal Message window appears.   info
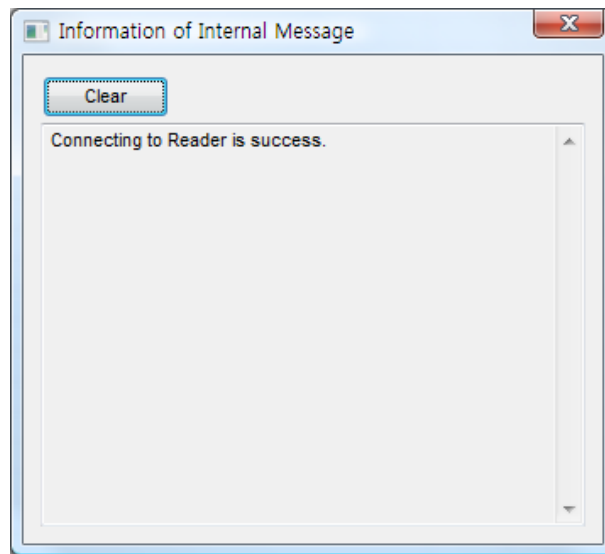
4.3 Search the reader using the program and Ethernet

① Connect the Ethernet cable to the reader.

② Either select the Search Reader from the Function or Scan button [scan] to search the reader.
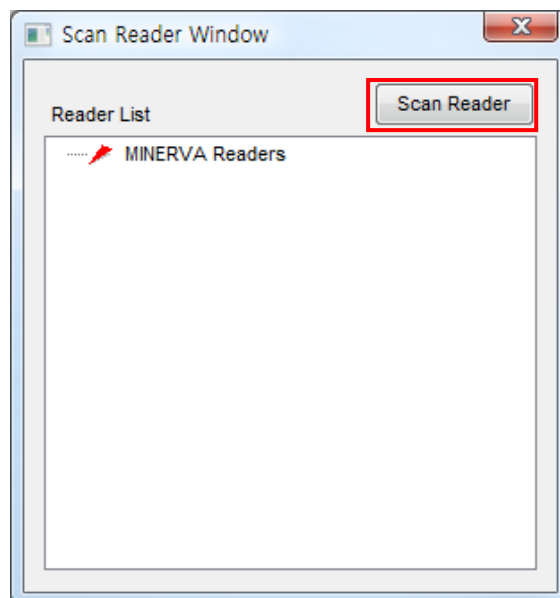
③ Click a Scan Reader button.

④ The information about thea reader on the local network area will appear.
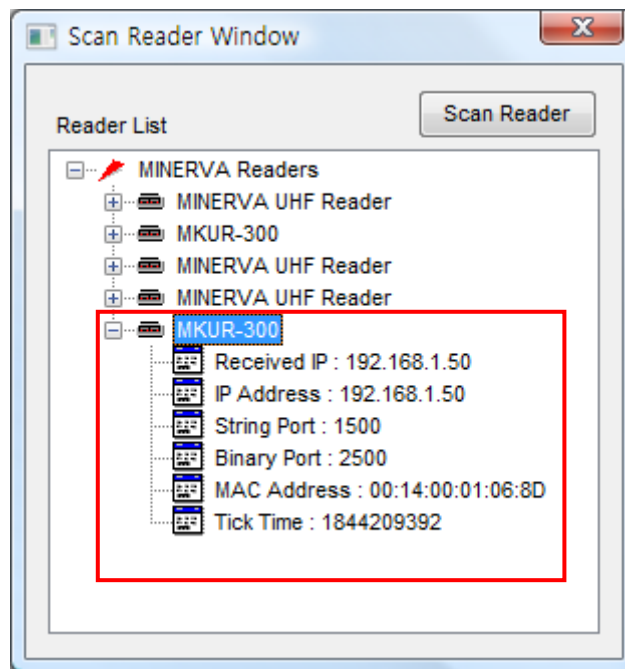
4.4 Connect the host PC and reader through the Ethernet

① Connect the reader and host PC using the Ethernet Cable (Cross Cable). If you have multiple readers, use the Ethernet Network Hub to connect with the PC.

② From the Main Menu, select Help → Option or configuration button. The Configuration window appears.
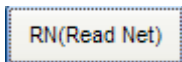
③ From the Configuration window, select the Ethernet from the Communication Type.

④ Type the IP Address of the reader and set port number as 2500 and then click OK.
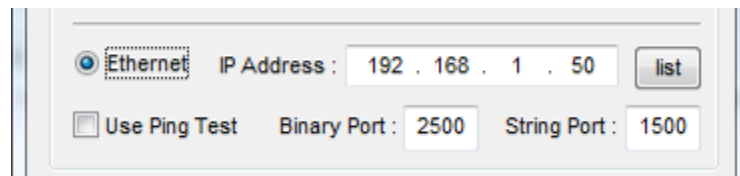
⑤ From the main window, click the Connect button to connect the reader and the host PC.

⑥ To check the connectivity between the reader and the host PC, click the Info button.

※ **How to check the IP Address of the reader**

1. Connect the reader and the host PC through the RS232.

2. From the main window, click the reader button. The Reader Config Command window appears.

3. Click the RN(Read Net) button from the Reader Network to see the IP Address, Subnet Mask, Default Gateway and DNS Address.

Reader Config Command

Reader Network   ⊙ Static   ○ DHCP
IP Address :   192 . 168 . 1 . 50
Subnet Mask :   255 . 255 . 255 . 0
Default Gateway : 192 . 168 . 1 . 1
DNS Address :   168 . 126 . 63 . 1

RN(Read Net)   WN(Write Net)

Serial Baudrate   Select Protocol Type
115200 ▼ bps   ○ String   ⊙ Binary
BR(BaudRate)   PM(Protocol Mode)

UDP Heart Beat
☐ Send Port :   3000   Send   Receive
☐ Receive Port : 3100   ●   ●
Internal Send Time :   10   RU(Rd UDP)
Receive Max Time Out : 10   WU(Wrt UDP)

Reader Time/Date
Cur. Tm 2008-04-18 ▲▼ 오후 4:23:30 ▲▼
RT(Rd Tm)   WT(Wrt Tm)
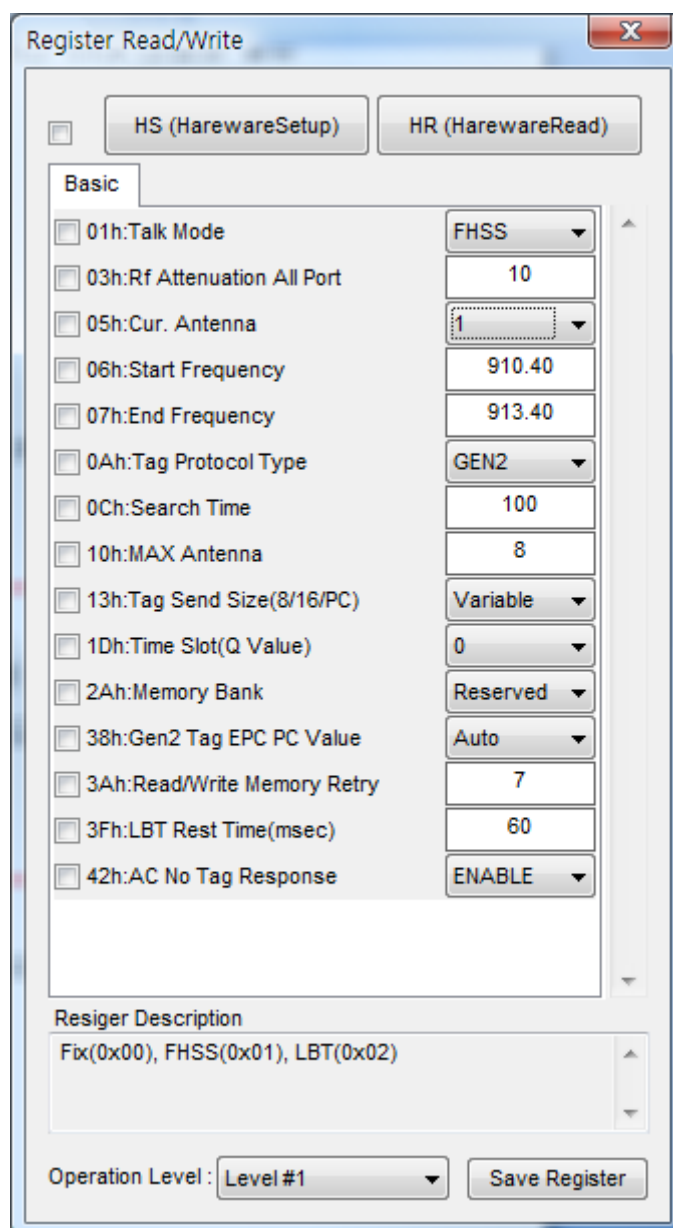
4.5 Check or change the register settings

You can view the value of the Register using the HR(HardwareRead) button. And also you can modify the value using the HS(HardwareSetup) button.

① Connect the reader and the host PC, click Register button. [register] The Register Read/Write window appears.

.

② To check the default value of the Register, click HR(Hardware Read). [HR (HarewareRead)]

> ※ If the HS or HR are deactivated,
> check the connectivity between the reader and the host PC.

③ Check the check box to modify the value of the Register.

④ Click the HS(HardwareSetup) button to apply the changed value.

⑤ To check the modified value, click HR(HardwareRead) button

> ※ If you want to have more information on the Register, please see the chapter6 for the Binary protocols.

※ **How to keep the current setting as the default register value**
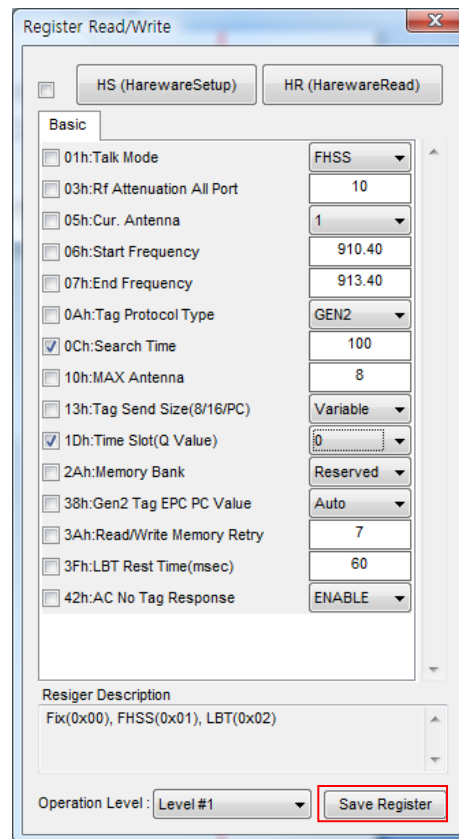
① The default register value is saved on the flash memory.

② You can change the default register setting using the SR Command.

③ From the Main Menu, click the Register button. **register**   The Register Read/Write window appears.

④ Click the HR(HardwareRead) to view the current register value. Ant the click the Save Register button.

4.6 How to read tags while using the single port

> ※ **NOTICE:**
>
> 1. Place the Gen 2 tags in front of the antenna.

① You need to set the Register value in the reader to read the tag.

② Click the Register button ▦ register from the Main Menu, the Register Read/Write window appears.

> ※ If the button is deactivated, HS (HarewareSetup)　HR (HarewareRead)
> check the connection between the reader and the host PC.

③ Click the HR(HardwareRead) button to set the current register value. HR (HarewareRead)

④ Check the antenna port number that is connected to the reader.

⑤ After any changes in the register value, click HS(HardwareSetup) to set the changes.

⑥ After setting the Register value, click the TagCmd button ▦ tagcmd from the Main Menu, the Command Window1 (Tag) appears.

Command Window1 (Tag)

AC(Anti Conllision)

○ 1 Port Notify Start   ○ Multi Port Notify Start   ● Stop Notify

Read/Write Data

Start : 4   Size : 8   ○ 8Byte ● 16Byte   RB(Read Block)
Tag UID : 00.00.00.00.00.00.00.00.00.00.00.00.00.00.00.00 ☐   WB(Write Block)
Data : 11.22.33.44.55.66.77.88

☐ Continuous Read / Write
Success   Fault   Count   Max   Tag Num   ☐ R/W TEST
0   /   0   0   /   100000   1   Reset

⑦   Click 1 Port Notify Start button [1 Port Notify Start] from the AC(Anti Collision) to read tags.

※   To view the raw data view, click Raw button from the Main Menu. The Serial Raw Data View window appears.

From this window, you can see the [Send Data] from the reader to the host PC and the [Receive Data] for their responses.

Serial Raw Data View

[Send Data]

[001-16:36:30] 02 01 FF 04 41 43 00 01 F9 03

Clear

[Receive Data]

[046-16:36:33] 02 FF 01 F4 61 63 00 51 26 0E 30 00 00 00 00 00 00 00 00 00 00 00
[047-16:36:33] 02 FF 01 5B 61 63 01 51 26 05 30 00 00 00 00 00 00 00 00 00 00 00
[048-16:36:33] 02 FF 01 F4 61 63 00 51 26 0E 30 00 00 00 00 00 00 00 00 00 00 00
[049-16:36:33] 02 FF 01 8E 61 63 01 51 26 08 30 00 00 00 00 00 00 00 00 00 00 00

Send Custom Data

Send   BCC

※ Use this view to check other commands.

⑧ The tag data is displayed. Each raw show the tag ID, number of times tag has been read, antenna number and the tag reading time.

⑨ Click Stop Notify button to stop reading tags.

4.7 How to change antenna setting while using a Single Port

① Connect the reader and the host PC.

② Check the current port.
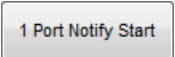
③ Change the antenna cable from ANT1 to ANT2.

④ Click the Register button [register icon] from the Main Menu.

⑤ Select the 05h:Cur. Antenna and choose 2 for the antenna port 2. Click HS(HardwareSetup) button to save the changes.

⑥ From the Main Menu, click the Tagcmd button [tagcmd icon] to open the Command window1 (Tag). Click 1 Port Notify Start button. [1 Port Notify Start]

⑦ From the Main Menu, the Ant1 has been changed to Ant2.

4.8 How to read tags while using multiple ports

① Connects the reader with more than 2 antennas.

② Connect the reader and the host PC, click Resister button.

   Register Read/Write window appears.

③ Select 10h:MAX Antenna and choose 2. Click HS(HardwareSetup) to save the changes.

☐ 0Ch:Search Time	100
☑ 10h:MAX Antenna	2
☐ 13h:Tag Send Size(8/16/PC)	Variable ▼

④ From the Main Menu, click the Tagcmd button to open the Command window1 (Tag). Click 1 Port Notify Start button.

⑤ From the Main Menu, you can see the number of antenna which is activating with the tags.

No	Tag UID(PC + EPC + CRC) or Memory Data (Tag RSSI dBm)	Count	Ant	Read Time	Size	Index	Map
07	3000 0000 0000 0000 0000 0000 00CF 250E	115	1	08/04/18-16:44:33	96 bit	192	X
08	3000 0000 0000 0000 0000 0000 00D0 C6D0	160	2	08/04/18-16:44:33	96 bit	193	X
09	3000 0000 0000 0000 0000 0000 00D1 D6F1	82	2	08/04/18-16:44:33	96 bit	193	X
10	3000 0000 0000 0000 0000 0000 00DA 679A	65	1	08/04/18-16:44:33	96 bit	192	X
11	3000 0000 0000 0000 0000 0000 00DF 373F	134	2	08/04/18-16:44:33	96 bit	193	X
12	3000 0000 0000 0000 0000 0000 00E1 E0A2	102	1	08/04/18-16:44:33	96 bit	192	X
13	3000 0000 0000 0000 0000 0000 00E2 D0C1	123	2	08/04/18-16:44:33	96 bit	193	X
14	3000 0000 0000 0000 0000 0000 00E3 C0E0	159	2	08/04/18-16:44:33	96 bit	193	X
15	3000 0000 0000 0000 0000 0000 00E4 B007	89	2	08/04/18-16:44:33	96 bit	193	X
16	3000 0000 0000 0000 0000 0000 00E7 8064	69	1	08/04/18-16:44:32	96 bit	190	X
17	3000 0000 0000 0000 0000 0000 00E9 61AA	85	1	08/04/18-16:44:33	96 bit	192	X
18	3000 0000 0000 0000 0000 0000 00EA 51C9	5	1	08/04/18-16:44:16	96 bit	169	X
19	3000 0000 0000 0000 0000 0000 00EC 310F	82	1	08/04/18-16:44:33	96 bit	192	X
20	3000 0000 0000 0000 0000 0000 00EE 114D	89	1	08/04/18-16:44:33	96 bit	192	X
21	3000 0000 0000 0000 0000 0000 00EF 016C	96	1	08/04/18-16:44:33	96 bit	192	X
22	3000 0000 0000 0000 0000 0000 00F4 A236	72	1	08/04/18-16:44:32	96 bit	190	X
23	3000 0000 0000 0000 0000 0000 00F8 63BA	102	1	08/04/18-16:44:33	96 bit	192	X
24	3000 0000 0000 0000 0000 0000 00F9 739B	78	1	08/04/18-16:44:33	96 bit	192	X
25	3000 0000 0000 0000 0000 0000 0111 3C8C	86	1	08/04/18-16:44:33	96 bit	192	X
26	3000 0000 0000 0000 0000 0000 0142 561A	115	2	08/04/18-16:44:33	96 bit	193	X
27	3000 0000 0000 0000 0000 0000 014D A7F5	99	1	08/04/18-16:44:33	96 bit	192	X
28	3000 0000 0000 0000 0000 0000 0159 F540	68	1	08/04/18-16:44:33	96 bit	192	X
29	3000 2233 0000 0000 0000 0000 00B1 55A0	87	1	08/04/18-16:44:33	96 bit	192	X

※ If you want to use certain antenna while using the multiple ports, you can simply set the number of antenna on the 05h:Cur.Antenna.
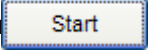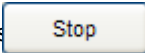
4.9 Tag Read Test

① From the Main Menu, click the Test button [test] The Tag Read Test window appears.

