

MR Manual – MF Plus EV1

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MR Manual – MF Plus EV1

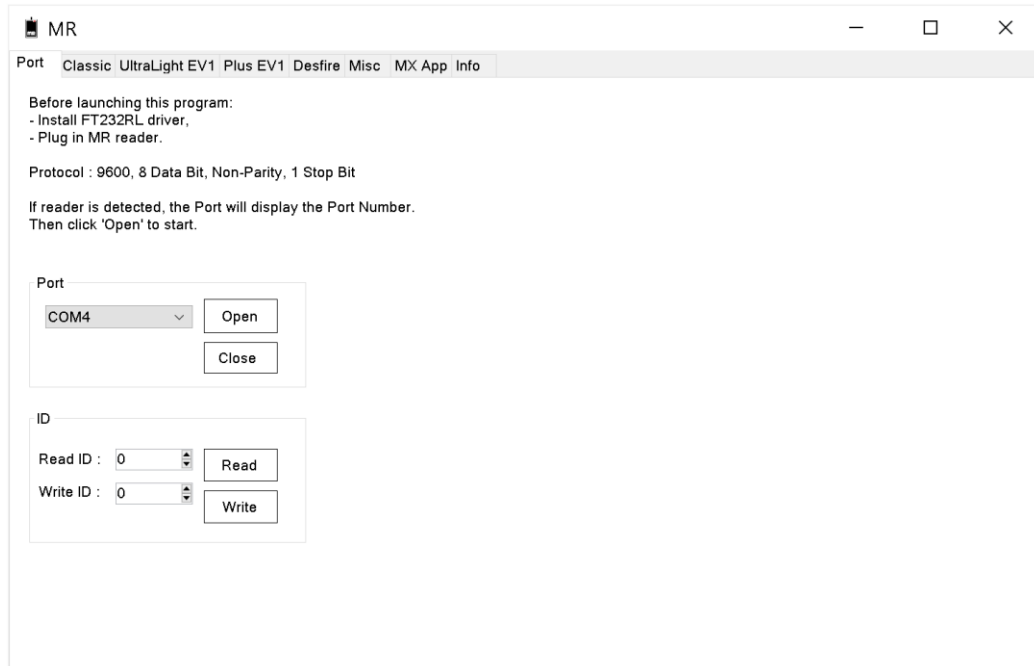
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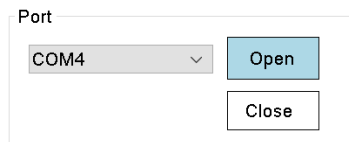
1. General

Plug in MR Reader then launch the MR Software.



Main screen.

If Serial Com Port available, or USB Virtual Com available, it will be shown on screen.



Select the port where reader is connected, then click  to open port.

Upon open port, reader will send command to get reader ID, and turn on the RF. Getting reader ID should be the first command to execute, because if the ID is not matched, reader will not response.

1.0 Protocol

To ease development, sending and receiving protocols are recorded and saved in the **C:\Mylab\MR** folder, as shown below:

Function : Open Port

6:47:51 PM, TX : 02 00 00 01 50 53 03

6:47:51 PM, RX : 02 00 00 02 00 00 00 03

6:47:51 PM, TX : 02 00 00 02 54 01 55 03

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They are briefly explained as below:

Communication Protocol:

Item	Value
Baud rate	9600
Data bit	8
Parity	None
Stop bit	1

For card related command:

TX : 02 / 00 / Reader ID / No of byte / Command / PICC Command / Data / BCC / 03

RX : 02 / 00 / Reader ID / No of byte/ Message / CSN length / Card Serial Number / Card Type / PICC Message / Data / BCC / 03

For hardware setting related command:

TX : 02 / 00 / Reader ID / No of byte / Command / Data / BCC / 03

RX : 02 / 00 / Reader ID / No of byte/ Message / Data / BCC / 03

Item	Length	Meaning
STX (Start of Text)	1	02
MID	1	00
Reader ID/RID	1	00 – FF hex
No of byte/NOB	1	No of byte in TX Data or RX Data
Command/CMD	1	Refer manual or sending protocol 0 = none 10 hex = eread 11 hex = ewrite 12 hex = evalue 1B hex = slsl3mixedmodeplus 1F hex = pluspicc 27 hex = aesloadkeyplus 2D hex = aesloadkey 2E hex = desloadkey 46 hex = load_key 48 hex = areadsnr 49 hex = areadsnrsize 4A hex = rats 4B hex = pcdtopicc 4D hex = picctransparent 50 hex = read_id 51 hex = write_id 54 hex = control_rf 6A hex = read_setting 6B hex = write_setting

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		6D hex = control_beep_led 6E hex = control_beep 6F hex = control_led F0 hex = read_version F1 hex = PlusDirectKey
PICC Command	1	Refer manual or sending protocol
Message/MESG	1	00 – Success, others – Error
CSN length/CSNL	1	0 or 4 or 7 (when 0, there is no serial number returned, hence the Card Serial Number and Card Type column will not be available in the RX protocol too.)
Card Serial Number/CSN	4 or 7	4B or 7B CSN
Card Type/CT	1	Refer Mifare Card Information 08 hex = Mifare Classic 18 hex = Mifare Plus (SL1 or Mixed mode) 20 hex = Mifare Plus (SL3) 20 hex = Mifare Desfire
PICC Message/PMESG	1	00 hex – Transfer cannot be granted 01 hex – Parity or CRC error 04 hex – Invalid operation 05 hex – Parity or CRC error 0A hex – Acknowledge AF hex – Access Condition not fulfilled, the block does not exist 05 hex – TMAC error 06 hex – Authentication error 07 hex – Command overflow error 08 hex – MAC error 09 hex – Block number error 0A hex – Invalid block number 0B hex – Command invalid 0C hex – Format error, Length error 0D hex – Not supported 0F hex – General Failure 90 hex - OK
Data	variable	Transmit or Received string
DF Name	17	1B length, 16B DF Name (If Virtual Card is enabled)
BCC	1	Exclusive-Or from byte SOF to Last Byte of Data
ETX (End of Text)	1	03

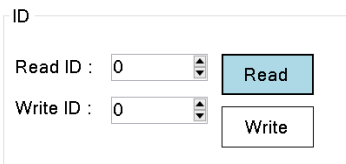
1.1 Reader ID

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The default reader ID is 00, it can be changed to other value. In RS485 or multi-drop application, reader with different ID is needed to ensure proper communication.

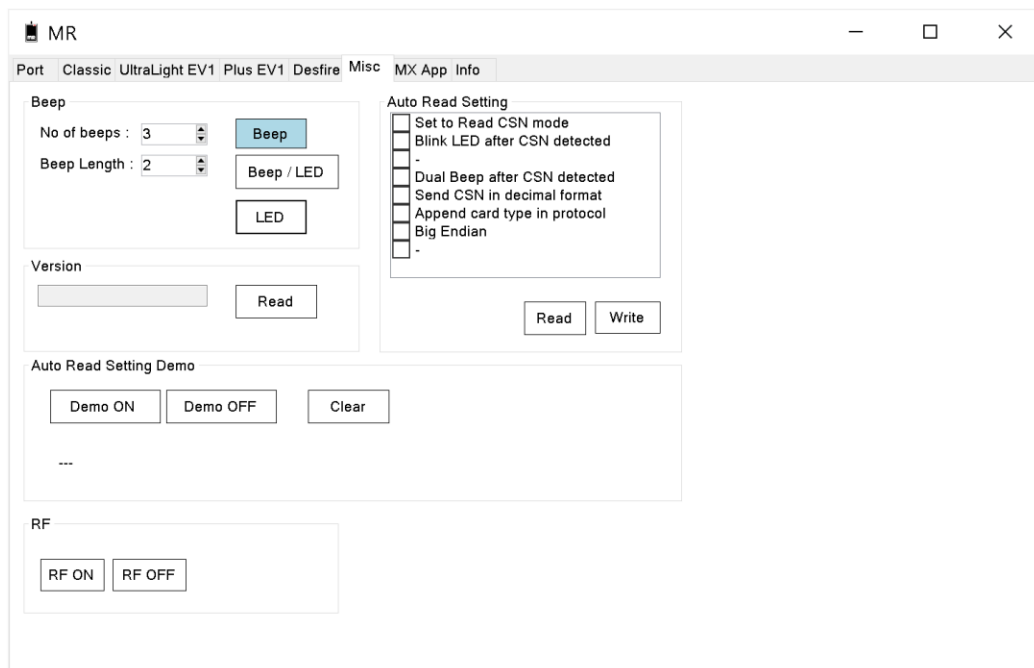
To set ID value, enter a value in the Write ID numeric box, and then create 'Write'. After you changed the ID, remember to click  to get the new reader ID, or manually update the read ID numeric box. If not, communication may be fail because the ID in the program is different from the ID in the reader. Therefore, always get the reader ID first before proceeding further.

The value will be saved in the non volatile memory.



1.2 Beep

There are two beep mode available; beep only and beep with LED. Beep with LED will generate beep sound and trigger the on board LED. Multiple beeps can be generated by setting the 'No of beeps' and 'Beep length'.



Click  will generate 3 beeps.

1.3 RF

No communication between card and reader is possible when the RF is turned off. Therefore, it is important to ensure the RF is turned on when accessing the card. By default, the RF is on.

Sometimes it may be necessary to control the RF to reset the card in the field.



To reset RF in the reader field, click , and then click .

1.4 Reader Internal EEPROM

The hardware settings, and the authentication keys are saved into the internal EEPROM by using instruction. This is a non-volatile memory, the content will be kept even though power is removed.

Due to security reason, the authentication keys are not readable.

- Please bear in mind that EEPROM is intended to provide nonvolatile storage for configuration data and settings that do not need to change frequently. If an application program were to write to an EEPROM cell frequently it would quickly wear it out, shorten the lifetime of the product.

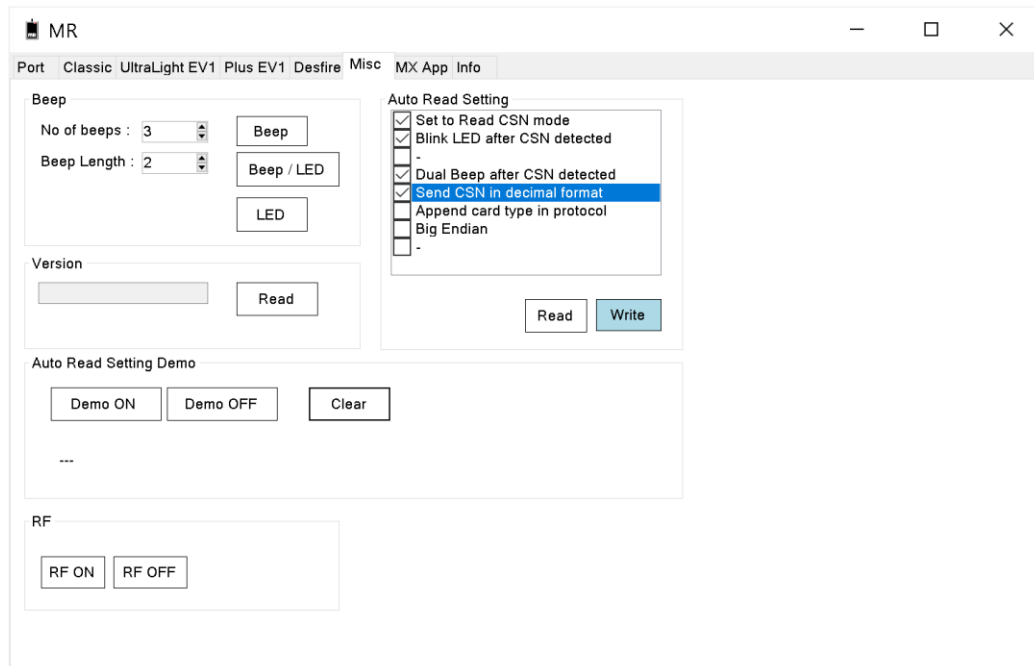
1.5 Remark

After a Mifare card's sector has been authenticated successfully, the sector will be opened, and read or write is permitted. The card will remain in the 'Open' state until the RF field is reset, or the card is removed from the RF area, then a new authentication is needed.

In the examples given below, the testing result may be different if the RF reset is not performed after changing Key or changing authentication method. Therefore, if the testing result is different from the given answer, kindly reset the RF by calling command 'RF Off' and 'RF On', or merely remove the card from reader, and then put back the card on the reader. The author has omitted this, to avoid duplicated words and for easy reading. It is also recommended to perform RF reset prior to create new application or new file.

2. How to set to Read Serial Number mode

By default the reader is in Read/Write mode. User can switch the reader to work on Auto Read Serial Number mode by checking the following box. Both 4B and 7B serial number lengths are supported.



The above setting will switch the reader to work on Read Serial Number mode. When a valid card is detected, it will blink LED, sound two beeps, and send the serial number to Host in decimal and Little Endian format.

Available functions:

- Set to Read Card SNR mode – Enable Read Serial Number mode, default is Read / Write mode.
- Blink LED after SNR detected – Blink LED when a valid card is detected.
- Dual Beep after SNR detected – Sound dual beep when a valid card is detected.
- Send SNR in Decimal format – Send Serial Number in decimal format, default is sending Serial Number in Hex format.
- Append Card Type in protocol – Append card type in the protocol. Only if Hex format is enabled, or 'Send SNR in Decimal format' is unchecked.
- Big Endian – Send Serial Number in Big Endian format, default is sending Serial Number in Little Endian format.

We will try it now by setting the check box as shown below:

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Auto Read Setting

☒	Set to Read CSN mode
☒	Blink LED after CSN detected
☐	-
☒	Dual Beep after CSN detected
☒	Send CSN in decimal format
☐	Append card type in protocol
☐	Big Endian
☐	-

Read Write

Click **Write** to send the check box setting to reader.

We will see how it works now by turning on the Demo mode.

Auto Read Setting Demo

Demo ON Demo OFF Clear

33 36 31 33 33 33 31 37 33 36 34 35 36 36 32 37 36 0D 0A

Click **Demo ON** to detect any valid card in the RF field. If available, display the Serial Number in decimal format, blink LED, and sound dual beep.

You may refer Activity text file in C:\Mylab\MR, for detailed protocol received string.

