



DualCard User Manual

DUALi Inc.

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We have our development center in South Korea to provide technical support. For any technical assistance can contact our technical support team as below;

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Revision History

- 2009.02. (Ver. 1.0) : First Release
- 2009.05. (Ver. 1.01) : 15693(Optional. DE-620R) Function Added
- 2010.04. (Ver. 1.02) : Mifare plus function tap added
- 2013.08. (Ver. 1.1) : Layout composition modified (DualCard version 3.1)
 - Update Script input more user-friendly
 - Mifare tab: 4/7/10 bytes UID support function added
 - NFC tab : LLCP/SNEP (ISO 18092) and NFC Barcode test function added.
 - UTIL tab : device number check, serial communication speed select function, Triple DES function added.
- 2015.03.11 (Ver.2.0) : DualCard layout composition modified. (DualCard version 4.0)
 - DESFire function improved. (Batch function)
 - Util tab revision (Util 1/ Util 2)
 - PCSC mode test function (all tabs)
- 2016.04.12 (Ver.2.1) : MIFARE Ultralight C tap added (Ch.4.4)
 - Contents modified
 - Felica, DesFire features improved.

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Introduction

A. Intended Readership

This manual has been written keeping in mind the end-user, who uses the application and which mainly acts as a reference manual.

B. Purpose

This manual contains information for establishing your work using this software. It describes the various functions that will be provided in the application. The purpose of this document is to give detail description about the Application Controls, Interface with Reader and Card.

C. Scope

DualCard program supports following DUALi Readers which in return support wide range of Tags /Cards compliant with ISO 7816, ISO 14443 Part 3 & 4 TYPE A/B, ISO 18092, Mifare series, DesFire and Sony's Felica specifications

Supportive DUALi reader

- DE-620/620R/620V/620A, DE-630/631, Dragon, DE-930/950 FDK, NFC PAD
- All DUALi modules

Application of DualCard are:-

- Card Test Solution.
- DUALi Reader Test Solution.

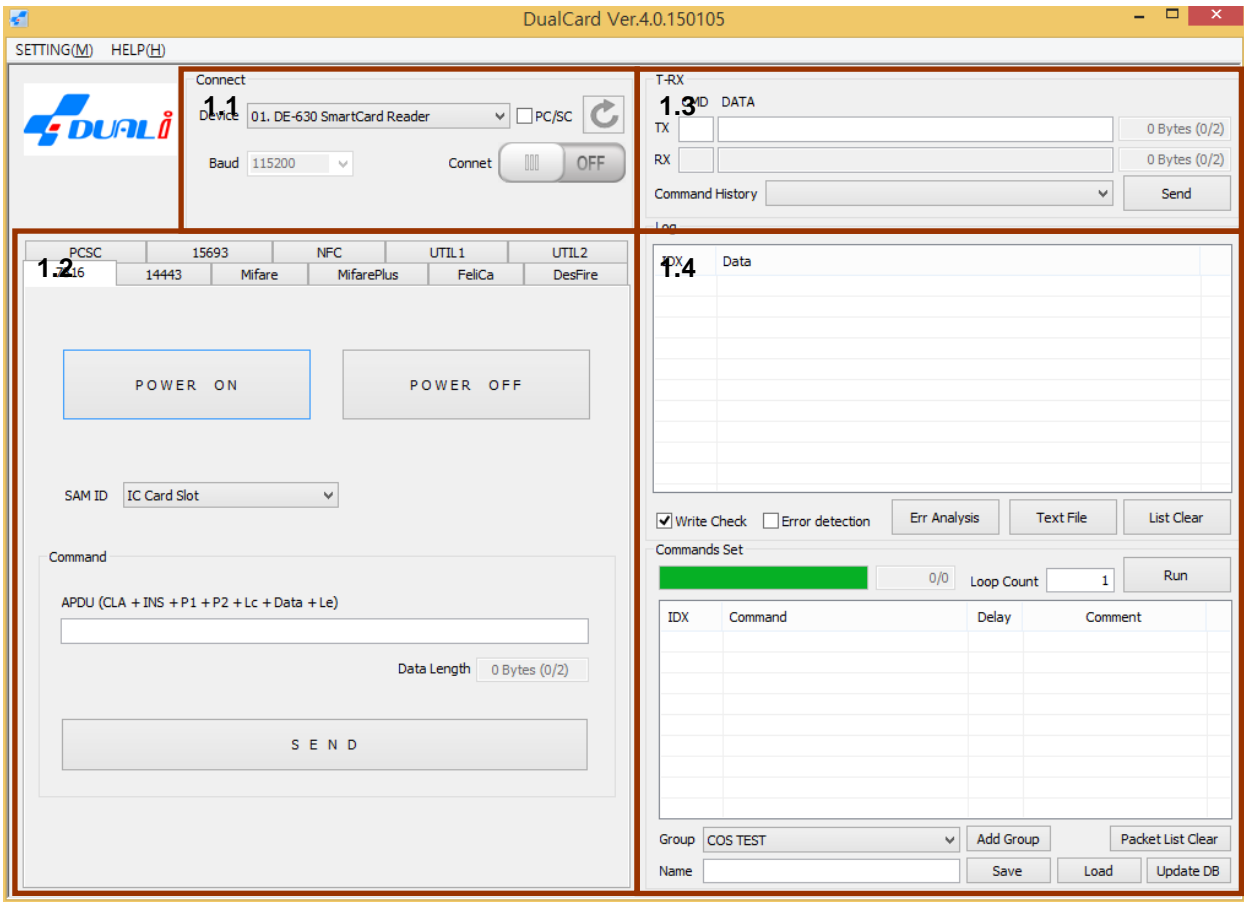
FeliCa is registered trademark of SONY corporation