② Select the 1Port Notify Start and set the time for tag reading test. Click Start button [Start]

③ The Stop button stops the test [Stop]

※ **Auto Clear Option**: Before the test, delete the tag data from the Main Menu automatically.

▪ **Clear Tag Data**: Delete the all tag data from the Main Menu.

▪ **Clear Attenuate Data**: Delete the tag data of Accumulate tab window from the Main Menu

▪ **Clear Only Attenuate Count**: Initialize the Count of Accumulate tab window from the Main Menu.

4.10　　　How to write the tags

① From the Main Menu, click the TagCmd button. [tagcmd] The Command Window1 (Tag) window appears.

② From the Read/Write Data, the default setting is 4 for the start and 8 for the size. The memory blocks stats at the 4th Byte and the maximum length is 12 Byte.

③ The tag data must be recorded as an ASCII value.

※ E.g.) **The case to write 47914-9 at UHF Tag**

Command Window1 (Tag)

AC(Anti Conllision)
○ 1Port Notify Start　　○ Multi Port Notify Start　　☐ Use Special AC
○ 1Port Search Start　　○ Multi Port Search Start　　[AC(Anti Collision)]
◉ Notify Stop

Read/Write Data
Start : 4　　Size : 8　　○ 8Byte　◉ 16Byte　　[RB(Read Block)]
Tag UID : 00.00.00.00.00.00.00.00.00.00.00.00.00.00.00.00 ☐　[WB(Write Block)]
Data : 34.37.39.31.34.2D.39.00

☐ Continuous Read / Write
Success　　Fault　　　Count　　　Max　　Tag Num　☐ R/W TEST
0 / 0　　　0 / 100000　　1　　[Reset]

Picture 1] UHF Tag Write

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④ Click WB(Write Block) button. [WB(Write Block)]

※ **Always place only one tag in the antenna's field when writing.**

⑤ If the write was successful, the Information of Internal Message window appears.
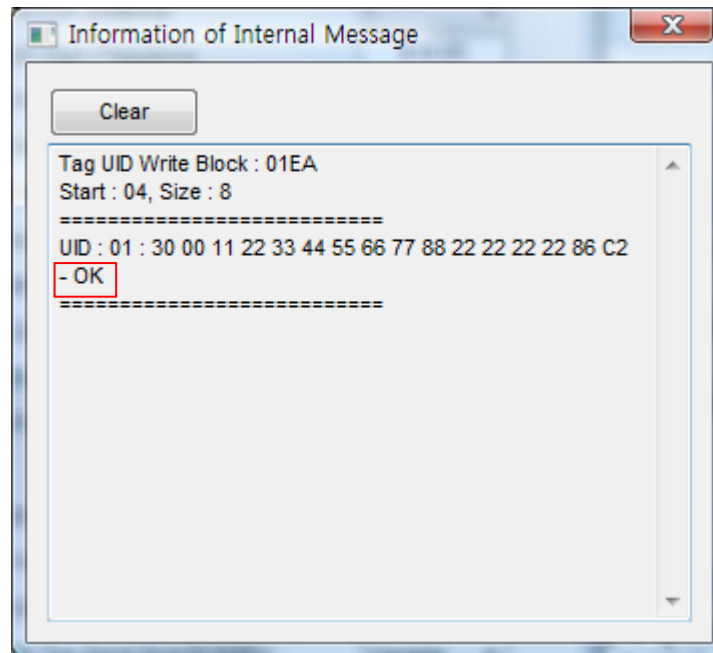
> ※ You can also check the Main Menu for the write.
> - If the Count is 0, the write is successful.
> - If the Count is other than 0, the write is fail.

⑥ Click RB(Read Block) button RB(Read Block) to check the tag data from the Information of Internal Message window.
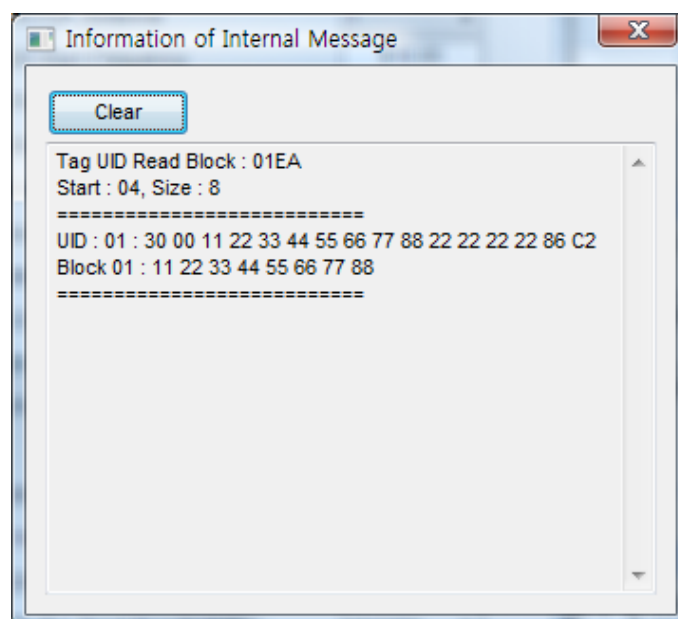
4.11   View the Tag ID as a map

Use Tag Map windows to see the tag ID by two- dimensional way. It is possible to see only the registered tags and the currently reading tags depend on the selection Mode.

① While the reader is reading the tags, click the Map button [📋 map] from the Main Menu.
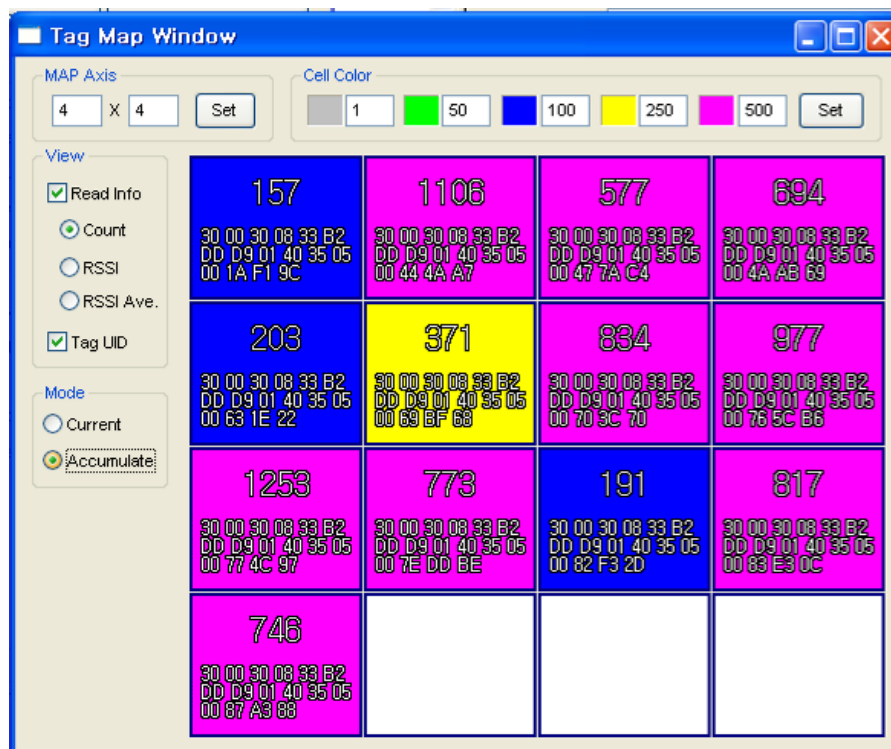
| ※ | **MAP Axis**: Change the size of a map. |
| | **Cell Color**: Change the colors of cells. |

② After changing the settings, select the tags from the Main Menu and then right click. Choose the Insert to Map.
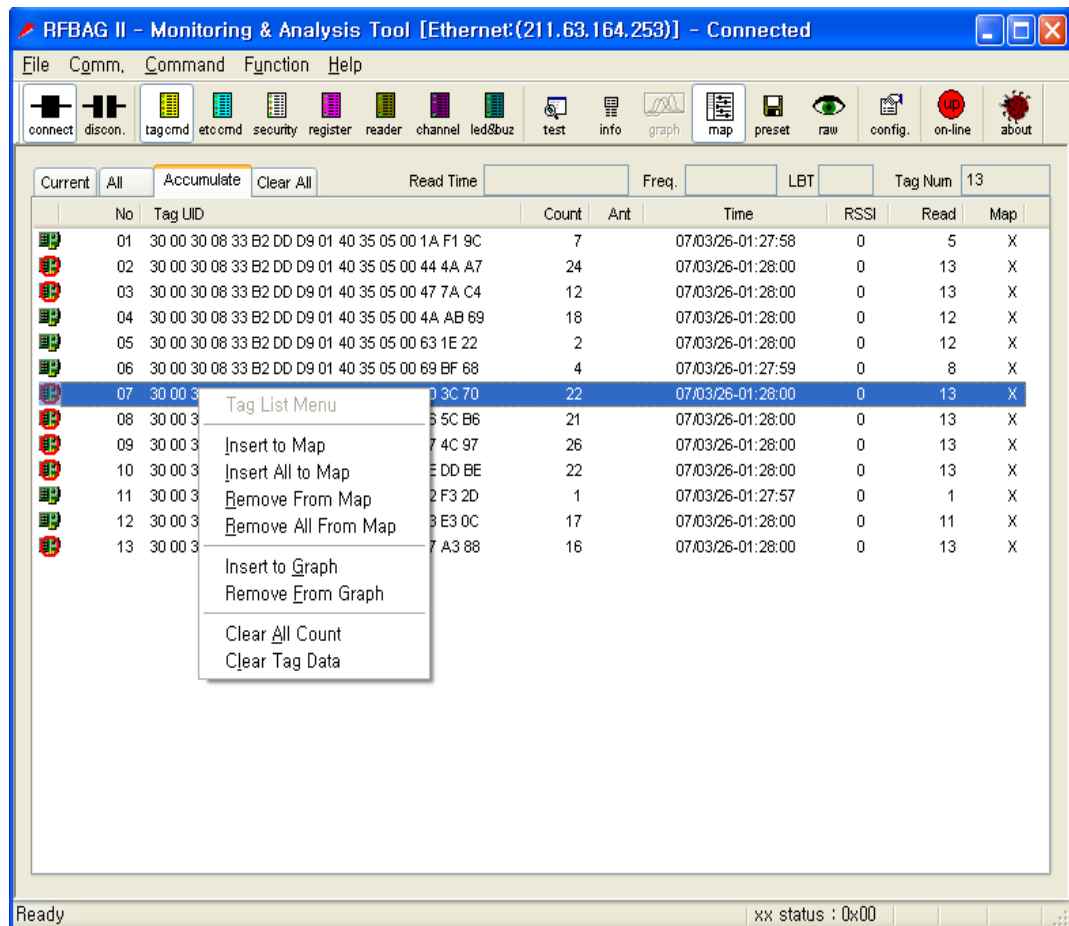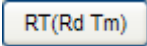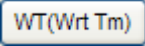
※ Insert to Map: Add the selected tag to the map.

Insert All to Map: Add all tags to the Map.

Remove From Map: Remove the selected tag from the Map.

Remove All From Map: Remove all tags from the Map.

Insert to Graph: Not available

Remove From Graph: Not available

Clear All Count: Initialize all Count to 0.

Clear Tag Data: Delete all tags.

4.12   Set the data and time for the reader

① From the Main Window click the Reader button,   Reader Config Command window appears.
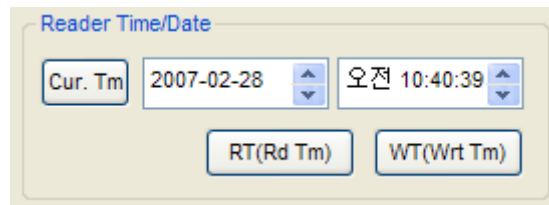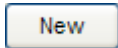
② From the Reader Time/Dat, click the RT(Rd Tm)   [RT(Rd Tm)]   to check the date and time.

③ If the date and time is wrong, click the Cur.Tm button [Cur. Tm] to to view the current time setting from the hostPC and then click the WT(Wrt Tm) [WT(Wrt Tm)] button to save the changes.

4.13   Preset Register

① From the Main Menu, click the Preset button,   the Preset Resister window appears.
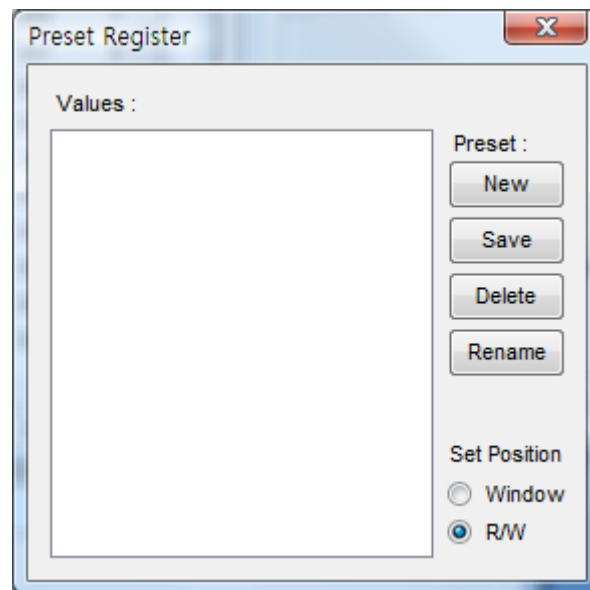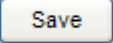
② From the Main Menu, click the Register button [register] to open the Register Read/Write Window and then change the settings.

③ From the Preset Register Window, click the New button. [New] Type the name and then click OK.
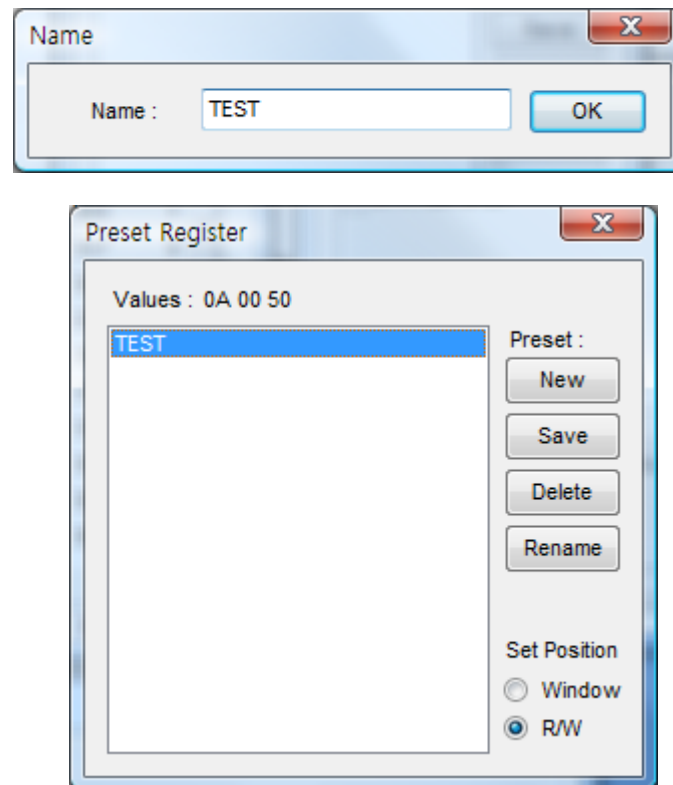
④ Choose the TEST and then click the Save button.

⑤ If you want to use this resister setting value, double click the name.
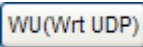
※ : Delete the name.
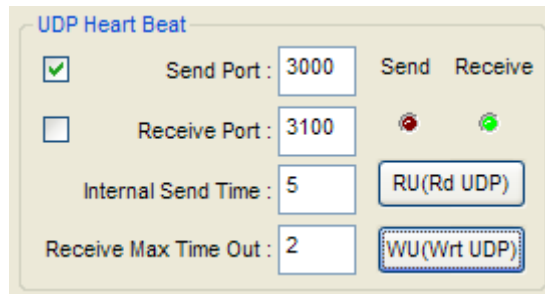
 : Change the name.

※ If you click New button without selecting the Register setting value, the error appears.
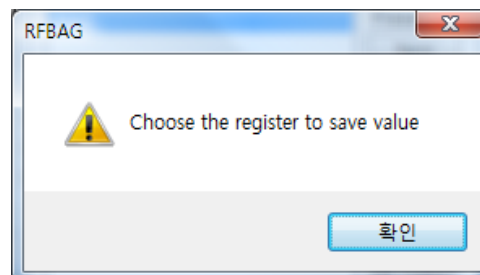
4.14   Set the UDP Heart Beat

①   Use UDP Heart Beat to monitor the reader's status.

②   Click the Reader button,   the Config Command window appears.

③   Type the port number and Interval Send Time (second) to send the UDP packet to the host PC.

④   Check the check box of Send Port and then click the WU(Wrt UDP) button. WU(Wrt UDP)

⑤   If the reader is working well, the green light of Receive blinks in every 5seconds.
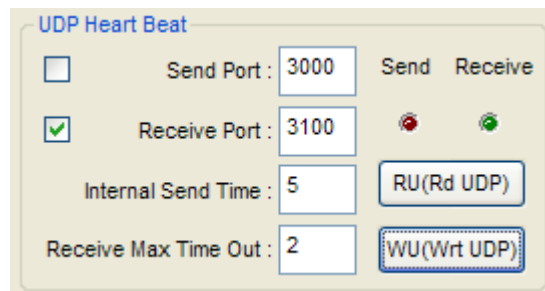
⑥   If you want to send the UDP packet reader from the host PC to the reader, type 3100 on the
     Receive port and set the maximum time limit to receive the packet on the Receive Max Time Out
     box. Check the check box of Receive Port and then click the WU(Wrt UDP) button

⑦   From the Main Menu, click the Config button   to open the Configuration window.