Function : Write Card Setting

12:08:47 PM, TX : 02 00 00 02 6B 1B 70 03

12:08:47 PM, RX : 02 00 00 01 00 03 03

Function : Demo On

12:08:55 PM, RX : 32 34 31 38 31 34 32 31 39 30 0D 0A

12:08:57 PM, RX : 33 36 31 32 35 32 32 36 33 32 33 38 30 31 38 36 30 0D 0A

12:09:07 PM, RX : 33 36 31 33 33 33 31 37 33 36 35 35 34 39 33 31 36 0D 0A

Turn off the demo now by clicking **Demo OFF**, and try another setting as shown below:

Auto Read Setting

☒	Set to Read CSN mode
☒	Blink LED after CSN detected
☐	-
☒	Dual Beep after CSN detected
☐	Send CSN in decimal format
☒	Append card type in protocol
☒	Big Endian
☐	-

Read Write

Click **Write** to send the check box setting to reader. This setting will include the card type in protocol.

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Auto Read Setting Demo

02 00 00 09 00 04 49 12 8A 0F 5F 80 20 2E 03

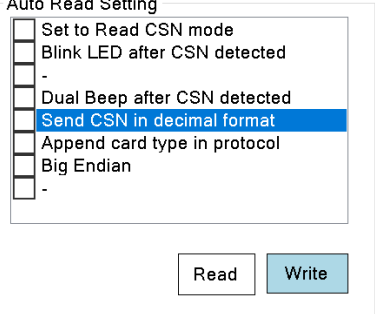
Click to detect any valid card in the RF field. If card available, it will return the Serial Number in Hex format, append the card type in the protocol, blink LED, and sound beep. As shown in the protocol 02 00 00 09 00 04 49 12 8A 0F 5F 80 20 2E 03, the card type is 20 hex. Refer Chapter 1-0 Protocol, we know that the card is Mifare Desfire or Mifare Plus (SL3).

Always remember to turn off the demo by clicking .

The setting will be stored as non volatile in the reader's memory.

3. How to set to Read / Write mode

By default the reader is in Read/Write mode. If the reader has been set to Auto Read Serial Number mode, we can switch it back to Read/Write mode by un-checking all the items in the following box, then click .



The image shows a software window titled "Auto Read Setting". It contains a list of seven settings, each with an unchecked checkbox:

- ☐ Set to Read CSN mode
- ☐ Blink LED after CSN detected
- ☐ -
- ☐ Dual Beep after CSN detected
- ☐ Send CSN in decimal format
- ☐ Append card type in protocol
- ☐ Big Endian
- ☐ -

Below the list are two buttons: "Read" and "Write". The "Write" button is highlighted with a blue background.

The reader is now in Read/Write mode.

The reader must be in the Read/Write mode in order to follow the examples in the chapters that follow.

The setting will be stored as non volatile in the reader's memory.

4. Mifare Plus EV1

Click the 'Plus EV1' tab now to enter the page. This program will show you how to access MF Plus EV1 card.

The screenshot shows the 'MR' software window with the 'Plus EV1' tab selected. The interface includes a top menu bar with 'Port', 'Classic', 'UltraLight EV1', 'Plus EV1', 'Desfire', 'Misc', 'MX App', and 'Info'. Below this is a sub-menu bar with 'SL0 / Switching', 'Key', 'Basic', 'PC / VC / Random SNR', 'TMAC', and 'Misc'. The main area is divided into several sections:

- SL 0 / For New Plus**: Contains four text input fields for 'Card Master Key', 'Card Config Key', 'L3 Switch Key', and 'SL1 Auth Key', each with a 32-character hexadecimal display. To the right are buttons for 'Write Perso (Card)', 'Switch to SL1', and 'Save Key'.
- SL 1 / Switch Sector to SL1SL3MixedMode**: Includes a 'Select Sector to be switched' grid (sectors 0-31) and an 'Auth Key = L1L3MixSectorSwitchKey' field with a 'Switch to MixedMode (Sector)' button.
- SL 1 / Switch Sector to SL3**: Includes a 'Select Sector to be switched' grid (sectors 0-31) and an 'Auth Key = L3SectorSwitchKey' field with a 'Switch to SL3 (Sector)' button.
- SL1 / Switch to SL3**: Includes an 'Auth Key = L3SwitchKey' field and a 'Switch to SL3 (Card)' button.

At the bottom, there is an 'Access Method' section with checkboxes for 'ProximityCheck' and 'VirtualCard', and a 'DF Name' input field.

Plus EV1 main screen.

4.0 Access Method

To access the MF Plus card content, a successful authentication is necessary. The card is protected by 6B Key (SL1 mode) or 16B AES Key (SL3 mode), and by default they are all FF hex. If the Key does not match, an error code will be returned. Before authentication can be called successfully, a 'Load Key' command to load the authentication key to the reader is required. The key will be stored in non volatile memory.

It has 4 modes; SL0, SL1, Mixed mode, and SL3.

When the card is new, it is in SL0 mode. We need to switch the card to a higher mode before we can start using the card. If we switch it to SL1, then the card works similarly to Mifare Classic card. For highest security, we can switch it to SL3, then all the authentication will be done in AES key. However, when the system is not fully ready for SL3 level, we can temporarily switch the card to Mixed-mode. In this mode, the card can work in both SL1 and SL3 mode. When the system becomes ready for SL3, then we can switch it to SL3 level.

When accessing the card, it is necessary to specify whether ProximityCheck or VirtualCard is enabled. The access will fail if the selection is not correct.

This screenshot shows the 'Access Method' section of the software interface. It features two checkboxes: 'ProximityCheck' and 'VirtualCard'. To the right of these checkboxes is a text input field labeled 'DF Name'.

4.1 Card Structure

Depends on the card size, their memory location may be different. User is advised to refer to the card manufacturer's documentation for details.

The 2K Byte Mifare[®] Plus memory is organized in 32 sectors with 4 blocks each, whereas 4K Byte Mifare[®] Plus memory is organized in 32 sectors with 4 blocks and in 8 sectors with 16 blocks. One block consists of 16 bytes.

		Byte number within a block																
Sector	Block	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Description
0	0																Manufacturer Data	
	1																Data	
	2																Data	
	3																Sector Trailer	
1	4																Data	
	5																Data	
	6																Data	
	7																Sector Trailer	
2	8																Data	
	--																--	
	--																--	
	--																--	
31	7C																Data	
	7D																Data	
	7E																Data	
	7F																Sector Trailer	
32	80																Data	
	81																Data	
	--																--	
	--																--	
	--																--	
	--																--	
	8E																Data	
	8F																Sector Trailer	
	--																--	
	--																--	
	--																--	
39	F0																Data	
	--																--	
	--																--	
	FC																Data	
	FD																Data	
	FE																Data	
	FF																Sector Trailer	

Block 0 of sector 0 is reserved for manufacturer's data, and it is read-only.

- 6B Key A (Byte 5 is the Plain Communication Byte in SL3 mode.)
- 4B Access Condition
- 6B Key B

- Key A – FFFFFFFFFFFFFFFF

- Key B – FFFFFFFFFF
- Access Condition – FF 07 80 xx (Key A is not readable and is used to read or write, Key B as data. If Key B is readable, then it cannot be used for authentication.)

In SL3 mode, 6B crypto1 Key A will not be used. So the 5th byte of the Key A is used for Plain Communication Access Byte, which determines whether plain communication is possible in SL3.

4.2 Before we start

As mentioned, authentication is required before you can perform read and write access. If you want to read block 0 of sector 1, then first you need to load sector 1's key to reader. If both the reader's key and the card's key are matched, authentication will be successful. Else an error will be returned.

5. SL 0

At this level, the following keys need to be written to the card.

- Card configuration key
- Card master key
- Level 3 switch key
- SL1 authentication key

We set the Keys to all 00 hex. You may set to other value, but you should memorize or write down the keys. It can be changed later.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

SL 0 / For New Plus

Card Master Key : 00000000000000000000000000000000 Write Perso (Card)

Card Config Key : 00000000000000000000000000000000 Switch to SL1

L3 Switch Key : 00000000000000000000000000000000 Save Key

SL1 Auth Key : 00000000000000000000000000000000

SL 1 / Switch Sector to SL1SL3MixedMode

Select Sector to be switched

☐ 0	☐ 6	☐ 12	☐ 18	☐ 24	☐ 30
☐ 1	☐ 7	☐ 13	☐ 19	☐ 25	☐ 31
☐ 2	☐ 8	☐ 14	☐ 20	☐ 26	
☐ 3	☐ 9	☐ 15	☐ 21	☐ 27	
☐ 4	☐ 10	☐ 16	☐ 22	☐ 28	
☐ 5	☐ 11	☐ 17	☐ 23	☐ 29	

Auth Key = L1L3MixSectorSwitchKey

Switch to MixedMode (Sector)

SL 1 / Switch Sector to SL3

Select Sector to be switched

☐ 0	☐ 6	☐ 12	☐ 18	☐ 24	☐ 30
☐ 1	☐ 7	☐ 13	☐ 19	☐ 25	☐ 31
☐ 2	☐ 8	☐ 14	☐ 20	☐ 26	
☐ 3	☐ 9	☐ 15	☐ 21	☐ 27	
☐ 4	☐ 10	☐ 16	☐ 22	☐ 28	
☐ 5	☐ 11	☐ 17	☐ 23	☐ 29	

Auth Key = L3SectorSwitchKey

Switch to SL3 (Sector)

SL1 / Switch to SL3

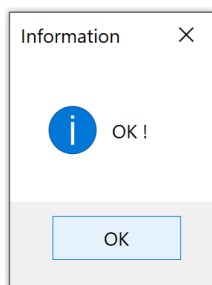
Auth Key = L3SwitchKey

Switch to SL3 (Card)

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name :

Click **Write Perso (Card)** to write the Keys to card.



If the MF Plus card is new, then the above processes will usually success.

We will save the keys to reader for authentication purpose.

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Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

SL 0 / For New Plus

Card Master Key : 00000000000000000000000000000000 Write Perso (Card)

Card Config Key : 00000000000000000000000000000000 Switch to SL1

L3 Switch Key : 00000000000000000000000000000000 Save Key

SL1 Auth Key : 00000000000000000000000000000000

SL 1 / Switch Sector to SL1SL3MixedMode

Select Sector to be switched

0	6	12	18	24	30
1	7	13	19	25	31
2	8	14	20	26	
3	9	15	21	27	
4	10	16	22	28	
5	11	17	23	29	

Auth Key = L1L3MixSectorSwitchKey

Switch to MixedMode (Sector)

SL 1 / Switch Sector to SL3

Select Sector to be switched

0	6	12	18	24	30
1	7	13	19	25	31
2	8	14	20	26	
3	9	15	21	27	
4	10	16	22	28	
5	11	17	23	29	

Auth Key = L3SectorSwitchKey

Switch to SL3 (Sector)

SL1 / Switch to SL3

Auth Key = L3SwitchKey

Switch to SL3 (Card)

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name :

Click  to save the keys to reader's non-volatile memory.

Now we will switch the card to Security Level 1.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

SL 0 / For New Plus

Card Master Key : 00000000000000000000000000000000 Write Perso (Card)

Card Config Key : 00000000000000000000000000000000 Switch to SL1

L3 Switch Key : 00000000000000000000000000000000 Save Key

SL1 Auth Key : 00000000000000000000000000000000

SL 1 / Switch Sector to SL1SL3MixedMode

Select Sector to be switched

0	6	12	18	24	30
1	7	13	19	25	31
2	8	14	20	26	
3	9	15	21	27	
4	10	16	22	28	
5	11	17	23	29	

Auth Key = L1L3MixSectorSwitchKey

Switch to MixedMode (Sector)

SL 1 / Switch Sector to SL3

Select Sector to be switched

0	6	12	18	24	30
1	7	13	19	25	31
2	8	14	20	26	
3	9	15	21	27	
4	10	16	22	28	
5	11	17	23	29	

Auth Key = L3SectorSwitchKey

Switch to SL3 (Sector)

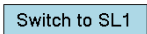
SL1 / Switch to SL3

Auth Key = L3SwitchKey

Switch to SL3 (Card)

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name :

Click  button, to switch the card to SL1 level.

If the returned protocol is success, then the card is now in SL1 level.

Please refer [C:\Mylab\MR](#) for details communication flow.

6. SL 1

At this level, the card works similarly to MF Classic card.

We can read the block 0 using the Mifare Classic protocol.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

Load Key

KeyType : Key A

KeyAddr : 0

KeyData : FFFFFFFF

Save Key

Access Card

KeyType : Key A

KeyAddr : 0

Block : 0

Trans. Block : 0

Trans. Method : Select

Epcure Value :

Data (16B) : 044A298A0F5F8018420080000002318

Halt : No Halt

Read CSN Read Write Value Create Value Block

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataRow	Rd	Wr	Inc	Dec
000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

SecTrailer	Key A	Acc Bits	Key B			
	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Go to Classic Tab, Click **Save Key** to load Key A FFFFFFFF hex, to memory address 0, and then click **Read** to read block 0 of the card.

You can try other MF Classic functions too.

Please refer <C:\Mylab\MR> for details communication flow.

In the following examples, we will add AES functions to the card, by switching:

- Sector 9 and 10 to SL1SL3Mixed mode,
- Sector 11 and 12 to SL3 mode,
- Other sectors remain in SL 1 mode.

7. Mixed Mode

Now we will set sector 9, and 10 to Mixed-Mode.

To switch sector to mixed mode, two authentications are needed; the first one with L1L3MixSectorSwitchKey, and the second one with the sector's Key B. And by default, all new Plus AES key are 16B FF hex. So, we need to load these default key to L1L3MixSectorSwitchKey register, and the sector's Key B register.

Change Main Key

Addr : L1L3MixSectorSwitchKey Write Card

Key : FFFFFFFFFFFFFFFFFFFFFFFFFFFF Save Key

Key
 Card Master Key = Card Master Key
 Card Config Key = Card Config Key
 L3SwitchKey = Card Master Key
 L3SectorSwitchKey = Card Master Key
 L1L3MixSectorSwitchKey = Card Master Key

Sector Key

Auth Key : Select Write Card

Dest. Key : Select Save Key

Sector : Select

KeyData :

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name :

Go to page Key, in the Change Main Key section, select the address from list, and enter the key value. Click Save Key, to load the key required for mixed mode switching to reader.

Load Key

KeyType : Key B Save Key

Sector : 9

KeyData : FFFFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType : Select CRI

Sector : Select Read CSN

Block : 0 --- Create Value Block

Transfer Block : 0 ---

Transfer Method : Select

Epurse Value (4B) :

Data (16B) :

CRI (If enabled) :

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock:

	Rd	Wr	Inc	Dec
000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

Plain Communication (Byte 5)
Only for SL3 level.