Mifare and DesFire are registered trademarks of NXP Semiconductors

Supportive O/S

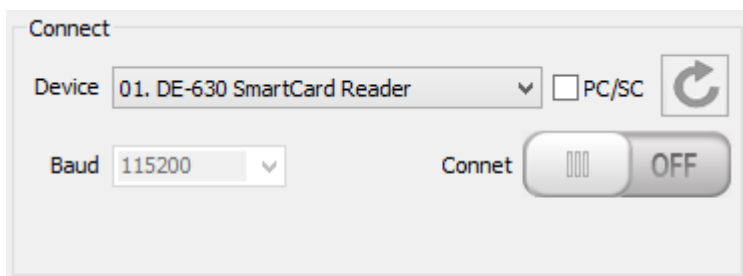
Windows 2000, Windows XP, Windows Vista (32bit), Windows 7 (32/64bit), Windows 8, Windows 8.1, Windows 10

1. DualCard Layout



< Figure 1-1 > DualCard Main Layout

1.1 Connect (Vender mode)




<Figure 1-2>

Once device is connected, product name is displayed on Device sector.

(support interface is USB or Hyper Terminal(RS-232))

In case of using UART, standard communication speed set as 115200bps

- Select reader from Device list and click  button to start test.

- When additional reader is connected while program runs, click  button for refresh the list

- When device is connected, status changes to



DualCardDII API :

```
DE_InitPort([PORT],[BAUD]);
```

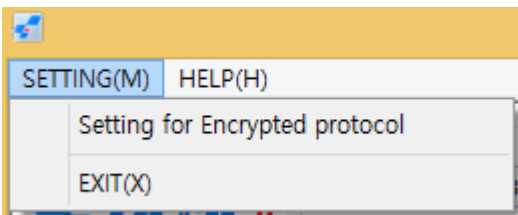
- When device is disconnected, status changes to



DualCardDII API :

```
DE_ClosePort(m_pDoc->m_nPort);
```

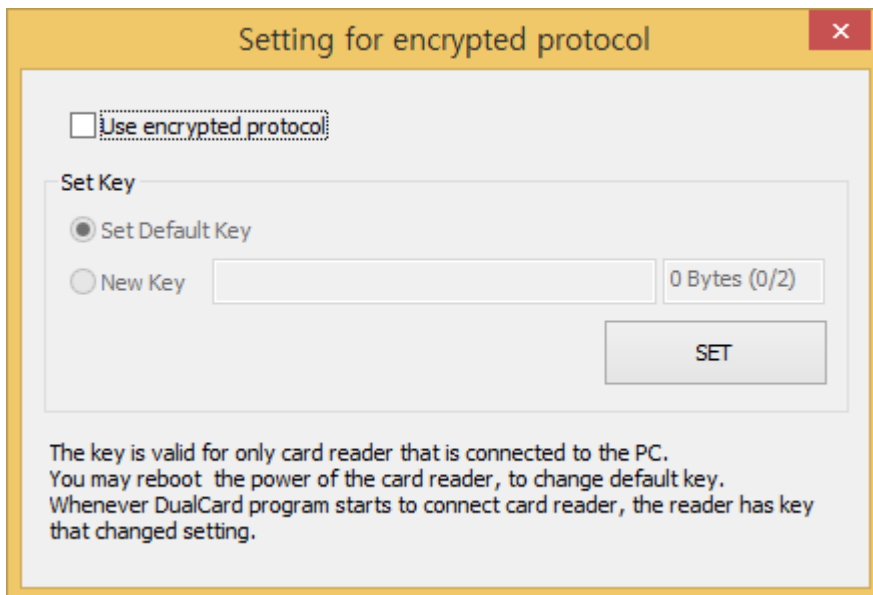
1.1.1 Encrypted Protocol



From DualCard 4.0 version, it is capable to use encrypted protocol between PC and DUALi device

To use this function, please select 'Setting for Encrypted protocol" from the main setting menu and check.

To use this function, updating firmware is necessary. Please contact DUALi sales for further assistance.



<Figure 1-4>

- Use encrypted protocol select the check box to activate encrypted communication

- **Set Default Key** : Check this option to use default key in terminal for encrypted communication.

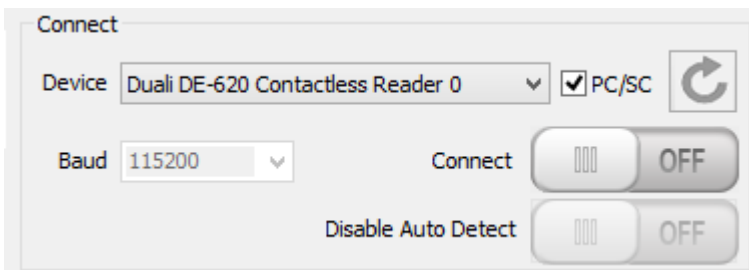
The reader set as default key after reset.

- **New Key** : To use user's key for encrypted communication. New key setting is valid after exit DualCard and execute again. But after reader reset, it returns to default key.

- :To save the setting. While this function activated, you can find

Encryption mode under Duali logo on program.

1.2 Connect (PC/SC mode)

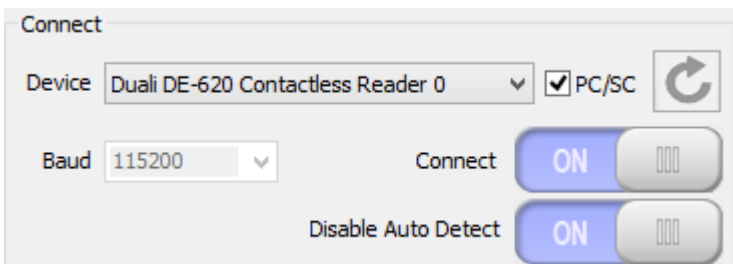


<Figure 1-3>

Check **PC/SC** to see PCSC devices on list and refresh

Place RF card on reader, and click Connect button.