⑧   From the Reader UDP Heart Beat, check the check box of the Send UDP Packet and type the
     Send Time Interval and send port as 3100. Click OK.

⑨ On the UDP Heart Beat from the Reader Config Command window, the red button blinks in every 3 seconds.

⑩ Click the RU(Rd UDP) button to view the settings.

※ **NOTICE**

When the host PC sends the packet to the reader, if the reader does not receive the packet in the Receive Max Time Out, the reader Reboots

---

4.15　　　　Tag Map File (*.tda) Save/Load

① To edit the map data of tag, choose File→Export to TDA File from the Main Menu.
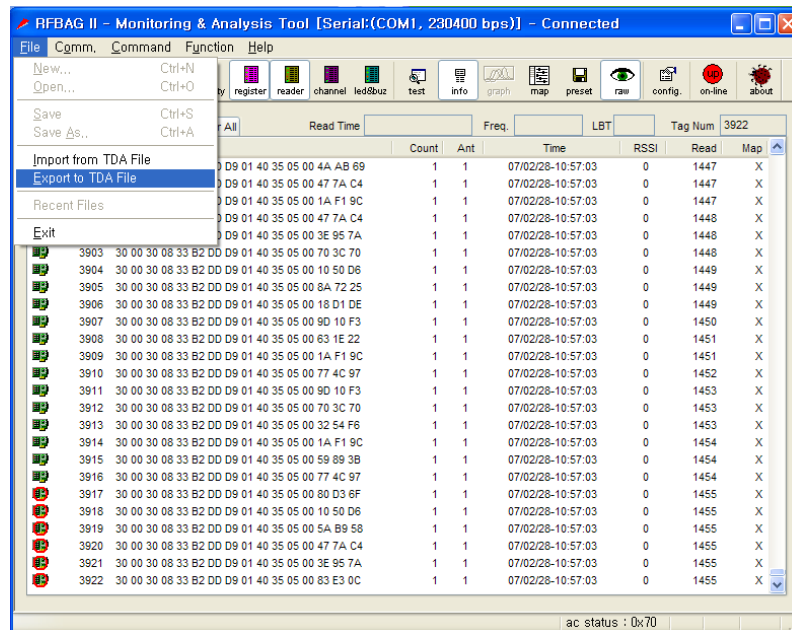
② Select the folder to save and the save as the Tag Data Files (*.tda).
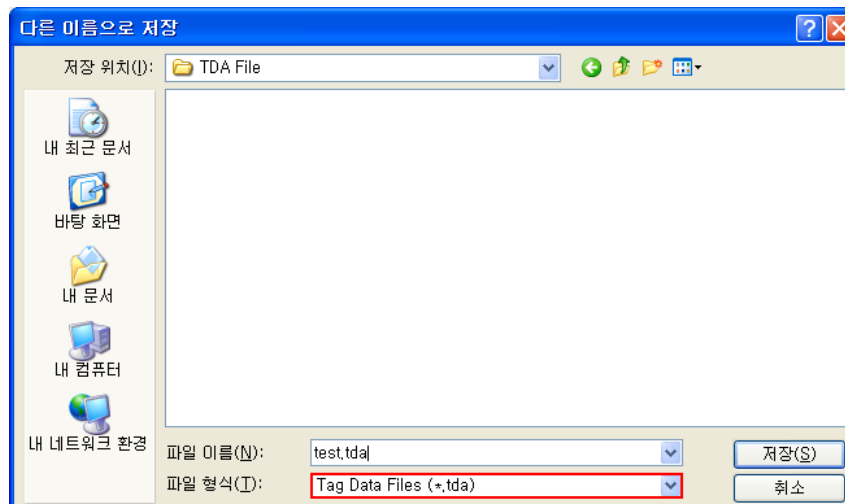
③ To open the TDA file or read the TDA file from the RfBag v1.78 version (and lower version), choose File→File→Import from TDA File from the Main Menu.

④ In the Accumulate from the Main Menu, view the tag data.

RFBAG II - Monitoring & Analysis Tool [Serial:(COM1, 230400 bps)] - Connected

File Comm, Command Function Help

connect discon. tagcmd etccmd security register reader channel led&buz test info graph map preset raw config. on-line about

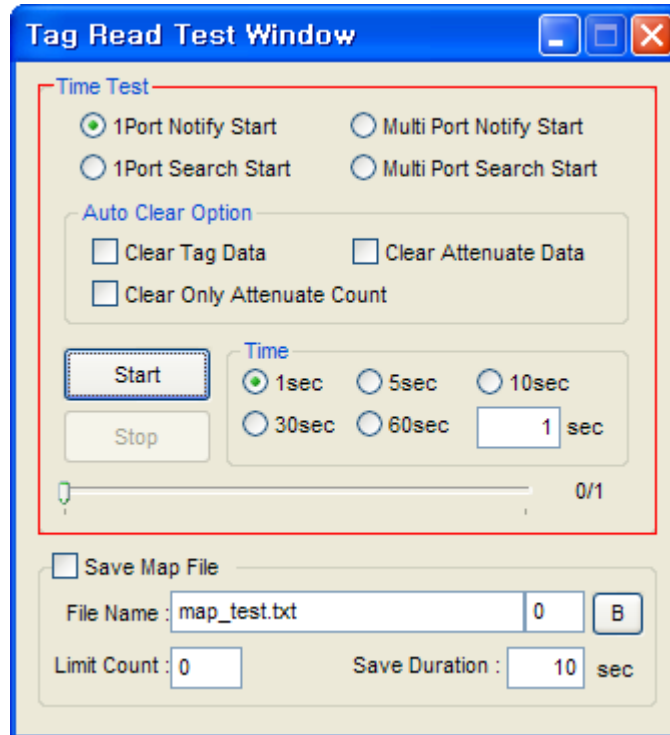Current All Accumulate Clear All   Read Time   Freq.   LBT   Tag Num 24

No	Tag UID	Count	Ant	Time	RSSI	Read	Map
01	30 00 11 11 11 11 FF FF FF FF FF FF FF FF 51 13	21			0	X	X
02	30 00 30 08 33 B2 DD D9 01 40 35 05 00 10 50 D6	24			0	X	X
03	30 00 30 08 33 B2 DD D9 01 40 35 05 00 18 D1 DE	21			0	X	X
04	30 00 30 08 33 B2 DD D9 01 40 35 05 00 1A F1 9C	13			0	X	X
05	30 00 30 08 33 B2 DD D9 01 40 35 05 00 2A C7 CF	32			0	X	X
06	30 00 30 08 33 B2 DD D9 01 40 35 05 00 32 54 F6	25			0	X	X
07	30 00 30 08 33 B2 DD D9 01 40 35 05 00 3E 95 7A	30			0	X	X
08	30 00 30 08 33 B2 DD D9 01 40 35 05 00 44 4A A7	13			0	X	X
09	30 00 30 08 33 B2 DD D9 01 40 35 05 00 47 7A C4	54			0	X	X
10	30 00 30 08 33 B2 DD D9 01 40 35 05 00 4A AB 69	20			0	X	X
11	30 00 30 08 33 B2 DD D9 01 40 35 05 00 59 89 3B	38			0	X	X
12	30 00 30 08 33 B2 DD D9 01 40 35 05 00 5A B9 58	10			0	X	X
13	30 00 30 08 33 B2 DD D9 01 40 35 05 00 63 1E 22	21			0	X	X
14	30 00 30 08 33 B2 DD D9 01 40 35 05 00 69 BF 68	21			0	X	X
15	30 00 30 08 33 B2 DD D9 01 40 35 05 00 70 3C 70	32			0	X	X
16	30 00 30 08 33 B2 DD D9 01 40 35 05 00 76 5C B6	25			0	X	X
17	30 00 30 08 33 B2 DD D9 01 40 35 05 00 77 4C 97	30			0	X	X
18	30 00 30 08 33 B2 DD D9 01 40 35 05 00 7B 8D 1B	29			0	X	X
19	30 00 30 08 33 B2 DD D9 01 40 35 05 00 7E DD BE	9			0	X	X
20	30 00 30 08 33 B2 DD D9 01 40 35 05 00 80 D3 6F	15			0	X	X
21	30 00 30 08 33 B2 DD D9 01 40 35 05 00 83 E3 0C	19			0	X	X
22	30 00 30 08 33 B2 DD D9 01 40 35 05 00 87 A3 88	5			0	X	X
23	30 00 30 08 33 B2 DD D9 01 40 35 05 00 8A 72 25	16			0	X	X
24	30 00 30 08 33 B2 DD D9 01 40 35 05 00 9D 10 F3	17			0	X	X

Ready   ac status : 0x70

4.16   Check the Firmware Version

①   Click the Etc Cmd button, the Command Window2 (ETC) window appears.
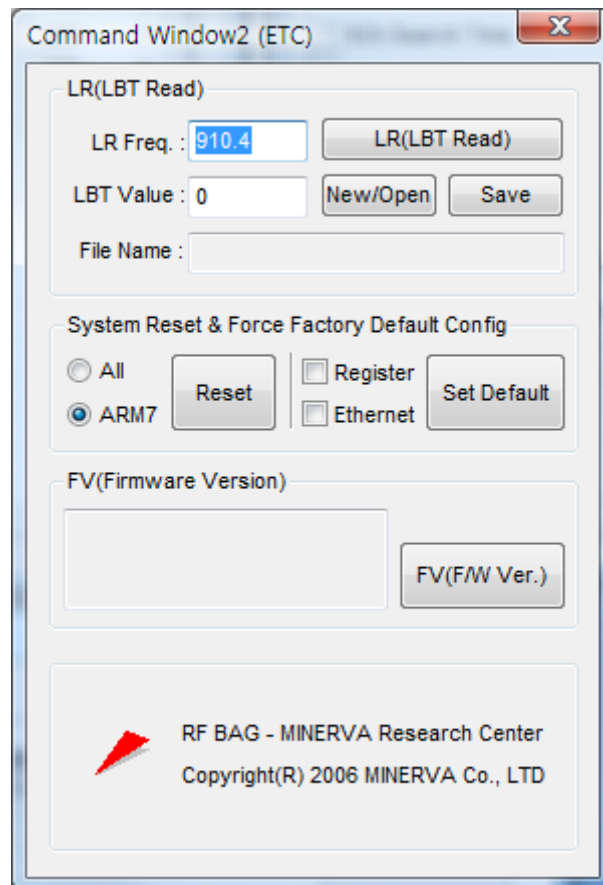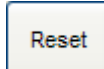
②   On the FV(Firmware Version), click the FV(F/W Ver.) button.
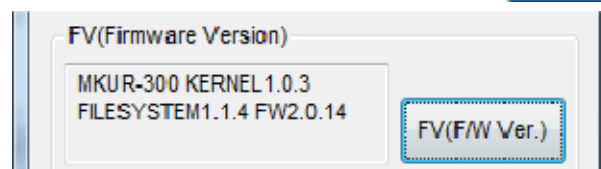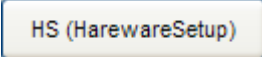
4.17   System Reset, Factory Default Config

①   Click the Etc Cmd button,   the Command Window2 (ETC) Window appears.

②   On the System Reset & Force Factory Default Config, select All or ARM7 and then click the Reset button   to reboot the system.

③   Select the check box of Register and click Set Default to set the register value as default
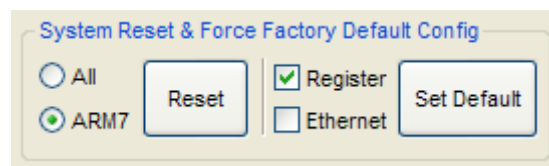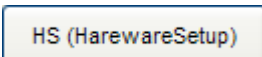
4.18   Modulation Off

①Click the Register button,   the Register Read/Write window appears.

②   Select 01h:Talk Mode and set the value as the FIX.

③   Select 02h:Modulation and set the value as the OFF.

④   Click the HS(HardwareSetup) button.   HS (HarewareSetup)

⑤   Use the Spectrum Analyzer to change settings.

4.19   Change the Frequency Band

> ※ NOTE
>
> Before start, set the Modulation Off.

①   Click the Register button.   The Register Read/Write window appears.

②   Select the 06h:Start Frequency and set the frequency.

③   Click the HS(HardwareSetup) button.   HS (HarewareSetup)

Chapter 5. Web Interface

This chapter explains about the remote setting changes, the command execution and command monitoring available through the web interface.
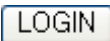
5.1 Connect to the Web Interface

① Launch your web browser and type the reader's default IP address of http://192.168.1.50 in the address bar and pressing ENTER.

> ※   See the chapter **4.4 How to connect the host PC and the reader though the Ethernet**

> ※   Do not use the String mode, Binary mode and the Web interface simultaneously.
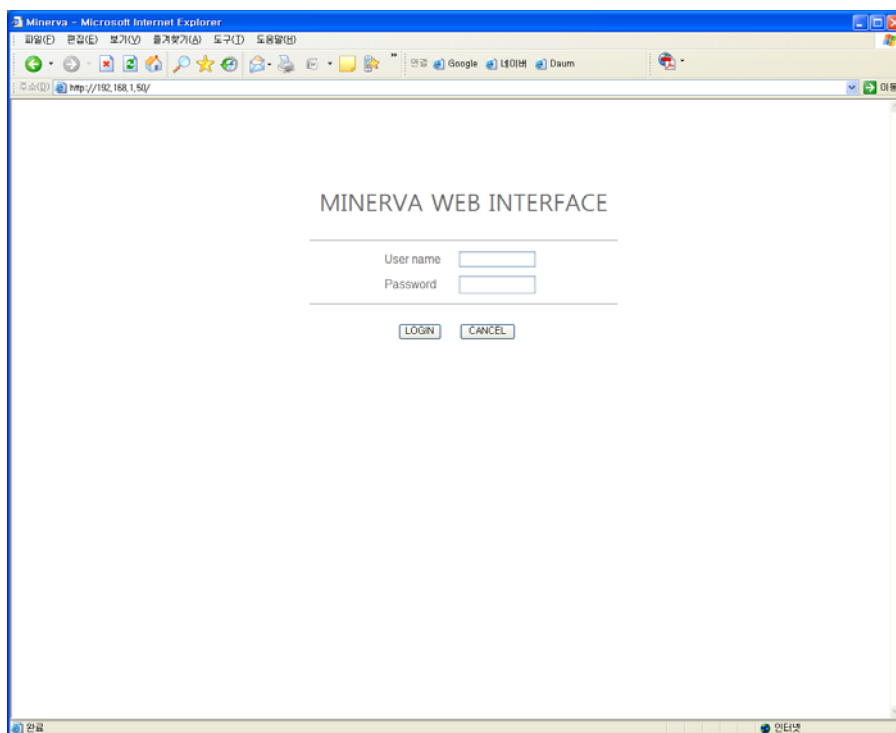
② Enter the default User name: Minerva and Password: 0000). Click LOGIN. [LOGIN]

The Minerva Web Interface page appears.
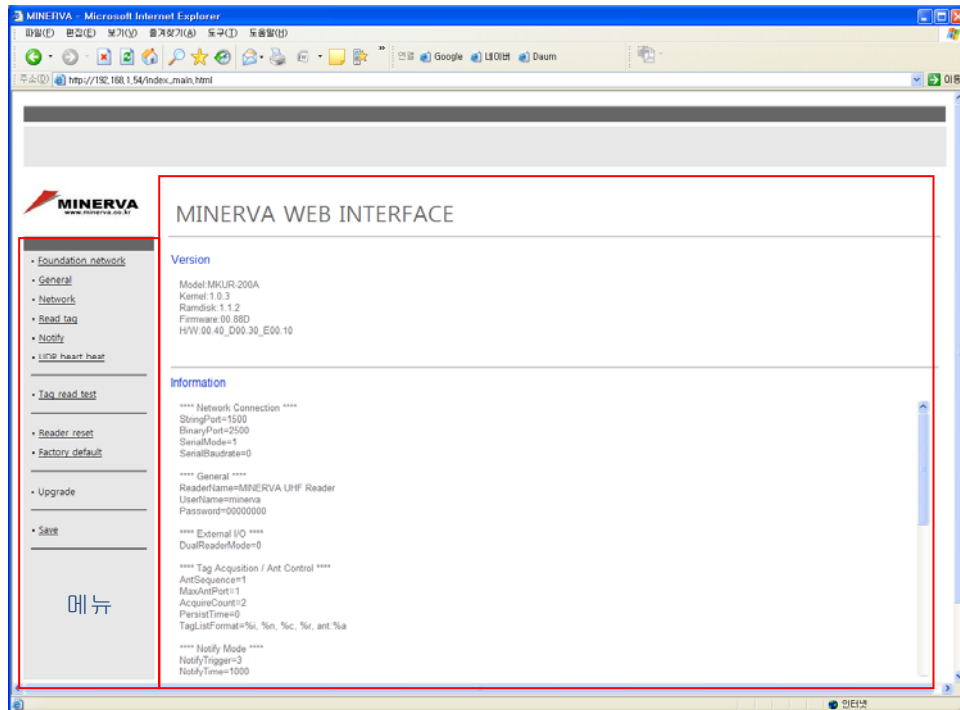
③ From the Main page, you can confirm the software version and information about the reader.

5.2 Page Index

The table below explains the web interface functions available on each page.

