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## NFC – C Linux Demo Tool User Guide

## DOCUMENT CONTROL SPECIFICATION

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## Revision history

| Version | Date       | Author | Description  |
|---------|------------|--------|--|
| 1.0     | 2021/09/22 | Johnny | Initial version <ul style="list-style-type: none"><li>● HW Version : CT-NFC-C Serial</li><li>● FW Version : V1.0.1.0</li><li>● SW Version : V1.0.0.0</li></ul> |
| 1.1     | 2022/02/10 | Johnny | Modify description "Install the Chilitag driver" to "Install the "cdc-acm" driver if need"   |
|         |            |        |  |
|         |            |        |  |

## Contact information

For additional information, please visit: <http://www.chilitag.com.tw/>

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## Chapter 1. Getting Started

This user guide to Chilitag NFC Reader with hardware version C. The Reader must be connected to the host PC with a USB cable Type A. For the communication with the reader a Chilitag virtual COM port driver (VCP) for the USB interface is mandatory. If the driver is not installed automatically by the operating system.

### 1.1 “lsusb” and “usb-devices” cmoomand

The driver will map the USB to a serial communication port. In Linux platform you can use command line to inquire USB devices PID, UID and Driver, we will provide two methods for your information. “lsusb” and “usb-devices” respectively



```

pi@raspberrypi: ~
檔案(E) 編輯(E) 分頁(T) 說明(H)
pi@raspberrypi:~ $ lsusb
Bus 001 Device 011: ID 0483:aaa8 STMicroelectronics
Bus 001 Device 003: ID 0424:ec00 Standard Microsystems Corp. SMSC9512/9514 Fast Ethernet Adapter
Bus 001 Device 002: ID 0424:9514 Standard Microsystems Corp. SMC9514 Hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
pi@raspberrypi:~ $
  
```

Figure 1.1-1 Getting VID and PID use “lsusb” command

Step by Step:

1. Open terminal on Raspberry Pi platform.
2. Executed command “lsusb” as show in Figure 1.1-1.



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```

pi@raspberrypi: ~
檔案(F) 編輯(E) 分頁(T) 說明(H)
pi@raspberrypi:~ $ usb-devices

T: Bus=01 Lev=00 Prnt=00 Port=00 Cnt=00 Dev#= 1 Spd=480 MxCh= 1
D: Ver= 2.00 Cls=09(hub ) Sub=00 Prot=01 MxPS=64 #Cfgs= 1
P: Vendor=1d6b ProdID=0002 Rev=05.10
S: Manufacturer=Linux 5.10.52-v7+ dwc_otg_hcd
S: Product=DWC OTG Controller
S: SerialNumber=3f980000.usb
C: #Ifs= 1 Cfg#= 1 Atr=e0 MxPwr=0mA
I: If#=0x0 Alt= 0 #EPs= 1 Cls=09(hub ) Sub=00 Prot=00 Driver=hub

T: Bus=01 Lev=01 Prnt=01 Port=00 Cnt=01 Dev#= 2 Spd=480 MxCh= 5
D: Ver= 2.00 Cls=09(hub ) Sub=00 Prot=02 MxPS=64 #Cfgs= 1
P: Vendor=0424 ProdID=9514 Rev=02.00
C: #Ifs= 1 Cfg#= 1 Atr=e0 MxPwr=2mA
I: If#=0x0 Alt= 1 #EPs= 1 Cls=09(hub ) Sub=00 Prot=02 Driver=hub

T: Bus=01 Lev=02 Prnt=02 Port=00 Cnt=01 Dev#= 3 Spd=480 MxCh= 0
D: Ver= 2.00 Cls=ff(vend.) Sub=00 Prot=01 MxPS=64 #Cfgs= 1
P: Vendor=0424 ProdID=ec00 Rev=02.00
C: #Ifs= 1 Cfg#= 1 Atr=e0 MxPwr=2mA
I: If#=0x0 Alt= 0 #EPs= 3 Cls=ff(vend.) Sub=00 Prot=ff Driver=smc95xx

T: Bus=01 Lev=02 Prnt=02 Port=01 Cnt=02 Dev#= 12 Spd=12 MxCh= 0
D: Ver= 2.00 Cls=02(commc) Sub=00 Prot=00 MxPS=64 #Cfgs= 1
P: Vendor=0483 ProdID=aaa8 Rev=02.00
S: Manufacturer=Chilitag
S: Product=Chilitag Virtual COM Port
C: #Ifs= 2 Cfg#= 1 Atr=c0 MxPwr=100mA
I: If#=0x0 Alt= 0 #EPs= 1 Cls=02(commc) Sub=02 Prot=01 Driver=cdc_acm
I: If#=0x1 Alt= 0 #EPs= 2 Cls=0a(data ) Sub=00 Prot=00 Driver=cdc_acm
pi@raspberrypi:~ $
    
```

Figure 1.1-2 Getting VID, PID and Driver use “usb-devices” command

Step by Step:

1. Open terminal on Raspberry Pi platform.
2. Executed command “usb-devices” as show in Figure 1.1-2.

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## 1.2 Recommended Environment

For the communication with the reader you need the Chilitag Reader Tool, or a Terminal Program, which is delivered with Chilitag NFC Reader.

The recommended environment as show in Table 1.2-1

| Operating System | Windwos 10      | Raspberry Pi OS (10 Buster) |
|------------------|-----------------|-----------------------------|
| Python version   | 3.8.11          | 3.7.3                       |
| Pyserial version | 3.4             | 3.4                         |
| Tkinter version  | 8.6             | 8.6                         |
| Resolution       | 1920*1080(16:9) | 1920*1080(16:9)             |

Table 1.2-1 Environment Table

Step by Step:

1. Install the "cdc-acm" driver if need
2. Connect the reader via the USB slot to the PC
3. Setup your Python environment
4. Using Python command line execute script in terminal
  - Windwos 10: **python ISO14443A\_UI.py**
  - Raspberry Pi OS (10 Buster): **python3 ISO14443A\_UI.py**

Now you can communicate with the reader

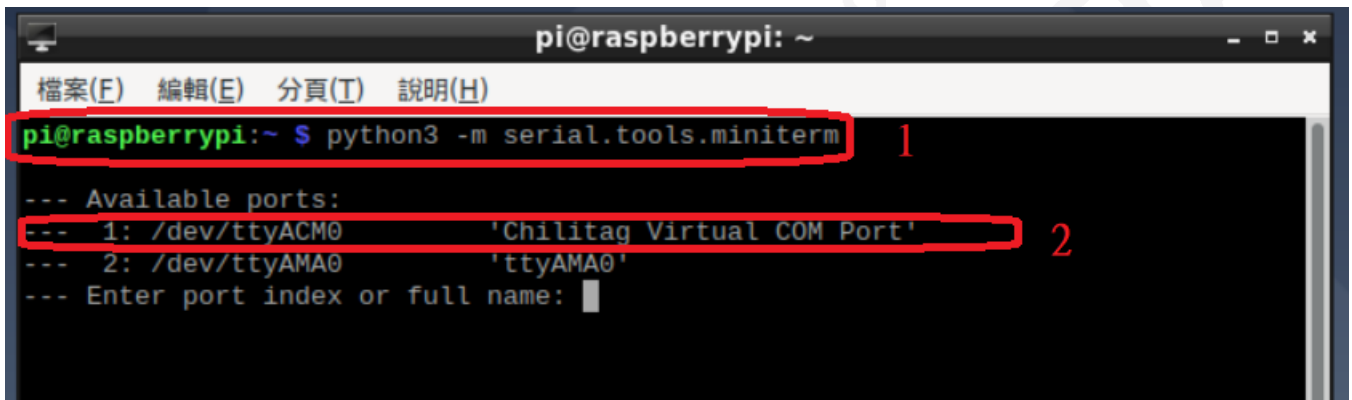
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## Chapter 2. GUI Description

### 2.1 Check Comport

Based on Reader connection method(USB to Serial Port),user must find the correct number of comport to connect the device.

We recommend that use python “Pyserial” module to get comport on Raspberry Pi platform



```

pi@raspberrypi: ~
檔案(E) 編輯(E) 分頁(T) 說明(H)
pi@raspberrypi:~ $ python3 -m serial.tools.miniterm 1
--- Available ports:
--- 1: /dev/ttyACM0 'Chilitag Virtual COM Port' 2
--- 2: /dev/ttyAMA0 'ttyAMA0'
--- Enter port index or full name:
    