To use all Dualcard function tabs, plz disable auto detect function

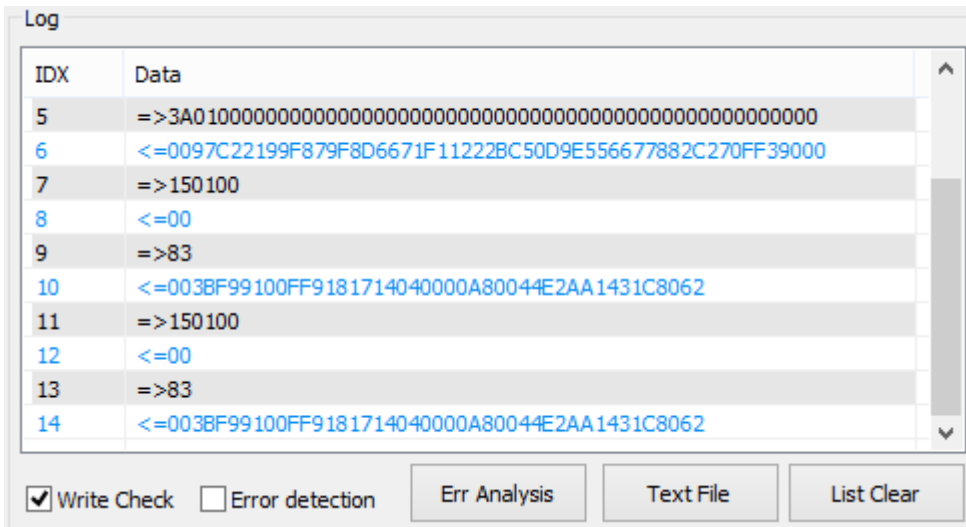


DualCardDII API :

```
DE_SCardConnect([PORT]);
```

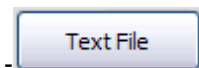
```
DE_SCardDisConnect(m_pDoc->m_nPort);
```


1.5 Packet list



<Figure 1-7>

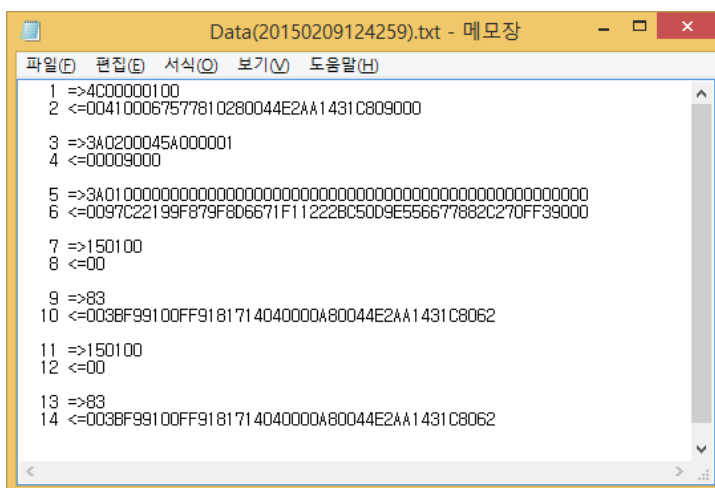
This section displays Send & Received data Lists, it shows all communication data between PC and Device. By double-clicking command; you can add selected command to packet list of <Figure 1-10>



: This button is for making lists of commands and responses <Figure 1-7> as text format file as <Figure 1-8>. The file name generated automatically following year, month, date as following e.g.

E.g) Data(20081222140537).txt

file will be saved in 'DualCard\text' folder.



<Figure 1-8>

- : Delete all the commands and responses in the List.
- **Write Check** : If you check this box, all communication data(Commands & Responses) will be shown at Packet list and if it's not checked, the command and response <Figure 1-5> will be not shown on the list.

2. 7816

This tap <Figure 2-1> supports Communication with ISO 7816 IC Contact cards.

It is comprised of Power ON/OFF function part and Command execution part.

PCSC	15693	NFC	UTIL1	UTIL2
7816	14443	Mifare	MifarePlus	FeliCa
				DesFire

2.1

POWER ON

POWER OFF

SAM ID

2.2 Command

APDU (CLA + INS + P1 + P2 + Lc + Data + Le)

Data Length

S E N D

<Figure 2-1>

2.1 Power On, Off

POWER ON

POWER OFF

SAM ID

<Figure 2-2>

- : This button is Power On command of Card slot (SAM Slot/ IC Card Slot) which was

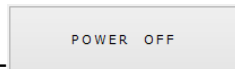
selected from

DualCardDII API :

DE_IC_PowerOn([PORT], [SLOT NO], [RLEN], [RBUF]);

DUALi RW Protocol :

C0[SLOT NO]00



: This button is Power Off command of Card slot (SAM Slot/ IC Card Slot) which was

selected from 

DualCardDII API :

DE_IC_PowerOff([PORT], [SLOT NO]);

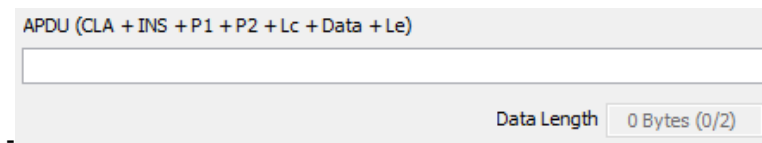
DUALi RW Protocol :

C5[SLOT NO]

2.2 Command



<Figure 2-3>



: Input command (digit Hexadecimal) as IC

Card command format and press



button to execute command. Then

response will be shown at the List.

DualCardDII API :

DE_IC_Case4 ([PORT], [SLOTNUM], [SLEN] , [SBUF], [RLEN], [RBUF]);

DUALi RW Protocol :

C4[SLOT NO][APDU]

3. 14443

This tap <Figure 3-1> supports Communication with ISO 14443 A/B compliant cards. It comprised of Type A Command set part, Type B Command set part, Card detect function part, User command transmit part and RF field control part.

For technical detail of protocol, refer to ISO 14443 Specification.