Type	Page Name	Functions
Setting	Foundation network	Check and change the setting of the network. (IP Address, DNS, Netmask, Route)
	General	Check and change general setting for the reader . (Reader name, User name, Password, Max ant port, Ant sequence, RF attenuation, Serial mode, Serial baudrate)
	Network	Check and change the port or Wireless LAN setting. (IP mode, Network timeout, String port, Binary port, WLAN mode)
	Read tag	Check and change the settings to read tags. (Persist time, Taglist format, Acquire count)
	Notify	Check and change the settings to notify the mode. (Notify trigger, Notify time, Notify address, Notify format, Notify retry count, Notify retry pause)
	UDP heart beat	Check and change the settings for the heartbeat of reader. (UDP send address, UDP send port, UDP send time)
Test & Apply	Tag read test	To test the tags.
	Reader reset	Turn off the reader and reboot.
	Factory default	Revert settings to the factory default.
	Upgrade	Not available
	Save	Save settings to the flash memory.

5.3 General Page

From the General Page, you can you can see the general information on the reader and change some settings.

① Click General from the Main Menu, the General page appears.
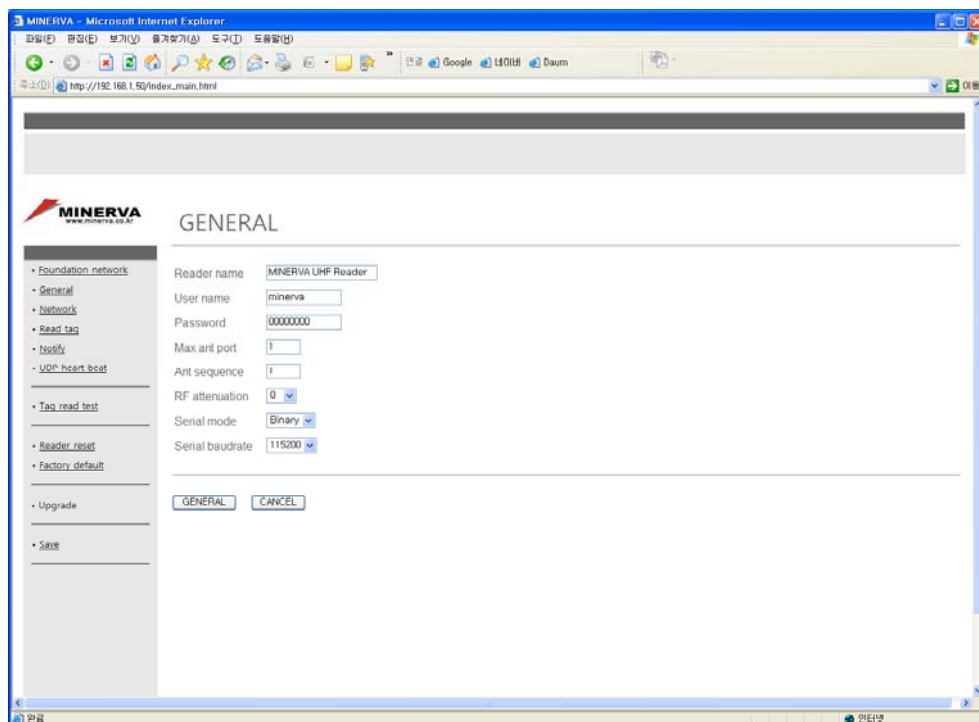
② Change the settings and then click GENERAL button [GENERAL] to save.

Reader name	MKUR-200
Password	00000000
Max ant port	1
Ant sequence	1
RF attenuation	0
Serial mode	Binary
Serial baudrate	230400

115200
230400
57600
38400
19200
9600

GENERAL

③ These changed values will be removed when the reader is turned off. Use Save from the Main Menu to permanently keep the settings.

5.4 Tag Read Test

The Tag Read Test is mainly used to set up and run Anti-Collision searches quickly and give you immediate feedback.

① From the Main Menu, click the Tag Read Test. The Tag Read Test page appears.
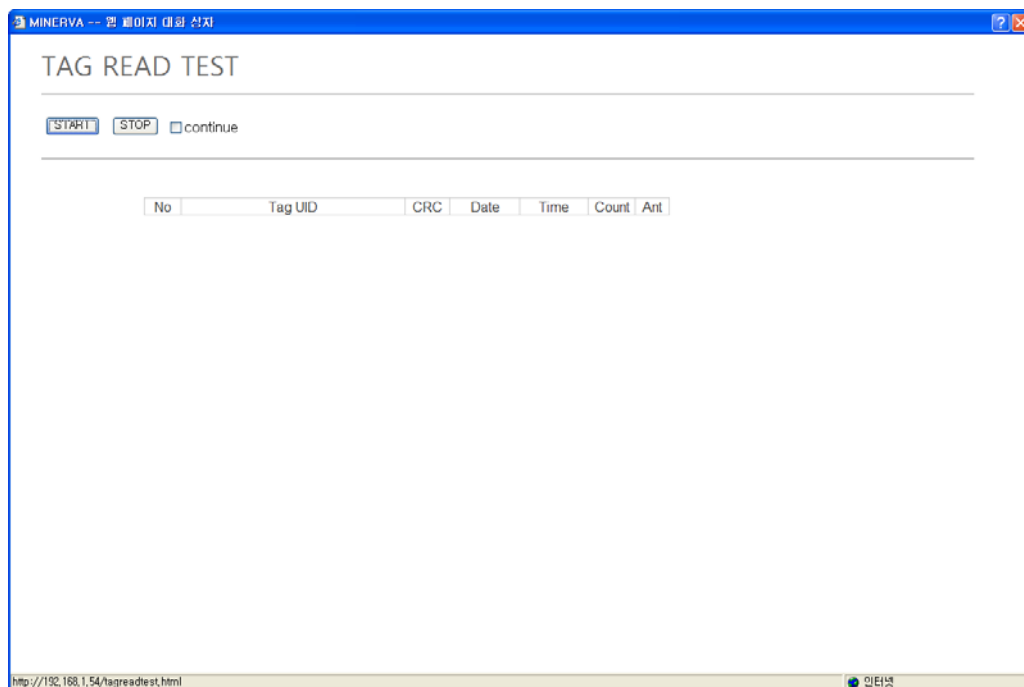
※ The default settings for reading tags are Search count= 1 and Acquire count=1.

② Click START button.

TAG READ TEST

START STOP ☐ continue

No	Tag UID	CRC	Date	Time	Count	Ant
1	1122 3344 5566 7788 3505 00C3	4295	20/12/25	11:02:01	2	1
2	3008 33B2 DDD9 0140 3505 0005	1242	20/12/25	11:02:01	1	1
3	3008 33B2 DDD9 0140 3505 000F	B308	20/12/25	11:02:01	1	1
4	3008 33B2 DDD9 0140 3505 0011	40F7	20/12/25	11:02:01	1	1
5	3008 33B2 DDD9 0140 3505 0017	2031	20/12/25	11:02:01	1	1
6	3008 33B2 DDD9 0140 3505 001E	B118	20/12/25	11:02:01	2	1
7	3008 33B2 DDD9 0140 3505 0026	0643	20/12/25	11:02:01	1	1
8	3008 33B2 DDD9 0140 3505 0029	F7AC	20/12/25	11:02:01	1	1
9	3008 33B2 DDD9 0140 3505 002C	A709	20/12/25	11:02:01	1	1
10	3008 33B2 DDD9 0140 3505 0030	74B4	20/12/25	11:02:01	2	1
11	3008 33B2 DDD9 0140 3505 0037	0453	20/12/25	11:02:01	1	1
12	3008 33B2 DDD9 0140 3505 0039	E59D	20/12/25	11:02:01	1	1
13	3008 33B2 DDD9 0140 3505 003F	855B	20/12/25	11:02:01	1	1
14	3008 33B2 DDD9 0140 3505 005D	C9BF	20/12/25	11:02:01	1	1
15	3008 33B2 DDD9 0140 3505 0071	2C51	20/12/25	11:02:01	1	1
16	3008 33B2 DDD9 0140 3505 009C	00D2	20/12/25	11:02:01	1	1
17	3008 33B2 DDD9 0140 3505 009F	30B1	20/12/25	11:02:01	1	1
18	3008 33B2 DDD9 0140 3505 00A0	F70D	20/12/25	11:02:01	1	1
19	3008 33B2 DDD9 0140 3505 00C8	1AA3	20/12/25	11:02:01	1	1

Total : 19

http://192.168.1.54/tagreadtest.html

③ If you check the Continue and click START, the result appears every 1 seconds.

④ If you want to view other page, close this page first.

5.5 Reader Reset

Disconnect the network connection and reboot the reader.

> After the reader reboots, connect it again through the web interface.

5.6 Factory default

Revert all settings to the factory default.

> ※   After the reader reboots, connect it again through the web interface.

5.7 Save

Save the settings to the flash memory.

Chapter 6. String Reader Protocols

This chapter explains the string reader protocols that can be used for either the MtoM(Machine-to-Machine) communication and direct input command by the user. If you use a Serial communication, the serial communication mode need to be set as a String. In case of using TCP/IP communication, set the connection port as a string port.

Serial Communication

It uses RS-232C cable and the specification as follows;

Baud Rate	: 115200 bps
Data Bits	: 8
Parity	: None
Stop Bits	: 1
Flow Control	: None

If you want to use a Serial Terminal program, the terminal mode need to be set as VT-100 and set a Echo for sending text.

Network Communication

The default reader setting is as follows;

IP Address	: 192.168.1.50
Subnetmask	: 255.255.255.0
Gateway	: 192.168.1.1
DNS	: 168.126.63.1

The default port while using a String is "**1500**".

Protocol Specification

The host transmits/receives the data in the form of ASCII. For each command consist of command itself and the spaces (0x20). Each line devided into (\r\n:0x0A0D) which is same to commands and the receiving messages. The tab is not allowed. When the reader transmit the commands, the space in front of the fist letter of the character (either alphabet of number) or the space after the last character will be ignored.

All waiting status means that the Prompt Message("MINERVA > ") has been sent from the reader and need to receive it by the host and transmit the command.

Once the command has been received, the reader executes the command. If it fails, 3 types of error messages below will be delivered to the host. The Prompt Message will be transmitted.

- The command is success: "\r\n\0"
- The command is fail: "Fail\r\n"
- The command is received but fail to execute: "Error\r\n"

The factory default user name is "minerva" and the password is '0000'. These values are changeable by the user.

The commands are not case sensitive except the user name and password. For example, SetIPaddress, SETIPADDRESS or SetIPaddress are all same.

Communication Sequence

Communication Sequence is described in the flow chart below.

```
                    ┌──────────────────┐
                    │ Initial connection│
                    └──────────────────┘
                              │
   FAIL                       ▼
         ┌──────────────►┌──────────────┐
         │               │ Input UserName│
         │               └──────────────┘
         │                      │
         │                      ▼
         │               ┌──────────────┐
         │               │ Input Password│
         │               └──────────────┘
         │                      │
         │                      ▼
         │               ╱ UserName OK? ╲
         └──────────────◄   & Password OK? ►
                         ╲               ╱
                    OK           │
                                 ▼
   ┌───────────────►┌──────────────┐          ┌──────────────┐
   │                │Command prompt │─────────►│ Input command │
   │                └──────────────┘          └──────────────┘
   │                      ▲                           │
   │                ┌──────────────┐                  ▼
   │                │    Error     │◄──── FAIL  ╱ Accurate ╲
   │                │   message    │            ╲ command? ╱
   │                └──────────────┘                  │
   │                                            OK    ▼
   │                                          ┌──────────────┐
   │                                          │Execute command│
   │                                          └──────────────┘
   │                ┌──────────────┐                  │
   │                │   Command    │          ┌──────────────┐
   └────────────────│  completed   │◄─────────│    Resutl    │
                    │   message    │          └──────────────┘
                    └──────────────┘
```
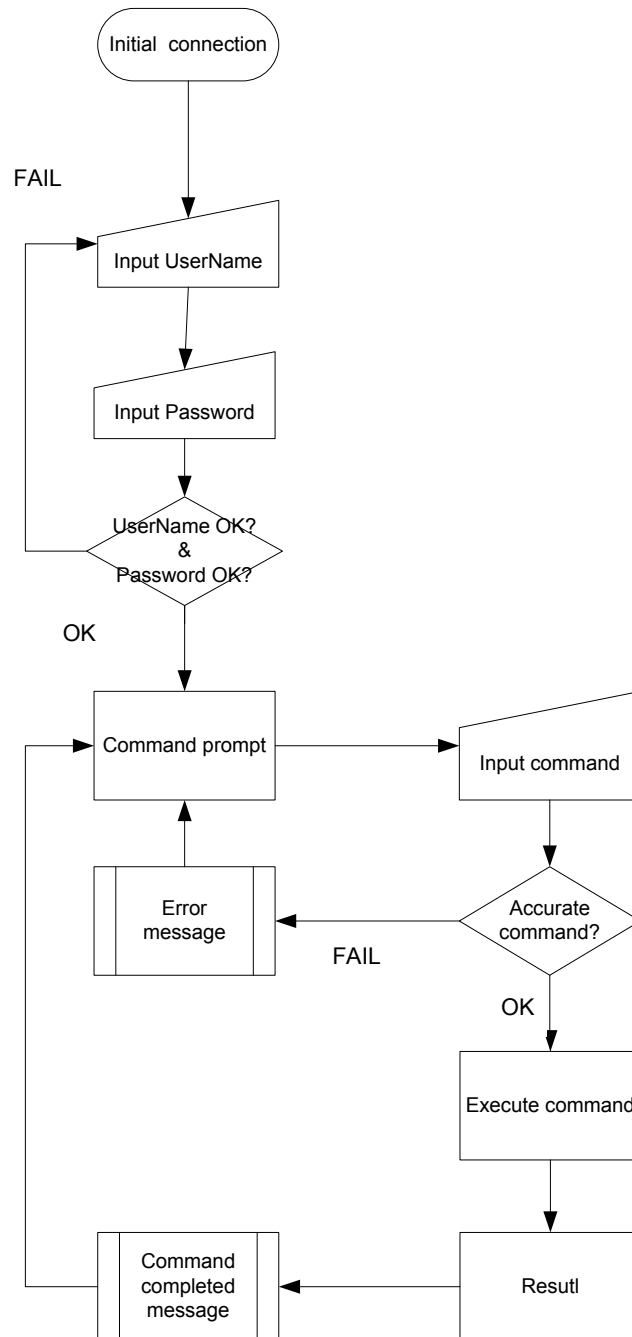
6.1 General Commands

There are some commands includes Set/Get. Set is to set up and accomplish the command and Get is used to acquire the command result. Most of Set commands execute immediately (except for network related commands) but need to be saved to keep the changes.

① **Info (i)**

Info shows the current setting value of the reader. It executes typing "I" instead of "Info".

Example)

MINERVA> i
**** Network Connection ****
StringPort=1500
BinaryPort=2500
SerialMode=1 (0:String Protocol, 1:BianryProtocol)
SerialBaudrate=0   (0:115200bps, 1:230400bps, 2:57600bps, 3:38400bps, 4:19200bps, 9600bps)

**** General ****
ReaderName=MKUR-300
UserName=minerva
Password=0000

**** Tag Acqusition / Ant Control ****
AntSequence=1,2,3,4   (Antenna Sequence)
MaxAntPort=1(Maxiumn Number of Ant Port for Reading)
AcquireCount=2
PersistTime=0
TagListFormat=%i'st tag : %n, crc : %c, time:%d-%t, count:%r, ant:%a

**** Notify Mode ****
NotifyTrigger=3   (0:Disable, 1:Continuous, 2:On Demand, 3:Interval)
NotifyTime=1500   ((msec))
NotifyAddress=192.168.1.201:3000   (IP Address:Port)

NotifyRetryCount=1000

NotifyRetryPause=3

NotifyFormat=Tag:%n, Disc:20%d %t, Last:20%d %t, Count:%r, Ant:%a, Proto:2

NotifyHeader=1   (1:Use, 0:Not Use)

NotifyMode=0 (1:Use, 0:Not Use)

**** Tag Memory Read/Write ****

MemoryAccessAnt=1

MemoryBank=1   (0:Reserved, 1:EPC, 2:TID, 3:User Memory)

MemoryStart=4

MemoryLength=12

**** UDP Heart Beat ****

HeartbeatAddress=255.255.255.255   (Heart-beat Broadcast Address)

HeartbeatPort=2314

HeartbeatTime=10

**** Network Phygical ****

DNS=168.126.63.1   (DNS Server)

IPAddress=192.168.1.50   (Reader IP Address)

Netmask=255.255.255.0   (Reader Netmask)

Gateway=192.168.1.1   (Network Default Gateway)

② **Save**

It saves the current setting value into the flash memory and keeps the same value after the reader has been turned off.

Save Example	
Command Response	>Save

③ **ReaderName(Get/Set)**

It can provide the name to the reader when the multiple readers are operating. The names can be changed anytime while the reading is operating.

ReaderName Examples	
Command Response	>getReaderName
	MKUR-300

Command Response	>setReaderName MKUR-300

④ **Username(Get/Set)**

It sets the user name.

- Need to type once for a serial connection.
- The default   username is   "minerva".
  NOTE: username is case sensitive.

Username Examples	
Command Response	>getUsername
	minerva
Command Response	>setUsername Admin

⑤ **Password(Get/Set)**

It sets the password.

- The default password is "0000".
  NOTE: The password is case sensitive.

Password Examples	
Command Response	>getPassword
	0000
Command Response	>setPassword 1234abcd

⑥ **AntSequence(Get/Set)**

When the Reader supports multiple numbers of antennas, it set the order of the antenna.

- If you use only one antenna, set one antenna port.
- If you use multiple antennas, set all antenna ports.
- The default AntennaSequence is 1. For example, if you use the antenna port 1 and 2, set the AntennaSequence as "1,2". It is related with the MaxAntPort command. It is not working if the MaxAntPort is lower than number of antennas that is being used. For example, If the MaxAntPort is "1" and the AntSequence is   "1,2", the 2nd antenna is not operating. Also, if you set AntennaSequence as "1, 2, 2, 2", the reader reads the tag once with the 1st antenna while the 2nd antenna read the tags

tree times.