```

Figure 2.1-1 COM Port for Reader Hardware displays on Raspberry Pi platform.

Step by Step:

1. Open terminal on Raspberry Pi platform.
2. Executed command “**python3 -m serial.tools.miniterm**” like step1 in Figure 2.1-1.
3. Aiming your expect comport like step2 in Figure 2.1-1.

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## 2.2 Software Component

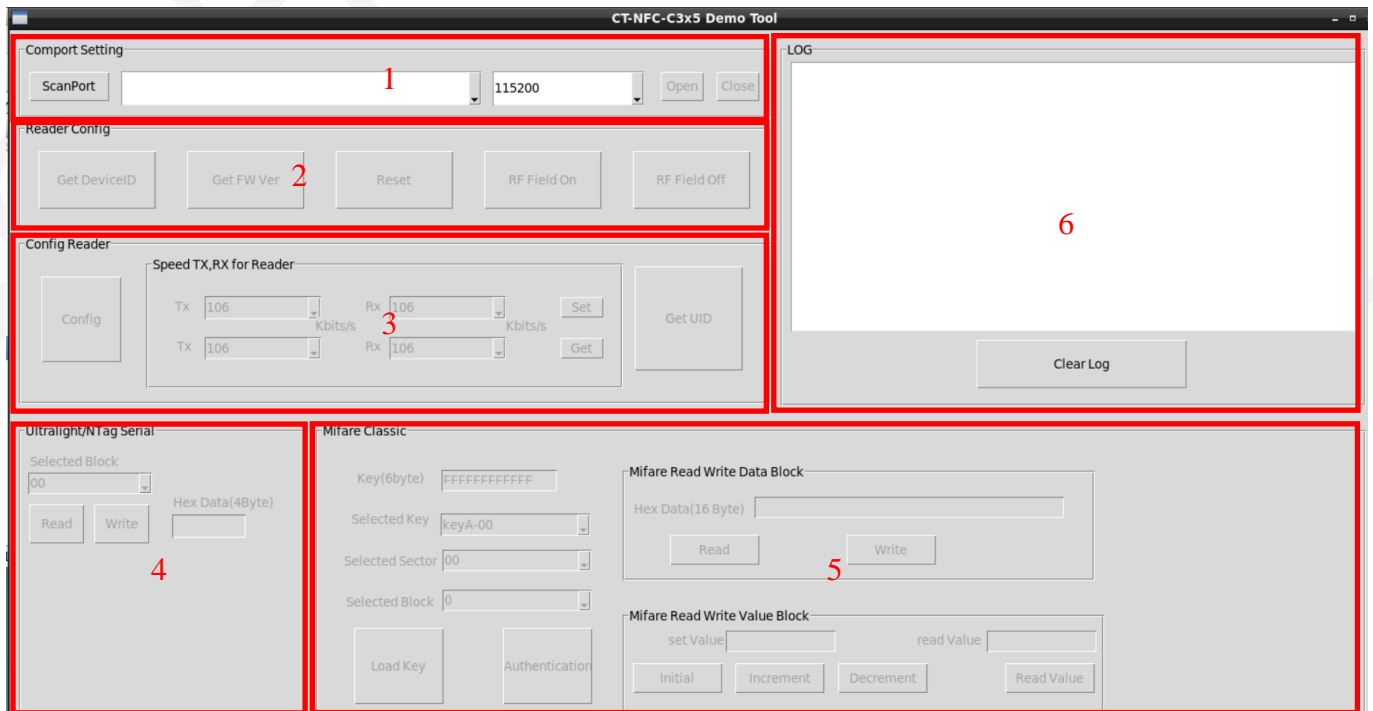


Figure 2.2-1 Sections in Demonstration software

This software mainly consists of six sections as shown in Figure 2.2-1

1. Comport Setup
2. Reader Configuration
3. 14443A RFID protocol Configuration
4. Ultralight/NTag Serial Operate
5. Mifare Classic Operate
6. Transaction logs output

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## 2.3 Comport Setup

Open port is used to open communication port to the reader device.

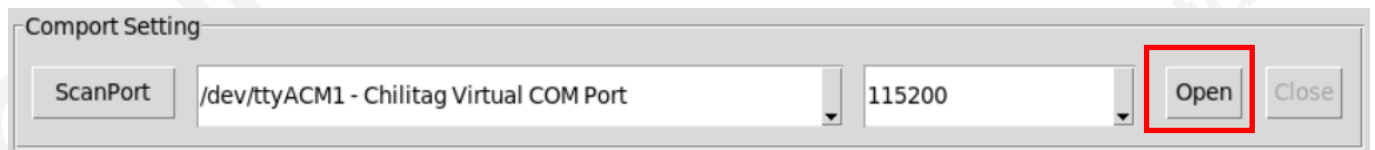


Figure 2.3-1 Open com port button

- Click “ScanPort” button to scan available com port present in computer.
- Selected the ”COM Port” to reader hardware.
- Selected the “Baud Rate” of reader being operated to open communication.
- Click “Open” button to connect the COM port.
- If connection is successful, there will be displayed at LOG Block text view, as shown in Figure 2.3-2.

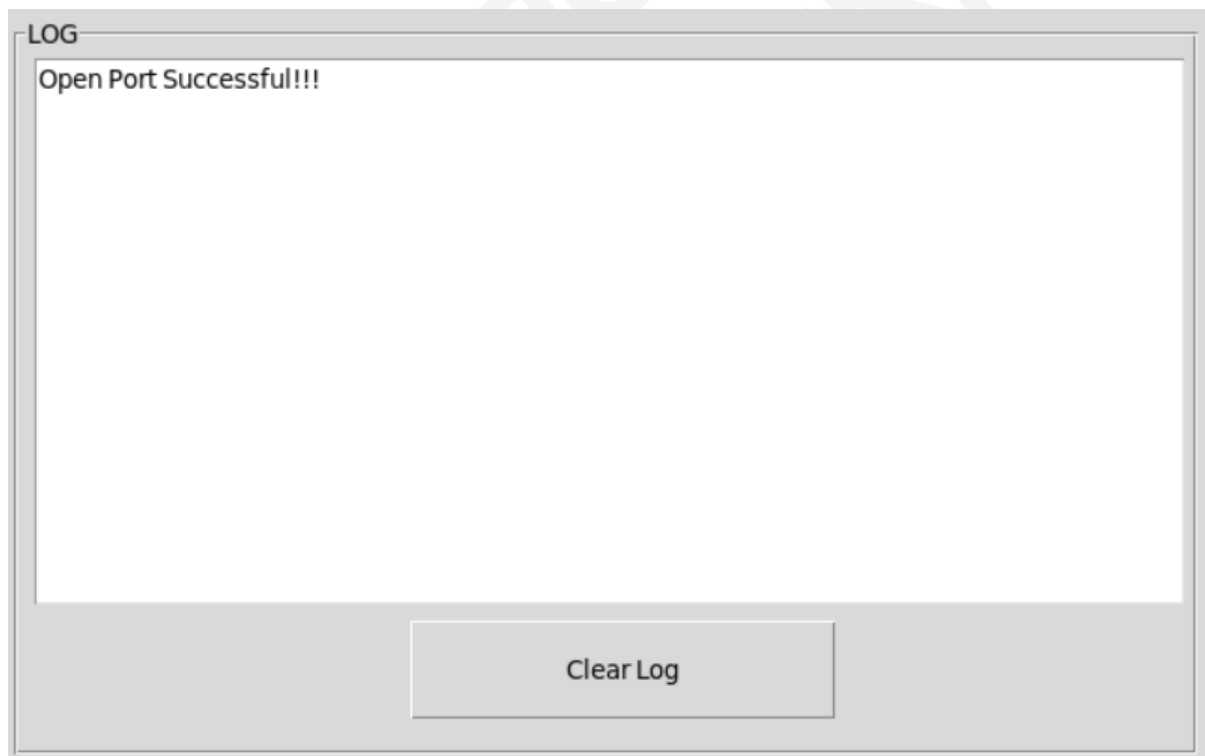


Figure 2.3-2 connected com port

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Close port is used to close current communication port.

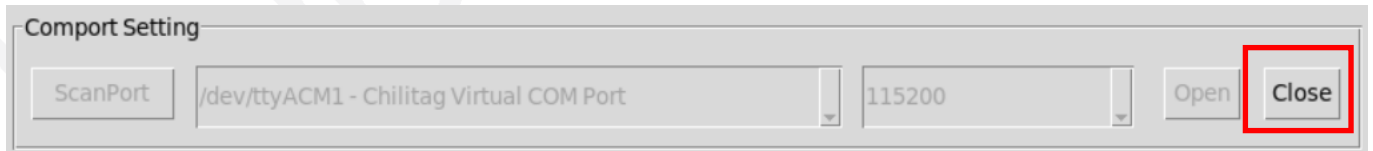


Figure 2.3-3 Close com port button

- Click “Close” button to close current operating COM port.
- There will be displayed at LOG Block text view indicated that the comport was closed, as shown in Figure 2.3-4.

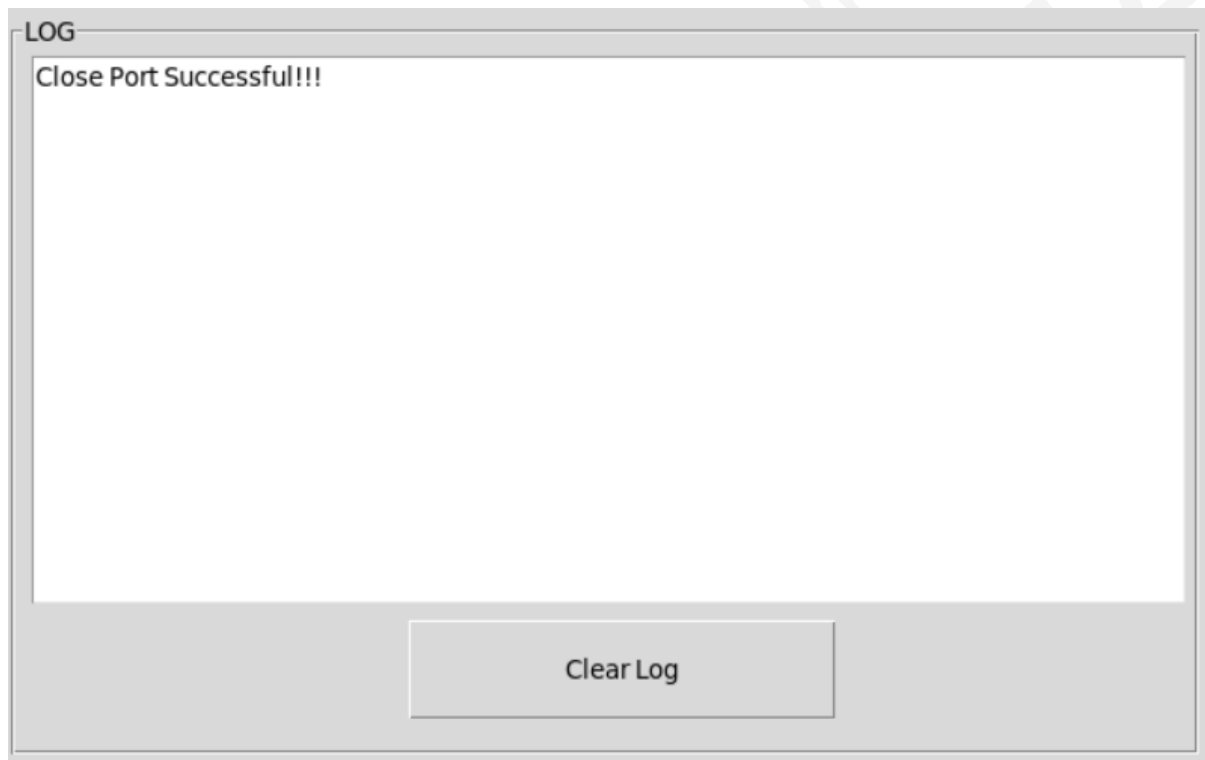


Figure 2.3-4 closed com port

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## Chapter 3. LOG Block

### 3.1 Text View Logs Output

When user operates GUI , transmit “Command Frame” to module, The LOG Block text view will show “Response frame” information log as show in Figure 3.1-1 and Figure 3.2-1

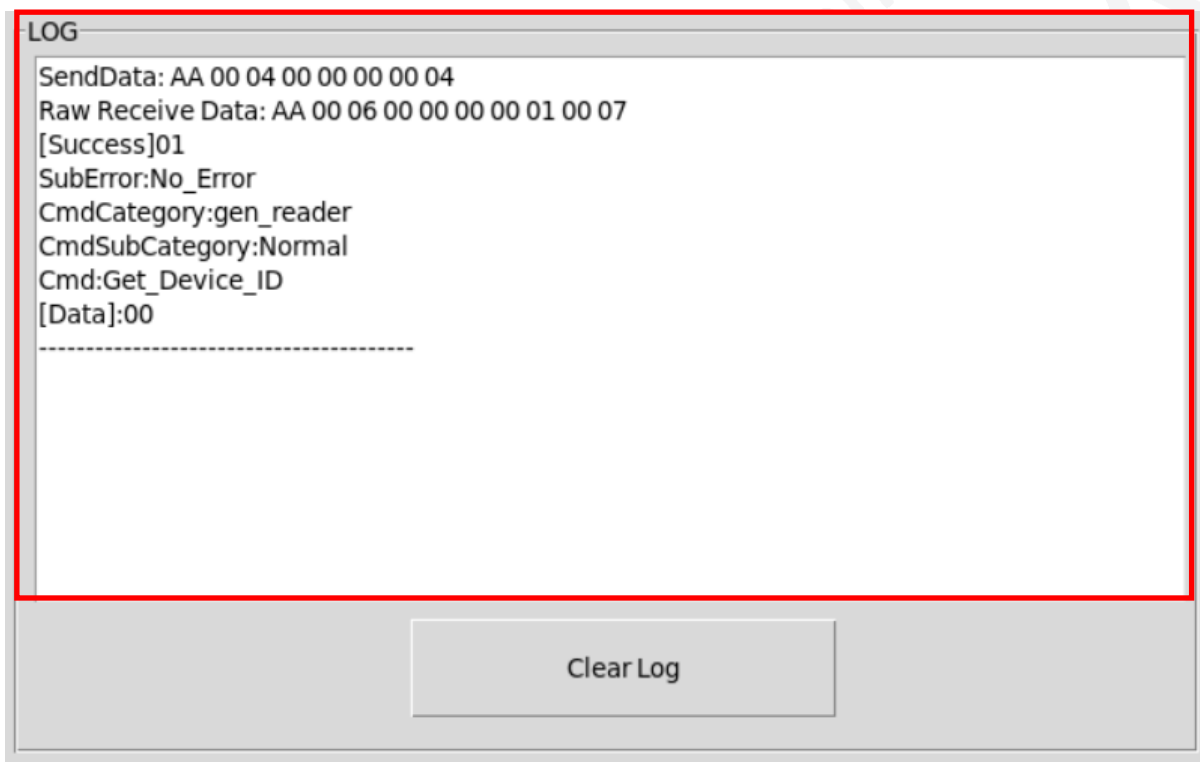


Figure 3.1-1command execute success



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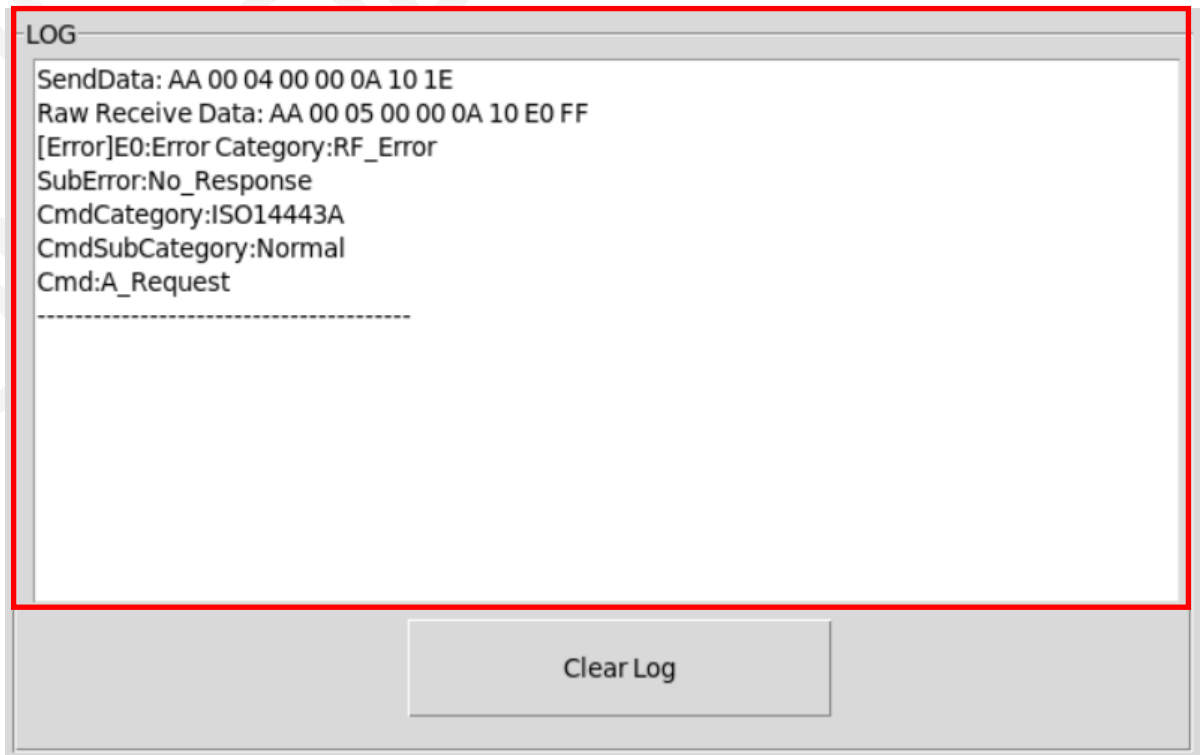


Figure 3.1-1 command execute fail