☐ Block 0
☐ Block 1
☐ Block 2
☐ Block 3

SecTrailer:

	Key A	Acc Bits	Key B
	Rd	Wr	Rd
000	X	A	A
010	X	X	A
100	X	B	A/B
001	X	A	A
011	X	B	A/B
101	X	X	A/B

Start

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name :

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MR

Port Classic UltraLight EV1 **Plus EV1** Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType : Key B

Sector : 10

KeyData : FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType : Select

Sector : Select

Block : 0 ---

Transfer Block : 0 ---

Transfer Method : Select

Epurse Value (4B) :

Data (16B) :

CRI (If enabled) :

Access Method

☐ ProximityCheck ☐ VirtualCard

DF Name :

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock:	Rd	Wr	Inc	Dec	Plain Communication (Byte 5)
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

Only for SL3 level.

☐ Block 0 ☐ Block 1 ☐ Block 2 ☐ Block 3

SecTrailer:

	Key A		Acc Bits		Key B	
	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Go to page Basic, in the Load Key section, click to save default key to sector 9 and 10's Key B.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

SL0 / For New Plus

Card Master Key : 00000000000000000000000000000000

Card Config Key : 00000000000000000000000000000000

L3 Switch Key : 00000000000000000000000000000000

SL1 Auth Key : 00000000000000000000000000000000

SL1 / Switch Sector to SL1SL3MixedMode

Select Sector to be switched

☐ 0	☐ 6	☐ 12	☐ 18	☐ 24	☐ 30
☐ 1	☐ 7	☐ 13	☐ 19	☐ 25	☐ 31
☐ 2	☐ 8	☐ 14	☐ 20	☐ 26	
☐ 3	☐ 9	☐ 15	☐ 21	☐ 27	
☐ 4	☒ 10	☐ 16	☐ 22	☐ 28	
☐ 5	☐ 11	☐ 17	☐ 23	☐ 29	

Auth Key = L1L3MxSectorSwitchKey

SL1 / Switch Sector to SL3

Select Sector to be switched

☐ 0	☐ 6	☐ 12	☐ 18	☐ 24	☐ 30
☐ 1	☐ 7	☐ 13	☐ 19	☐ 25	☐ 31
☐ 2	☐ 8	☐ 14	☐ 20	☐ 26	
☐ 3	☐ 9	☐ 15	☐ 21	☐ 27	
☐ 4	☐ 10	☐ 16	☐ 22	☐ 28	
☐ 5	☐ 11	☐ 17	☐ 23	☐ 29	

Auth Key = L3SectorSwitchKey

SL1 / Switch to SL3

Auth Key = L3SwitchKey

Access Method

☐ ProximityCheck ☐ VirtualCard

DF Name :

Now, go to page SL0/Switching, check 9 and 10, click , to perform sector switching.

MR Manual – MF Plus EV1

If the returned protocol shows success, then the two sectors are now in mixed mode. They can be accessed using SL 1 (MF Classic) protocol, and SL 3 (AES) protocol. We will verify it now.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

Load Key

KeyType : Key A Save Key

KeyAddr : 0

KeyData : FFFFFFFFFF

Access Card

KeyType : Key A

KeyAddr : 0

Block : 36 Sector 9, Block 0

Trans. Block : 0

Trans. Method : Select

Epurse Value :

Data (16B) : 00000000000000000000000000000000

Halt : No Halt

Read Read Write Value Create Value Block

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock:	Rd	Wr	Inc	Dec
000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Go to Classic Tab, click , to read block 36 (Sector 9, block 0). OK. You may need to reset the card from the RF field (remove the card from reader, and then put back the card on the reader) in order to view this.

The card can be accessed using the SL 1 or 'Classic' protocol. Now we will try to access using SL 3 protocol or AES Key. Bear in mind that the default Plus key is 16B FF hex.

Since this is the first time we access SL 3, we need to load the default key to reader, before we can use Key A to read from the card.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType : Key A Save Key

Sector : 9

KeyData : FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

KeyType : Key A

Sector : 9

Block : 36 Sector 9, Block 0

Transfer Block : 0

Transfer Method : Select

Epurse Value (4B) :

Data (16B) : 00000000000000000000000000000000

CRI (If enabled) :

Read Read Write Value CRI Read CSN Create Value Block

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock:	Rd	Wr	Inc	Dec
000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name :

MR Manual – MF Plus EV1

Go to Plus EV 1 Tab, page 'Basic'. First, click  to load AES Key A, 16B FF to memory address 9. Then, click , to read block 36 (Sector 9, block 0). OK.

As can be seen here, the mixed mode sector can be accessed by SL 1 and SL 3 protocol.

It is good to record the card sector mode for reference.

Mode	Sector
SL 1	0 to 8, 11 to 31
Mixed mode sector	9, 10
SL 3	

These mixed mode sector can be switched to SL 3 if necessary. Refer Chapter 'Switch Mixed Mode to SL 3' for details.

Please refer <C:\Mylab\MR> for details communication flow.

8. SL 3

Now we will set sector 11, and 12 to SL 3 level.

To switch sector to SL3 mode, two authentications are needed; the first one with L3SectorSwitchKey, and the second one with the sector's Key B. And by default all new Plus AES key are 16B FF hex. So, we need to load these default key to L3SectorSwitchKey register, and the sector's Key B register.

Go to page Key, in the Change Main Key section, select the address, enter key value, and click , to load the key required for SL 3 switching, to reader.

MR Manual – MF Plus EV1

Go to page Basic, in the Load Key section, select Key B, sector 11, enter default Key Data, then click

Save Key

Switch to SL3
(Sector)

Go to page SL0/Switching, check Sector 11, and click

If the returned protocol shows success, then Sector 11 is now in SL 3 mode. They can be accessed only by SL 3 (AES) protocol. We will verify it now.

Read

Go to Classic Tab, click

MR Manual – MF Plus EV1

The card cannot be accessed using the SL 1 or 'Classic' protocol. Now we will try to access using SL 3 protocol or AES Key.

The screenshot shows the MR software interface. The 'Basic' tab is selected under 'Plus EV1'. In the 'Load Key' section, 'KeyType' is set to 'Key B' and 'Sector' is set to '11'. The 'Access Card' section shows 'Block' set to '44'. The 'Access Condition Calculation' section contains two tables: 'DataBlock' and 'SecTrailer'. The 'DataBlock' table shows access conditions for blocks 000 to 111. The 'SecTrailer' table shows access conditions for Key A and Key B. The 'Access Method' section at the bottom has 'ProximityCheck' and 'VirtualCard' options.

Go to Plus EV 1 Tab, page 'Basic', select Key B in the KeyType. Then, click , to read block 44 (Sector 11, block 0). OK.

As can be seen here, the SL 3 mode sector can only be accessed by SL 3 protocol.

You may access Sector 11 by using Key A too; first, Load Key A to Sector 11, and then in the Access Card portion, select Key A, instead of Key B.

Again, we record down the card sector mode.

Mode	Sector
SL 1	0, to 8, 12, to 31
Mixed mode sector	9, 10
SL 3	11

Please refer <C:\Mylab\MR> for details communication flow.

9. Change Main Key

Some authentication keys are set when the card is in level SL 0. We can still change it. Here we will show you how to change the Card Master Key, as this is one of the frequently used authentication keys.

Earlier, we have set the Card Master Key to 16B 00 hex, when the card is in SL 0, and we have also saved the key in the reader. Please load the 16B 00 hex to reader, if you have not done so. You may do it here:

Change Main Key

Addr :

Key :

Write Card

Save Key

Key

Auth Key

Card Master Key = Card Master Key

Card Config Key = Card Config Key

L3SwitchKey = Card Master Key

L3SectorSwitchKey = Card Master Key

L1L3MixSectorSwitchKey = Card Master Key

Go to page Key, click

Save Key

 to load 16B Card Master Key to reader.

Now, both the card and reader are ready for the Card Master Key authentication. To change the Card Master Key to other value, we need to authenticate with the Card Master Key. Let say we change the key to a new value of 16B 11 hex.

Change Main Key

Addr :

Key :

Write Card

Save Key

Key

Auth Key

Card Master Key = Card Master Key

Card Config Key = Card Config Key

L3SwitchKey = Card Master Key

L3SectorSwitchKey = Card Master Key

L1L3MixSectorSwitchKey = Card Master Key

Select the address, enter the new key value and click

Write Card

 to change the Card Master Key.

After this, remember to click

Save Key

 to save the key to reader for the next authentication.

Another commonly used authentication key is Card Config Key. To change this key, it is required to authenticate with Card Config Key itself. Like the Card Master Key, we set the Card Config Key to 16B 00 hex when the card was in SL 0 mode. So remember to load 16B 00 hex to reader for Card Config Key, if you have not done so. After that, the step to change the key is just similar to Card Master Key as shown above.

Step 1: Load existing Card Config Key to reader

Step 2: Change the Card Config Key with new key

Step 3: Load the new Card Config Key to reader

Change Main Key

Addr :

Key :

Write Card

Save Key

Key

Auth Key

Card Master Key = Card Master Key

Card Config Key = Card Config Key

L3SwitchKey = Card Master Key

L3SectorSwitchKey = Card Master Key

L1L3MixSectorSwitchKey = Card Master Key

Select the address, enter the new key value, and then, click

Write Card

 to change Card Config Key. And then click

Save Key

 to save the key to reader.

MR Manual – MF Plus EV1

To change L3SectorSwitchKey, the required authentication key is Card Master Key, not L3SectorSwitchKey, so remember to load the Card Master Key to reader prior changing the L3SectorSwitchKey.

You may refer to the table below for the authentication key required for changing other key:

Key	Auth Key
Card Master Key	= Card Master Key
Card Config Key	= Card Config Key
L3SwitchKey	= Card Master Key
L3SectorSwitchKey	= Card Master Key
L1L3MixSectorSwitchKey	= Card Master Key

Let us summarize the two keys that we have changed just now:

Item	Value
Card Master Key	11111111111111111111111111111111
Card Config Key	22222222222222222222222222222222

We will use these two keys later.

Please refer <C:\Mylab\MR> for details communication flow.

10. Read Card Serial Number

Read CSN

Place a Card on the reader, then click **Read CSN** to read the unique serial number. This version supports both 4B and 7B serial number. There are displayed in Hex, and is displayed from LSB to MSB.

The screenshot shows the MR software interface with the following sections:

- Port:** Classic UltraLight EV1, Plus EV1, Desfire Misc, MX App Info
- SL0 / Switching Key:** Basic, PC / VC / Random SNR, TMAC Misc
- Load Key:** KeyType: Key A, Sector: 11, KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF, Save Key
- Access Card:** KeyType: Key A, Sector: 11, Block: 44, Transfer Block: 0, Transfer Method: Select, Epurse Value (4B):, Data (16B): 044A298A0F5F80, CRI (If enabled):, Read, Write, Value, CRI, Read CSN, Create Value Block
- Access Condition Calculation:** Data Blk 0: Select, Data Blk 1: Select, Data Blk 2: Select, Sec Trailer: Select, DataBlock: Rd | Wr | Inc | Dec, Plain Communication (Byte 5) Only for SL3 level, Block 0, Block 1, Block 2, Block 3
- SecTrailer:** Key A | Acc Bits | Key B, Rd | Wr | Rd | Wr | Rd | Wr, Start
- Access Method:** ProximityCheck, VirtualCard, DF Name:

If the reader returns error, try resets the card from RF field.

Please refer [C:\Mylab\MR](#) for details communication flow.

11. Load Key

We will use sector 11 in our following examples, bear in mind that sector 11 has been set to SL 3 mode. Before authentication can be successful, we need to load the authentication key to the reader. The key will be stored in non volatile memory.

MR

Port: Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SLO / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 11

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

KeyType: Key A Read Write Value CRI Read CSN Create Value Block

Sector: 11

Block: 44 Sector 11, Block 0

Transfer Block: 0 ---

Transfer Method: Select

Epurse Value (4B):

Data (16B): 044A298A0F5F80

CRI (If enabled):

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name:

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock:	Rd	Wr	Inc	Dec	Plain Communication (Byte 5) Only for SL3 level.
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

Block 0
Block 1
Block 2
Block 3

SecTrailer:	Key A	Acc Bits	Key B			
	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

In the Load Key portion, select Key A, Sector 11, and enter 16B FF hex to KeyData, then click .

Please refer <C:\Mylab\MR> for details communication flow.

12. Read

Since we have loaded the authentication Key, we can now read block 44 (Sector 11, block 0), using Key A from Sector 11. Bear in mind that, for new MF Plus card, Key A is 16B FF hex.

The screenshot shows the MR software interface with the 'Basic' tab selected. The 'Load Key' section has 'Key A' selected as the KeyType, Sector 11, and KeyData filled with 16 'F's. The 'Access Card' section has 'Key A' selected as the KeyType, Sector 11, Block 44, and Transfer Block 0. The 'Access Condition Calculation' section shows a table for DataBlock and SecTrailer. The 'Access Method' section has 'ProximityCheck' and 'VirtualCard' options.

Load Key

KeyType: Key A
Sector: 11
KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

KeyType: Key A
Sector: 11
Block: 44
Transfer Block: 0
Transfer Method: Select
Epcure Value (4B):
Data (16B): 00000000000000000000000000000000
CRI (If enabled):

Access Condition Calculation

Data Blk 0: Select
Data Blk 1: Select
Data Blk 2: Select
Sec Trailer: Select

DataRow	Rd	Wr	Inc	Dec	Plain Communication (Byte 5)
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer:

DataRow	Key A Rd	Key A Wr	Acc Bits Rd	Acc Bits Wr	Key B Rd	Key B Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name:

Click **Read** to read memory block 44 of sector 11. Authenticate the card using Key A of Sector 11. The returned protocol shows the card serial number is 04 4A 29 8A 0F 5F 80, the card type is 18, and the card content of block 44 is 00000000000000000000000000000000 hex.

You may refer Activity text file in C:\Mylab\MR, for detailed transmit and receive protocol string.

Please refer [C:\Mylab\MR](#) for details communication flow.

13. Write

We will write 16B data to block 44 (Sector11, block 0), and then read it out to verify.

The screenshot shows the MRUSB software interface with the 'Basic' tab selected. The 'Access Card' section is active, and the 'Write' button is highlighted. The 'KeyType' is set to 'Key A', 'Sector' is '11', and 'Block' is '44'. The 'Data (16B)' field contains the hex value '0123456789ABCDEF0123456789ABCDEF'. The 'Access Condition Calculation' section shows a table for 'DataBlock' and 'SecTrailer'.

