

COMMANDS MANUAL

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**RFID**

**HF**

**CUSTOM<sup>®</sup>**

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#### GENERAL INSTRUCTIONS

CUSTOM S.p.A. declines all responsibility for accidents or damage to persons or property occurring as a result of tampering, structural or functional modifications, unsuitable or incorrect installations, environments not in keeping with the equipment's protection degree or with the required temperature and humidity conditions, failure to carry out maintenance and periodical inspections and poor repair work.

#### GENERAL SAFETY INFORMATION

Your attention is drawn to the following actions that could compromise the characteristics of the product:

- Read and retain the instructions which follow.
- Follow all indications and instructions given on the device.
- Make sure that the surface on which the device rests is stable. If it is not, the device could fall, seriously damaging it.
- Make sure that the device rests on a hard (non-padded) surface and that there is sufficient ventilation.
- Do not fix indissolubly the device or its accessories such as power supplies unless specifically provided in this manual.
- When positioning the device, make sure cables do not get damaged.
- [Only OEM equipment] The equipment must be installed in a kiosk or system that provides mechanical, electrical and fire protection.
- The mains power supply must comply with the rules in force in the Country where you intend to install the equipment.
- Make sure that there is an easily-accessible outlet with a capacity of no less than 10A closely to where the device is to be installed.
- Make sure the power cable provided with the appliance, or that you intend to use is suitable with the wall socket available in the system.
- Make sure the electrical system that supplies power to the device is equipped with a ground wire and is protected by a differential switch.
- Before any type of work is done on the machine, disconnect the power supply.
- Use the type of electrical power supply indicated on the device label.
- These devices are intended to be powered by a separately certified power module having an SELV, non-energy hazardous output. (IEC60950-1 second edition).
- [Only POS equipment] The energy to the equipment must be provided by power supply approved by CUSTOM S.p.A.
- Take care the operating temperature range of equipment and its ancillary components.
- Do not block the ventilation openings.
- Do not insert objects inside the device as this could cause short-circuiting or damage components that could jeopardize printer functioning.
- Do not carry out repairs on the device yourself, except for the normal maintenance operations given in the user manual.
- The equipment must be accessible on these components only to trained, authorized personnel.
- Periodically perform scheduled maintenance on the device to avoid dirt build-up that could compromise the correct, safe operation of the unit.
- Do not touch the head heating line with bare hands or metal objects. Do not perform any operation inside the printer immediately after printing because the head and motor tend to become very hot.
- Use consumables approved by CUSTOM S.p.A.



THE CE MARK AFFIXED TO THE PRODUCT CERTIFY THAT THE PRODUCT SATISFIES THE BASIC SAFETY REQUIREMENTS.

The device is in conformity with the essential Electromagnetic Compatibility and Electric Safety requirements laid down in Directives 2006/95/CE and 2004/108/CE inasmuch as it was designed in conformity with the provisions laid down in the following Standards:

- EN 55022 Class B (*Limits and methods of measurements of radio disturbance characteristics of Information Technology Equipment*)
- EN 55024 (*Information Technology Equipment – Immunity characteristics – Limits and methods of measurement*)
- EN 60950-1 (*Safety of information equipment including electrical business equipment*)

The device is in conformity with the essential requirements laid down in Directives 1999/05/CE about devices equipped with intentional radiators. The Declaration of Conformity and other available certifications can be request to support@custom.it please providing the correct part number shown on product label or in the invoice.



GUIDELINES FOR THE DISPOSAL OF THE PRODUCT

The crossed-out rubbish bin logo means that used electrical and electronic products shall NOT be mixed with unsorted municipal waste. For more detailed information about recycling of this product, refer to the instructions of your country for the disposal of these products.

- Do not dispose of this equipment as miscellaneous solid municipal waste, but arrange to have it collected separately.
- The re-use or correct recycling of the electronic and electrical equipment (EEE) is important in order to protect the environment and the wellbeing of humans.
- In accordance with European Directive WEEE 2002/96/EC, special collection points are available to which to deliver waste electrical and electronic equipment and the equipment can also be handed over to a distributor at the moment of purchasing a new equivalent type.
- The public administration and producers of electrical and electronic equipment are involved in facilitating the processes of the re-use and recovery of waste electrical and electronic equipment through the organisation of collection activities and the use of appropriate planning arrangements.
- Unauthorised disposal of waste electrical and electronic equipment is punishable by law with the appropriate penalties.



The format used for this manual improves use of natural resources reducing the quantity of necessary paper to print this copy.