**“Send Data”** : User transmit “Command Frame” to module.

**“Receive Data”**: Receive “Response frame” from module.

**“[Success]”** : The command was executed success as show in Figure 3.1-1.

**“[Error]”** : Which error code and error category as show in Figure 3.2-1.

**“SubError”** : Which error response name

**“CmdCategory”** : Which command Category was executed like “Reader Configuration”, ”Reader IC Configuration” or ”ISO14443A” Command group.

**“CmdSubCategory”** : Which command SubCategory was executed like “MIFARE” or “MIFARE Ultralight” in ISO14443A Command group.

**“Cmd”** : Which command was executed.

**“[Data]”** : Extract data block form “Response frame” if the command was executed success. If command no data block in “Response frame” the indicate will empty.

If you need more details information. Please reference “Protocol Package” chapter in Protocol datasheet.

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### 3.2 Clear Log

“Clear Log” button is used to clear text view as shown in Figure 3.2-1.

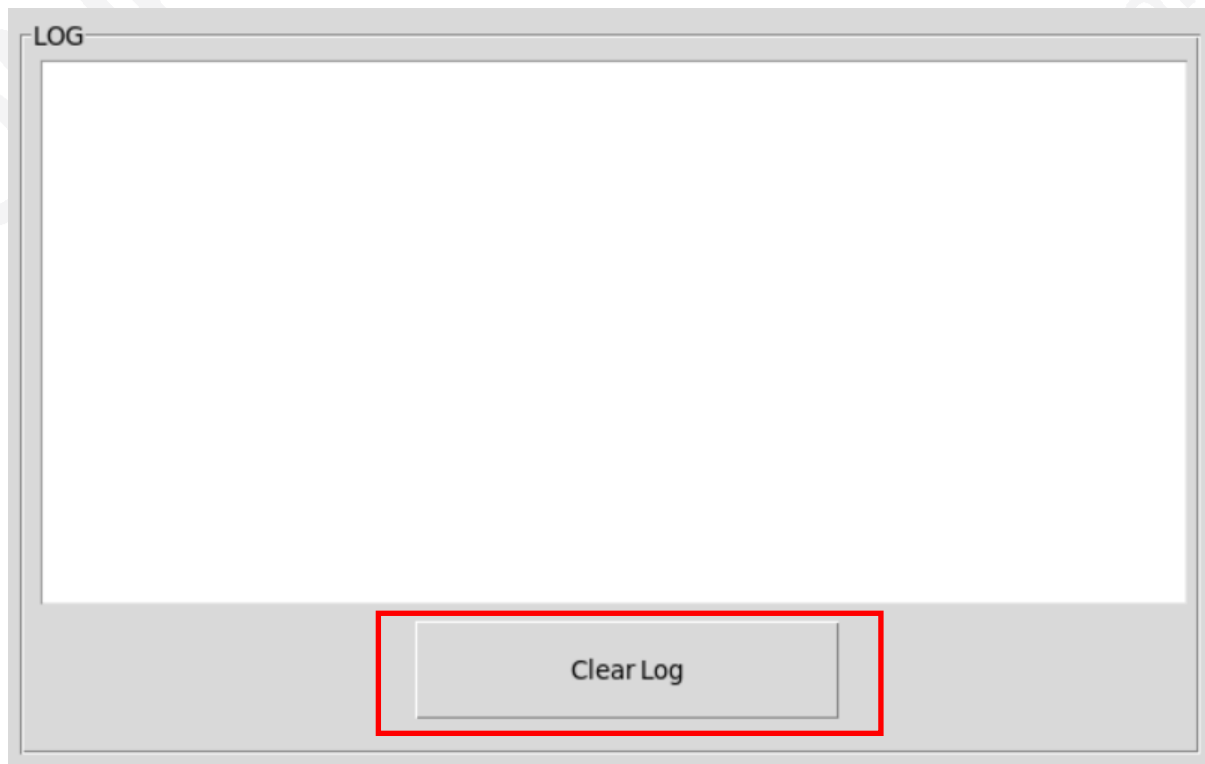


Figure 3.2-1 Clear Log button

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## Chapter 4. Reader General Function Demonstration

### 4.1 Reader Config Block

The “Reader Config Block” is implement Reader and Reader IC Configuration Command as shown in Figure 4.1-1



Figure 4.1-1 Reader Config Block

### 4.2 Get Device ID

“Get DeviceID” button is used to get the device ID of connected device. The device ID will show at LOG Block block text view as shown in Figure 4.2-2.

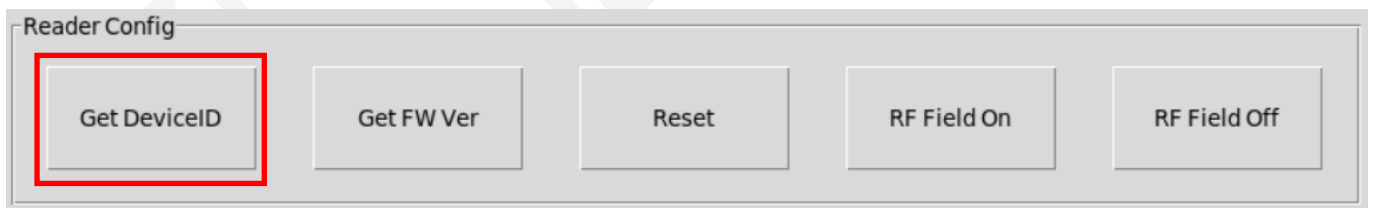


Figure 4.2-1 Get Device ID button

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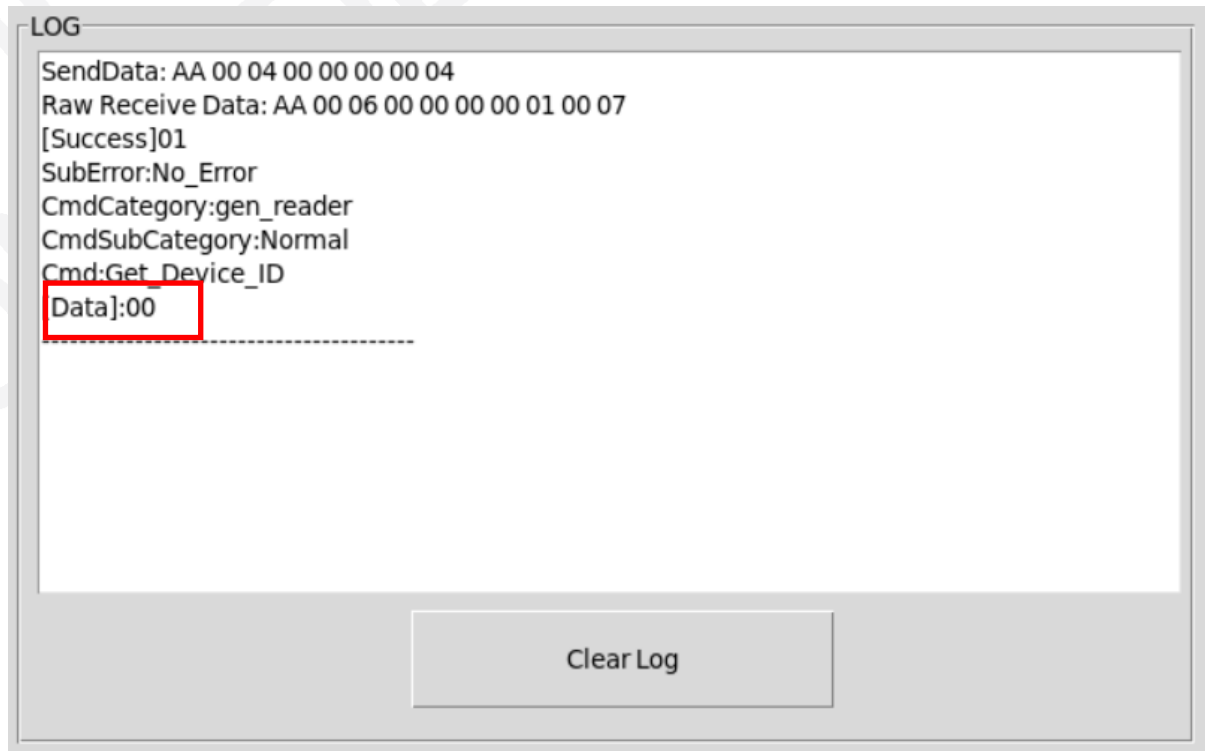


Figure 4.2-2 Device ID was showed at LOG Block

### 4.3 Get Firmware Version

“Get FW Ver” button is used to get firmware version from the connected device. The firmware version will show at LOG Block text view as shown in Figure 4.3-2.



Figure 4.3-1 Get Firmware Version button

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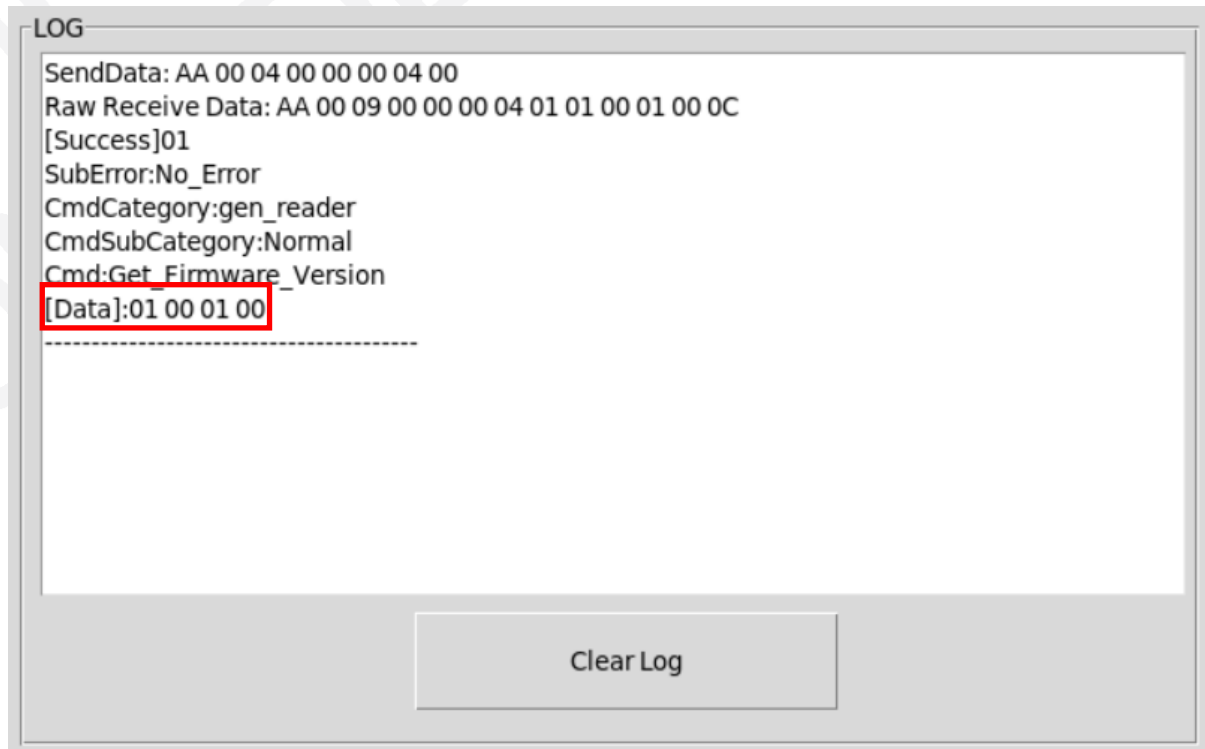


Figure 4.3-2 The firmware version was showed at LOG Block text view

## 4.4 Reset

“Reset” button is used to reset reader IC.

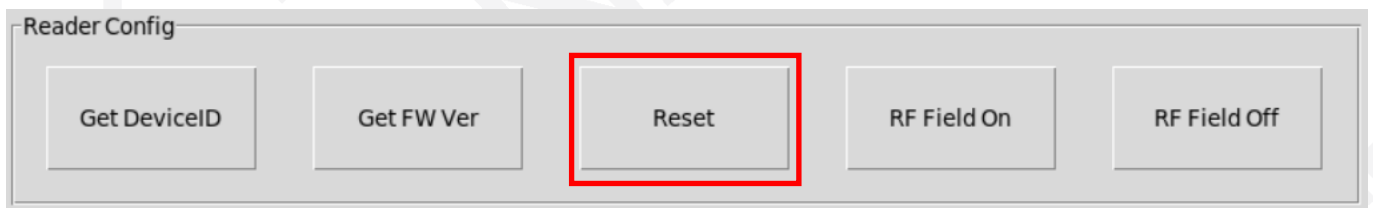