The screenshot shows the software interface for ISO 14443 communication. At the top, there are tabs for PCSC (7816, 14443), NFC (Mifare, MifarePlus), UTIL1 (FeliCa), and UTIL2 (DesFire). The main interface is divided into several sections:

- 3.1 RF field control:** Contains buttons for "Deactivate RF" and "Activate RF".
- 3.2 TYPE A:** Contains buttons for "REQA", "ANTICOLLISION (Cascade level)", "RATS", and "PPS". It also includes input fields for "Parameter for RATS 0x 80" and "Parameter for PPS 0x 00".
- 3.3 TYPE B:** Contains buttons for "REQB" and "ATTRIB". It includes an input field for "Parameter for ATTRIB 0x 00080100".
- 3.4:** Contains a "Time Out 0x 50" input field, a "Transparent" button, and a "Response data analysis" button.
- 3.5 Simple Card command:** Contains a "Communication speed" dropdown (106 Kbps), "CID 0", "NAD 1", a "Detect Card" button, an "APDU" input field, a "Data Length 0 Bytes (0/2)" input field, and a "SEND" button.

<Figure 3-1>

3.1 RF field Activation

: De-activate RF field.

DualCardDII API :

DE_RFOff([PORT]);

DUALi RW Protocol :

11

Activate RF

: Activate RF field.

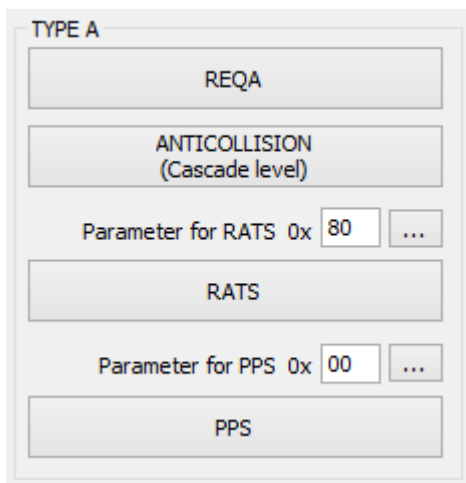
DualCardDII API :

DE_RFOn([PORT]);

DUALi RW Protocol :

10

3.2 Type A



<Figure 3-2>

REQA

: To execute REQA command and get response.

DualCardDII API :

DEA_Idle_Req([PORT],[RLEN],[RBUF]);

DUALi RW Protocol :

21

ANTICOLLISION
(Cascade level)

: To execute “Anti Collision which supports cascade level” command and get response.

DualCardDII API :

DEA_AntiSelLevel([PORT],[RLEN],[RBUF]);

DUALi RW Protocol :

3D

RATS

: To execute RATS Command and get response.

DualCardDII API :

DE_Polling([PORT],[SLEN],[SBUF],[RLEN],[RBUF]);

DUALi RW Protocol :

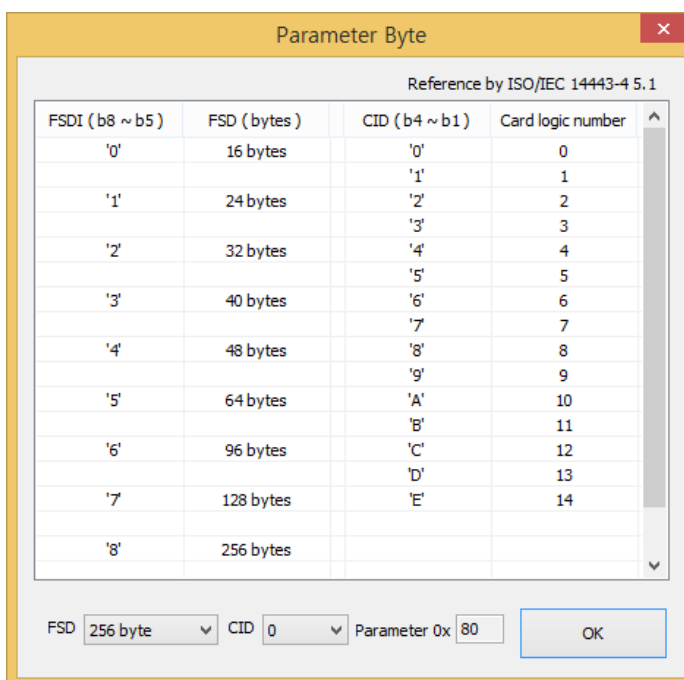
41E0[RATS][TIMEOUT]

Parameter for RATS 0x 80

: Show Parameter byte for RATS.



: Press this button shows parameter byte setting window for RATS <Figure3-3>.



<Figure 3-3>

PPS

: To execute PPS Command and get response.

DualCardDII API :

DE_Polling([PORT],[SLEN],[SBUF],[RLEN],[RBUF]);

DUALi RW Protocol :

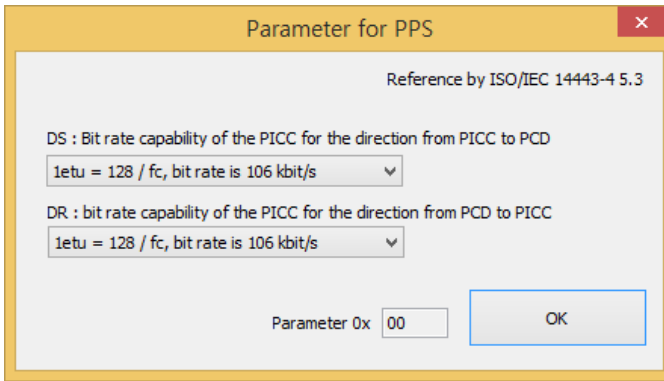
41[PPS]1100[TIMEOUT]

Parameter for PPS 0x 00

: Parameter byte for PPS

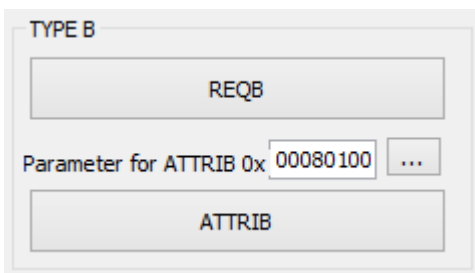


: Press this button shows parameter byte setting window for PPS <Figure 3-4>.