DataBlock	Rd	Wr	Inc	Dec
000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

SecTrailer	Key A	Acc Bits	Key B			
	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Enter data as shown above, and click **Write** to write 0123456789ABCDEF0123456789ABCDEF hex to block 44.

And then click **Read** to read the content of block 44. The returned data shows the previous 'Write' was successful.

Please refer <C:\Mylab\MR> for details communication flow.

14. Create Value Block

For E-Purse application, it is necessary to create value block. We will now convert block 45 (Sector 11, block 1) to value block. We have loaded the authentication key to reader previously.

MR

Port: Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 11

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

KeyType: Key A

Sector: 11

Block: 45 Sector 11, Block 1

Transfer Block: 0 ---

Transfer Method: Select

Epurse Value (4B): 00000000

Data (16B):

CRI (If enabled):

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock:	Rd	Wr	Inc	Dec	Plain Communication (Byte 5)
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Access Method

☐ ProximityCheck ☐ VirtualCard

DF Name:

Assign a 4B init Epurse Value, and then click **Create Value Block**. In this example we set the init value as 00000000 hex. Now, we will read block 45 to get the value.

MR

Port: Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 11

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

KeyType: Key A

Sector: 11

Block: 45 Sector 11, Block 1

Transfer Block: 0 ---

Transfer Method: Select

Epurse Value (4B): 00000000

Data (16B): 00000000FFFFFFFF000000002DD2DD2

CRI (If enabled):

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock:	Rd	Wr	Inc	Dec	Plain Communication (Byte 5)
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Access Method

☐ ProximityCheck ☐ VirtualCard

DF Name:

A light blue rectangular button with the word "Read" in black text.

Click  to read the content of block 45. The returned data shows the previous 'Create Value Block' was successful. In the 16B returned data, the first 4B is the significant E-purse value, which is 00000000 hex.

Please refer <C:\Mylab\MR> for details communication flow.

15. Value - Increase

Since value blocks have been created, we can now perform increment and decrement commands.

A typical E-Purse program flow for Increment or Decrement command is:

- Increase or decrease an amount from an original value block, and transfer the remaining value to a temp value block. Must be from the same sector,
- Restore the remaining value from the temp value block to the original value block,
- When performing these steps, the card should remain in the RF field.

Block 45 is the original value block and 46 is the temp value block.

In the previous examples, we have programmed default value 00000000 hex to original block (Block 45). We will now do the first part; top up 12000000 hex, (LSB to MSB), to the value, and transfer the result to temp value block (Block 46).

Item	Value
Block	45 (2D hex)
Transfer Block	46 (2E hex)
Transfer Method	Increment
Epurse Value (4B)	12000000 hex

The screenshot shows the MR software interface with the 'Value' tab selected. The 'Access Condition Calculation' section displays the following tables:

DataBlock	Rd	Wr	Inc	Dec	Plain Communication (Byte 5) Only for SL3 level.
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer	Key A	Acc Bits	Key B			
	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Click **Value** to increase 12000000 hex to the block 45's value, and transfer the result which is 12000000 hex to block 46. The returned data shows the process is successful.

At this stage, the original block still holds the original value, which is 00000000 hex, and not yet updated. The actual value is stored at temp value block. You may read block 46 to confirm this.

MR Manual – MF Plus EV1

Access Card

Read Write Value

KeyType : Key A

Sector : 11

Block : 46 Sector 11, Block 2

Transfer Block : Sector 11, Block 2

Transfer Method :

Epurse Value (4B) :

Data (16B) : 12000000EDFFFFFF120000002DD2DD2

CRI (If enabled) :

Read CSN

Create Value Block

Click  button to read block 46. The data shows the temp value is 12000000 hex.

Now, we will complete the second part; restore the value from the temp value block (Block 46) to original block (Block 45). Please note that, when calling 'Restore', the 'Transfer Block No' is not significant. Only the original block, Block 45, is needed in the sending protocol.

Item	Value
Block	45 (2D hex)
Transfer Block	0
Transfer Method	Restore
Epurse Value (4B)	00000000 hex

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType : Key A

Sector : 11

KeyData : FFFFFFFFFFFFFFFFFFFFFFFFFF

Save Key

Access Card

Read Write Value

KeyType : Key A

Sector : 11

Block : 45 Sector 11, Block 1

Transfer Block : Sector 11, Block 2

Transfer Method : Restore

Epurse Value (4B) : 00000000

Data (16B) :

CRI (If enabled) :

Read CSN

Create Value Block

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock: Rd | Wr | Inc | Dec

000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

Plain Communication (Byte 5)
Only for SL3 level.

Block 0
Block 1
Block 2
Block 3

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Access Method

☐ ProximityCheck ☐ VirtualCard

DF Name :

Reset the Epurse Value to 00000000 hex, select 'Restore' in the option, and click .

Now we will read block 45 to verify the result.

The screenshot shows the MR software interface with the 'Basic' tab selected. The 'Load Key' section has 'KeyType' set to 'Key A', 'Sector' set to '11', and 'KeyData' set to 'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF'. The 'Access Card' section has 'KeyType' set to 'Key A', 'Sector' set to '11', 'Block' set to '45', and 'Data (16B)' set to '12000000EDFFFFFF120000002DD22DD2'. The 'Read' button is highlighted. The 'Access Condition Calculation' section shows a table for 'DataBlock' and 'SecTrailer'.

DataBlock	Rd	Wr	Inc	Dec	Plain Communication (Byte 5)
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer	Key A	Acc Bits	Key B
000	X	A	A
010	X	X	A
100	X	B	A/B
001	X	A	A
011	X	B	A/B
101	X	X	A/B

Click  to read block 45. The first 4B of the returned data is 12000000 hex, which is correct. Now, block 45 has been updated with the actual value.

Please refer <C:\MyLab\MR> for details communication flow.

16. Value - Decrease

The process is same as Increase.

From the previous example, we know that block 45 has a value of 12000000 hex. Now, we will deduct 03000000 hex from this block. We will still use block 45 as original block, and block 46 as temp value block.

We will do the first part; deduct 03000000 hex, (LSB to MSB), to the value, and transfer the result to temp value block (Block 46).

Item	Value
Block	45 (2D hex)
Transfer Block	46 (2E hex)
Transfer Method	Decrement
Epurse Value (4B)	03000000 hex

The screenshot shows the MR software interface with the 'Value' tab selected. The 'Block' is set to 45 and 'Transfer Block' is set to 46. The 'Transfer Method' is set to 'Decrement' and 'Epurse Value (4B)' is set to '03000000'. The 'Value' button is highlighted with a red box.

Click **Value** to decrease 03000000 hex to the block 45's value, and transfer the result which is 0F000000 hex to block 46. The returned data shows the process is successful.

Now, we will complete the second part; restore the value from the temp value block (Block 46) to original block (Block 45). Please note that when calling 'Restore', the 'Transfer Block No' is not significant. Only the original block, Block 45, is needed in the sending protocol.

MR Manual – MF Plus EV1

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 11

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType: Key A

Sector: 11

Block: 45 Sector 11, Block 1

Transfer Block: 0 Sector 0, Block 0

Transfer Method: Restore

Epurse Value (4B): 00000000

Data (16B):

CRI (If enabled):

Access Method

ProximityCheck VirtualCard DF Name:

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock:	Rd	Wr	Inc	Dec	Plain Communication (Byte 5)
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

Block 0
Block 1
Block 2
Block 3

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Reset the Epurse Value to 00000000 hex, select 'Restore' in the option, and click **Value**.
Now we will read block 45 to verify the result.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 11

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType: Key A

Sector: 11

Block: 45 Sector 11, Block 1

Transfer Block: 0 Sector 0, Block 0

Transfer Method: Restore

Epurse Value (4B): 00000000

Data (16B): 0F000000F0FFFFFFF0000002DD22DD2

CRI (If enabled):

Access Method

ProximityCheck VirtualCard DF Name:

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock:	Rd	Wr	Inc	Dec	Plain Communication (Byte 5)
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

Block 0
Block 1
Block 2
Block 3

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Click **Read** to read block 45. The first 4B of the returned data is 0F000000 hex, which is correct. Now, block 45 has been updated with the actual value.

Please refer [C:\Mylab\MR](#) for details communication flow.

17. Proximity Check

Proximity Check allows a reader to verify whether a card is within a certain distance.

We will enable this feature here.

We are going to use Card Config Key for authentication when we enable the Proximity Check register later. Earlier we have set the Card Configuration Key and save it to reader already.

Item	Value
Card Master Key	11111111111111111111111111111111
Card Config Key	22222222222222222222222222222222

Next, we need to use Card Config Key to enable VCProximityKey, VCSelectENCKey, and VCSelectMACKey in the card.

Go to page PC/VC/Random SNR and assign Keys for these 3 items, as shown below:

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SLO / Switching Key Basic PC / VC / Random SNR TMAC Misc

ProximityCheck / VirtualCard / Random CSN

Auth Key = Card Config Key

VCPProximityKey : 01010101010101010101010101010101

VCSEnCKey : 02020202020202020202020202020202

VCSElMACKey : 03030303030303030303030303030303

Auth Key = Card Master Key

VCIID / DF Name :

Auth Key = Card Config Key

Random ID :

PCMandatory :

Auth VCMandatory :

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name :

Click to change these 3 keys. After changing the key, remember to click to save it to reader, for authentication later.

Next, we will enable the PCMandatory flag in the Field Config Block. Set the Field Config Block as shown below:

MR Manual – MF Plus EV1

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

ProximityCheck / VirtualCard / Random CSN

Auth Key = Card Config Key

VCProximityKey : 01010101010101010101010101010101 Write Card

VCSelENCKey : 02020202020202020202020202020202 Save Key

VCSelMACKey : 03030303030303030303030303030303

Auth Key = Card Master Key

VCIID / DF Name : Write Card

Auth Key = Card Config Key

Random ID : 00 - No Change Write Card

PCMandatory : AA - PC is mandatory

Auth VCMandatory : 00 - No Change

Access Method

☒ ProximityCheck ☐ VirtualCard DF Name :

Select 'PC is mandatory', and click  to enable PCMandatory flag.

Now, we have turned on the Proximity Check feature of the card. The reader will have to perform Proximity Check before accessing the card. If the check is failed, access will be denied.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType : Key A Save Key

Sector : 11

KeyData : FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

KeyType : Key A

Sector : 11

Block : 44 Sector 11, Block 0

Transfer Block : 0

Transfer Method : Select

Epurse Value (4B) : 00000000

Data (16B) : 0123456789ABCDEF0123456789ABCDEF

CRI (If enabled) :

Read Write Value

CRI

Read CSN

Create Value Block

Access Condition Calculation

Data Blk 0 : Select Data Blk 2 : Select

Data Blk 1 : Select Sec Trailer : Select

DataBlock: Rd | Wr | Inc | Dec Plain Communication (Byte 5) Only for SL3 level.

000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Access Method

☒ ProximityCheck ☐ VirtualCard DF Name :

Check the 'ProximityCheck' flag in the Access Method, then click  to read block 44.

If you access the card without ProximityCheck flag, the access will return "Command Invalid" error. You may try it yourself.

We summarize the keys that we have changed:

Item	Value
VCPximityKey	01010101010101010101010101010101
VCSeIENCKey	02020202020202020202020202020202
VCSeIMACKey	03030303030303030303030303030303

Enable Proximity Check will enhance the card security, but it will slow down the overall access time, since extra verification need to be performed.

If Proximity Check is no longer needed, you may disable it.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SLO / Switching Key Basic PC / VC / Random SNR TMAC Misc

ProximityCheck / VirtualCard / Random CSN

Auth Key = Card Config Key

VCPximityKey : 01010101010101010101010101010101 Write Card

VCSeIENCKey : 02020202020202020202020202020202 Save Key

VCSeIMACKey : 03030303030303030303030303030303

Auth Key = Card Master Key

VCIID / DF Name : Write Card

Auth Key = Card Config Key

Random ID : 00 - No Change Write Card

PCMandatory : 55 - PC is not mandatory

Auth VCMandatory : 00 - No Change

Access Method

☒ ProximityCheck ☐ VirtualCard DF Name : Write Card

Select 'PC is not mandatory', and click  to disable PCMandatory flag.

Now, we have turned off the Proximity Check feature of the card.

Please refer <C:\Mylab\MR> for details communication flow.

18. Virtual Card

Once this feature is enabled, the reader will need to compare the card's DF Name before granting access.

In the following example, we will continue to use the previous card, where Proximity Check has been enabled. So when accessing the card, remember to select Proximity Check in the Access Method.

Access Method	DF Name :
☒ ProximityCheck ☐ VirtualCard	

We are going to use Card Master Key for authentication when we enable the Virtual Card register later. Earlier we have set the Card Master Key and save it to reader already.

Item	Value
Card Master Key	11111111111111111111111111111111
Card Config Key	22222222222222222222222222222222

First, we need to assign a name for the card.

Item	Value
VCIID / DF Name	01020300000000000000000000000000

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

ProximityCheck / VirtualCard / Random CSN

Auth Key = Card Config Key

VCPproximityKey : 01010101010101010101010101010101

VCSEIENCKey : 02020202020202020202020202020202

VCSEIMACKey : 03030303030303030303030303030303

Auth Key = Card Master Key

VCIID / DF Name : 01020300000000000000000000000000

Auth Key = Card Config Key

Random ID : 00 - No Change

PCMandatory : AA - PC is mandatory

Auth VCMandatory : 00 - No Change

Access Method

☒ ProximityCheck ☐ VirtualCard DF Name :

Click to assign a DF name to card.

Next, we will enable the VCMandatory flag in the Field Config Block. Set the Field Config Block as shown below:

MR Manual – MF Plus EV1

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

ProximityCheck / VirtualCard / Random CSN

Auth Key = Card Config Key

VCProximityKey : 01010101010101010101010101010101 Write Card

VCSeIENCKey : 02020202020202020202020202020202 Save Key

VCSeIMACKey : 03030303030303030303030303030303

Auth Key = Card Master Key

VCIID / DF Name : 01020300000000000000000000000000 Write Card

Auth Key = Card Config Key

Random ID : 00 - No Change Write Card

PCMandatory : 00 - No Change

Auth VCMandatory : AA - VC is mandatory

Access Method

☒ ProximityCheck ☐ VirtualCard DF Name :

Select 'VC is mandatory', and click  to enable VCMandatory flag

Now, we have turned on the Virtual Card feature of the card. From now on, if you want to access this card, you need to specify the DF Name, and select Proximity Check and Virtual Card option in the Access Method field. If the DF name is not matched, or the Virtual Card option is not selected, access will be denied.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType : Key A Save Key

Sector : 11

KeyData : FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType : Key A

Sector : 11

Block : 44 Sector 11, Block 0

Transfer Block : 0 ---

Transfer Method : Select

Epurse Value (4B) : 00000000

Data (16B) : 0123456789ABCDEF0123456789ABCDEF

CRI (If enabled) : ---

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock	Rd	Wr	Inc	Dec
000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

Plain Communication (Byte 5)
Only for SL3 level.