Figure 4.4-1 Reset button

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## 4.5 RF Field On

“RF Field On” button is used to start 13.56-MHz carrier emission.

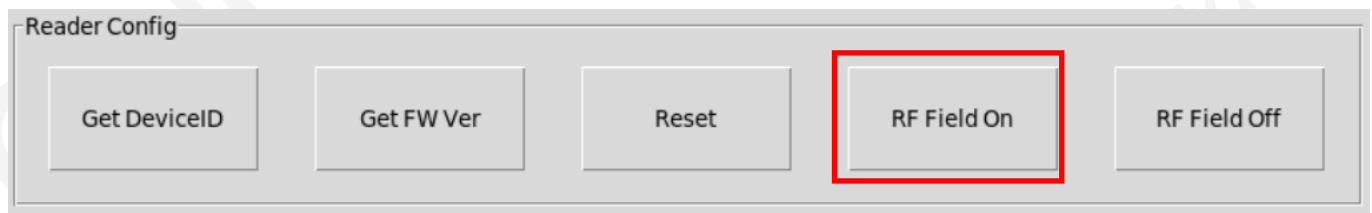


Figure 4.5-1 RF Field On button

## 4.6 RF Field Off

“RF Field Off” button is used to stop 13.56-MHz carrier emission.

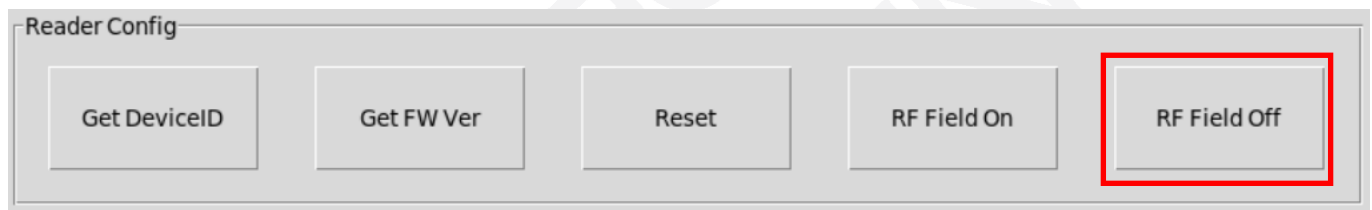


Figure 4.6-1 RF Field Off button

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## Chapter 5. ISO14443A Function Demonstration

### 5.1 Config

“Config” button is used to setup parameters in the reader to be ready to transmit and receive following standard of ISO14443A. User must activate this setup before performing any RF-related operations in ISO14443A protocol.

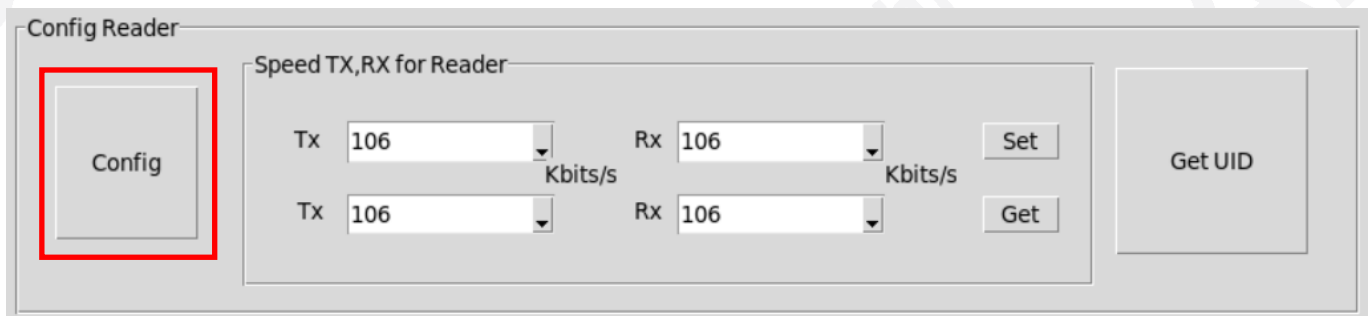


Figure 5.1-1 ISO14443A Config button

### 5.2 SET Speed

“SET Speed” button is used to configure Tx and Rx speed of CODEC in reader. User must configure speed before performing any RF-related operations in ISO14443A protocol.

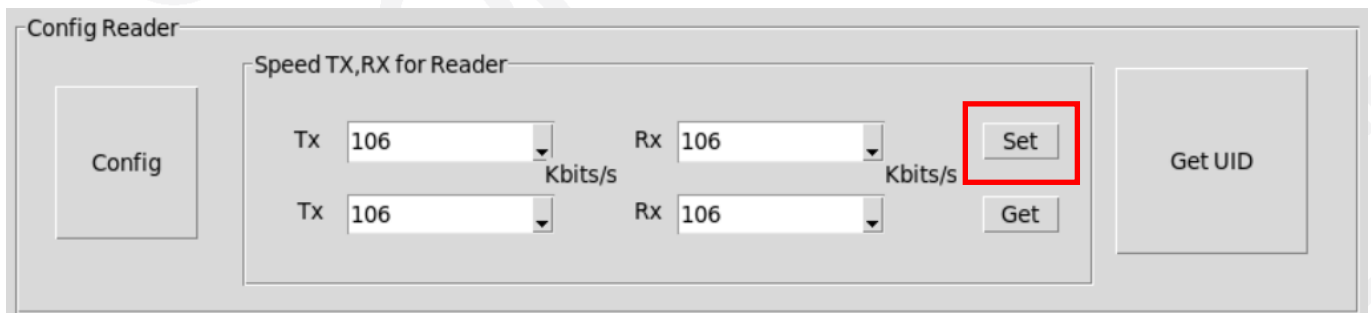


Figure 5.2-1 ISO14443A SET Speed button



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### 5.3 GET Speed

“GET Speed” button is used to get current speed of CODEC in reader.

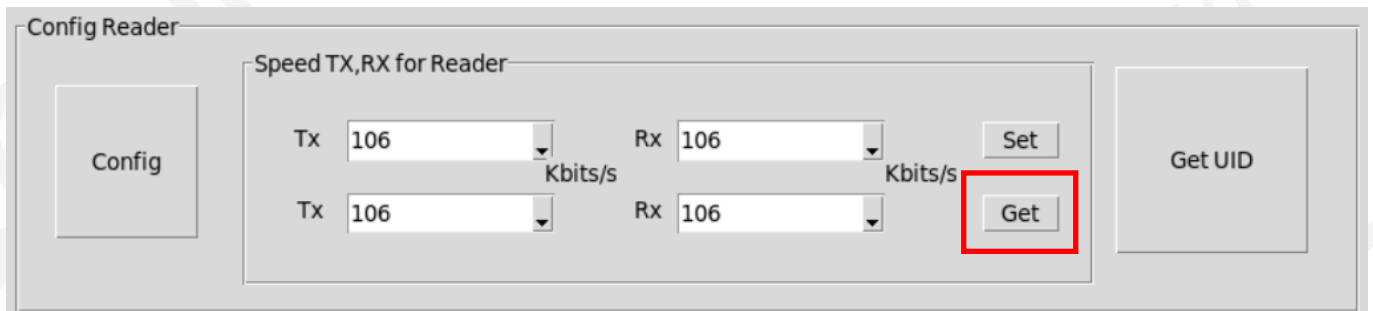


Figure 5.3-1 ISO14443A GET Speed button

### 5.4 Get UID

“Get UID” button is used to get UID and select card in field. The UID will show at LOG Block text view show as in Figure 5.4-2.

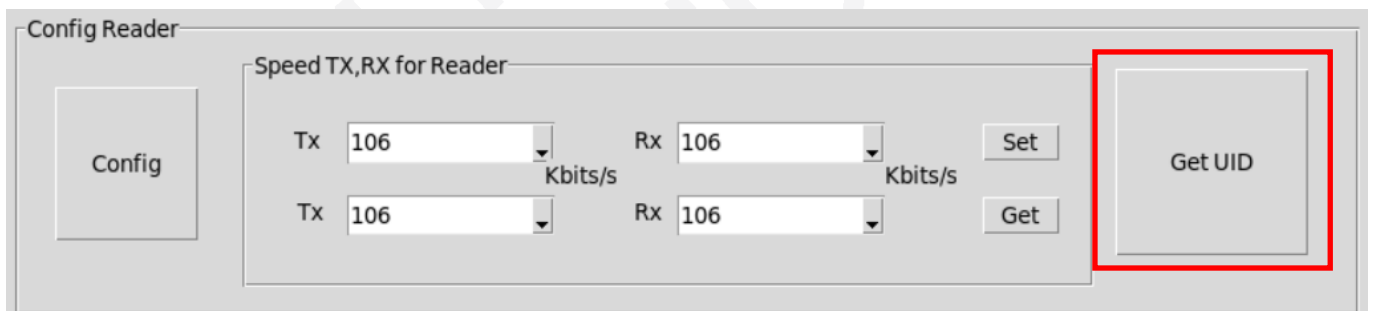


Figure 5.4-1 ISO14443A Get UID button

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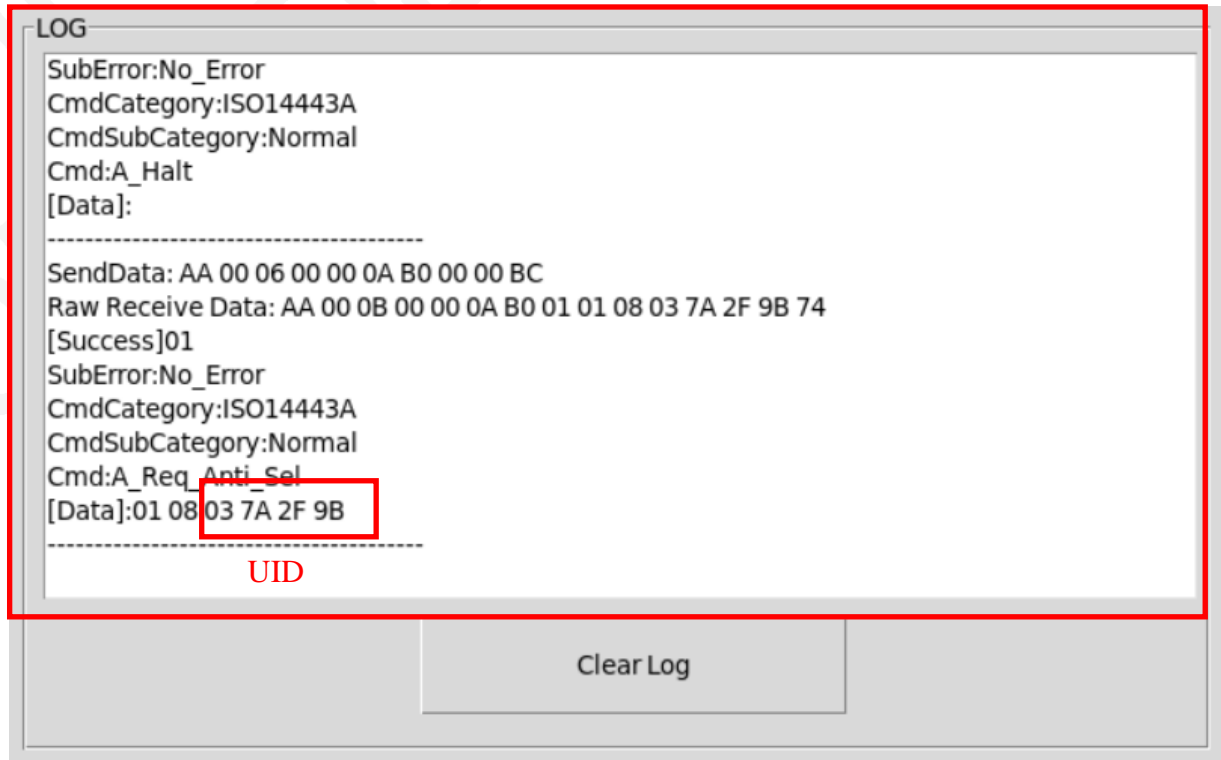


Figure 5.4-2 ISO14443A Show UID. It was extracted data block form “Response frame”

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## Chapter 6. Mifare Classic Function Demonstration

### 6.1 Mifare Classic Block

The Mifare Classic Block as shown in Figure 6.1-1

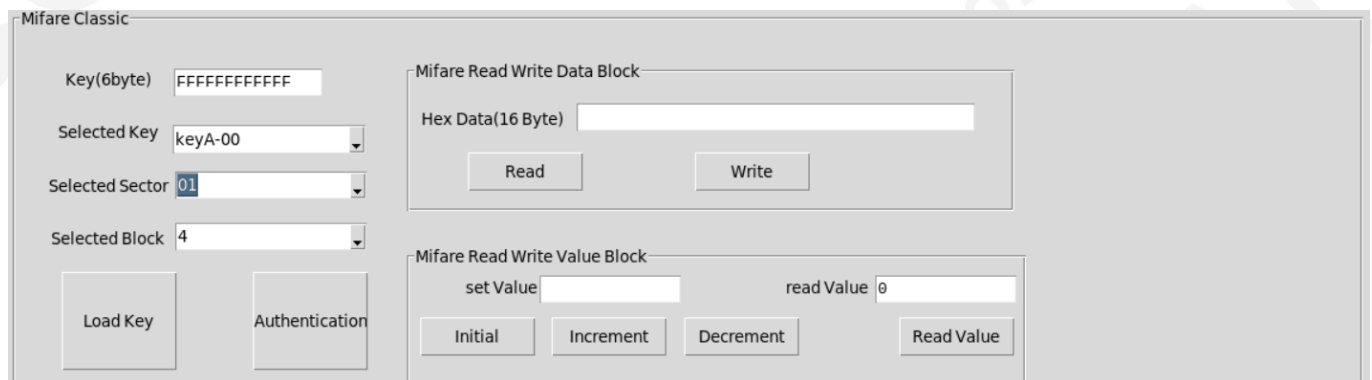


Figure 6.1-1 The Mifare Classic Block

### 6.2 Load Key

“Load Key” button is used to load a 6-byte hexadecimal key into key buffer to be used authentication.

The steps are described as follows:

1. Click “Get UID” button to select card.
2. Input 6-byte hexadecimal key to be used authentication, as shown in Figure 6.2-1.