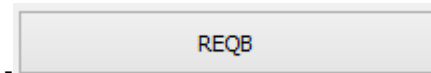


<Figure 3-4>

3.3 Type B



<Figure 3-5>



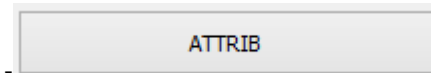
: To execute "REQB" command and get response.

DualCardDII API :

```
DE_Polling([PORT],[SLEN],[SBUF],[RLEN],[RBUF],[TOUT]);
```

DUALi RW Protocol :

```
6005000050
```



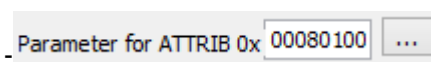
: To execute "ATTRIB" command and get response.

DualCardDII API :

```
DE_Polling([PORT],[SLEN],[SBUF],[RLEN],[RBUF],[TOUT]);
```

DUALi RW Protocol :

```
601D[ID][PARAMETER][TIMEOUT]
```



: Parameter byte for ATTRIB.



: Press this button shows parameter byte setting window for ATTRIB<Figure 3-6>

Parameter for ATTRIB ✕

b8	b7	b6	b5	b4	b3	b2	b1
Minimum TR0	Minimum TR1	EOF	SOF	RFU			

All RFU bits shall be set to 0 if not otherwise specified

Minimum TR0 indicates to the PICC the minimum delay before responding after the end of a command sent by a PCD. Minimum TR0
default value ▾

Minimum TR1 indicates to the PICC the minimum delay between subcarrier modulation start and beginning of data transmission. Minimum TR1
default value ▾

b3 and b4 indicate the PCD capability to support suppression of the EOF and/or SOF from PICC to PCD, which may reduce communication overhead. EOF
Yes ▾

SOF
Yes ▾

Parameter 2

b4~b1 : Maximum Frame Size 256 byte ▾

b6~b5 : Bit rate(PCD to PICC) 1etu = 128 / fc, bit rate is 106 kbit/s ▾

b8~b7 : Bit rate(PICC to PCD) 1etu = 128 / fc, bit rate is 106 kbit/s ▾

Parameter 3

b4~b1 : Protocol Types PICC not compliant with ISO/IEC 14443-4 ▾

b8~b5 : This bytes set to (0000)b, all other values are RFU.

Parameter 4

b4~b1 : CID 0 ▾

b8~b5 : This bytes set to (0000)b, all other values are RFU.

Default
Parameter 0x:
OK

<Figure 3-6>

3.4 Common Function

- : It defines the waiting time from device send command and get response.

- : Press this button shows Time-out windows as <Figure 3-10> following time out box setting.

- : To transmit defined command from the protocol (PC and Device) spec or APDU type command comply with ISO 14443 spec. You should input PCB, CID and NAD according to your card specification.

Time Out(HEX)	Time Value	FWI
0x02	1.208 msec	2
0x03	2.416 msec	3
0x05	4.832 msec	4
0x0A	9.664 msec	5
0x14	19.32 msec	6
0x27	38.66 msec	7
0x4E	77.3 msec	8
0x9B	154.6 msec	9
0xB0~	309.3 msec	10
0xC0~	618.6 msec	11
0xD0~	1.2371 sec	12

<Figure 3-7> Actual waiting time following Time-out setting.

DualCardDII API :

Type A : `DEA_Transparent([PORT],[DATA LEN],[DATA],[TIMEOUT],[RLEN],[RBUF]);`

Type B : `DEB_Transparent([PORT],[DATA LEN],[DATA],[TIMEOUT],[RLEN],[RBUF]);`

DUALi RW Protocol :