■ You can connect maximum 4 antennas for the MKUR-300 reader. The setting vale for the antenna port that is not being used is "0".

AntSequence Examples	
Command Response	>getAntennaSequence 1, 2,3,4
Using one antenna	>setAntennaSequence 2
Using two antennas	>setAntennaSequence 1, 2
Using multiple antennas in a sequence	>setAntennaSequence 1, 1, 1, 2

⑦ **MaxPort(Get/Set)**

Setting the number of antenna port. The maximum number of MaxPort is 4 for the MKUR-300.

MaxAntPort Examples	
Command Response	>getMaxAntPort 1
Command Response	> setMaxAntPort 3

⑧ **RFAttenuation(Get/Set)**

This command can set the reader's attenuation value. Reducing the value of a software-controlled digital attenuation affects the decreasing of RF output, whereas the signal coming back from the tag is not decreasing. The RFAttenuation value is available from 0 to 33(Minimun output). The maximum RF output is 0 and the default value is 30dBm(RFAttenuation=3).   The difference between each value of RFAttenuation is 1dBm.

■ RFAttenuation value can be set from 0 to 33.

■ The default factory setting value is 3 which might be less than 30dBm from the real antenna port.

■ When the RFAttenuation value increases by 1, the RF output decreases by 1 dBm.

RFAttenuation Examples	
Command Response	>getRFAttenuation 3
Command Response	>setRFAttenuation 7

⑨ **SerialMode (Get/Set)**

The purpose of this command is for setting up the operational protocol of serial port to Binary or String. You can not use two protocols simultaneously as the Serial communication uses only one channel. However, for the TCP/IP communication, the port is not separated as String or Binary, you can make the reader communicate without considering the setting value as the following commands.

Serial Mode Attribute	
0	Communicate with a String Protocol
1	Communicate with a Binary Protocol.

Reboot the reader followed by using "Save" command to save the changes.

Serial Mode Examples	
Command Response	>getSerialMode 1
Command Response	> setSerialMode 0

⑩ **SerialBaudrate(Get/Set)**

Determines the speed of Serial communication. The default value is 115200bps.

SerialBaudrate Attribute	
0	115200 bps
1	230400 bps
2	57600 bps
3	38400 bps
4	19200 bps
5	9600 bps

Reboot the reader followed by using "Save" command to save the changes.

SerialBaudrate Examples	
Command Response	>getSerialBaudrate 1
Command Response	> setSerialBaudrate 0

⑪ **Reboot**

This command for restarting the reader.

Reboot Example	
Command Response	>Reboot

⑫ **FactoryDefault**

Erase any changes made to the reader's configuration settings and revert to factory default settings.

■   The reader reboots automatically after the command is activated.

FactoryDefault Example	
Command Response	>FactoryDefault

⑬ **ReaderVersion**

This command is to check the reader's software version.

ReaderVersion Example	
Command Response	>ReaderVersion
	Model:MKUR-300
	Kernel:1.0.3
	Filesystem:1.2.0
	Firmware:2.1.0

6.2 Network Configuration Commands

① **IPAddress(Get/Set)**

This command sets the reader's IP address.

- **"Save" and reboot the reader.**

IPAddress Examples	
Command Response	>getIPAddress 192.168.1.50
Command Response	>setIPAddress 192.168.1.60

② **Gateway(Get/Set)**

Gateway setting needs for the network communication.

- **"Save" and reboot the reader.**

Gateway Examples	
Command Response	>getGateway 192.168.1.1
Command Response	>setGateway 192.168.1.10

③ **Netmask(Get/Set)**

Setting the Subnet value.

- **"Save" and reboot the reader.**

Netmask Examples	
Command Response	>getNetmask 255.255.255.0
Command Response	>setNetmask 255.255.255.128

④ **DNS(Get/Set)**

Set DNS server's address.

- **"Save" and reboot the reader.**

DNS Examples	
Command Response	>getDNS

	168.126.63.1
Command Response	>setDNS 192.168.1.1

⑤ **S**

tringPort(Get/Set)

Setting the reader's port for string protocol.

- ■ **"Save" and reboot the reader.**

StringPort Examples	
Command Response	>getStringPort 1500
Command Response	>setStringPort 23

⑥ **BinaryPort(Get/Set)**

Setting the reader's port for string protocol.

- ■ **"Save" and reboot the reader.**

BinaryPort Examples	
Command Response	>getBinaryPort 1500
Command Response	>setBinaryPort 2600

⑦ **HeartbeatAddress(Get/Set)**

The reader can send heartbeat message periodically. The heartbeat broadcast   to the whole subnet or certain address in the form of   single UDP packet (Universal Datagram Packet).

The transmitting message is a XML formate as follows.

<MINERVA-RFID-UHF-Reader-Heartbeat>

<ReaderName>MKUR-300</ReaderName>

<IPAddress>192.168.1.55</IPAddress>

<StringPort>1500</StringPort>

<BinaryPort>2500</BinaryPort>

<HeartbeatTime>10</HeartbeatTime>

</MINERVA-RFID-UHF-Reader-Heartbeat>

- ■ The default value of 255.255.255.255 is the "multicast" address that whole device

on the subnet can receive the packets.

- This command can be applied immediately.

HeartbeatAddress Examples	
Command Response	>getHeartbeaAddress
	255.255.255.255
Command Response	>setHeartbeatAddress 10.1.70.17

⑧ **HeartbeatPort(Get/Set)**

This command designates the current port number for sending the packets.

The Heartbeat can be used for searching the reader in the network and for checking the reader's operating status.

- The default port value is 2314.

- This command can be applied immediately.

HeartbeatPort Examples	
Command Response	>getHeartbeaPort
	2314
Command Response	>setHeartbeatPort 1000

⑨ **HeartbeatTime(Get/Set)**

Setting the Heartbeat rate.

- The number is set by one second.

- 0(second) stop the transmission.

- The default value is 10 seconds.

- This command can be applied immediately.

HeartbeatTime Examples	
Command Response	>getHeartbeaTime
	10
Command Response	>setHeartbeatTime 60

6.3 Time Commands

① **Time(Get/Set)**

Setting the time for a reader.

- The time sets as YYYY/MM/DD hh:mm:ss.
- This command can be applied immediately.

Time Examples	
Command Response	>getTime 2007/3/22 9:23:01
Command Response	>setTime 2007/3/9 19:23:01

6.4 TagList Commands

① **ReadTagList (L)**

Use this command to search the tags list..

- The maximum tag number is 8192 on the TagList.
- "ReadTagList" can also be used as "L".
- **If the NotifyMode is activating, it cause the Error.**
- **If the reader is not excuting BeginRead,** reader is searching the whole tags and sending the current TagList. The multi-line response will be showed for each activating tags. If the Taglist is empty, the "No Tag Found"   will be displayed.
- **If the reader is excuting the BeginRead command,   the** reader is showing the Taglist that have been saved previously.

TagList Examples	
When the tag is on the Tag List	>getTagList Tag:8000 8004 0000 003B, Disc:2003/12/04 12:35:11, Last: 2003/12/04 12:35:11, Count:3, Ant:0 Tag:8000 8004 9999 0004, Disc:2003/12/04 12:35:11, Last: 2003/12/04 12:35:11, Count:3, Ant:0
When the tag is not on the Tag List	>getTagList No Tag Found

② **PersistTime(Get/Set)**

It will be supported.

③ **TagListFormat(Get/Set)**

This command sets the format of TagList.

TagList Format	
%i	Indicates tag ID.
%n	Display the tag ID by 2Byte. E.g.: 3008 33B2 DDD9 0140 3505 001A
%u	Display the tag D without space. E.g.:300833B2DDD901403505001A
%c	Display the tag's CRC value (2byte).
%l	Display the tag's PC value (2Byte).
%t	Indicates the time that the tags have been read. HH:MM:SS
%d	Indicates the date that the tags have been read. YY/MM/DD
%r	Indicates the number of times that the tags have been read.
%a	Indicates that the number of antennas that the tags have been read.
%p	Indicates the protocol types of the tags.
%%	Indicates '%'

Example)

MINERVA> setTagListFormat %i'st tag : %n, crc : %c, time:%d-%t, count:%r, ant:%a

MINERVA> l

1'st tag: 3008 33B2 DDD9 0140 3505 001A, crc : F19C, time:49/01/13-03:59:54, count:1, ant:1

2'st tag: 3008 33B2 DDD9 0140 3505 0044, crc : 4AA7, time:49/01/13-03:59:54, count:2, ant:1

3'st tag: 3008 33B2 DDD9 0140 3505 004A, crc : AB69, time:49/01/13-03:59:54, count:1, ant:1

4'st tag: 3008 33B2 DDD9 0140 3505 0063, crc : 1E22, time:49/01/13-03:59:54, count:1, ant:1

5'st tag: 3008 33B2 DDD9 0140 3505 0069, crc : BF68, time:49/01/13-03:59:54, count:3, ant:1

6'st tag: 3008 33B2 DDD9 0140 3505 0070, crc : 3C70, time:49/01/13-03:59:54, count:4, ant:1

7'st tag: 3008 33B2 DDD9 0140 3505 0076, crc : 5CB6, time:49/01/13-03:59:54, count:7, ant:1

TagType Examples	
Command Response	>setTagListFormat Tag's UID is %c
ReadTagList	Tag's UID is 3008 33B2 DDD9 0140 3505 001A
	Tag's UID is 3008 33B2 DDD9 0140 3505 0044
Command Response	>getTagListFormat
	taglistformat=%i'st tag : %n, crc : %c, time:%d-%t, count:%r, ant:%a

④ **BeginRead**

Use the BeginRead to search the tags. The ReadTaglist command while this command is not being executed, the reader searches the tag once depends on the the value of the AcquireCount. But sometimes the reader can not read the some tags because of the time difference between the reader and the Host while they are sending and receiving commands. Therefore, if you need to collect the tags ID without loss, use this command to read the tags continuously.

- **If the NotifyMode is activating, it cause the Error.**
- If the BeginRead command is executing, The reader starts to search the tags and waits for other commands.
- Delete the previous TagList and create the new TagList which lasts until the next command.
- Use FinishRead to stopt.

BeginRead Examples	
Command Response	> BeginRead

⑤ **FinishRead**

It stops reading the tag. The Taglist will be saved until the ReadTagList is being excuted.

FinishRead Examples	
Command Response	> FinishRead

6.5 Acquisition Commands

① **AcquireCount(Set/Get)**

The AcquireCoun value is available from 0 to 32 of single interger. This sets the number of Anti-Collision command to read tags.

If the AcquireCount value is 10, the reader executes the Anti-Collision command 10 times for each antenna.

Acquire Count Examples	
Command Response	>setAcquireCount 3
Command Response	>getAcquireCount AcqCount = 3

6.6 Notify Mode Commands

The Notify Mode is the method to send tag List which reader connects to the server through the Ethernet according to the form of Trigger. This guarantees the fast transmission in MtoM, also guarantees the stable transmission of TagList to reconnect to the network using Retry function .

The Notify Mode is not working while the BeginRead commend is being executed and vice versa. Stop one of commands to work properly.

If the NotifyMode is on, the GetTagList command is not working.

It applis to tag ID collection according to the AcquireCount setting.

① **NotifyTrigger(Set/Get)**

Trigger defines the notification mothod.

NotifyTrigger Attribute		
Value	Status	Details
0	Disable	Stop the transmission of NotifyList to the server. If this value is specified and the Notify Mode is currently the operating, it connects to the NotifyServer and collects the TagList only for saving it not transmitting it to the server. If you want to receive the actual data immediately from the Notified Server side, change the Trigger to different value and set on the NotifyMode.
1	Continuous	Transmit the TagList to the server according to the AcquireCount.
2	On Demand	When only the NotifyNow is on, transmits the TagList.
3	Interval	Transmit the TagList according to the NotifyTime value. While the reader is not transmitting the TagList, the NotifyNow will allow to transmit it.

If the Trigger is not Disable and the NotifyMode is on, reader collects the tags continually in the similar way of BeginRead command. The different point is that Trigger transmits to the Notified Server not to the String Port.

Notify Trigger Examples	
Command Response	>setNotifyTrigger 3
Command Response	>getNotifyTrigger 0

② **Notifyddress(Set/Get)**

Specify the address of the server when the reader sends the TagList.

The address form is IP address:Connection Port.

If the NotifyMode is On, the result is as follows,

Notify Address Examples	
Command Response	>setNotifyAddress 100.100.100.100:3500
Command Response	>getAcquireCount 0

③ **NotifyTime(Set/Get)**

When the NotifyTrigger is appointed to the Interval, definite the transmission time.

The unit is a second.

Notify Address Examples	
Command Response	>setNotifyTime 10
Command Response	>get NotifyTime 30

④ **NotifyFormat(Set/Get)**

The NotifyFormat command defines the format of the TagList. This is different from the TagListFormat.

Notify Format	
%i	Indicates tag ID.
%n	Display the tag ID by 2Byte.

	E.g.: 3008 33B2 DDD9 0140 3505 001A
%u	Display the tag D without space.
	E.g.:300833B2DDD901403505001A
%c	Display the tag's CRC value (2byte).
%l	Display the tag's PC value (2Byte).
%t	Indicates the time that the tags have been read.
	HH:MM:SS
%d	Indicates the date that the tags have been read.
	YY/MM/DD
%r	Indicates the number of times that the tags have been read.
%a	Indicates that the number of antennas that the tags have been read.
%p	Indicates the protocol types of the tags.
%%	Indicates '%'

ples of this command refer to the TagList command..

NotifyFormat Examples	
Command Response	>setNotifyFormat Tag's UID is %c
Notify	Tag's UID is 3008 33B2 DDD9 0140 3505 001A
	Tag's UID is 3008 33B2 DDD9 0140 3505 0044
Command Response	>getNotifyFormat
	Notify tag : %n, crc : %c, time:%d-%t, count:%r, ant:%a

⑤ **NotifyRetryCount(Set/Get)**

If there is an error while transmitting the tag List between the reader and the Notified Server, the reader stops the connection and tries to reconnect to the Server. This command sets the number of trial time. If the trial time exceeds the setting value, the reader stops the trial and turn off the NotifyMode.

Notify Retry Count Examples	
Command Response	>setNotifyRetryCount 5
Command Response	>get NotifyRetryCount
	3

⑥ **NotifyRetryPause(Set/Get)**

This command sets the interval time when the reader tries to reconnect to the Notified server. The reader pauses for the designated time and retries. The unit of the time is a second.

If the retrial time is high and the pause time is low, this affects the reader's performance.

Notify Retry Pause Examples	
Command Response	>setNotifyRetryPause 30
Command Response	>get NotifyRetryPause 40

⑦ **NotifyNow**

The NotifyNow command transmit the TagList while the Trigger is onDemand or during the interval. If the trigger is disabled, there is no transmission.

NotifyNow Examples	
Command Response	>NotifyNow

⑧ **NotifyMode(Set/Get)**

This operates the Notify function. If you want to execute the Notify command immediately after the reader is operating, set the Notify mode ON and then Save the changes.

※ If you have saved the NotifyMode is On, the reader tried to connect immediately with the NotifySever after rebooting. If the connection is OK , the reader send the information to the Server.   If it is not connected properly, the reader tries up to the RetryCount and then the NotifyMode is turned off automatically.

If the reader is not connected to the antenna before booing, it will damage the reader because the Rader sends RF output immediately.

NotifyMode Examples	
Command Response	>SetNotifyMode 1
Command Response	>get NotifyMode 0

⑨ **NotifyHeader(Set/Get)**

The NotifyHeader sets the transmission of the Header and Tail of notification message.

Notify Header	
Header	"#MINERVA UHF RFID reader Notification Message"
Tail	"#End of Notification Message"

NotifyHeader Examples	
Command Response	>SetNotifyHeader 0
Command Response	>get NotifyHeader 1

6.7 Tag Memory Read/Write Command

Use this command to read all memory area of tag and write the EPC and User Memory area. It is only available if there is no password and possible to access. **Currently the Read/Write command only applies to EPC Class1 Gen2 protocol.**

The sequence to write/read is as follows.

```
┌─────────────────────────────┐
│    Select the Memory Bank   │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│ Select the starting byte point to │
│         Read/Write          │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│ Select the Byte size to Read/Write │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│  Execute Read/Write command │
└─────────────────────────────┘
```
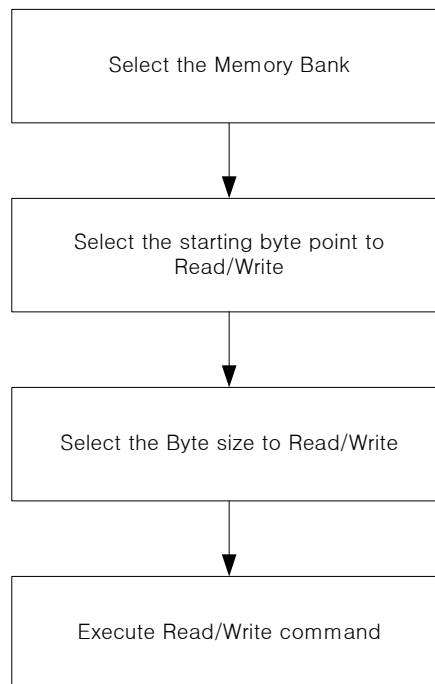
> ※ **NOTICE**
>
> The Read/Write command applies only one tag at a time. If multiple tags are present, it might not be working correctly.
>
> To Read/Write the memory works well where there is the strong antenna fields.
>
> If you need to place the tag within 0.3m(1ft), decrease the RF Attenuation value. (Reduce RF output).The tag may be damaged if it is too close to the antenna.

① **MemoryBank(Set/Get)**

In the case of using EPC Gen2 protocol, you need to specify the bank area of tag where you want to Read/Write memory. The default value is 1 that indicates the EPC area.