☐ Block 0
☐ Block 1
☐ Block 3

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

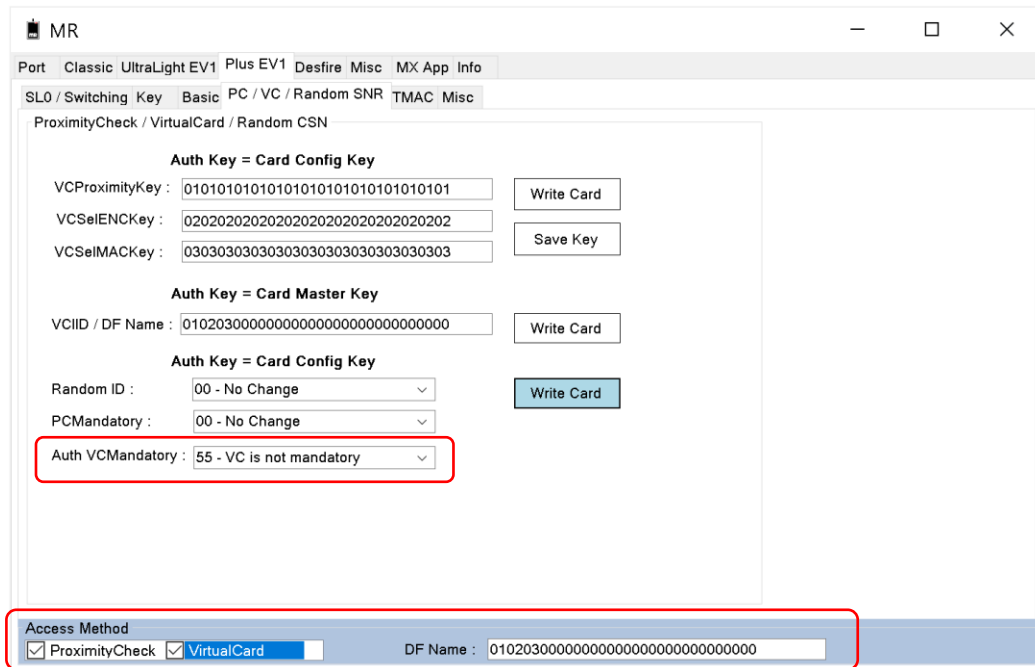
Start

Access Method

☒ ProximityCheck ☒ VirtualCard DF Name : 01020300000000000000000000000000

If the DF Name is matched, Proximity Check and Virtual Card option are checked, the  command will be succeeded.

If Virtual Card check is no longer needed, it can be turned off.



The screenshot shows the MR software interface with the 'Basic' tab selected. The 'PC / VC / Random SNR' sub-tab is active. The 'ProximityCheck / VirtualCard / Random CSN' section is visible. The 'Auth Key = Card Config Key' section has three input fields: VCPximityKey (01010101010101010101010101010101), VCSeIENCKey (02020202020202020202020202020202), and VCSeIMACKey (03030303030303030303030303030303). The 'Auth Key = Card Master Key' section has a VCIID / DF Name field (01020300000000000000000000000000) and a 'Write Card' button. The 'Auth Key = Card Config Key' section has a Random ID field (00 - No Change), a PCMandatory field (00 - No Change), and an Auth VCMandatory field (55 - VC is not mandatory). The 'Access Method' section at the bottom has checkboxes for ProximityCheck and VirtualCard, both of which are checked. The DF Name field is also present.

Select 'VC is not mandatory', and click  to disable VCMandatory flag.

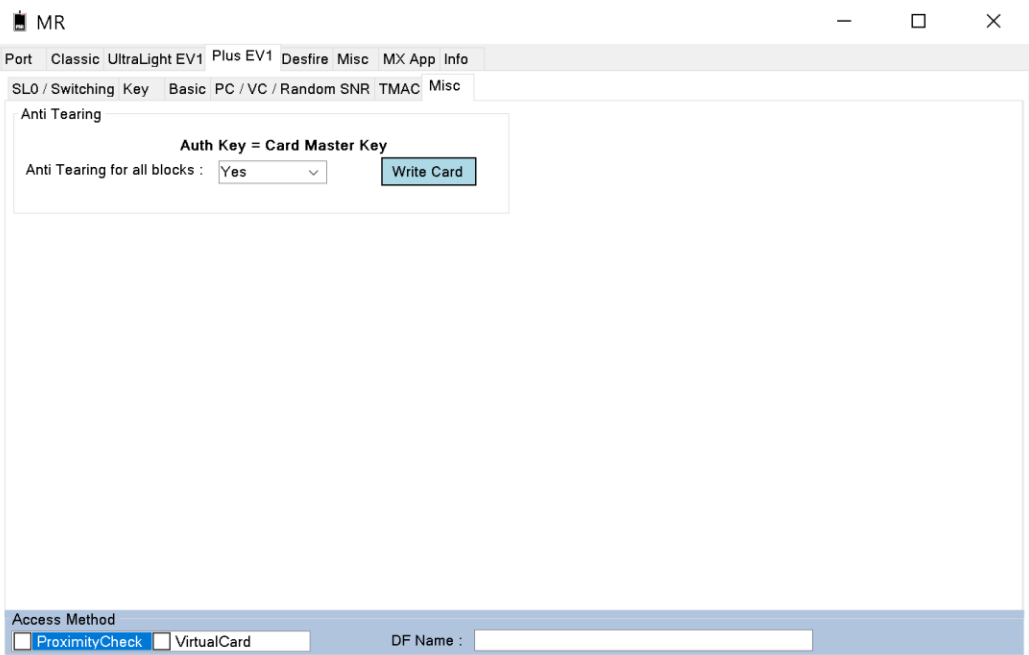
For simplicity, we have turned off the Proximity Check and Virtual Card Check, in all our following examples.

Please refer <C:\Mylab\MR> for details communication flow.

19. Anti-Tearing

This feature will ensure the memory content cannot become corrupted during update process. And it is recommended to enable this feature to ensure data integrity.

We will enable the Anti-Tearing for whole card now.



The screenshot shows the MR software interface. At the top, there is a menu bar with options: Port, Classic, UltraLight EV1, Plus EV1, Desfire, Misc, MX App, and Info. Below this is a sub-menu bar with options: SL0 / Switching, Key, Basic, PC / VC / Random SNR, TMAC, and Misc. The main area is titled 'Anti Tearing' and contains the text 'Auth Key = Card Master Key'. Below this, there is a label 'Anti Tearing for all blocks :' followed by a dropdown menu set to 'Yes' and a 'Write Card' button. At the bottom of the window, there is a section titled 'Access Method' with two radio buttons: 'ProximityCheck' (selected) and 'VirtualCard'. To the right of these is a label 'DF Name :' followed by an empty text input field.

Select 'Yes' in AntiTearing For All Block option, and click .

Please refer <C:\Mylab\MR> for details communication flow.

20. TMAC

The Transaction MAC feature helps preventing fraudulent merchant attacks.

There are 4 sets of TMAC, user can choose any TMAC key for any block. But only one TMAC key for a block. If the block has been protected by a TMAC key already, the block will not be accessed by other TMAC key.

In this example, we will use TMAC1 Key to protect Block 44, 45 and 46, all from sector 11. Remember block 44 is data block, block 45 and 46 are the value blocks, in our previous example.

We select TMAC 1 in the TMAC No option, and then we set the Configuration Key for the TMAC1, or TMACConfigKey1. If you choose TMAC 2 in the option, then the Key will be for TMACConfigKey2, and so on.

We set the value for TMACConfigKey1 as follow:

Item	Value
TMACConfigKey1	A0B0C000000000000000000000000000

We need to load this key to reader, and program it to card.

Select TMAC1 from option, enter the TMAC Config Key value, and click **Save Key** to load the Key to reader. The TMACConfigKey will be used to access the TMAC block, which we will describe later.

Next, we enable the TMC/TMV by setting it to 'Yes', disable the Enable CRI for now, and check block 44, 45, and 46 in the checklist.

Click **Write Card** to program the TMAC for block 44, 45 and 46.

We will verify it now, by calling a 'Write' command.

MR Manual – MF Plus EV1

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 11

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType: Key A

Sector: 11

Block: 44 Sector 11, Block 0

Transfer Block: 0

Transfer Method: Select

Epurse Value (4B):

Data (16B): 00112233445566778899AABBCCDDEEFF

CRI (If enabled): 01000000, 9A8D41B2B7E20936

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock: Rd | Wr | Inc | Dec Plain Communication (Byte 5) Only for SL3 level.

000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name:

Click **Write** to write a string to block 44. The command was successful. The RX protocol returned 4B TMC (01000000 hex), and 8B TMV (16 B7 0D 2A 15 C5 DF 37 hex) value.

The TMC (TMAC Counter) is 01000000 hex (LSB to MSB), means this is the first update of the counter. This counter will increase every time when we perform memory update to card.

TMV, stands for TMAC value, is an encrypted value of the TMAC operation. Please refer manufacturer manual for details.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 11

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType: Key A

Sector: 11

Block: 44 Sector 11, Block 0

Transfer Block: 0

Transfer Method: Select

Epurse Value (4B):

Data (16B): 00112233445566778899AABBCCDDEEFF

CRI (If enabled): 02000000, 164B13C00F6C741C

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock: Rd | Wr | Inc | Dec Plain Communication (Byte 5) Only for SL3 level.

000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name:

Write

Click again to write another string to block 44. The command was successful. This time the RX protocol returned 4B TMC (02000000 hex), and 8B TMV (EF 9E 19 A7 18 9A D7 44 hex) value.

Please note that the TMC has been incremented by 1 to 02000000 hex, and the TMV has changed to EF 9E 19 A7 18 9A D7 44 hex.

But when we read from card, TMC is not incremented. This is because 'Read' command does not involve update memory.

MR

Port: Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 11

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

KeyType: Key A

Sector: 11

Block: 44 Sector 11, Block 0

Transfer Block: 0

Transfer Method: Select

Epurse Value (4B):

Data (16B): 00112233445566778899AABBCCDDEEFF

CRI (If enabled):

02000000, 164B13C00F6C741C

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock:	Rd	Wr	Inc	Dec
000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

Plain Communication (Byte 5) Only for SL3 level.

Block 0
Block 1
Block 2
Block 3

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Access Method

ProximityCheck VirtualCard DF Name:

But there is no TMC/TMV returned when we do 'Read', as this command does not involve update memory.

Same as 'Write', TMC will be incremented when we perform Value operation, like 'Decrement', and 'Increment'.

MR

Port: Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 11

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

KeyType: Key A

Sector: 11

Block: 45 Sector 11, Block 1

Transfer Block: 46 Sector 11, Block 2

Transfer Method: Decrement

Epurse Value (4B): 01000000

Data (16B):

CRI (If enabled):

03000000, 6EAA8BE97AFA9410

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock:	Rd	Wr	Inc	Dec
000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

Plain Communication (Byte 5) Only for SL3 level.

Block 0
Block 1
Block 2
Block 3

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Access Method

ProximityCheck VirtualCard DF Name:

MR Manual – MF Plus EV1

TMC/TMV is returned when we do 'Decrement', as this command involve update memory.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SLO / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 11

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType: Key A

Sector: 11

Block: 45 Sector 11, Block 1

Transfer Block: 0 Sector 0, Block 0

Transfer Method: Restore

Epurse Value (4B): 00000000

Data (16B):

CRI (If enabled):

04000000, AB4095EC1984053F

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock:	Rd	Wr	Inc	Dec	Plain Communication (Byte 5) Only for SL3 level.
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Access Method

ProximityCheck VirtualCard

DF Name:

TMC/TMV is returned when we do 'Restore', as this command involve update memory.

We can also get the TMC/TMV value by reading the TransactionMACBlock. Since the Protected Block is Block 44, 45 and 46, Sector 11 Key will be used for authentication.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SLO / Switching Key Basic PC / VC / Random SNR TMAC Misc

TMAC Register

Auth Key = TMAC Config Key

Addr: TransactionMACBlock1 Read Card

Block: 46 Write Card

Data: 04000000AB4095EC1984053F00000000

TMAC

TMAC No: TMAC 1 Auth Key = Card Master Key Save Key

TMAC Config Key: A0B0C000000000000000000000000000 Write Card

Enable TMC / TMV: Yes

Enable CRI: No

Select Block To Be Protected

0	4	8	12	16	20	24	28	32	36	40	44	48	52	56
1	5	9	13	17	21	25	29	33	37	41	45	49	53	57
2	6	10	14	18	22	26	30	34	38	42	46	50	54	58
3	7	11	15	19	23	27	31	35	39	43	47	51	55	59

Access Method

ProximityCheck VirtualCard

DF Name:

Click **Read Card** to retrieve the content of TransactionMACBlock1. The TMC = 04000000 hex and the TMV = AB4095EC1984053F hex, which is same as shown in the previous example above.

To write to the TransactionMACBlock, an authentication with TMACConfKey is needed.

Let say we want to reset the TransactionMACBlock1 to all 00 hex.

MR Manual – MF Plus EV1

The screenshot shows the MR software interface with the following sections:

- TMAC Register:** Contains fields for Addr (TransactionMACBlock1), Block (46), and Data (00000000000000000000000000000000). Buttons for Read Card and Write Card are present.
- TMAC:** Contains fields for TMAC No (TMAC 1), TMAC Config Key (A0B0C000000000000000000000000000), and Auth Key (Card Master Key). Buttons for Save Key and Write Card are present.
- Enable TMC / TMV:** Set to Yes.
- Enable CRI:** Set to No.
- Select Block To Be Protected:** A grid of checkboxes for blocks 0 to 59. Block 46 is selected.
- Access Method:** ProximityCheck and VirtualCard options. DF Name field.

Click  to write data to TransactionMACBlock1. And then click  to retrieve the content of TransactionMACBlock1. It shows that the block data has been reset to all 00 hex.

Please refer <C:\Mylab\MR> for details communication flow.