3. Click “Load Key” button to load key into key buffer.

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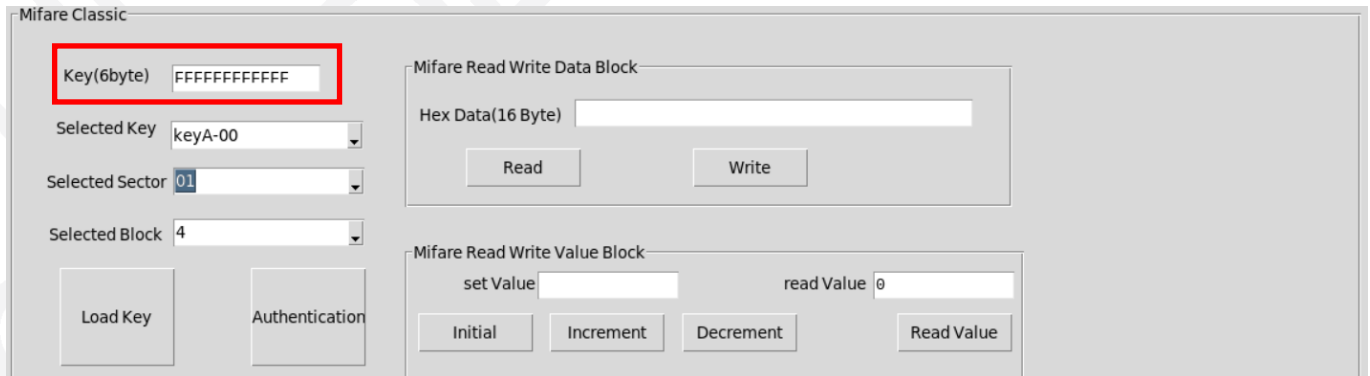


Figure 6.2-1 Input 6-byte hexadecimal key

### 6.3 Authentication

“Authentication” button is used to perform MIFARE authentication in specific card sector. For typical 1k-byte MIFARE card, every four blocks is governed by keys (A and B) of each sector. For example, block 4, 5, 6 and 7 rely on the same key stored in block. If block 4 was authenticated, block 5, 6 and 7 can also be accessed with re-authentication.

If authentication is failed, the access process must be restart from operation of select card.

The steps are described as follows:

1. Click “Get UID” button to select card.
2. Input 6-byte hexadecimal key to be used authentication.
3. Click “Load Key” button to load key into key buffer.
4. Click “Selected Key” drop-down list to select KeyA or KeyB to be used in authentication, as shown in Figure 6.3-1.
5. Click “Selected Sector” and “Selected Block” drop-down list to select the block address to be accessed, as shown in Figure 6.3-2.
6. Click “Authentication” button to authenticate.

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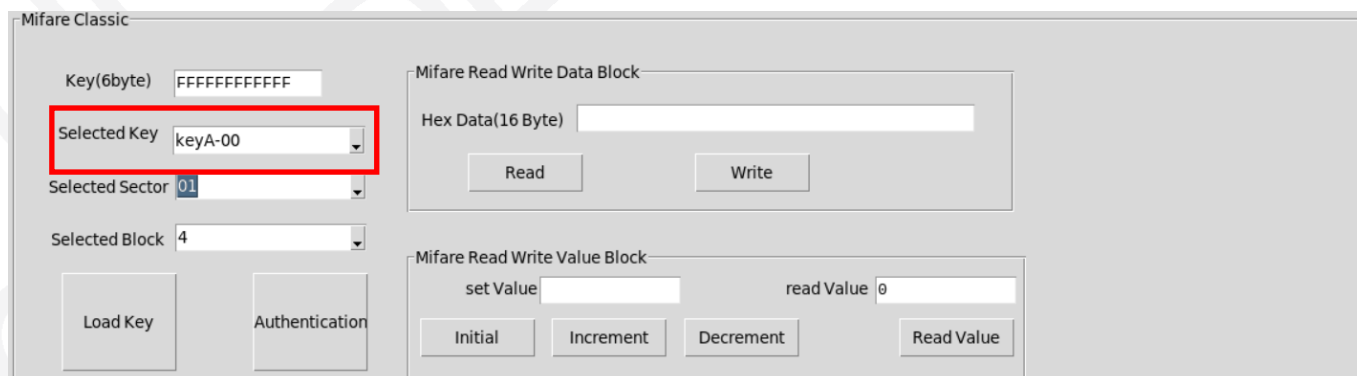


Figure 6.3-1 Select KeyA or KeyB to be used in authentication

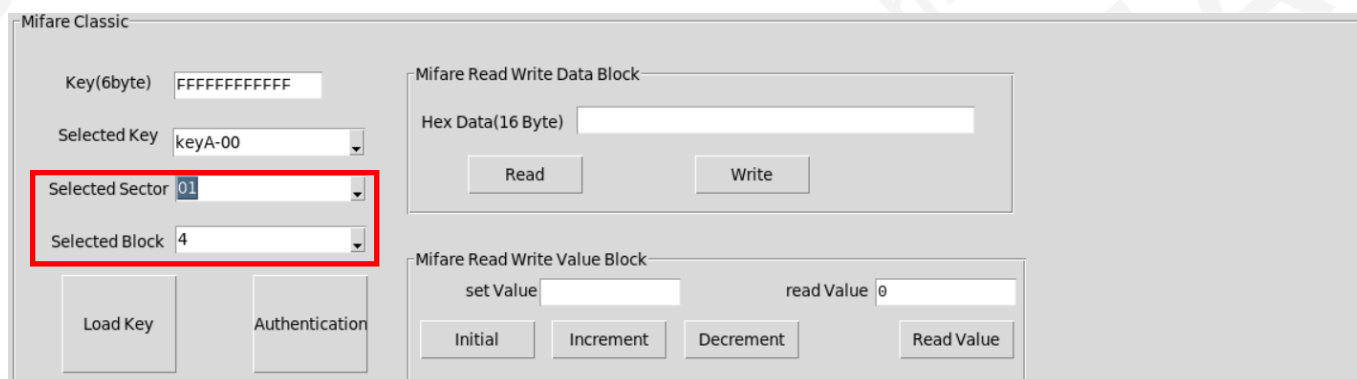


Figure 6.3-2. Select the block address to be accessed

## 6.4 Read

“Read” button is used to read data from target block address. User should read data with in authenticated sector. If authentication is failed, the access process must be restart from operation of select card. The steps are described as follows:

1. Click “Get UID” button to select card.
2. Input 6-byte hexadecimal key to be used authentication.
3. Click “Load Key” button to load key into key buffer.
4. Click “Selected Key” drop-down list to select KeyA or KeyB to be used in authentication.
5. Click “Selected Sector” and “Selected Block” drop-down list to select the block address to be accessed.

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- Click “Authentication” button to authenticate.
- Click “Read” button to read data.
- Result of response will show at LOG Block text view, as shown in Figure 6.4-1.