Memory Bank Attribute		
Value	Bank	Details
0	Reserved	The area where Kill or Access Password have been saved.
1	EPC	The area where the values of EPC, the Protocol Control and CRC-16 are saved. The size of EPC varies depends on the size of Protocol Control.
2	TID	The unique tag identification number determined by tag manufacturer.
3	User Memory	The area where user can save data. The availability of user memory depends on the tag type.

Memory Bank Examples	
Command Response	>setMemoryBank 3
Command Response	>getMemoryBank 1

② **MemoryStart(Set/Get)**

Assign the starting point of memory bank to Read/Write the tag. The unit is Byte, 0 stands for the first bank and the available range varies depends on the bank and tag type.

Memory Start Examples	
Command Response	>setMemoryStart 0
Command Response	>getMemoryStart 4

③ **MemoryLength(Set/Get)**

Assign the size of memory bank to Read/Write. The unit is Byte, the available range varies depends on the bank and tag type.

Memory Start Examples	
Command Response	>setMemoryLength 8
Command Response	>getMemoryStart 12

④ **MemoryAccessAnt(Set/Get)**

Define the antenna number to Read/Write a tag. Only one antenna can be used to Read/Write. The Antenna Port number for reading a tag applies differently and does not influence each other.

Memory Ant Examples	
Command Response	>setMemoryAccessAnt 2
Command Response	>getMemoryAccessAnt 1

⑤ **ReadMemory**

The values of memory bank are determined by the settings of Memory Bank/Start/Length command.

When the Reader fails to read the tag, it tries the number of times depends on the MemoryAccessRetry setting. If it fails, error message appears. If it is success, the data appears in a byte.

Read Memory Examples	
Command Response	>ReadMemory
Command is success	30 08 33 B2 DD D9 01 40
Command is fail	Read Fail

⑥ **WriteMemory**

The values of memory bank are determined by the settings of Memory Bank/Start/Length command.

When the Reader fails to read the tag, it tries the number of times depends on the MemoryAccessRetry setting. If it fails, error message appears. If it is success, the reader returns the values.

Use this command as WriteMemory [Byte0] [Byte1] [Byte2] [Byte3]…[ByteN]. Each byte represents with the ASCII format of Hex value.

Write Data Example	
Data (HEX)	ASCII Format
0A	0a / 0A
000A01	000a01 / 000A01 / 00 0a 01 / 000a 01
01000BFF00	01 00 0B FF 00 / 0100 0BFF 00 / 01000BFF

As above, the writing data need to have ASCII format. Each byte has 2 ASCII values If the data is bigger than the MemoryLength, the rest numbers will be ignored. On the contrary, if the data is smaller than the MemoryLength, the value is filled with 0. Only if the write is fail, the error message appears.

Write Memory Examples	
Command Response	>WriteMemory 11 22 33 44
Set the Bank/Start/Legth and write/read memory	>MemoryBank 1 >MemoryStart 4 >MemoryLength 4 >WriteMemory 11223344 >ReadMemory 11 22 33 44
If the data length is smaller than the MemoryLength	>MemoryLength 8 >WriteMemory AAbbccFF >ReadMemory AA BB CC FF 00 00 00 00
If the data length is bigger than the MemoryLength	>MemoryLength 8 >ReadMemory 11 22 33 44 AA BB CC DD >MemoryLength 2 >WriteMemory 55 66 77 88 >MemoryLength 8 >ReadMemory 55 66 33 44 AA BB CC DD

The write is success	MINERVA>
The write is fail.	Write Fail

6.8 The External Input/Output (I/O)

This chapter discusses how to control the output value and monitor the digital input of the external devices. MKUR-300 also provides the function of Input Trigger , Output Pulse status, Tag Reading Output status, Input port value and Output port redirection. (See Chapter 8)

① **InitExtOut**

Use this command to send value to the Ext. Output port. MKUR-300 has 8 Output ports. The value of the Output uses 1/0 (On/Off) of the binary 8 bits and uses the decimal value as the command factor.

The number 1 ports assigns for the 0 bit and the number 8 ports assigns for the 7 bit.

The factory default value for Ext. Output is all ON.

InitExtOut Example										
Decimal	Binary (Hexadecimal)	Port Output								Command
		8	7	6	5	4	3	2	1	
0	0000 0000 (00)	off	off	off	off	off	off	off	off	> InitExtOut 0
16	0001 0000 (10)	off	off	off	on	off	off	off	off	> InitExtOut 16
72	0100 1000 (48)	off	on	off	off	on	off	off	off	> InitExtOut 72
150	1001 0110 (96)	on	off	off	on	off	on	on	off	> InitExtOut 150
255	1111 1111 (FF)	on	on	on	on	on	on	on	on	> InitExtOut 255

② **ReadExtOutputValue**

Use this command to check the status of External Output port and indicates the status of ON /OFF from   the number 8 port to the number 1 port.

ReadExtOutputValue Examples	
Only the 5th port is ON	>ReadExtoutputValue OFF OFF OFF ON OFF OFF OFF OFF
All ports are ON	>ReadExtoutputValue ON ON ON ON ON ON ON ON
Change the 1st and 8th port to ON by InitExtOut	>InitExtOut 129 >ReadExtoutputValue ON OFF OFF OFF OFF OFF OFF ON

③ **ReadExtInputValue**

Use this command to monitor the External Input status. As the ReadExtOutputValue command, it indicates the statues from the number 4 to number 1 port.

ReadExtInputValue Examples	
Only the 4th port is ON	>ReadExtInputValue ON OFF OFF OFF
All port is ON	>ReadExtoutputValue ON ON ON ON

6.9 Reader Register Read/Write

MKUR-300 provides various tuning configuration for its functions in various applications. This is called as the MKUR-300 Register.

Reader Register is used in the binary protocol. For the String Protocol, you can monitor the reader's status and change the Register value.

The Register is composed with the address and the value. The address is 1Byte(0-255:0x00-0xFF), and the values is 2Byte(0-65535:0x0000-0xFFFF).

※ NOTICE

1. Changing the Register setting may cause the malfunction of reader.

2. Contact our technical team before changing any Register settings. If not, we do not guarantee the repairing in free of charge.

3. See Chapter 7 for more details.

---

① **ReadRegister**

Use this to reader Register settings. The address value is the hexadecimal.

Read Register Examples	
Read 0x01 register	>ReadRegister 01
	0x0001
Read 0xF1 register	
	>ReadRegister F1
Wrong example	0x0000
	> ReadRegister 1
	>ReadRegister 0x01
	>ReadRegister 151

② **WriteRegister**

Use this to change the Register settings. The Register address and value is hexadecimal. Use the space for each byte of address and value.

Write Register Examples	
Change the 0x00 to the 0xFF11	>WriteRegister 00 FF 11 >ReadRegister 0xFF11
Wrong example	>WriteRegister 00 FF >WriteRegister 00 FF 11 33 >WriteRegister 00 FF11 >WriteRegister FF >WriteRegister 00FF11

Chapter 7. Binary Reader Protocols

This chapter explains about the Binary Protocaol which is used for the MtoM (Machine to Machine) communication.

In order to use the binary protocol through the serial, check the current SerialMode from the Protocol Mode. Read this manual thoroughly as it is very different from using String Reader protocol.

Serial Communication

It uses RS-232C cable and the specification as follows;

Baud Rate	: 115200 bps
Data Bits	: 8
Parity	: None
Stop Bits	: 1
Flow Control	: None

Network Communication

The default reader setting is as follows;

IP Address	: 192.168.1.50
Subnetmask	: 255.255.255.0
Gateway	: 192.168.1.1
DNS	: 168.126.63.1

Set the host's network setting and the default port while using a Binary "**2500**" which is changeable.

7.1 Communication specification

Using the Binary Protocol, you can use either RS-232C and Ethernet (TCP/IP). You can not use them simultaneously.

① **Flame Format**

The Flame Format starts from the STX and the structure is as follows.

N Byte

STX	ID1	ID2	Len	Data Part	BCC	ETX

Name	Byte number	Details
STX	1	Control Code(02h) for the head of data communication
ID1	1	Receiving ID(Address)
ID2	1	Transmitting ID(Address)
Len	1	Length of Data Part (n Byte)
Data Part	n	Data for each Command
BCC	1	Exclusive OR Byte(ID1~Data Part)
ETX	1	Control Code(03h) for the tail of data communication

■ The BCC is XOR values from the ID1 to the Data Part.

■ NOTICE: If the Len(Data Length) is 0xFF, it does not mean that the data length is 255 but the DL Command Format which transmits 1Kbyte.

② **Data Part Format**

The Data Parameter of communication flame to send/receive the command is as follows.

Command Format

Receive the command from the host to the reader.

Command	Option 1	Option 2	Data 1	.....	Data n
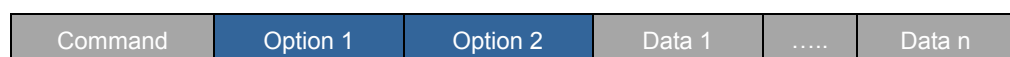
Name	Byte Number	Details
Command	2	Command(ASCII) to the reader
Option 1	1	Command Option 1
Option 2	1	Command Option 2
R Data	n	Data for each command

Response Format

Respond the command from the host to the reader.

Name	Byte Number	Details
Response	2	The special Command(ASCII) for response
Status	1	The Status (Binary) of readers, tags, receiving data
Option 1	1	Response Option 1
Option 2	1	Response Option 2
Data	n	Data for each response

■ Regardiing the Response Format Option 1, if the Command Format Option 1 and the Option 2 are "00", there is no transmission from the Response Format.

③ **Command List**

The Command from the host to the reader.

No	CMD	Name	Details
1	FV	Version	Firmware Version
2	AC	Anti-collision	Sending the tag UID from the Anti-collision
3	HS	Hardware Setup	Setup the device status
4	HR	Hardware Read	Read the status
5	RB	Read Block	Read the tag memory area

6	WB	Write Block	Write the tag memory area
7	SD	Shut Down	System Shut Down
10	WN	Write Network Configuration	Write the Ethernet Network setting
11	RN	Read Network Configuration	Read the Ethernet Network setting
12	WU	Write UDP Heart Beat Config	Write the settings of Heart Beat action through UDP
13	RU	Read UDP Heart Beat Config	Read the settings of Heart Beat action through UDP
14	RR	Get Rotary S/W Value	Read the settings of Rotary
15	WT	Write System Time	Write the time(YYYY/MM/DD hh:mm:ss)
16	RT	Read System Time	Read the time(YYYY/MM/DD hh:mm:ss)
19	BR	Serial BaidRate	Set the reader's Serial Baudrate
20	PM	Serial Mode	Set the reader's protocol operation mode
22	FD	Factory Default	Set the reader to the factory Default
23	SR	Save Register	Save the reader's Register Setup Value
24	EI	External Input	Read the External Input
25	EO	External Output	Change the External Output

④ **Response**

Responding message from the reader to the host use the lower case characters.

Also, indicate the result for each command at the Status.

■ See the Chapter 7.4 Status List for the details.

7.2 Communication sequence

① **Communication between the host and the reader**

Normal process
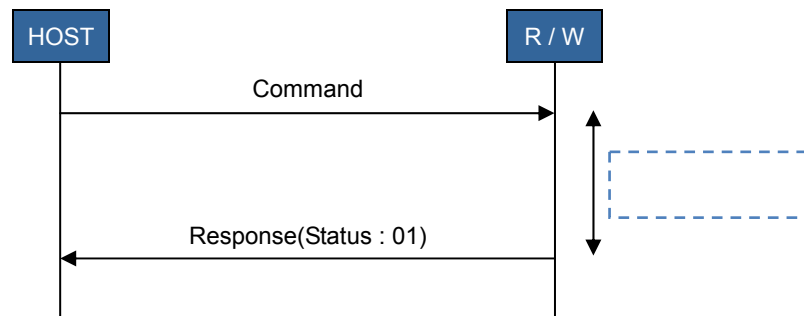
Multiple processes
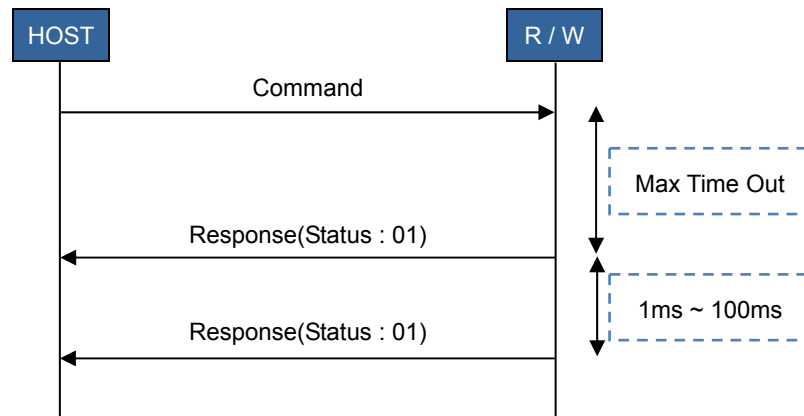
When the reader receives the command from the host, it executes the command and then transmits the response to the host.

- In the case of Status'00', Reader executes the command and has 2 responses to deal with.
- In the case of Status'01', Reader executes the command and there is no response to deal with.

7.3 Command

I. FV(Version)

Receive the Firmware Version.

Host ⇒ R / W

1	2	3	4
F	V	0x00	0x00

R / W ⇒ Host

1	2	3	3 + 1	……	3 + 55
f	v	Status	Version 1	……	Version 55

- Status: 01h(OK), Others (Error)
- The Version Data with ASCII format has five information.

  [model name] [space(0x20)] [Kernel] [space(0x20)] [Filesystem] [space(0x20)] [Firmware]

  [space(0x20)]   [Hardware]

- EX) "**MKUR-300** KERNEL**01.0.3** FILESYSTEM**1.2.0** FW**2.1.0**"

  ■   Ex)

  Command: 02 01 FF 04 46 56 00 00 EA 03

  Response: 02 FF 01 15 66 76 01 4D 4B 55 52 2D 31 30 30 43 20 46 56 20 30 30

  2E 33 34 9D 03   (MKUR-100C FV 00.34)

II. AC(Anti-collision)

Read the tag UID(Serial number)

Host ⇒ R / W

1	2	3	4
A	C	Option 1	Option 2

- Regarding the Option 1 and Option 2, see the Option List.

R / W ⇒ Host

1	2	3	4	5	6	7…?	?	? … ?	?

a	c	Status	Option1	Option2	Tag Sum	UID-1 (8Byte) or EPC-1 (16Byte)	UID-1 Status	UID-n (8Byte) or EPC-n (16Byte)	UID-n Status

- Status: 01h(OK), Others(Error)

- Regarding the Option 1 and Option 2, see the Option List.

- Tag Sum: Total tag number

- UID-1(8Byte) or EPC-1(16Byte): Tag UID-1 or EPC-1 Data

- UID-1 Status: Reading time (1Byte)

- UID-n(8Byte) or EPC-n(16Byte): Tag UID-n or EPC-n Data

- UID-n Status: Reading time (1Byte)

- EPC Data 16Byte = EPC 96Bit(12Byte) + 4Byte(optional Data)

- The Option 2(8xh) is not in use   for the Command(Use 0xh). For the Response, use the Register Address 13h to check the host (8Byte & 16Byte)

- If the value of AC Option 2 is 01 (The tag UID and reading time during the search time),
   - UID-1 Status: UID-1 number during the search time
   - UID-n Status: UID-n number during the search time

- If the value of Option 2 is 02 (The tag UID and reading time during the search time using 4 antennas),
   - The tag UID and reading time for each antenna, reader transmits AC.
   - If there are   4 antennas in use, reader transmit 4 times during the search time.

- EX)
   Command: 02 01 FF 04 41 43 00 01 F9 03
   Response: 02 FF 01 03 61 63 73 8C 03
   02 FF 01 17 61 63 01 21 81 01 E0 04 00 00 33 32 3E 01 00 00 00 00 22 22 22 22 01 9E 03
   02 FF 01 28 61 63 01 21 81 02 E0 04 00 00 D9 4C 3E 01 22 22 22 22 22 22 22 22 02 E0 04 00 00 33 32 3E 01 00 00 00 00 22 22 22 22 02 E3 03

III. HS(Hardware Setup)

Set up the reader register.

Host   ⇒   R / W

1	2	3	4	5	6	7	8
H	S	0x00	0x00	Sum Register	Register 1 Address	Register 1 Data 1	Register 1 Data 2

9	10	11	12	13	14
Register 2 Address	Register 2 Data 1	Register 2 Data 2	Register n Address	Register n Data 1	Register n Data 2

- Sum Register: Total number of Register Address

- Register Address: Refer to the Register Address List

- Register Data 1: High Value, Refer to the Register Address List (When you use the Register data Word, otherwise it is fixed to 00h)

- Register Data 2: Low Value, Refer to the Register Address List

R / W   ⇒   Host

1	2	3
h	s	status

- Status: 01h(OK), Others (Error)

IV. HR(Hardware Read)

Use this to read the reader register.

Host ⇒ R / W

1	2	3	4
H	R	0x00	0x00

R / W ⇒ Host

1	2	3	4	5	6	7
h	r	Status	Sum Register	Register 1 Address	Register 1 Data 1	Register 1 Data 2

9	10	11	12	13	14
Register 2 Address	Register 2 Data 1	Register 2 Data 2	Register n Address	Register n Data 1	Register n Data 2

- Status: 01h(OK), Others (Error)

- Sum Register: Total number of the Register Address

- Register Data 1: High Value

- Register Data 2: Low Value

- For each Address, data is 2Byte, For the 1Byte data, put 0x00 into the High value. See 7.6.Reader Register for more details

  ■ Ex)

  Command: 02 01 FF 04 48 52 00 00 E0 03

  Response: 02 FF 01 45 68 72 01 01 01 00 02 55 00 03 0D 00 04 55 00 05 01 00 06
  6E 28 07 71 14 08 00 C8 09 19 00 0A 20 00 0B FF 00 0C 02 00 0D 05
  00 0E 01 00 0F 01 00 10 04 00 11 12 34 12 01 00 13 80 00 14 01 00 15
  20 00 16 00 00 12 03

V. RB(Read Block)

Use this to read the tag block. (Bit & Byte)

Host ⇒ R / W

1	2	3	4	5	6	7 ~ ?
R	B	Option 1	Option 2	First block number	Number of Block	UID Option 2 use only X6h

- See the Option List for Option 1 and Option 2.