21. CommitReaderID

This feature is usually worked with a built in external key, so that the key required to commit the ReaderID cannot be known by third party.

Anyway, we can still demo the feature in the following examples.

Bear in mind that we have protected Block 44, 45 and 46 using TMAC1.

We will enable the CommitReaderID now. Follow the diagram shown below:

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SLO / Switching Key Basic PC / VC / Random SNR TMAC Misc

TMAC Register

Auth Key = TMAC Config Key

Addr : TransactionMACBlock1 Read Card

Block : 46 Write Card

Data : 00000000000000000000000000000000

TMAC

TMAC No : TMAC 1 Auth Key = Card Master Key

TMAC Config Key : A0B0C000000000000000000000000000 Save Key

Enable TMC / TMV : Yes Write Card

Enable CRI : Yes

Select Block To Be Protected

0	4	8	12	16	20	24	28	32	36	40	44	48	52	56
1	5	9	13	17	21	25	29	33	37	41	45	49	53	57
2	6	10	14	18	22	26	30	34	38	42	46	50	54	58
3	7	11	15	19	23	27	31	35	39	43	47	51	55	59

< >

Access Method

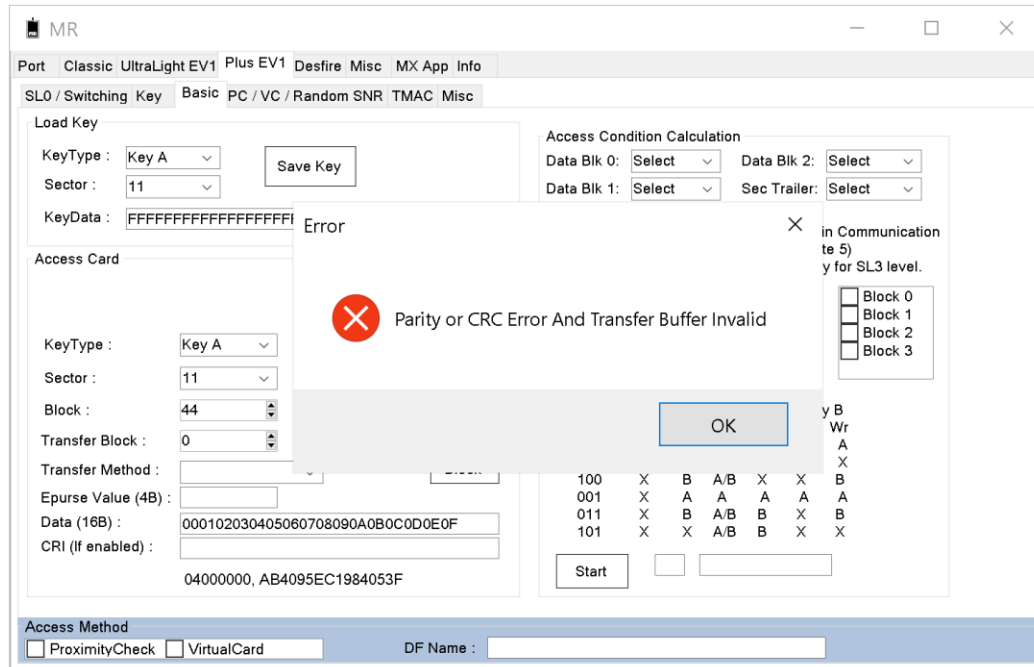
☐ ProximityCheck ☐ VirtualCard DF Name :

Select TMAC1, enable the TMC/TMV, and CRI. Click  to program the card.

We have enabled the CommitReaderID.

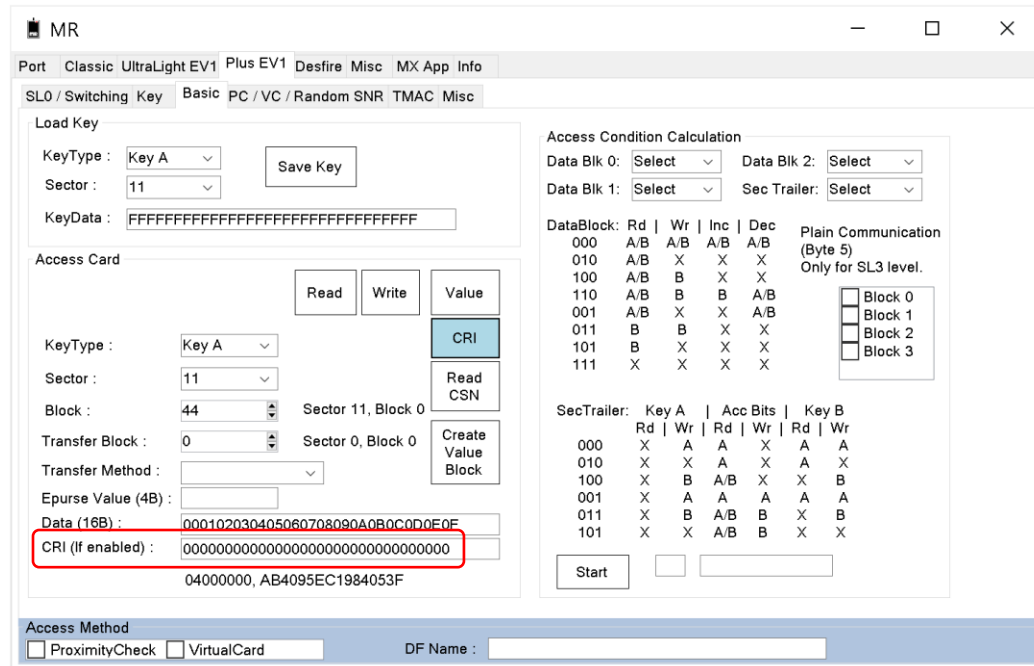
Now, if we do a 'Write', it will fail.

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Attempting to write or update the card will fail. But reading card is allowed.

Since we have enabled the CommitReaderID, we need to commit the ReaderID first. In this example, we will set the ReaderID key as 16B zeros, or 00000000000000000000000000000000 hex.



Click **CRI**, the RX data in the protocol, 96 B6 58 6D 8A 60 D9 FC C8 B0 A9 F7 97 8B 15 4D hex, is called TMRI. It will be stored in the CommitReaderIDBlock.

Now we will click **Write** again.

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This time the 'Write Block' is successful. The returned TMC is 01000000 hex, and TMV is 63 55 C8 74 06 01 29 3E hex.

Therefore, after enable the CRI, the 'Commit Reader ID' has to be called before any write or update memory command, in order to be succeeded.

If the TMAC is no longer needed, we can disable it.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SLO / Switching Key Basic PC / VC / Random SNR TMAC Misc

TMAC Register

Auth Key = TMAC Config Key

Addr : TransactionMACBlock1 Read Card

Block : 46 Write Card

Data : 00000000000000000000000000000000

TMAC

TMAC No : TMAC 1 Auth Key = Card Master Key Save Key

TMAC Config Key : A0B0C000000000000000000000000000

Enable TMC / TMV : No Write Card

Enable CRI : No

Select Block To Be Protected

0	4	8	12	16	20	24	28	32	36	40	44	48	52	56
1	5	9	13	17	21	25	29	33	37	41	45	49	53	57
2	6	10	14	18	22	26	30	34	38	42	46	50	54	58
3	7	11	15	19	23	27	31	35	39	43	47	51	55	59

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name :

Select 'No' for TMC/TMV option, and CRI option, and uncheck all the items in checklist. Click  to turn off the TMAC feature.

Now, we try the 'Write' command again.

MR Manual – MF Plus EV1

The screenshot shows the MR software interface with the 'Write' button highlighted in the 'Access Card' section. The 'Load Key' section shows 'Key A' selected and 'Sector: 11'. The 'Access Card' section shows 'Key A' selected, 'Sector: 11', 'Block: 44', and 'Transfer Block: 0'. The 'Access Condition Calculation' section shows a table of access conditions for DataBlock, Rd, Wr, Inc, Dec, and Plain Communication. The 'Access Method' section shows 'ProximityCheck' and 'VirtualCard' options.

Load Key

KeyType : Key A

Sector : 11

KeyData : FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

KeyType : Key A

Sector : 11

Block : 44 Sector 11, Block 0

Transfer Block : 0 Sector 0, Block 0

Transfer Method :

Epurse Value (4B) :

Data (16B) : 98765432109876543210987654321098

CRI (If enabled) : 00000000000000000000000000000000

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock	Rd	Wr	Inc	Dec	Plain Communication (Byte 5)
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer:

Key A	Acc Bits	Key B				
Rd	Wr	Rd	Wr	Rd	Wr	
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Access Method

☐ ProximityCheck ☐ VirtualCard

DF Name :

Click to write a string to block 44.

The command is successful, but no TMV/TMV is returned, and no need to call CRI command prior to the 'Write' command. Clearly, the TMAC has been disabled.

Please refer <C:\Mylab\MR> for details communication flow.

22. Random ID

If random UID is necessary in your application, you may enable the Random UID flag in the Field Config Block.

Select 'Random ID in SL1 and SL3', click  to enable the Random ID.

We verify it now.

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Read
CSN

Click **Read CSN** to get the card UID in SL1 mode. The diagram shows that the UID vary every time when the command is called. RF reset is necessary in order to see the random ID.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType : Key A Save Key

Sector : 11

KeyData : FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

KeyType : Key A

Sector : 11

Block : 44 Sector 11, Block 0

Transfer Block : 0 Sector 0, Block 0

Transfer Method :

Epurse Value (4B) :

Data (16B) : 98765432109876543210987654321098

CRI (if enabled) :

Read Write Value CRI Read CSN Create Value Block

Access Condition Calculation

Data Blk 0: Select Data Blk 2: Select

Data Blk 1: Select Sec Trailer: Select

DataBlock:	Rd	Wr	Inc	Dec	Plain Communication (Byte 5)
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

Block 0
Block 1
Block 2
Block 3

SecTrailer:

	Key A	Acc Bits	Key B			
	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start

Access Method

☐ ProximityCheck ☐ VirtualCard

DF Name :

When read card in SL3, the returned UID is also random. Please refer to protocol.

In the received protocol string, it returned only 4B serial number, instead of 7B.

For simplicity, we have turned off the Random ID, in all our following examples.

Please refer <C:\Mylab\MR> for details communication flow.

23. Access Condition

The access bit control the rights of memory access using the keys A and B. We have developed a calculator to generate the 4B access condition value, based on selection.

There are 4 blocks in a sector in MF Plus card; 3 data blocks, and 1 sector trailer.

First we look at the access option for data blocks.

DataBlock:	Rd	Wr	Inc	Dec
	A/B	A/B	A/B	A/B
000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

Access option for Data Block.

We can define how the data block can be accessed, or using which Key to access it, and what function can the key perform.

If we choose 000 for a data block, it means Key A or Key B can be used to perform Read, Write, Increment and Decrement. If we choose 100 for a data block, it means Key A or B can be used to perform Read, Key B can perform Write, but Increment and Decrement are prohibited.

By default, 000 is chosen for all data blocks in a new MF Plus card.

Now we look at the access option for sector trailer.

SecTrailer:	Key A		Acc Bits		Key B	
	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Access option for Sector Trailer.

This access bit control whether Key A, Key B and the Access Condition can be read or changed.

If we choose 000 for a sector, it means Key A can be used to change Key A, read Access Bits, to read and write Key B. if we choose 011 for a sector, it means Key A can be used to read Access Bits only, but Key B can be used to write Key A, read and write Access Bits, and write Key B.

By default, 001 is chosen for all sectors in a new MF Plus card.

In SL 3 mode, crypto Key A is not used, instead AES Key is used for authentication in that sector. Byte 5 from the crypto Key A, will be used as Plain Communication byte. It defines whether Plain Read and Plain Write commands can be used for a block. If Plain communication of a data block is allowed, check the block in the Access Condition Calculation.

We will now see how to generate the access condition.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 11

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType: Key A

Sector: 11

Block: 44 Sector 11, Block 0

Transfer Block: 0 Sector 0, Block 0

Transfer Method:

Epurse Value (4B):

Data (16B): 98765432109876543210987654321098

CRI (If enabled):

Access Condition Calculation

Data Blk 0: 000 Data Blk 2: 000

Data Blk 1: 000 Sec Trailer: 001

DataBlock:

DataBlock	Rd	Wr	Inc	Dec	Plain Communication (Byte 5)
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer:

SecTrailer	Key A	Acc Bits	Key B
000	X	A	A
010	X	X	A
100	X	B	A/B
001	X	A	A
011	X	B	A/B
101	X	X	A/B

Access Method

☐ ProximityCheck ☐ VirtualCard

DF Name:

Start 0F FF078000

Click **Start** to generate the access condition for the sector.

The value is 0F and FF078000 (same as FF0780xx or FF078069, the last two digits are insignificant.) This access condition means

- Key A is not readable,
- Key A is used to read or write,
- Key B is disabled,
- Plain communication in SL 3 is allowed.

This is the default access condition for a new MF Plus card.

Now we will generate another commonly used access condition, which will be used in our 'Application with Key A and B' example. This new access condition will

- enable Key A and B,
- Key A is used for Read / Decrement,
- Key B can perform all functions,
- Plain communication in SL 3 is allowed.

To fulfill this requirement, we choose 110 for all data blocks, and 011 for sector trailer.

We use calculator to compile the value.

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MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SLO / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 11

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType: Key A

Sector: 11

Block: 44 Sector 11, Block 0

Transfer Block: 0 Sector 0, Block 0

Transfer Method:

Epc Value (4B):

Data (16B): 98765432109876543210987654321098

CRI (if enabled):

CRI Read CSN Create Value Block

Access Condition Calculation

Data Blk 0: 110 Data Blk 2: 110

Data Blk 1: 110 Sec Trailer: 011

DataBlock	Rd	Wr	Inc	Dec
000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

Plain Communication (Byte 5)
Only for SL3 level.

☒ Block 0
☒ Block 1
☒ Block 2
☒ Block 3

SecTrailer	Key A	Acc Bits	Key B			
	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start 0F 08778F00

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name:

Click  to generate the access condition for the sector.

The value is 0F and 08778F00. We will use this access condition in the 'Application with Key A and Key B' example later.

24. Change Key A

Due to security concern, most application will not use the default Key. Thus, card personalization is needed before project deployment. Here, we will show you how to change the card default key to a new Key.

The steps to change key are:

- Load current sector key to reader,
- Change the card sector key to a new key,
- Save the new key to reader for next authentication.