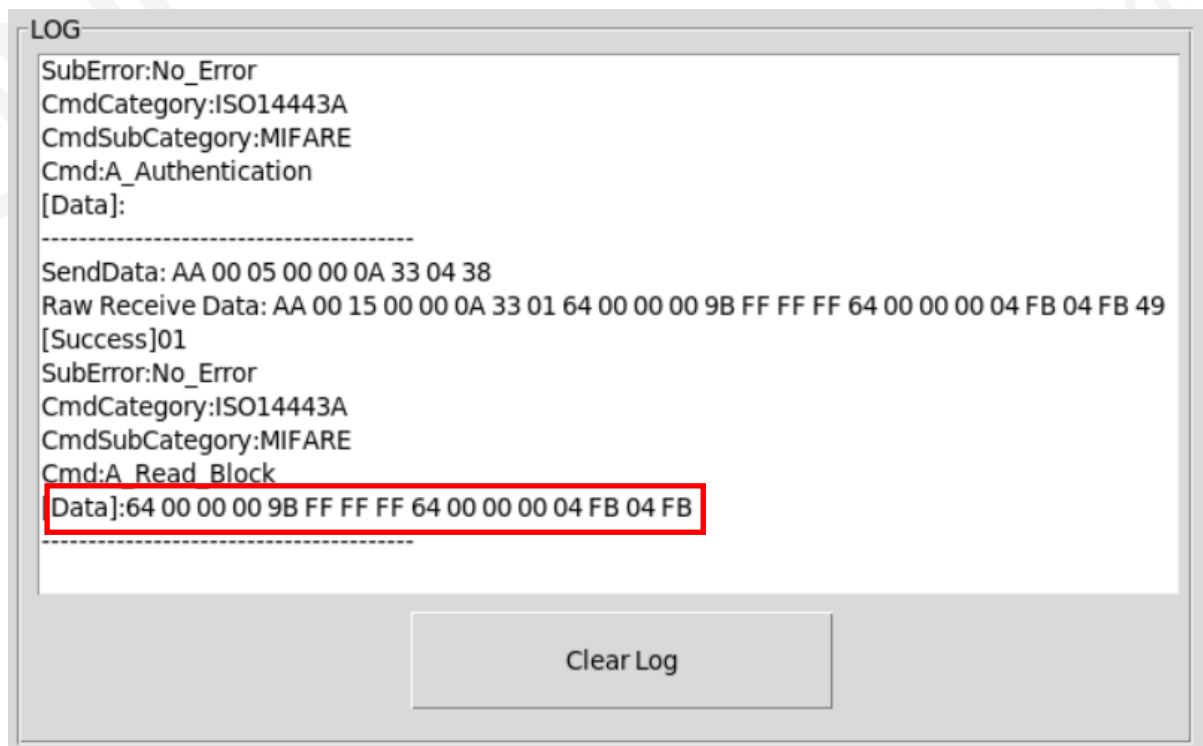


Figure 6.4-1 Read data LOG Block text view

## 6.5 Write

“Write” button is used to write data to target block address. User should write data with in authenticated sector. If authentication is failed, the access process must be restart from operation of select card. The steps are described as follows:

- Click “Get UID” button to select card.
- Input 6-byte hexadecimal key to be used authentication.
- Click “Load Key” button to load key into key buffer.
- Click “Selected Key” drop-down list to select KeyA or KeyB to be used in authentication.

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- Click “Selected Sector” and “Selected Block” drop-down list to select the block address to be accessed.
- Click “Authentication” button to authenticate.
- Input 16-byte hexadecimal data to be written, as shown in Figure 6.5-1.
- Click “Write” button to write data.

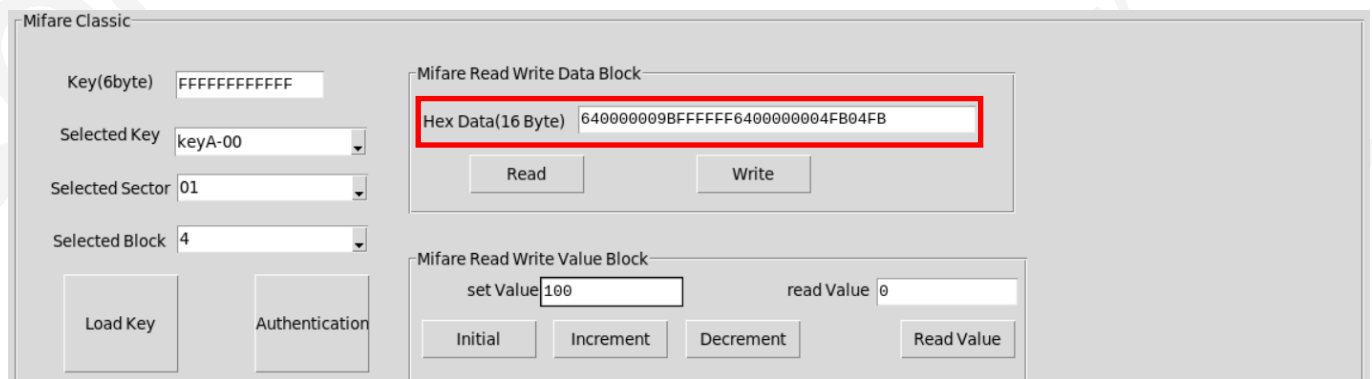


Figure 6.5-1 Input 16-byte hexadecimal data

## 6.6 Read Value

“Read Value” button is used to read value from target value block. User should read value with in authenticated sector. If authentication is failed, the access process must be restart from operation of select card.

The steps are described as follows:

- Click “Get UID” button to select card.
- Input 6-byte hexadecimal key to be used authentication.
- Click “Load Key” button to load key into key buffer.
- Click “Selected Key” drop-down list to select KeyA or KeyB to be used in authentication.
- Click “Selected Sector” and “Selected Block” drop-down list to select the block address to be accessed.
- Click “Authentication” button to authenticate.
- Click “Read Value” button to read value.
- Value of response will displayed at GUI, as shown in Figure 6.6-1.



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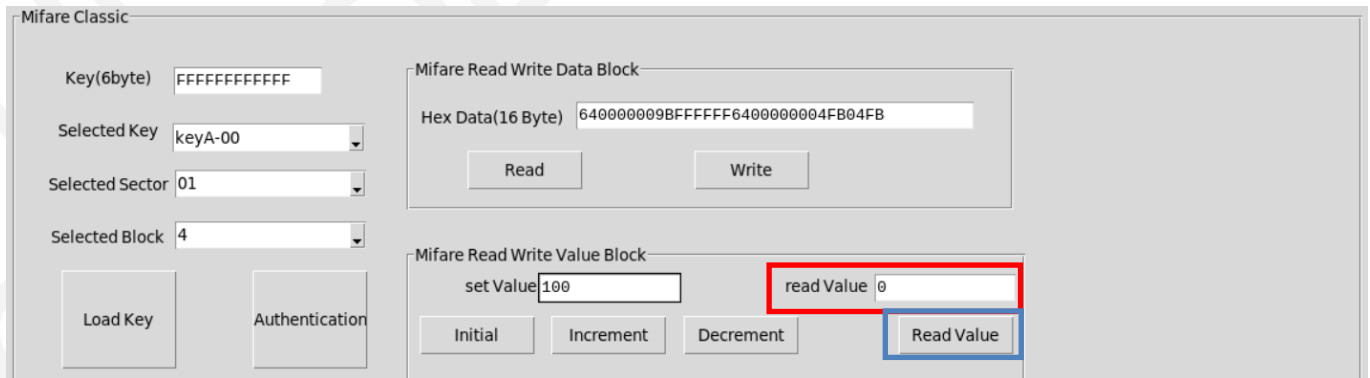


Figure 6.6-1 Read value displayed at GUI

## 6.7 Initial

“Initial” button is used to initial value block data to target block address. User should initial value with in authenticated sector. If authentication is failure, the access process must be restart from operation of select card.

The steps are described as follows:

1. Click “Get UID” button to select card.
2. Input 6-byte hexadecimal key to be used authentication.