Type A : `41[DATA][TIMEOUT]`

Type B : `60[DATA][TIMEOUT]`

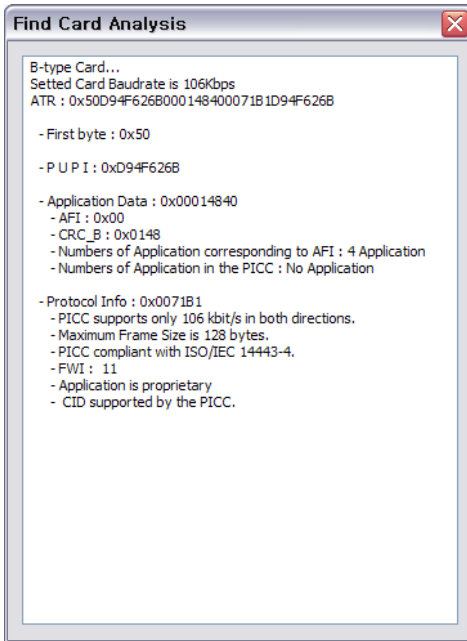
Response data analysis

: After execute [REQA] / [Anti-collision] / [Select] / [RATS] / [REQB] or

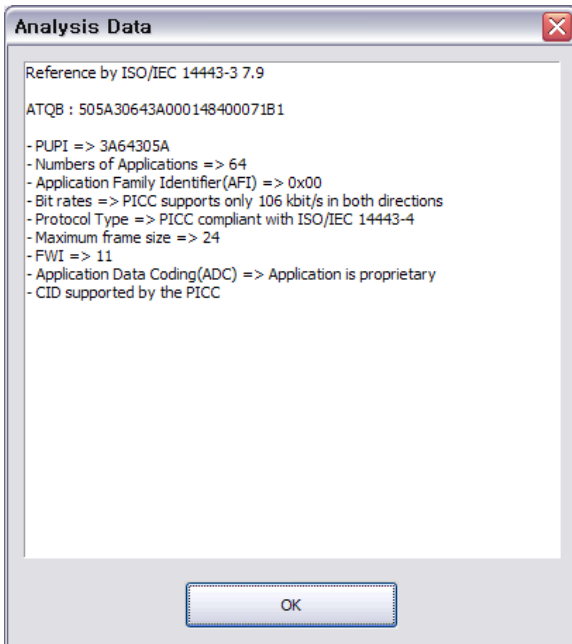
[Detect Card] command, Press

Response data analysis

 will show the response data analysis window as

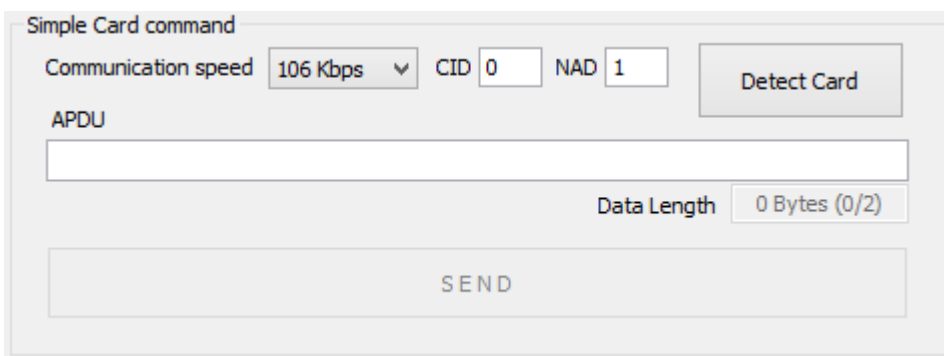


<Figure 3-8 Analysis for [Detect Card]>

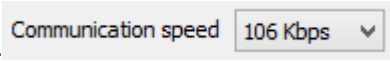


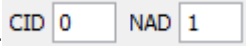
<Figure 3-9 Analysis for A-type after RATS>

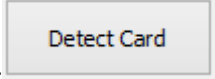
3.5 Simple Card Command



<Figure 3-10>

 : Change communication speed as 106/212/424/848kbps

 : To set CID and NAD value for card communication.

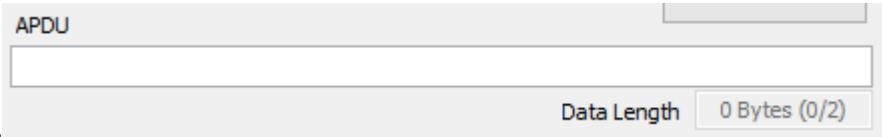
 : To execute Detect Card command.

DualCardDII API :

```
DE_FindCard([PORT],[BAUD],[CID],[NAD],[OPTION],[RLEN],[RBUF]);
```

DUALi RW Protocol :

```
4C[BAUD][CID][NAD][OPTION]
```

 :

Input APDU then click [SEND] button.

PCB, CID are automatically set as default value (0) and added into user's command(APDU).

 : transmit APDU

DualCardDII API :

```
DE_APDU([PORT],[SLEN],[SBUF],[RLEN],[RBUF]);
```

DUALi RW Protocol :

```
61[DATA]
```


4. Mifare

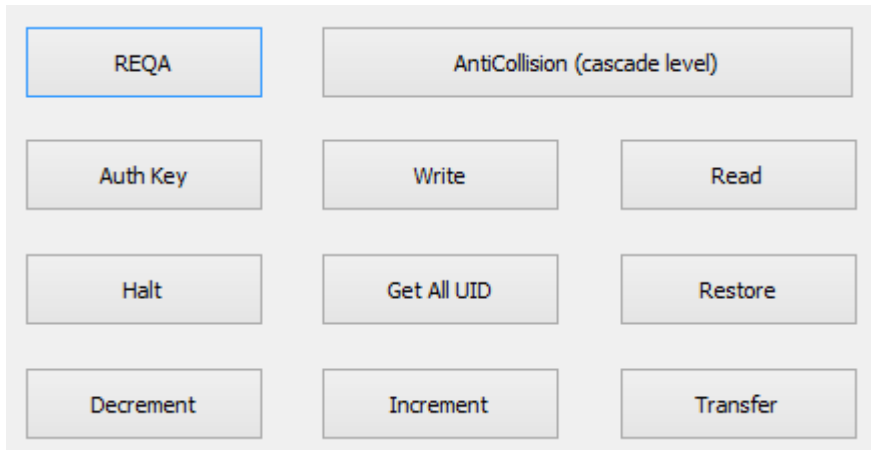
This tap <Figure 4-1> supports Communication with NXP's contactless memory card MIFARE protocol. Users could test all Functions in Mifare specification. Mifare cards (up to layer 2) use same protocol as ISO 14443 type A, and use their own protocol from layer 3.

It requires Authentication process to access memory of Mifare card. By providing 6 byte key gives permission to read/ write data inside memory. Each block is made of 16 byte, and the data process has to follow same 16byte format. Refer to NXP's Specification for detail technical information.

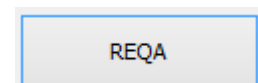
The screenshot shows a software interface for testing Mifare protocols. At the top, there are tabs for PCSC (7816, 14443), NFC (Mifare, MifarePlus), UTIL1 (FeliCa), and UTIL2 (DesFire). The 'Mifare' tab is selected. Below this, section 4.4 has a checkbox for 'MIFARE Ultralight C'. Section 4.1 contains a grid of function buttons: REQA, AntiCollision (cascade level), Auth Key, Write, Read, Halt, Get All UID, Restore, Decrement, Increment, and Transfer. Section 4.2 features a 'Command' dropdown menu and a 'Run' button. Section 4.3 is the 'Setting' area, containing: 'Block (Decimal)' with two input boxes and a tilde symbol; 'Key Type' with radio buttons for 'A Key' (selected) and 'B Key'; 'Key No' with an input box; 'Key' with a long input box and 'Key Length' set to '0 Bytes (0/2)'; 'Data' with an input box and a 'HEX' dropdown; and 'Data Length' set to '0 Bytes (0/2)' with a 'Status' button.