We will see how to change the sector key now.

Recall that we have done some sector switching earlier.

Mode	Sector
SL 1	0 to 8, 12 to 31
Mixed mode sector	9, 10
SL 3	11

For change key in SL 1 mode, please refer to MF Classic manual. Here, we will deal with SL 3 mode only.

Since mixed mode cover SL 3 mode, so we have four SL 3 sectors in this card; sector 9, 10, 11 and 12.

From chapter 'Access Condition', we know that the default access condition for a new Plus card is FF078069. This access condition means:

- Key A is not readable,
- Key A is used to read or write,
- Key B is disabled.

To change the sector 11 key A, we will first load the current sector key to reader, and we have done it in the earlier chapter. If you have not done so, please do it now.

We go to page Basic, and enter the current Key for sector 11, and then click  to save the keys to reader. We don't need to load Key B, as it is disabled.

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The screenshot shows the MR software interface with the 'Load Key' and 'Access Condition Calculation' sections. The 'Load Key' section has 'KeyType' set to 'Key A', 'Sector' set to '11', and 'KeyData' set to 'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF'. The 'Access Condition Calculation' section shows 'Data Blk 0' set to '110', 'Data Blk 1' set to '110', 'Data Blk 2' set to '110', and 'Sec Trailer' set to '011'. The 'Access Method' section shows 'ProximityCheck' and 'VirtualCard' options.

We define new Key A as:

Key Register	Data
Current Key A	FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
New Key A	A0000000000000000000000000000000

Then, go to page Key, enter the new key A as shown below:

The screenshot shows the MR software interface with the 'Change Main Key' and 'Sector Key' sections. The 'Change Main Key' section has 'Addr' set to 'Select', 'Key' set to 'Key A', and 'Write Card' and 'Save Key' buttons. The 'Sector Key' section has 'Auth Key' set to 'Key A', 'Dest. Key' set to 'Key A', 'Sector' set to '11', and 'KeyData' set to 'A0000000000000000000000000000000'. The 'Access Method' section shows 'ProximityCheck' and 'VirtualCard' options.

Enter data as shown above, and click  to change the sector 11 key A, to a new value.

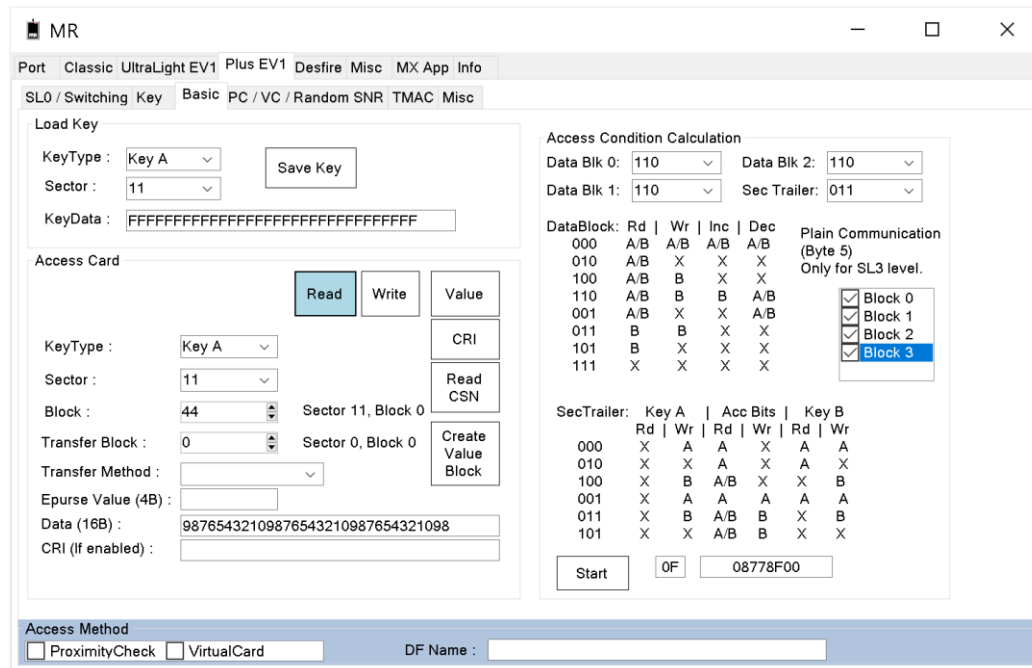
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From the protocol, it shows that the process is successful. So we have changed the sector 11 Key A.

After this is done, click  to save the key to reader.

Now we have changed the sector key, we can verify the key by reading the sector 11.

Go to page 'Basic' and read the content of block 44 (Sector 11, block 0), as shown below:



MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 11

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType: Key A

Sector: 11

Block: 44 Sector 11, Block 0

Transfer Block: 0 Sector 0, Block 0

Transfer Method: Create Value Block

Epurse Value (4B):

Data (16B): 98765432109876543210987654321098

CRI (If enabled):

Access Condition Calculation

Data Blk 0: 110 Data Blk 2: 110

Data Blk 1: 110 Sec Trailer: 011

DataBlock: Rd | Wr | Inc | Dec

000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

Plain Communication (Byte 5) Only for SL3 level.

Block 0 Block 1 Block 2 Block 3

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start 0F 08778F00

Access Method

ProximityCheck VirtualCard

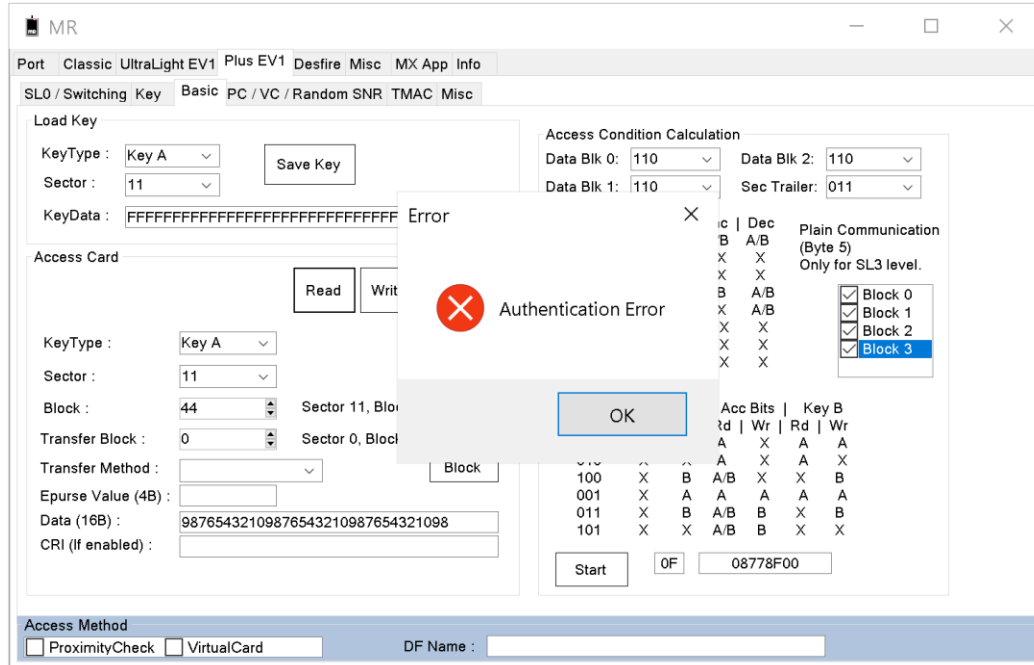
DF Name:

The reading of block 44 is successful.

For testing purpose, you may try to load other key value to reader to see if the new key is really changed. Try load

the default key 16B of FF hex to reader, and then click  button, as shown in the following screen. The read is failed. You may need to reset the RF or card to see the result.

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Before we forget, it is good to write down the keys that we have just programmed.

Sector	Value
11 (SL 3)	Key A : A0000000000000000000000000000000

Please refer [C:\Mylab\MR](#) for details communication flow.

25. Switch Sector SL1 to SL3

In this chapter, we will show you how to switch the SL1 sector to SL3 level.

Recall that we have done some sector switching earlier.

Mode	Sector
SL 1	0 to 8, 12 to 31
Mixed mode sector	9, 10
SL 3	11

We will switch the sector 12, which is currently in SL1 level, to SL3 level.

This process involves few steps:

- Load L3SectorSwitchKey to reader, (Skip this step, if you have loaded it earlier.),
- Load sector 12, Key B to default key of 16B FF hex,
- Switch the sector to SL 3 mode.

The screenshot shows the MR software interface with the 'Plus EV1' tab selected. The 'SL0 / Switching Key' section is active, showing the 'Change Main Key' and 'Sector Key' options. In the 'Change Main Key' section, the 'Addr' is set to 'L3SectorSwitchKey' and the 'Key' is 'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF'. The 'Write Card' and 'Save Key' buttons are visible. To the right, a list of keys is shown: 'Key', 'Auth Key', 'Card Master Key = Card Master Key', 'Card Config Key = Card Config Key', 'L3SwitchKey = Card Master Key', 'L3SectorSwitchKey = Card Master Key', and 'L1L3MixSectorSwitchKey = Card Master Key'. In the 'Sector Key' section, the 'Auth Key' is 'Key A', the 'Dest. Key' is 'Key A', the 'Sector' is '11', and the 'KeyData' is 'A0000000000000000000000000000000'. The 'Access Method' section at the bottom shows 'ProximityCheck' and 'VirtualCard' options, with 'DF Name' set to an empty field.

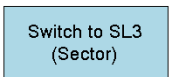
Step 1: Click  to load L3SectorSwitchKey to reader, (Skip this step, if you have loaded it earlier.). Assuming the card's L3SectorSwitchKey is still the default key. If not, load the reader with the new Key.

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The screenshot shows the MR software interface with the 'Basic' tab selected. The 'Load Key' section on the left has 'KeyType' set to 'Key B', 'Sector' set to '12', and 'KeyData' set to 'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF'. A 'Save Key' button is visible. The 'Access Condition Calculation' section on the right shows 'Data Blk 0' and 'Data Blk 1' both set to '110', and 'Sec Trailer' set to '011'. Below this, there are two tables: 'DataBlock' and 'SecTrailer'. The 'DataBlock' table has columns 'Rd', 'Wr', 'Inc', 'Dec' and rows for blocks 000 to 111. The 'SecTrailer' table has columns 'Key A', 'Key B', 'Acc Bits' and rows for blocks 000 to 101. A 'Start' button is at the bottom right of the 'Access Condition Calculation' section. The 'Access Method' section at the bottom shows 'ProximityCheck' and 'VirtualCard' options, with 'DF Name' set to an empty field.

Step 2: Click  to load sector 12, Key B to default key of 16B FF hex

The screenshot shows the MR software interface with the 'Basic' tab selected. The 'SL 0 / For New Plus' section on the left has 'Card Master Key', 'Card Config Key', 'L3 Switch Key', and 'SL1 Auth Key' all set to '00000000000000000000000000000000'. A 'Write Perso (Card)' button is visible. The 'SL 1 / Switch Sector to SL3' section on the right has 'Select Sector to be switched' set to '12' (highlighted with a red box). Below this, there are two tables: 'SL 1 / Switch Sector to SL3' and 'SL 1 / Switch to SL3'. The 'SL 1 / Switch Sector to SL3' table has columns '0' to '31' and rows for sectors 0 to 5. The 'SL 1 / Switch to SL3' table has columns '0' to '31' and rows for sectors 0 to 5. A 'Switch to SL3 (Sector)' button is at the bottom right of the 'SL 1 / Switch Sector to SL3' section. The 'Access Method' section at the bottom shows 'ProximityCheck' and 'VirtualCard' options, with 'DF Name' set to an empty field.

Step 3: Click  to Switch the sector to SL 3 mode.
If the returned protocol is successful, the sector 12 is now in SL3. You may verify it yourself.

MR Manual – MF Plus EV1

The current sector mode of the card is as follow:

Mode	Sector
SL 1	0 to 8, 13 to 31
Mixed mode sector	9, 10
SL 3	11, 12

Please refer <C:\Mylab\MR> for details communication flow.

26. Switch Mixed-mode Sector to SL3

In this chapter, we will show you how to switch the mixed mode sector to SL3 level.

Recall that we have done some sector switching earlier.

Mode	Sector
SL 1	0 to 8, 13 to 31
Mixed mode sector	9, 10
SL 3	11, 12

We will switch the sector 10, which is a mixed mode sector, to SL3 level.

This process involves few steps:

- Load L3SectorSwitchKey to reader, (Skip this step, if you have loaded it earlier.),
- Load sector 10, Key B to default key of 16B FF hex,
- Switch the sector to SL 3 mode.

The screenshot shows the MR software interface with the 'Plus EV1' tab selected. The 'Key' sub-tab is active, displaying the 'Change Main Key' section. In this section, the 'Addr' dropdown is set to 'L3SectorSwitchKey' and the 'Key' text box contains 'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF'. There are 'Write Card' and 'Save Key' buttons. To the right, a list of key mappings is shown: Card Master Key = Card Master Key, Card Config Key = Card Config Key, L3SwitchKey = Card Master Key, L3SectorSwitchKey = Card Master Key, and L1L3MixSectorSwitchKey = Card Master Key. Below this is the 'Sector Key' section with 'Auth Key' and 'Dest. Key' both set to 'Key A', 'Sector' set to '11', and 'KeyData' set to 'A0000000000000000000000000000000'. It also has 'Write Card' and 'Save Key' buttons. At the bottom, the 'Access Method' section shows 'ProximityCheck' and 'VirtualCard' checkboxes, with 'DF Name' set to an empty field.

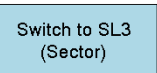
Step 1: Click  to load L3SectorSwitchKey to reader, (Skip this step, if you have loaded it earlier.).

MR Manual – MF Plus EV1

The screenshot shows the MR software interface with the 'Basic' tab selected. The 'Load Key' section on the left has 'KeyType' set to 'Key B', 'Sector' set to '10', and 'KeyData' set to 'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF'. A 'Save Key' button is visible. The 'Access Condition Calculation' section on the right shows 'Data Blk 0' through 'Data Blk 3' and 'Sec Trailer' set to '011'. Below this is a table for 'DataBlock' and 'SecTrailer' with columns for 'Rd', 'Wr', 'Inc', 'Dec', and 'Plain Communication (Byte 5)'. The 'Plain Communication' section shows 'Block 0' through 'Block 3' checked. The 'Access Method' section at the bottom shows 'ProximityCheck' and 'VirtualCard' options, with 'DF Name' set to an empty field.