  (Option 2 => x5h: Tag Select UID (8&16Byte), x6h: All Tag Select)

- First block number: The first block (Bit & Byte) to read

- Number of block: The block number (Bit & Byte) to read

- UID: Tag UID(8Byte & 16Byte) for each Option

- Possible to apply for the Option2 ISO Type B

R / W   ⇒   Host

1	2	3	4	5	6	7 ⋯ ?	?	? ⋯ ?
r	b	Status	Option 1	Option 2	Tag Sum	UID-1 (8Byte)	UID-1 Status	UID-1 Read Data

? ⋯ ?	?	? ⋯ ?
UID-n	UID-n Status	UID-n Read Data

- Status: 01h(OK), Others (Error)

- See the Option List for Option 1 and Option 2.

  (Use the value of Option 2(※1)m check the host whether the value is 8Byte UID(0xh) or 16Byte UID(8xh))

- Tag Sum: Total number of tags

- UID-1: Tag UID-1(8Byte & 16Byte)

- UID-1 Status: Tag UID-1 Status

- UID-n: Tag UID-n(8Byte & 16Byte)

- UID-n Status: Tag UID-n Status

VI. WB(Write Block)

Write the block and bit of the tag.

Host   ⇒   Reader

1	2	3	4	5	6	7 ~ ?
W	B	Option 1	Option 2	First block number	Number of Block	UID Option 2 use only X6h

? ⋯ ?
Write Data

- See the Option List for Option 1 and Option 2.

(※ Option 2: x5: Tag Select UID (8&16Byte), x6: All Tag Select)

- First block number: The first Block Address to read

- Number of block: The block (Byte: 1byte) number to read

- UID: Tag UID(8Byte & 16Byte) for each Option

- Write Data: Write data in block

- Possible to apply for the Option2 ISO Type B

Reader　⇒　Host

1	2	3	4	5	6	7 ··· ?	?	? ··· ?	?
w	b	Status	Option 1	Option 2	Tag Sum	UID-1 (8Byte)	UID-1 Status	UID-n	UID-n Status

- Status: 01h(OK), Others (Error)

- See the Option List for Option 1 and Option 2.

   (Use the value of Option 2(※1) to check whether the host value is 8Byte UID(0xh) or 16Byte

   UID(8xh)

- Tag Sum: Total tag number

- UID-1: Tag UID-1(8Byte & 16Byte)

- UID-1 Status: Tag UID-1 Status

- UID-n: Tag UID-n(8Byte & 16Byte)

- UID-n Status: Tag UID-n Status

VII. SD(Shut down)

   Reset(reboot) the reader.

   Reset the CPU depends on the mode.

Host　⇒　Reader

1	2	3	4	5
S	D	0x00	0x00	Mode

- Mode: All (ARM9 & ARM7) Reset(1), ARM7 Reset(2)

Reader　⇒　Host

1	2	3
s	d	status

- Status: 01h(OK), Others (Error)

- Reset the reader after the response
- Must send command after the reset & reboot.
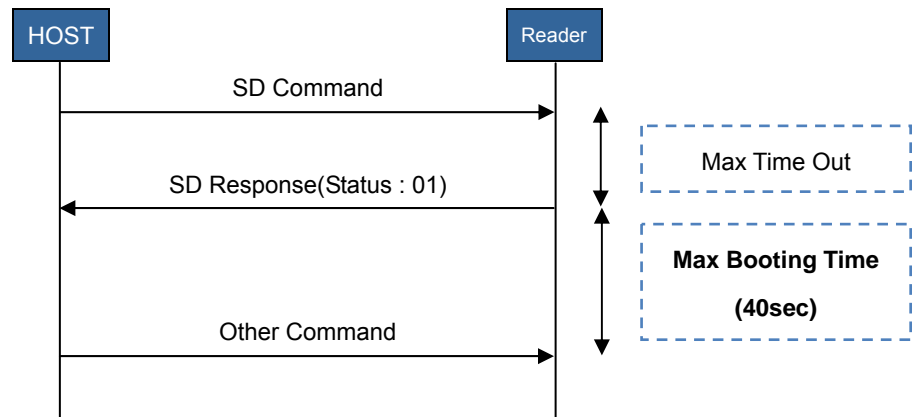
VIII.   WN(Write Network Configuration)

Use this command to set the reader's Ethernet IP, NetMask, Default Gateway and DNS Address. After rebooting, the changes of Ethernet(TCP/IP, UDP) can be applied. (Use SD command for rebooting)

Host   ⇒   Reader

1	2	3	4	5	6	7	8	9
W	N	0x00	0x00	Select Flag	IP Address1	IP Address2	IP Address3	IP Address4

10	11	12	13
NetMask1	NetMask2	NetMask3	NetMask4

14	15	16	17
Gateway Address1	Gateway Address2	Gateway Address3	Gateway Address4

18	19	20	21
DNS Address1	DNS Address2	DNS Address3	DNS Address4

- It is possible to select the items (IP Address, NetMask, Gateway Address, DNS Address) that need to be changed using the Select Flag. Each value can be combined with OR operation.

-

Value	Part
0x01	IP Address
0x02	Gateway Address
0x04	NetMask
0x08	DNS Address

- Each item is composed with 4Byte and applies the specified value by Octet into 1-4 of each field.

- E.g.) IP : 192.168.1.100

    IP Address1: 192(0xC0), IP Address2: 168(0xA8), IP Address3: 1(0x01), IP Address4: 100(0x64)

- E.g.) NetMask: 255.255.255.0

    NetMask1: 255(0xFF), NetMask2: 255(0xFF), NetMask3: 255(0xFF), NetMask4: 0(0x00)

- E.g.) Gateway: 192.168.1.1

    Gateway Address1: 192(0xC0), Gateway Address2: 168(0xA8), Gateway Address3: 1(0x01), Gateway Address4: 1(0x01)

- E.g.) DNS: 168.126.63.1

    DNS Address1: 168(0xA8), DNS Address2: 126(0x7E), DNS Address3: 63(0x3F), DNS Address4: 1(0x01)

- E.g.) Only for changing the IP: Select Flag: 0x01

    For changing the Gateway and DNS in a same time: Select Flag: 0x0a

Reader ⇒ Host

1	2	3
w	n	status

- Status: 01h(OK), Others (Error)

- ■ NOTICE

    When the Host is connected through TCP/IP, you need to reset the network after roobing.

IX. RN(Read Network Configuration)

Use this to read the reader's Ethernet IP, NetMask, Default Gateway and DNS Address.

Host ⇒ Reader

1	2	3	4
R	N	0x00	0x00

Reader ⇒ Host

1	2	3	4	5	6	7	8	9
r	n	Status	0x00	0x00	IP Address1	IP Address2	IP Address3	IP Address4

10	11	12	13
NetMask1	NetMask2	NetMask3	NetMask4

14	15	16	17
Gateway Address1	Gateway Address2	Gateway Address3	Gateway Address4

18	19	20	21
DNS Address1	DNS Address2	DNS Address3	DNS Address4

- Status: 01h(OK), Others (Error)
- Each Octet for the IP Address, NetMask, Gateway Address and DNS Address has the hexadecimal format.

X. WU(Write UDP HeartBeat Configuration)

Write the settings of Heart Beat UDP Packet that reader sends and the status of UDP Pack that is sent by the host.

Host ⇒ Reader

1	2	3	4	5	6	7	8	9
W	U	0x00	0x00	Select Flag	Send Port(MSB)	Send Port(LSB)	Receive Port(MSB)	Receive Port(LSB)

10	11	12	13
Send Time	Receive Time	Send Enable	Receive Enable

- Select the items below to change and combine the Flag using OR operation.

Flag Value	Items	Details
0x01	Send Port(2Bytes)	The UDP Packet Port (Range: 3000-3099) that is sent from the reader.
0x02	Receive Port(2Bytes)	The UDP Packet Port (Range: 3100-3199) that is sent from the host.
0x04	Send Time(1Byte)	The interval time (unit: sec) when the reader sends the UDP Packet.
0x08	Receive Time(1Byte)	When the reader receives the UDP packet from the host, it means the maximum time. (unit: sec)
0x10	Send Enable(1Byte)	Reader's status while sending send the Heart Beat UDP Packet. (0x01:Enable, 0x00:Disable)
0x20	Receive Enable(1Byte)	Reader's status while receiving the UDP Packet from the host. (0x01:Enable, 0x00:Disable)

R / W　⇒　Host

1	2	3
w	n	status

- Status: 01h(OK), Others (Error)

XI. RU(Read UDP HeartBeat Configuration)

Read the settings of Heart Beat UDP Packet that reader sends and the status of UDP Pack that is sent by the host.

Host　⇒　Reader

1	2	3	4
R	U	0x00	0x00

Reader　⇒　Host

1	2	3	4	5	6	7	8	9

					Send	Send	Receive	Receive
r	u	Status	0x00	0x00	Port(MSB)	Port(LSB)	Port(MSB)	Port(LSB)

10	11	12	13
Send Time	Receive Time	Send Enable	Receive Enable

- Status: 01h(OK), Others (Error)

- See the Chapter 3.12 for details

XII. WT(Write System Time)

Write the information (Year, Month, Day, Hour, Minute, Second) on RTC.

Host ⇒ Reader

1	2	3	4	5	6	7	8	9	10
W	T	0x00	0x00	Year	Month	Day	Hour	Minute	Second

- Year: Start from year **1900**, E.g.) Year 2006 = 106

- Month: 0x01 ~ 0x0b(Jan-Dec)

- Day: 0x01 ~ 0x1F(1-31 days)

- Hour: 0x00 ~ 0x17(0-23 hours)

- Minute: 0x00 ~ 0x3B(0-59 minutes)

- Second: 0x00 ~ 0x3B(0-59 seconds)

Reader ⇒ Host

1	2	3
w	t	status

- Status: 01h(OK), Others (Error)

XIII. RT(Read System Time)

Read the information (Year, Month, Day, Hour, Minute, Second) on RTC.

Host ⇒ Reader

1	2	3	4
R	T	0x00	0x00

Reader ⇒ Host

1	2	3	4	5	6	7	8	9	10
r	i	0x00	0x00	Year	Month	Day	Hour	Minute	Second

- Status: 01h(OK), Others (Error)

- Year: Starts from year **1900**, E.g.) Year 2006 = 106

- Month: 0x01 ~ 0x0b(Jan-Dec)

- Day: 0x01 ~ 0x1F(1-31 days)

- Hour: 0x00 ~ 0x17(0-23 hours)

- Minute: 0x00 ~ 0x3B(0-59 minutes)

- Second: 0x00 ~ 0x3B(0-59 seconds)

XIV. BR(serial BaudRate)

Use this command to change the communication speed for serial. It is executed after rebooting.

Host ⇒ Reader

1	2	3	4	5
B	R	0x00	0x00	BaudRate Select

- BaudRate Select:

    00h(115200bps), 01h(230400bps), 02h(57600bps), 03h(38400bps)

    04h(19200bps), 05h(9600bps)

Reader ⇒ Host

1	2	3
b	r	status

- Status: 01h(OK), Others (Error)

XV. PM(Serial Mode)

Apply the reader's communication mode.

Host   ⇒   Reader

1	2	3	4	5
P	M	0x00	0x00	Protocol Select

- Protocol   Select:

    00h(Binary Mode), 01h(String Mode),

Reader   ⇒   Host

1	2	3
p	m	status

- Status: 01h(OK), Others (Error)

XVI.   FD(Factory Default)

Set the reader to the factory default setting. It is executed after rebooting.

After rebooting, the changes of Ethernet(TCP/IP, UDP) can be applied. (Use SD command for rebooting)

Host   ⇒   Reader

1	2	3	4	5
F	D	0x00	0x00	Mode

- Mode (0x01) : Ethernet(TCP/IP, UDP) Default Setup
- Mode (0x02) : Register Default Setup (Refer to the Register List)
- Mode (0x03) : Ethernet, Register Default Setup

Reader   ⇒   Host

1	2	3
f	d	status

- Status: 01h(normalcy), the others(disorder)

    ■   NOTICE

    As the TCP/IP setting is change to the network default value, you need to reconnect after the booting for the Ethernet connection.

XVII.   SR(Save Register)

Save the Register Setup Value into the Flash memory. (Refer to the Register List)

It is possible to communicate after rebooting which takes 2~3 seconds. .

Host   ⇒   Reader

1	2	3	4
S	R	0x00	0x00

Reader   ⇒   Host

1	2	3
s	r	status

- Status: 01h(OK), Others (Error)

XVIII.   EI(External Input)

Read the reader's External Input value. The higher the Response value is the upper bit.

It is also possible to read the External Output value and the current output status.

Host   ⇒   Reader

1	2	3	4
E	I	0x00	0x00

R / W   ⇒   Host

1	2	3	4	5	6	7
s	r	status	0x01	0x00	Ext. Input	Ext. Output

- Status: 01h(OK), Others (Error)

XIX. EO(External Output)

Use this command to modify each port's value in the External Output. The same as the "EI" command, the higher port number is the upper bit.

Host ⇒ Reader

1	2	3	4	5
E	O	0x00	0x00	Ext. Output

Reader ⇒ Host

1	2	3
s	r	status

- Status: 01h(OK), Others (Error)

7.4 Status List

Status	Type	Details
00h	Response Continue	Multiple Responses
01h	Response END	Terminate the Response
10h	Flame Error	Error in the Flame Format
11h	Format Error	Error in the Data Format
12h	BCC Error	Error in the receiving Flame's BCC
21h	Setup Error	Error in the Command execution
22h	Command Error	Error in the Command
23h	HEX Format Error	Error in the receiving HEX File from the host
24h	Verify Error	Error in the Flash memory of the application area
25h	FPGA Write Error	Error while writing the FPGA Program
70h	Communication ACK	Receiving the host command
71h	Read Error	Error while reading
72h	Write Error	Error while writing
73h	No Tag Error	There are no tags
74h	Address Error	Error in the address block
76h	Not Use Tag	Error in the command
77h	Write Error 2	There is no block to write
79h	MAX Time Out Error	Error in the Time Out Error
80h	RF HW Setup Error	Error in the RF Power, PLL and Antenna connection etc
FFh	Error -cause unknown	undetermined error

7.5 AC Command / Response Option

Here explains about the options for the AC (Anti-Collision) Command and Response.

① Command

- Option 1 (00h)

  There is nothing to command in the option 1. It is fixed to 00h.

- Option2

  Assign the operating method depends on the number of antennas.

  This is applied if the "Command & Notify" (Register 14h) is set as Notify.

Option 2	Type	Details
01h	One Port Notify Start	Read the tag with the currently designated antenna port. (Register 05h)
03h	Multi Port Notify Start	Read the tags with the maximum antenna number (Register 10h)
FFh	Application STOP	Stop the notification of AC Command

② Response

- Option 1 (Protocol Type & Antenna number)

Options describes with 4bits of the tag type and antenna number using OR operation.

Option 1	Type	Details
1xh	Reserved	Currently not in use.
2xh	Reserved	Currently not in use.
3xh	Reserved	Currently not in use.
4xh	Reserved	Currently not in use.
5xh	EPC Gen2	ISO 18000-6C/ECP Gen2 Tag
x1h	Antenna 1	Tag from the antenna number 1
x2h	Antenna 2	Tag from the antenna number 2
x3h	Antenna 3	Tag from the antenna number 3.
x4h	Antenna 4	Tag from the antenna number 4

- Option2

Option2 is the tag UID size which is included in the AC Response. The tag UID has various sizes and may include the tag memory depends on the reader setting.