<Figure 4-1>

4.1 Button Type Command



<Figure 4-2>



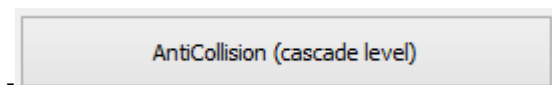
- : To execute Request Command and get response.

DualCardDII API :

DEA_Idle_Req([PORT],[RLEN],[RBUF]);

DUALi RW Protocol :

21



- : To execute Anti Collision Command and get response and to execute Select Command and get response.

DualCardDII API :

DEA_AntiSelLevel([PORT],[RLEN],[RBUF]);

DUALi RW Protocol :

3D



- : Setting value for Authentication process

- Followings are Authentication process. **(See Example 13.2)**

1) Input block number to read

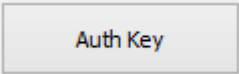
BLOCK (Decimal) ~

2) Select key type for using Authentication

KEY TYPE A Key B Key

3) Input key value to access selected block (Hexadecimal, 6byte)

KEY

4) Press  button will execute auth command and get response.

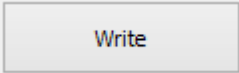
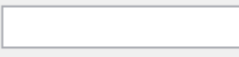
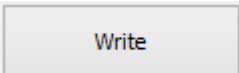
DualCardDII API :

DEA_Authkey([PORT],[MODE],[KEY],[BLOCK NO]);

DUALi RW Protocol :

30[MODE][KEY][BLOCK NO]

Following commands has to be executed after Authentication process above.

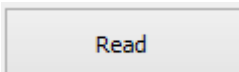
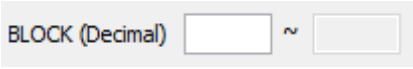
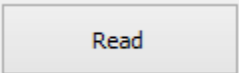
-  : To execute Write command. Input data  on <Figure 4-4> and press  button.

DualCardDII API :

DEA_Write([PORT],[BLOCK NO],[SLEN],[SBUF]);

DUALi RW Protocol :

28[BLOCK NO][DATA]


-  : To execute Read command, Input block number to read  on <Figure 4-4> and press  button. It'll show 16 bytes response when it succeed.

DualCardDII API :

DEA_Read([PORT],[BLOCK NO],[RLEN],[RBUF]);

DUALi RW Protocol :

27[BLOCK NO]

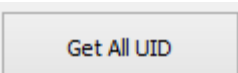
-  : To execute Halt command. After execute halt command, Mifare card doesn't response until it receive Wakeup Request.

DualCardDII API :

DEA_Halt([PORT]);

DUALi RW Protocol :

26

-  : To read the UID of all card in RF field. It'll be shown card's number which succeed Anti-collision process

DualCardDII API :

DEA_Req_Select([PORT],[MODE],[RLEN],[RBUF]);

DUALi RW Protocol :

3900

Restore

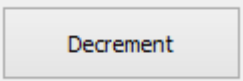
: To execute Restore command for Value block.

DualCardDII API :

DEA_Restore([PORT],[BLOCK NO]);

DUALi RW Protocol :

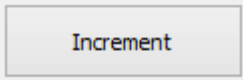
2D[BLOCK NO]

Decrement: To execute Decrement command for Value block. **(See Example 13.2)****DualCardDII API :**

DEA_Decrement([PORT],[BLOCK NO],[VALUE]);

DUALi RW Protocol :

2A[BLOCK NO][VALUE]

Increment: To execute Increment command for Value block. **(See Example 13.2)****DualCardDII API :**

DEA_Increment ([PORT],[BLOCK NO],[VALUE]);

DUALi RW Protocol :

29[BLOCK NO][VALUE]

Transfer

: To execute Transfer command for Value block.

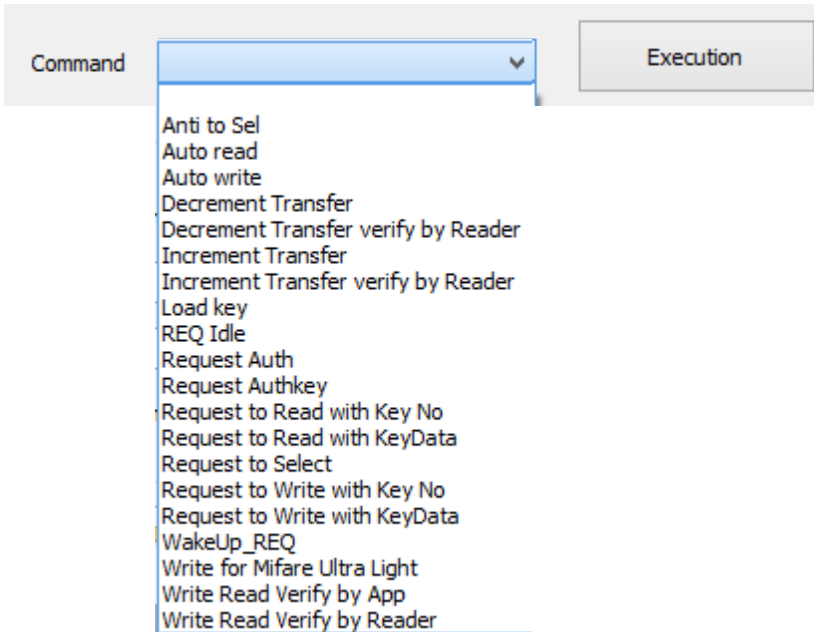
DualCardDII API :

DEA_Transfer([PORT],[BLOCK NO]);

DUALi RW Protocol :

2E[BLOCK NO]