3. Click “Load Key” button to load key into key buffer.
4. Click “Selected Key” drop-down list to select KeyA or KeyB to be used in authentication.
5. Click “Selected Sector” and “Selected Block” drop-down list to select the block address to be accessed.
6. Click “Authentication” button to authenticate.
7. Input value to be initial, as shown in Figure 6.7-1
8. Click “Initial” button to initial value block.

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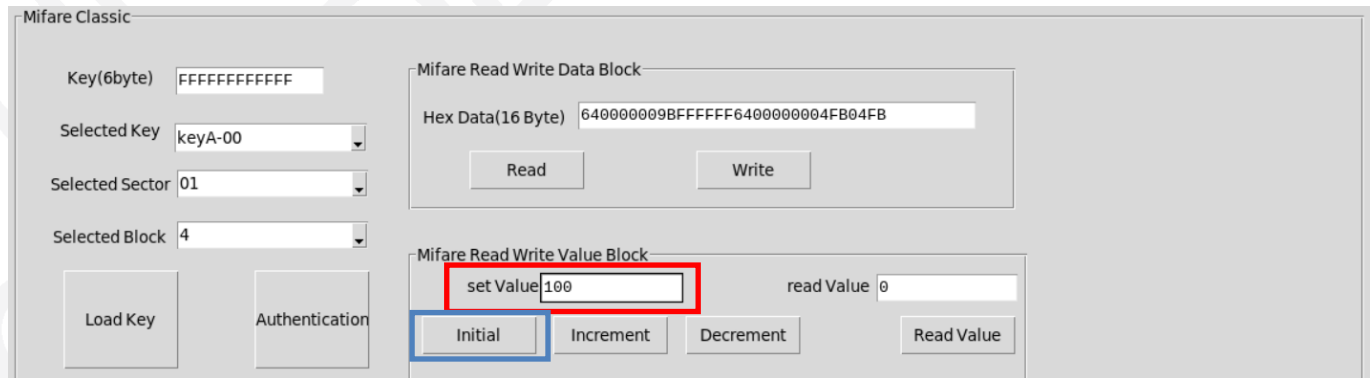


Figure 6.7-1 Initial value

## 6.8 Increment

“Increment” button is used to increase value block and transfer result to target block address. User should increase value with in authenticated sector. If authentication is failed, the access process must be restart from operation of select card.

The steps are described as follows:

1. Click “Get UID” button to select card.
2. Input 6-byte hexadecimal key to be used authentication.
3. Click “Load Key” button to load key into key buffer.
4. Click “Selected Key” drop-down list to select KeyA or KeyB to be used in authentication.
5. Click “Selected Sector” and “Selected Block” drop-down list to select the block address to be accessed.
6. Click “Authentication” button to authenticate.
7. Input value to be increase, as shown in Figure 6.8-1.
8. Click “Increment” button to increase value block.

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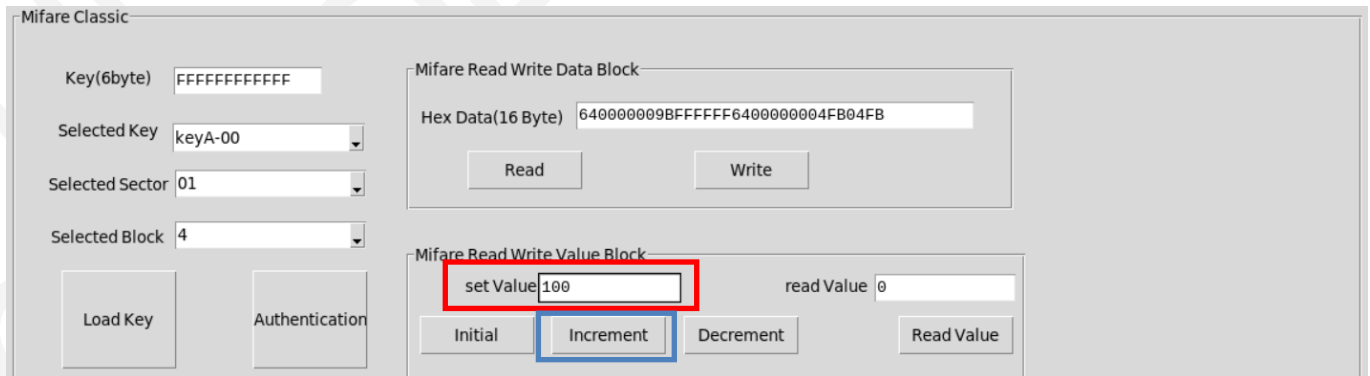


Figure 6.8-1 Increase value

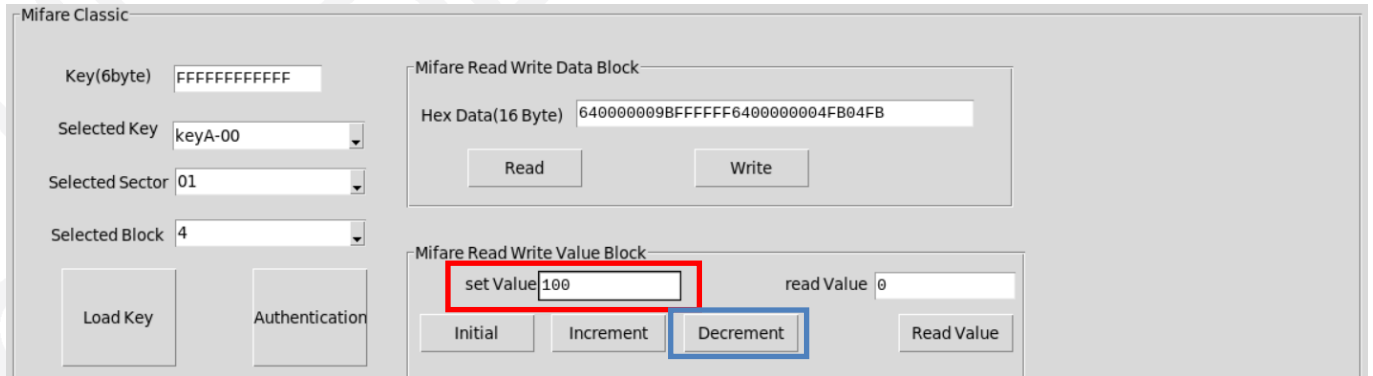
## 6.9 Decrement

“Decrement” button is used to decrease value block and transfer result to target block address. User should decrease value with in authenticated sector. If authentication is failed, the access process must be restart from operation of select card.

The steps are described as follows:

1. Click “Get UID” button to select card.
2. Input 6-byte hexadecimal key to be used authentication.
3. Click “Load Key” button to load key into key buffer.
4. Click “Selected Key” drop-down list to select KeyA or KeyB to be used in authentication.
5. Click “Selected Sector” and “Selected Block” drop-down list to select the block address to be accessed.
6. Click “Authentication” button to authenticate.
7. Input value to be decrease, as shown in Figure 6.9-1.