Option 2	Type	Details
2xh	The tags has variable size	The length of tag UID of the Response depends on the upper 4bit of Option2. The tag UID length = (4bit value $\times$ 2) + 4 Byte e.g.) Option2 : 26h The tag UID length = (6 $\times$ 2) + 4 = 16Byte

7.6 Reader Register

Addr.	Name	Initial	Remark
01h	Talk Mode	1	Assigns the frequency hopping mode in the designated frequency (Register 06h/07h). 0 : FIX – Sending the frequency using one designated starting frequency in the Register 07h. 1 : FHSS(Frequency Hopping Spread Spectrum) – Sending the frequency between the designated frequencies in (Register 06/07h) by the 200khz 2 : LBT(Listen Before Talk) – Sending the one channel between the designated frequencies in 06h and 07h. Requires the reader to listen on a channel before transmitting to determine if that channel is being used by another device.
03h	RF Attenuator All Port	3	Assigns the reader's output power. The initial value is 30dBm. When the value increases, the output power decreases. The unit is 1dBm.This setting is assigned for 4 antenna ports. Namely, the attenuation setting (Register 4Ah, 4Bh, 4Ch, 4Dh) for each port changes.
05h	Cur. Antenna	1	Assigns the current antenna port.
06h	Start Frequency	6E28h (910.4 Mhz)	Assigns the reader's frequency range. If the Talk Mode is FIX, it indicates the sending frequency. Except that, the reader does the frequency hopping within the starting frequency to the ending frequency. Frequency = (Upper 8bit + 900) MHz (Lower 8bit * 10) KHz E.g.) 6E3Ch Frequency : 6Eh(110) + 100Mhz = 910Mhz 3Ch(60) * 10khz = 600khz = 910.6Mhz
07h	End Freqeuncy	713Ch (913.6 Mhz)	Assigns the reader's frequency range. The reader does the frequency hopping within the starting frequency to the ending frequency except when the Talk Mode is FIX. Frequency = (Upper 8bit + 900) MHz (lower 8bit * 10) KHz e.g.) 7128h

			Frquency : 71h(113) + 100Mhz = 913Mhz
			28h(30) * 10khz = 400khz
			= 913.4Mhz
0Ah	Tag Protocol Type	20h	Specify the tag type
			20h : Support 18000-6C/EPC Gen2 only
0Ch	Search Time	1	When the reader reads the tag, it indicates the number of times for searching the tags.
10h	MAX Antenna	1	Using the multiple antennas, the maximum number of antenna.
11h	Antenna Step	1234h	Assigns the turns of antennas when the reader is connected to the multiple antennas.
13h	Tag Send Size	20h	Assigns the tag size while sending the tags UID. It is identical with the AND operation value of Option2 of AC Reponse to 0xF0. This Register has nothing to do with the actual tag UID size. 00h : 8Byte – Not in support 80h : 16Byte – Not in support 20h : Variable – It changes automatically and sends depends on the tag UID and memory size.
14h	Command & Notify	1	Assigns the response method of AC Command. 0: Command – Respond once for one command 1: Notify – If the AC Command's Option2 is 01h, 03h, it reads the tags continuously and sends the result to the host. If the FFh command of Option2 of AC Command's is sending, stops the reading and receiving.
1Dh	EPC Gen2 Q Value	6	Assigns the Q value for reading the EPC Gen2 tags
2Ah	Memory Bank	1	Tag's memory bank. 0 : Reserved, 1 : EPC Block 2 : TID 3 : USER Block
4Ah	RF Attenuation Port #1	17	Assigns output power of the number 1 antenna port. When the All Port setting of Register 03h changes, this setting changes too.
4Bh	RF Attenuation Port #2	17	Assigns output power of the number 2 antenna port. When the All Port setting of Register 03h changes, this setting changes too.
4Ch	RF Attenuation Port #3	17	Assigns output power of the number 3 antenna port. When the All Port setting of Register 03h changes, this setting changes too.

4Dh	RF Attenuation Port #4	17	Assigns output power of the number 4 antenna port. When the All Port setting of Register 03h changes, this setting changes too.
80h	External Output	00FFh	Use this to control the External Output and monitor the current status. The higher number applies to upper bit and number 1 port is applies to 0 bit.
81h	External Input	000Fh	Use this to monitor the External Input status. The higher number applies to upper bit and number 1 port is applies to 0 bit.
82h	External Output Func. #2-#1	0000h	Use this to apply special function on the number 1 and 2 of External Output port. See the chapter 8.3 Output special function, External I/O for more details.
83h	External Output Func. #4-#3	0000h	Use this to apply special function on the number 3 and 3 of External Output port. See the chapter 8.3 Output special function, External I/O for more details.
84h	External Output Func. #6-#5	0000h	Use this to apply special function on the number 5 and 6 of External Output port. See the chapter 8.3 Output special function, External I/O for more details.
85h	External Output Func. #8-#7	0000h	Use this to apply special function on the number 7 and 7 of External Output port. See the chapter 8.3 Output special function, External I/O for more details.
86h	External Input Trigger	0000h	Execute the Trigger function to read / stop reading. See the chapter 8.2 Input Trigger, External I/O for more details.

7.7 Write the EPC GEN2 tag(E.g. Impinj Monza) in Binary Protocol

① Operation

- The minimum unit of writing the EPC Gen2 tag is 1 word(2Byte).

- Can write on the EPC Block only

- E.g.) Start Address 0x0A, Length 6 byte, 11 22 33 44 55 66 Data Write

Operation flow for the writing command

Step 1. 02 01 FF 04 41 43 00 FF 07 03 : notify Stop Command

Step 2. 02 01 FF 0E 48 53 00 00 03 1C 00 00 0A 00 50 2A 00 01 85 03

: Data rate 40kbps, EPC Gen2, EPC Block → HS Command Setting

Step 3. 02 01 FF 0C 57 42 00 06 **0A 06** 11 22 33 44 55 66 9A 03

: Write Command Set

- **0A**: Start Address → Apply to the EPC memory Block 50h

 * See the EPC Gen2 Tag Memory Map below.

- **06**: Write Length(Over minimun 2 Byte, even byte,)

- 11 22 33 44 55 66: Write Data

※ Execute the Step 1 – Step2 only at the initial operation.

※ Address Setting: 0Ah First Start Address applies to the EPC Memory Block (50h ~ 5Fh).

※ See the Chapter 7.9 for more details on the tag memory map which varies depends on the tag chip manufacturer and the model type. In this manual, we use the Monza tag for example.

7.8 EPC Generation2 Tag Memory Allocation

Field	EPC Address	Content	Read / Write
E P C	0	CRC-16 1	Read Only
	1	CRC-16 2	Read Only
	2	PC(Protocol Control) 1	Read/Write
	3	PC(Protocol Control) 2	Read/Write
	4	EPC Data 1	Read/Write
	5	EPC Data 2	Read/Write
	6	EPC Data 3	Read/Write
	7	EPC Data 4	Read/Write
	8	EPC Data 5	Read/Write
	9	EPC Data 6	Read/Write
	10	EPC Data 7	Read/Write
	11	EPC Data 8	Read/Write
	12	EPC Data 9	Read/Write
	13	EPC Data 10	Read/Write
	14	EPC Data 11	Read/Write
	15	EPC Data 12	Read/Write
	…	…	
	n	Optional Data n	Read/Write

※   Use the Register **2Ah (Memory Access Select)** to select the Field (Reserved, EPC, TID, User).

※   **For the RB / WB** command, select the location of EPC Address of the **First block number, Number of block** and then read or write the tag memory.

E.g.) If the first block number = 10 and the number of block = 6, you can read or write the tag on the EPC Address from 10 to 15.

※   You can not write the CRC-16. If you modify the PC (Protocol Control), the tag might not be read.

MEM BANK #	MEM BANK NAME	MEM BANK BIT ADDRESS	BIT NUMBER															
			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
10_2	TID (ROM)	10_h-$1F_h$	0	0	0	1	MODEL NUMBER											
		00_h-$0F_h$	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0
01_2	EPC (NVM)	70_h-$7F_h$	EPC[15:0]															
		60_h-$6F_h$	EPC[31:16]															
		50_h-$5F_h$	EPC[47:32]															
		40_h-$4F_h$	EPC[63:48]															
		30_h-$3F_h$	EPC[79:64]															
		20_h-$2F_h$	EPC[95:80]															
		10_h-$1F_h$	PROTOCOL-CONTROL BITS (PC)															
		00_h-$0F_h$	CRC-16															
00_2	RESERVED (NVM)	30_h-$3F_h$	ACCESS PASSWORD[15:0]															
		20_h-$2F_h$	ACCESS PASSWORD[31:16]															
		10_h-$1F_h$	KILL PASSWORD[15:0]															
		00_h-$0F_h$	KILL PASSWORD[31:16]															

MEM BANK	MEM BANK NAME	MEM BANK BIT ADDRESS	BIT NUMBER	EPC Address
10h	TID (ROM)			
01h	EPC (NVM)	70h~7Fh	EPC[15:00]	**14,15**
		60h~6Fh	EPC[31:16]	**12,13**
		50h~5Fh	EPC[47:32]	**10,11**
		40h~4Fh	EPC[63:48]	**8,9**
		30h~3Fh	EPC[79:64]	**6,7**
		20h~2Fh	EPC[95:80]	**4,5**
		10h~1Fh	PC	**2,3**
		00h~0Fh	CRC-16	**0,1**
00h	RESERVED (NVM)			

7.9 TCP/IP connection, DP Heart Beat and Format

The following settings are when the reader and the host communicate through the TCP/IP and the initial UDP Heart Beat and its format.

① **Ethernet(TCP/IP connection) Default Setup Value**

A. Default Network Configuration

- IP Address: 192.168.1.50

- Gateway: 192.168.1.1

- Netmask: 255.255.255.0

- DNS Address: 168.126.63.1

- TCP Connection Port: 2500

B. Default UDP Heart Beat Configuration

- Send Port: 3000

- Receive Port: 3100

- Default Send Time Interval: 10 sec

- For the receiving, the Max Time Out: 10sec

② **UDP Heart Beat Data Format**

A. Send Packet Format

The UDP transmission format is composed of the string. And insert the port numbers if there are multiple readers on the network.

"Alive at [Send Port Number]"

- EX) Default : "Alive at 3000"

B. Receive packet format from the host.

The Heart Beat Format received from the hose is the string as follows.

"Reply at [Receive Port Number]"

- EX) Default : "Reply at 3100"

※ NOTICE: When the network settings have been changed, it is applied after rebooting.

Chapter 8. External I/O

MKUR-300 supports the External Input/Outputports that can control the lights, beeper and sensor.

The External I/O has 8 Output ports and 4 input ports.

8.1 Control the status and monitoring

① **String Protocol**

See the Chapter 6.8 External I/O, String Rader Protocol.

② **Binary Protocol**

See the Chapter 7.3 XVIII EI, XIX EO, Binary Reader Protocol. Or use the Register's 80h and 81h.

8.2 Input Trigger

The Input Trigger is the function that makes the reader to Read/Stop automatically depends on the status (On/Off) of External Input. It is possible to trigger to 4 ports and one port to command the functions. When the operating conditions meet the requirements, the reader can read the tag.

The Input Trigger assigns the value of read register of 86h.

Input Trigger	
Bit	Function
0-7	Defines the condition of operating condition while reading. Each port uses the 2bit from the lower. 0-1 bit : Number 1 Input port 2-3 bit : Number 2 Input port 4-5 bit : Number 3 Input port 6-7 bit : Number 4 Input port <table><tr><td>Bit</td><td>Operating condition</td></tr><tr><td>00</td><td>On : Stop reading tag Off : Start reading tag</td></tr><tr><td>01</td><td>On : Start reading tag Off : Stop reading tag</td></tr></table>

	10	Not in use
	11	Not in use
8-11	The Trigger for each port 8 bit : Use the Trigger for Number 1 port 9 bit : Use the Trigger for Number 2 port 10 bit : Use the Trigger for Number 3 port 11 bit : Use the Trigger for number 4 port	
12-15	Not in use	

If the trigger needs to be activated for more than two ports, the two ports must have same condition to operate for reading.

For example, if the value of register 86h is 0301h, the trigger is saved as follows.

- Activate the trigger to read tags for number 1 and 2 port.
- For the number 1 port, when the input value is OFF, activate the reading
- For the number 2 port, when the input value is ON, activate the reading.
- Therefore, the starting point for reading is when the number 1 port is OFF and the number 2 port is ON. Otherwise, stop reading.
- It is not affected by the input value of the number 3 and 4 port.

8.3 Output special function

MKUR-300 provides 8 Output ports. Each port provides the pulse output function, synchronization of Input port and On/Off port function while reading tags.

The Pulse Output function is that the Output port sends the on/off signal periodically. This output port ignores the on/off command from the host and keep sends the pulse until it is deactivated.

The synchronization of Input port function is that appoint one of ports from number 1 to 4 and the port's input ON/Off reflects to Output port.

Lastly, the function that can save in the output port is that you can change ON/OFF while reading tags.

Each function sets the 2 ports for one register from the register 82h to 85h and each register value does not after the other register address.

In the register value, the 14-15 bit selects the output function of 2,4,6,8 and the 6-7 bit selects the output function of 1, 3, 5, 7.

Output Special Function						
Register	Byte	Port	Bit	Function	Bit	Function

Address						
82h	Lower	1	06-07	Select special function	00-05	Select special function
	Upper	2	14-15	Select special function	08-13	Select special function
83h	Lower	3	06-07	Select special function	00-05	Select special function
	Upper	4	14-15	Select special function	08-13	Select special function
84h	Lower	5	06-07	Select special function	00-05	Select special function
	Upper	6	14-15	Select special function	08-13	Select special function
85h	Lower	7	06-07	Select special function	00-05	Select special function
	Upper	8	14-15	Select special function	08-13	Select special function

All uses the 2bit and the setting values are as follows.

Output Pulse	
Setting value (Binary)	Function
0 (00b)	Do not set any function.
1 (01b)	Execute Output Pulse function
2 (10b)	Execute the synchronization of Input port
3 (11b)	Execute the tag detecting output.

① **Pulse Output function**

Output Pulse	
Bit	Function
00-05 or 08-13	This 6bit sets the output pulse's On/Off period. This time period does not mean the total period but the lasting time for one On/Off.

② **The synchronization of Input port**

| Input	
Bit	Function
00-03 or 08-11	Appoints the input port for synchronization. You can set the port number from 1 to 4 and other number will be ignored.
04-05 or 12-13	00b : Change the Input port's status and send Output. 01b: Send the Output which is the same status of Input port. 10b, 11b: Not in use

③ **Tag detecting output**

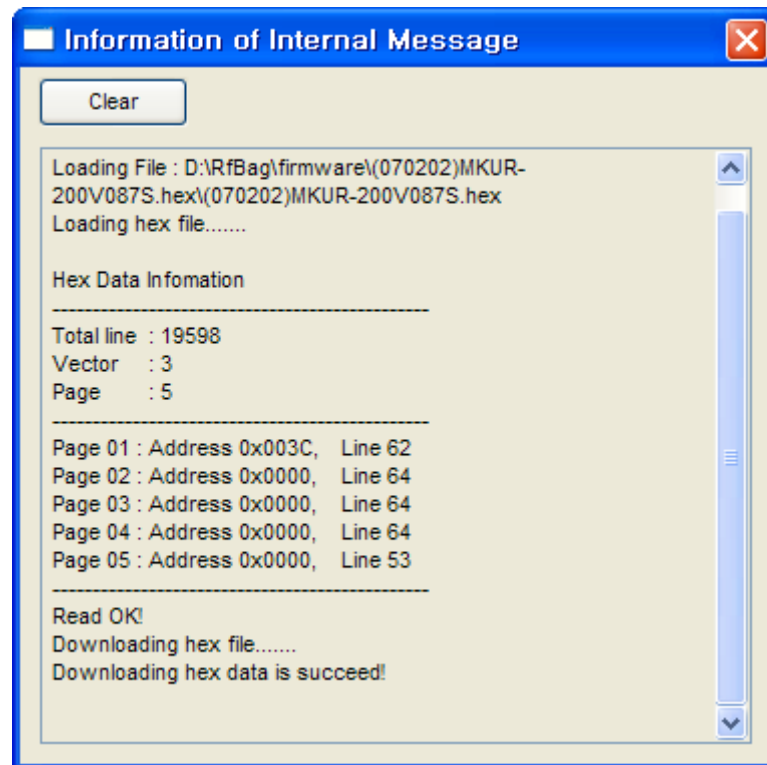| Input	
Bit	기능
00-03 or 08-11	Not in use
04-05 or 12-13	00b : Send the Off through Output while reading tags, Send the ON while not reading tags. 01b: Send the On through Output while reading tags, Send the Off while not reading tags. 10b, 11b: Not in use

Chapter 9. Appendix

9.1 Firmware Upgrade

① From the Main Menu, click the on-line button, [on-line] the Download Program window appears.
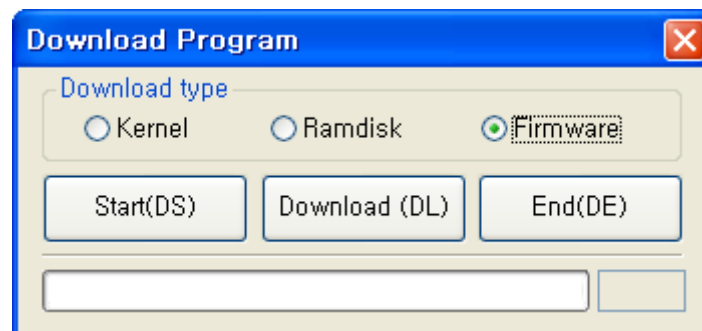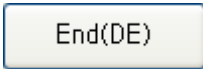
② Check the radio button of Firmware from the Download type, click the

Start(DS) button [Start(DS)] to change the Module mode to Boot mode.

③ In the Boot mode, click the Download (DL) button [Download (DL)] to upgrade the hex file.
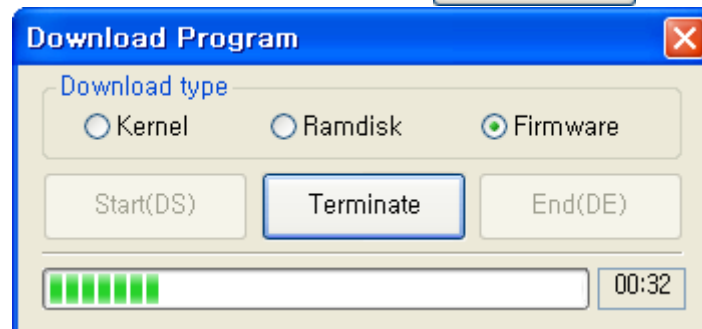
④ Once the Upgrade finishes, the message appears from the Information of Internal Message.

```
Information of Internal Message                        ×

   Clear

Loading File : D:\RfBag\firmware\(070202)MKUR-
200V087S.hex\(070202)MKUR-200V087S.hex
Loading hex file.......

Hex Data Infomation
--------------------------------------------
Total line  : 19598
Vector    : 3
Page      : 5
--------------------------------------------
Page 01 : Address 0x003C,   Line 62
Page 02 : Address 0x0000,   Line 64
Page 03 : Address 0x0000,   Line 64
Page 04 : Address 0x0000,   Line 64
Page 05 : Address 0x0000,   Line 53
--------------------------------------------
Read OK!
Downloading hex file.......
Downloading hex data is succeed!
```

⑤ Click the End(DE) button [End(DE)] to change from the Boot mode to the Application mode.