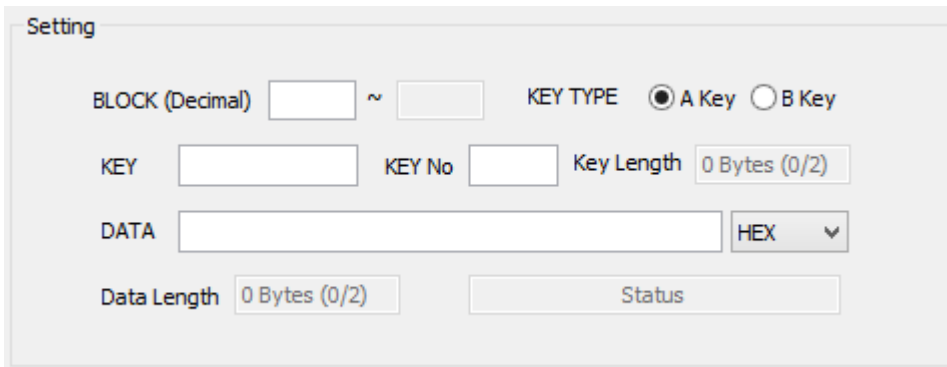
4.2 Combobox Type Command



<Figure 4-3>

From command list (Mifare Commands), select command to execute then click [Execution] button. (See Annex 12.1)

4.3 Setting



<Figure 4-4>

Fill out data into above blocks.

4.4 MIFARE Ultralight C



<Figure 4-5>

To active MIFARE Ultralight C block like <Figure 4-5>, check MIFARE Ultralight C . It activates only for [REQA], [AntiCollision], [Auth Key], [Write], [Read], [Halt] commands. After authentication by [Auth Key] , user could use Key function.

5. MifarePlus

This tap <Figure 5-1> supports Communication with NXP's MifarePlus which strengthen the security function compare with Mifare classic, so it isn't response before Pre-personalization.

MifarePlus level 1 card is compatible with Mifare card completely, MifarePlus level 2 card use AES128 algorithm for Authentication process, MifarePlus level 3 card adopt ISO 14443 Type A –APDU format.

PCSC	15693	NFC	UTIL 1	UTIL 2
7816	14443	Mifare	MifarePlus	FeliCa DesFire

5.1 Activation

Card Master Key	<input type="text" value="00000000000000000000000000000000"/>	Data Length	<input type="text" value="16 Bytes (2/2)"/>
Card Configuration Key	<input type="text" value="00000000000000000000000000000000"/>		<input type="text" value="16 Bytes (2/2)"/>
Level2 Switch Key	<input type="text" value="00000000000000000000000000000000"/>		<input type="text" value="16 Bytes (2/2)"/>
Level3 Switch Key	<input type="text" value="00000000000000000000000000000000"/>		<input type="text" value="16 Bytes (2/2)"/>

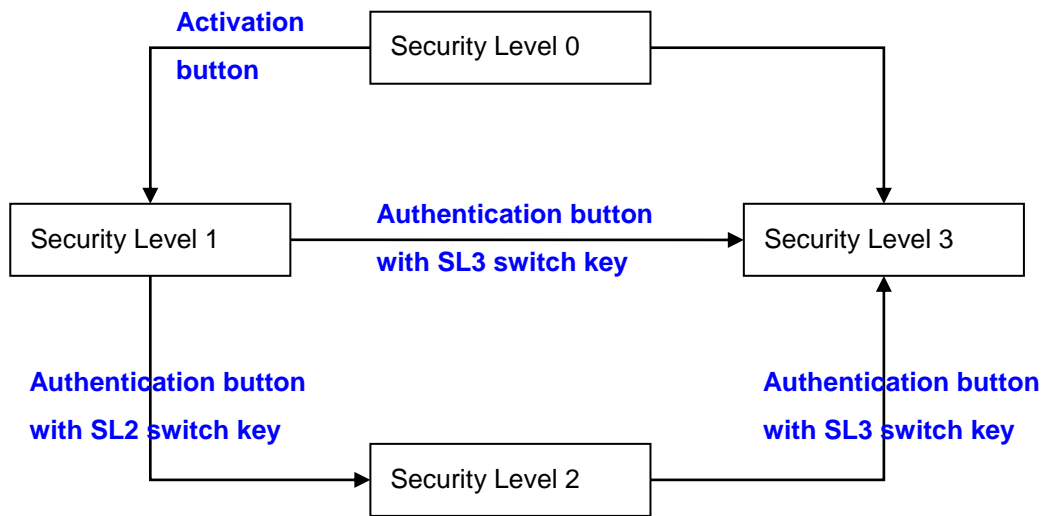
5.2 AES 128(MifarePlus)

Key	<input type="text"/>	Data Length	<input type="text" value="0 Bytes (0/0)"/>
Data	<input type="text"/>		<input type="text" value="0 Bytes (0/0)"/>
Result	<input type="text"/>		<input type="text" value="0 Bytes (0/0)"/>

5.3 Authentication

Key(LSB)	<input type="text"/>	<input type="button" value="First Auth"/>	<input type="button" value="Analysis"/>
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<Figure 5-1>

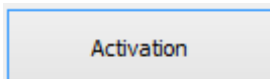


<Figure 5-2 Security level switching>

5.1 Activation

Activation		Data Length
Card Master Key	00000000000000000000000000000000	16 Bytes (2/2)
Card Configuration Key	00000000000000000000000000000000	16 Bytes (2/2)
Level2 Switch Key	00000000000000000000000000000000	16 Bytes (2/2)
Level3 Switch Key	00000000000000000000000000000000	16 Bytes (2/2)
<input type="button" value="Activation"/>		

<Figure 5-3>



- This button uses for converting Security level 0(default)card to Security level 1 card . Security Level 1 card is compatible with Mifare card.
- Fill out each key (default =0000000...000000), press “Activation button”. It'll process as following.
 - [REQA] -> [ANTICOLLISION] -> [SELECT] -> [RATS] -> [WRITE PERSO for each keys] -> [COMMIT PERSO]
- This Activation process, set [Card Master key]. [Card Configuration key], [Level 2 switch key], [Level 3 switch key] only which is mandatory to activate the card. Other keys can be changed after “Activation” process and “Authentication”.