8. Click “Decrement” button to decrease value block.

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The screenshot shows the Mifare Classic software interface. In the 'Mifare Read Write Value Block' section, the 'set Value' field is highlighted with a red box and contains the value '100'. The 'Decrement' button is highlighted with a blue box. Other fields include 'Key(6byte)' set to 'FFFFFFFFFFFF', 'Selected Key' set to 'keyA-00', 'Selected Sector' set to '01', and 'Selected Block' set to '4'. The 'Mifare Read Write Data Block' section shows 'Hex Data(16 Byte)' set to '640000009BFFFFFF6400000004FB04FB' with 'Read' and 'Write' buttons. The 'Mifare Read Write Value Block' section also has 'Initial', 'Increment', 'Decrement', and 'Read Value' buttons.

Figure 6.9-1 Decrease value

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## Chapter 7. Mifare Ultralight Function Demonstration

### 7.1 Read

“Read” button is used to read the specified memory pages. The result of response is the 16-byte (4-page) data starting from the starting page address.

The steps are described as follows:

1. Click “Get UID” button to select card.
2. Click “Selected Block” drop-down list to select the starting page address, as shown in Figure 7.1-1.
3. Click “Read” button to read memory pages.
4. Result of response will show at LOG Block text view, as shown in Figure 7.2-1.



Figure 7.1-1 Select the starting page address

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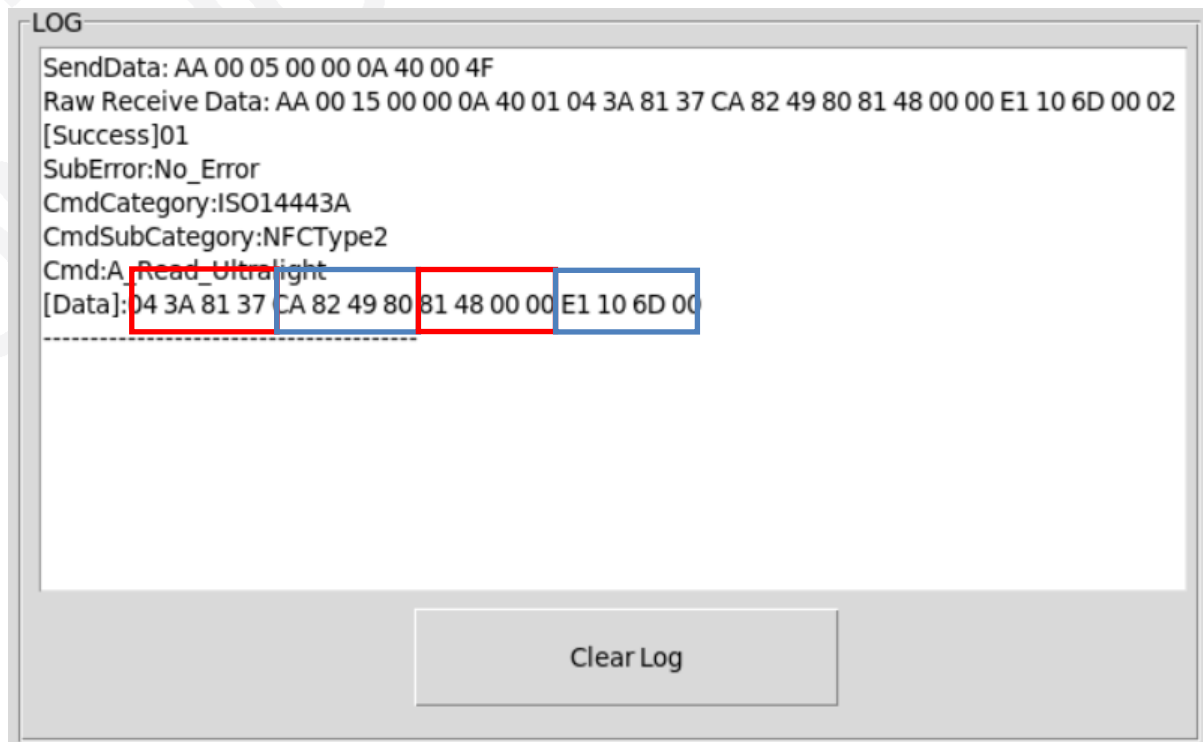


Figure 7.1-2 Result show 16-byte (4-page) at LOG Block text view

## 7.2 Write

“Write” button is used to program the data into a specified memory page.

The steps are described as follows:

1. Click “Get UID” button to select card.
2. Click “Selected Block” drop-down list to select the page address to be written, as shown in Figure 7.2-1.
3. Input 4-byte hexadecimal data to be written, as shown in Figure 7.2-2.
4. Click “Write” button to program memory pages.

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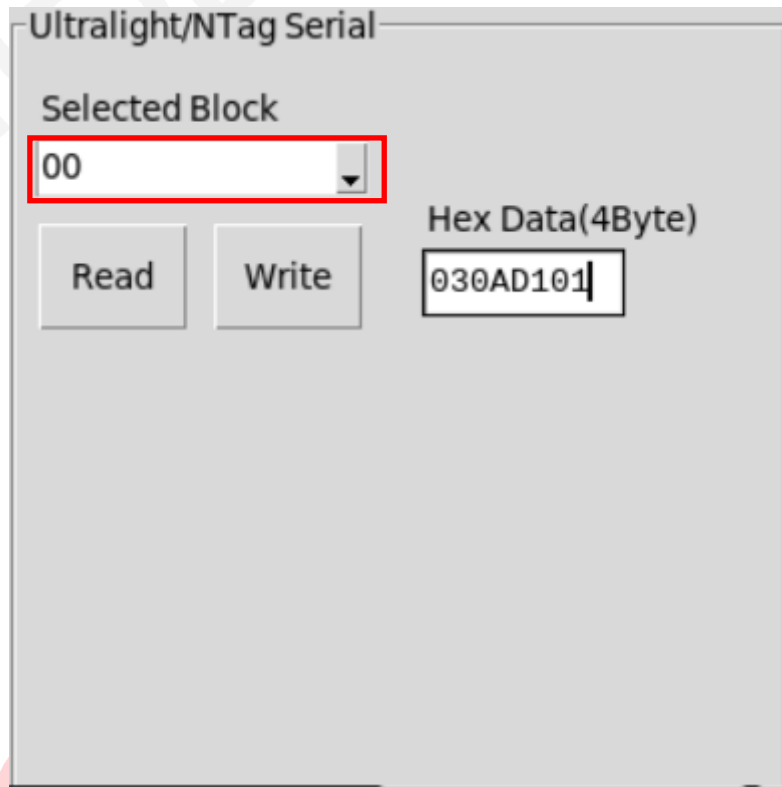


Figure 7.2-1 Select the page address



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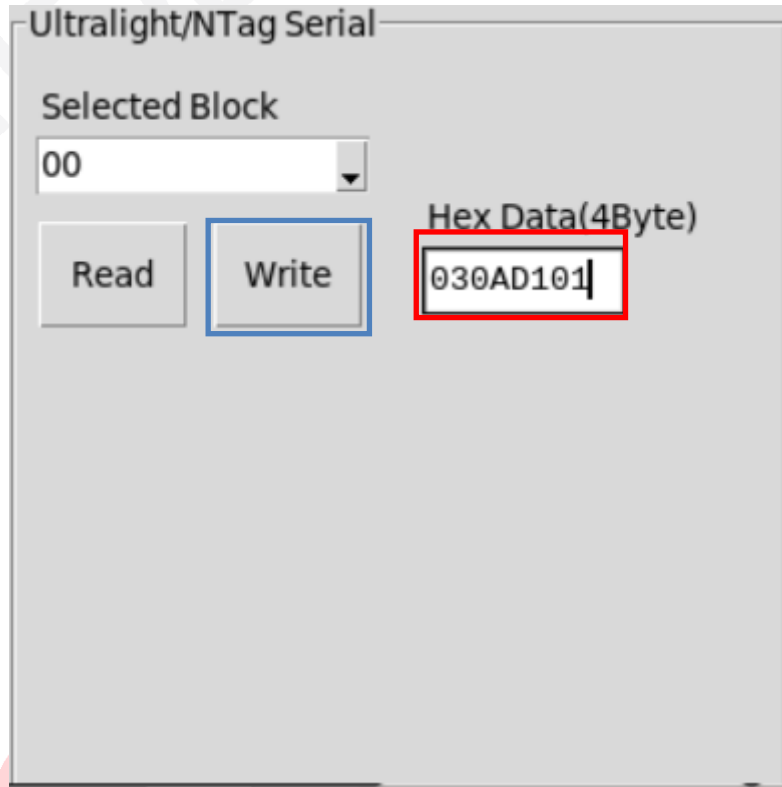


Figure 7.2-2 Input 4-byte hexadecimal data