Step 2: Click  to load sector 10, Key B to default key of 16B FF hex.

The screenshot shows the MR software interface with the 'Basic' tab selected. The 'SL 0 / For New Plus' section on the left has 'Card Master Key', 'Card Config Key', 'L3 Switch Key', and 'SL1 Auth Key' all set to '00000000000000000000000000000000'. A 'Save Key' button is visible. The 'SL 1 / Switch Sector to SL3' section on the right shows a grid of sectors (0-31) with '10' selected. The 'Auth Key = L3SectorSwitchKey' is displayed. The 'Access Method' section at the bottom shows 'ProximityCheck' and 'VirtualCard' options, with 'DF Name' set to an empty field.

Step 3: Click  to switch the sector 10 to SL 3 mode.

The Rx protocol shows that the process was successful.
You may verify it yourself.

MR Manual – MF Plus EV1

Remember to load the Sector 10's Key A with default key 16B FF hex, before you access the sector.

The current sector mode of the card is as follow:

Mode	Sector
SL 1	0 to 8, 13 to 31
Mixed mode sector	9
SL 3	10, 11, 12

Please refer <C:\Mylab\MR> for details communication flow.

27. Application with Key A and Key B

Some applications, especially the E-Purse applications may require higher security, that involve Key A and B. Thus, card personalization is needed before project deployment. Here, we will show you how to change the card default key A to a new Key A0A1A2A3A4A5A6A7A8A9A0A1A2A3A4A5 hex, and enable the Key B with key B0B1B2B3B4B5B6B7B8BB9B0B1B2B3B4B5 hex, in sector 10.

This process involves few steps:

- Load default sector key to reader, (Skip this step, if you have loaded it earlier.),
- Program the card sector default key A and B to new key A and B, and save the key,
- Change the sector trailer.

The screenshot shows the MR software interface with the following details:

- Port:** Classic UltraLight EV1, Plus EV1, Desfire, Misc, MX App, Info
- SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc**
- Load Key:**
 - KeyType: Key A
 - Sector: 10
 - KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF
 - Save Key button
- Access Card:**
 - KeyType: Key B
 - Sector: 10
 - Block: 48
 - Transfer Block: 0
 - Transfer Method: (dropdown)
 - Epurse Value (4B):
 - Data (16B): 00000000000000000000000000000000
 - CRI (if enabled):
 - Buttons: Read, Write, Value, CRI, Read CSN, Create Value Block
- Access Condition Calculation:**
 - Data Blk 0: 110, Data Blk 1: 110, Data Blk 2: 110, Sec Trailer: 011
 - Table:

DataBlock	Rd	Wr	Inc	Dec	Plain Communication (Byte 5) Only for SL3 level.
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	
 - Block selection: Block 0, Block 1, Block 2, Block 3 (all checked)
 - SecTrailer table:

Key A	Acc Bits		Key B	
	Rd	Wr	Rd	Wr
000	X	A	A	X
010	X	X	A	X
100	X	B	A/B	X
001	X	A	A	A
011	X	B	A/B	B
101	X	X	A/B	B
 - Buttons: Start, 0F, 08778F00
- Access Method:** ProximityCheck, VirtualCard, DF Name: (text field)

Step 1: Click  to load default sector key to reader, (Skip this step, if you have loaded it earlier.)

The image displays two screenshots of the MR software interface, specifically the 'Sector Key' configuration screen. The interface includes tabs for 'Port', 'Classic', 'UltraLight EV1', 'Plus EV1', 'Desfire', 'Misc', 'MX App', and 'Info'. The 'Key' tab is selected, showing options for 'SL0 / Switching', 'Basic', 'PC / VC / Random SNR', and 'TMAC / Misc'. The 'Change Main Key' section has 'Addr' set to 'L3SectorSwitchKey' and 'Key' set to 'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF'. The 'Sector Key' section has 'Auth Key' and 'Dest. Key' both set to 'Key A', 'Sector' set to '10', and 'KeyData' set to 'A0A1A2A3A4A5A6A7A8A9A0A1A2A3A4A5'. The 'Access Method' section has 'ProximityCheck' and 'VirtualCard' options, with 'DF Name' set to an empty field. The 'Write Card' and 'Save Key' buttons are highlighted with red boxes and numbered 1 and 2 respectively. The bottom screenshot shows the same interface but with 'Dest. Key' changed to 'Key B' and 'KeyData' changed to 'B0B1B2B3B4B5B6B7B8B9B0B1B2B3B4B5'.

Step 2: Program the card sector default key A and B to new key A and B, and save the key.

Step 3:

Change the sector trailer.

As we mentioned in chapter 'Access Condition', we need a new access condition value that can

- enable Key A and B,
- Key A is used for Read / Decrement,
- Key B can perform all functions,
- Plain communication in SL 3 is allowed.

The value is 0F and 08778F00.

MR Manual – MF Plus EV1

In SL 3 mode, crypto key is not used, we can fill the previously Key A and B with 00 hex. Therefore, the 16B data for this sector trailer is 0000000000 0F 08778F00 000000000000 hex.

Program the Sector Trailer (Block 3 of the sector), with new Key and access condition:

- 0000000000 hex (5B dummy)
- 0F (1B plain communication access byte)
- 08 77 8F 00 hex (4B Access Condition)
- 000000000000 hex (6B dummy.)

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 10

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType: Key A

Sector: 10

Block: 43 Sector 10, Block 3

Transfer Block: Sector 0, Block 0

Transfer Method: Create Value Block

Epurse Value (4B):

Data (16B): 00000000000F08778F00000000000000

CRI (If enabled):

Access Condition Calculation

Data Blk 0: 110 Data Blk 2: 110

Data Blk 1: 110 Sec Trailer: 011

DataBlock:	Rd	Wr	Inc	Dec	Plain Communication (Byte 5) Only for SL3 level.
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start 0F 08778F00

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name:

Click **Write** to program the sector trailer.

Alert !

! This block is Sector Trailer. Confirm to proceed ?

Yes No

Since this is a sector trailer, confirmation is required. Click 'Yes' to proceed.

After the change, Sector 10 will have Key A and B enabled.

We have programmed the sector trailer to limit its access to certain functions. It should be allowed to perform Read / Decrement using Key A, and perform all functions using Key B. We will try them now.

We are going to test this sector now by performing a top-up, and then a deduct value. There are few steps in the top-up:

- Step 1: Use Key B to create a value block, (Key A is prohibited to do 'Write', skip this step if the block is already a value block),
- Step 2: Use Key B to increase a value of 35000000 (LSB to MSB) hex to block 41, (Key A is prohibited to do 'Increment'),
- Step 3: Use Key B to restore value.

And then the deduct value involves few steps too:

- Step 4: Use Key A to deduct 10000000 (LSB to MSB) hex from block 41,
- Step 5: Use Key A to restore value,
- Step 6: Use Key A to read block 41.

Step 1: Use Key B to create a value block at block 41.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SLO / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType : Key A Save Key

Sector : 10

KeyData : FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType : Key B

Sector : 10

Block : 41

Transfer Block : Sector 10, Block 1

Transfer Method : Sector 0, Block 0

Epurse Value (4B) : 00000000

Data (16B) :

CRI (If enabled) :

Create Value Block

Access Condition Calculation

Data Blk 0: 110 Data Blk 2: 110

Data Blk 1: 110 Sec Trailer: 011

DataBlock:	Rd	Wr	Inc	Dec	Plain Communication (Byte 5) Only for SL3 level.
000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start 0F 08778F00

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name :

Select Key B, and sector 10. Click **Create Value Block** to convert block 41 to value block. Successful!

Step 2: Use Key B to top up 35000000 hex to block 41.

Block 41 is the original block, and block 42 is the temp value block.

MR Manual – MF Plus EV1

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 10

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType: Key B

Sector: 10

Block: 41 Sector 10, Block 1

Transfer Block: 42 Sector 10, Block 2

Transfer Method: Increment

Epurse Value (4B): 35000000

Data (16B):

CRI (If enabled):

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name:

Access Condition Calculation

Data Blk 0: 110 Data Blk 2: 110

Data Blk 1: 110 Sec Trailer: 011

DataBlock:	Rd	Wr	Inc	Dec
000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

Plain Communication (Byte 5) Only for SL3 level.

☒ Block 0

☒ Block 1

☒ Block 2

☒ Block 3

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start 0F 08778F00

Click **Value** to top up 35000000 hex to block 41, but transfer the balance value to block 42. Successful!

Step 3: Now we restore the value from block 42 to block 41.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 10

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType: Key B

Sector: 10

Block: 41 Sector 10, Block 1

Transfer Block: 42 Sector 10, Block 2

Transfer Method: Restore

Epurse Value (4B): 00000000

Data (16B):

CRI (If enabled):

Access Method

☐ ProximityCheck ☐ VirtualCard DF Name:

Access Condition Calculation

Data Blk 0: 110 Data Blk 2: 110

Data Blk 1: 110 Sec Trailer: 011

DataBlock:	Rd	Wr	Inc	Dec
000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

Plain Communication (Byte 5) Only for SL3 level.

☒ Block 0

☒ Block 1

☒ Block 2

☒ Block 3

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start 0F 08778F00

Click **Value** to restore the value from block 42 to block 41. Successful!

Now block 41 has a value of 35000000 hex. You may read the block content to verify the content.

Having done the top-up with Key B, we will now use Key A to deduct a value from Block 41.

MR Manual – MF Plus EV1

Step 1: Deduct 10000000 hex from Block 41, and transfer the balance to Block 42.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 10

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType: Key A

Sector: 10

Block: 41 Sector 10, Block 1

Transfer Block: 42 Sector 10, Block 2

Transfer Method: Decrement

Epcure Value (4B): 10000000

Data (16B):

CRI (If enabled):

Access Condition Calculation

Data Blk 0: 110 Data Blk 2: 110

Data Blk 1: 110 Sec Trailer: 011

DataBlock: Rd | Wr | Inc | Dec Plain Communication (Byte 5) Only for SL3 level.

000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start 0F 08778F00

Access Method

ProximityCheck VirtualCard DF Name:

Click **Value** to deduct 10000000 hex from block 41, and transfer the resulted value to block 42. Successful!

Step 2: Now we restore the value from block 42 to block 41.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 10

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType: Key A

Sector: 10

Block: 41 Sector 10, Block 1

Transfer Block: 42 Sector 10, Block 2

Transfer Method: Restore

Epcure Value (4B): 00000000

Data (16B):

CRI (If enabled):

Access Condition Calculation

Data Blk 0: 110 Data Blk 2: 110

Data Blk 1: 110 Sec Trailer: 011

DataBlock: Rd | Wr | Inc | Dec Plain Communication (Byte 5) Only for SL3 level.

000	A/B	A/B	A/B	A/B	
010	A/B	X	X	X	
100	A/B	B	X	X	
110	A/B	B	B	A/B	
001	A/B	X	X	A/B	
011	B	B	X	X	
101	B	X	X	X	
111	X	X	X	X	

SecTrailer: Key A | Acc Bits | Key B

	Rd	Wr	Rd	Wr	Rd	Wr
000	X	A	A	X	A	A
010	X	X	A	X	A	X
100	X	B	A/B	X	X	B
001	X	A	A	A	A	A
011	X	B	A/B	B	X	B
101	X	X	A/B	B	X	X

Start 0F 08778F00

Access Method

ProximityCheck VirtualCard DF Name:

Click **Value** to restore value from block 42 to block 41. Successful!

Step 3: Now block 41 has a value of 25000000 hex. We will read the block to verify the content.

MR

Port Classic UltraLight EV1 Plus EV1 Desfire Misc MX App Info

SL0 / Switching Key Basic PC / VC / Random SNR TMAC Misc

Load Key

KeyType: Key A Save Key

Sector: 10

KeyData: FFFFFFFFFFFFFFFFFFFFFFFFFF

Access Card

Read Write Value

KeyType: Key A

Sector: 10

Block: 41 Sector 10, Block 1

Transfer Block: Sector 10, Block 2

Transfer Method:

Epcure Value (4B):

Data (16B): 25000000DAFFFFFF2500000029D629D6

CRI (if enabled):

Access Condition Calculation

Data Blk 0: 110 Data Blk 2: 110

Data Blk 1: 110 Sec Trailer: 011

DataBlock: Rd | Wr | Inc | Dec Plain Communication (Byte 5) Only for SL3 level.

DataBlock	Rd	Wr	Inc	Dec
000	A/B	A/B	A/B	A/B
010	A/B	X	X	X
100	A/B	B	X	X
110	A/B	B	B	A/B
001	A/B	X	X	A/B
011	B	B	X	X
101	B	X	X	X
111	X	X	X	X

SecTrailer: Key A | Acc Bits | Key B

SecTrailer	Key A	Acc Bits	Key B
000	X	A	A
010	X	X	A
100	X	B	A/B
001	X	A	A
011	X	B	A/B
101	X	X	A/B

Start 0F 08778F00

Access Method

ProximityCheck VirtualCard DF Name:

Click  to read block 41. The data shows the value is 25000000 hex, which is correct.

The combined use of Key A and B, enhance the security of application. It should be adopted in all MF Plus application.

Remarks:

In this sector 10, since we have changed the sector trailer, only Key B is allowed to change the sector's Key A and B. Therefore, remember to load the correct Key B to reader, and select Key B for Auth Key in page Key, when you want to change key.

Sector Key

Auth Key: Key B Write Card

Dest. Key: Key A

Sector: 10

KeyData: 16B new Key Save Key

Please refer <C:\Mylab\MR> for details communication flow.

28. Important Summary

Card SNR : 04 4A 29 8A 0F 5F 80

Mode	Sector
SL 1	0 to 8, 13 to 31
Mixed mode sector	9
SL 3	10, 11, 12

Sector	Value
9 (Mixed Mode)	Key A : FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
10 (SL3) 0F 08778F00	Key A : A0A1A2A3A4A5A6A7A8A9A0A1A2A3A4A5 Key B : B0B1B2B3B4B5B6B7B8B9B0B1B2B3B4B5
11 (SL 3)	Key A : A0000000000000000000000000000000
12 (SL 3)	Key A : FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF

Item	Value
Card Master Key	11111111111111111111111111111111
Card Config Key	22222222222222222222222222222222

Item	Value
VCProximityKey	01010101010101010101010101010101
VCSelENCKey	02020202020202020202020202020202
VCSelMACKey	03030303030303030303030303030303

Item	Value
VCIID / DF Name	01020300000000000000000000000000

Item	Value
TMAC Config Key 1	A0B0C000000000000000000000000000

29. End