INTRODUCTION



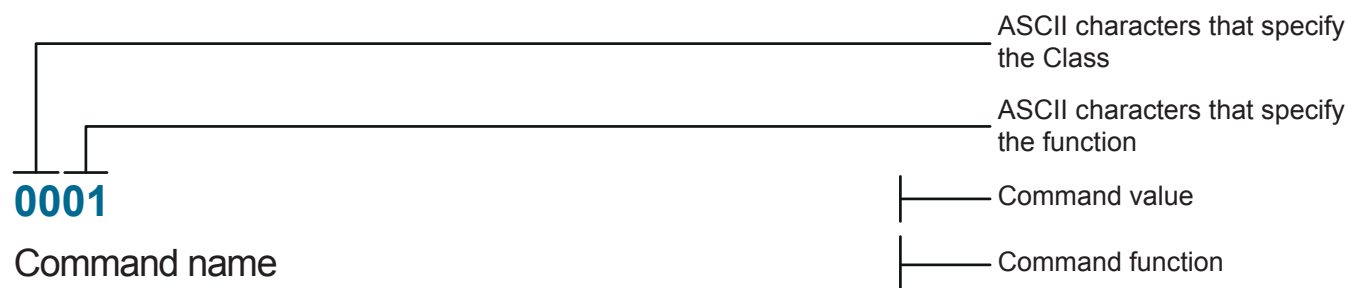
HF CUSTOM COMMANDS





# INTRODUCTION

Each command reported in this manual is described as shown in the following picture. In the first heading field is reported the ASCII command value. In the second heading field reported the command function.



[Format]	ASCII	0001
[Range]		
[Description]	Description of the comand is , this command functions in the same way as 0x0A,	
[Notes]	<p>This command sets the print position to the beginning of the line.</p> <ul style="list-style-type: none"> <li>• This command sets the print position to the beginning of the line.</li> <li>• This command is immediately executed even when the data buffer</li> <li>• This status is transmitted whenever data sequence is received. is full.</li> </ul>	
[Default]		
[Reference]	00A1	
[Example]		

The fields shown in the scheme of the previous figure have the following meaning:

[Format]	ASCII command value.
[Range]	Limits of the values the command and its variables can take
[Description]	Description of command function
[Notes]	Additional information about command use and settings .
[Default]	Default value of the command and its variables.
[Reference]	Pertaining commands related to described command.
[Example]	Example of using the command

Listed below are the meanings of some of symbols that may be found in the command description:

n, m, t, x, y are optional parameters that can have different values.



# PROTOCOL SPECIFICATIONS

This document describes the serial protocol of RFID encoder.

This protocol is called simple because it is based on a communication with ASCII characters which can also be tested manually by using a terminal program. There is no additional overhead for things like packet repetition, address bytes...

The communication is based on a command/response structure: RFID encoder will only send data to the host as a response of a command. Command and response are lines of bytes terminated by a carriage return. Carriage return is not shown explicitly anymore in the following documentation. A byte is always represented and transmitted by two hexadecimal ASCII characters.

## RESPONSE

A response always starts with a byte, which reflects execution of the command on protocol level. Following possible error values:

VALUE	ERROR LABEL (*)	DESCRIPTION
0	ERR_NONE	No error
1	ERR_UNKNOWN_FUNCTION	Function not recognized
2	ERR_MISSING_PARAMETER	Missing parameter
3	ERR_UNUSED_PARAMETERS	Unused parameter
4	ERR_INVALID_FUNCTION	Invalid function
5	ERR_PARSER	Parser error

Note (\*): Every error label can be considered as a function.



# DATA TRANSMISSION

Data can be transmitted by sending ASCII characters.

## **ASCII**

To transmit a value of e.g. 0x1F, it is necessary to split this into two ASCII characters '1' and 'F'. These characters has to be sent sequentially.

## **Reference messages**

The following table shows reference messages for function GetUSBType:

MODE	COMMAND (Host -> RFID encoder)	RESPONSE (RFID encoder -> Host)
ASCII	"0005\r"	"0001\r"



# DATA TYPES

The description of the commands is using data types, which have to be built-up as follows:

DATA TYPE	DESCRIPTION
[Byte]	One single byte (sent as two hex digits)
[UInt16]	Two bytes (LSB first)
[UInt32]	Four bytes (LSB first)
[Bool]	One single byte which can hold two values: 0 or 1
[Byte Array(n)]	A sequence of bytes with known and fixed number of bytes. The number of bytes is not transferred explicitly, because both host and RFID encoder do know this number.
[Byte Array(Var)]	A sequence of bytes, where the first byte holds the number of following bytes
[Byte Array(Var), x LB]	A sequence of bytes, where the first x bytes hold the number of following bytes
[ASCII string]	A sequence of bytes which contain ASCII characters, except the first byte which holds the number of following bytes

In Simple Protocol, all numbers are sent with LSB first. For example, the number 0x1234 has to be sent as 3412.

# RFID TAG TYPES

The tag type are defined as follows:

TAG	TYPE
80	ISO14443A
81	ISO14443B
82	ISO15693
83	LEGIC
84	iCLASS
85	FELICA
86	SRX
87	NFC



# MIFARE ULTRALIGHT®

The MIFARE Ultralight® is a member of the MIFARE® family but is considered as a ticket whose characteristics are very close to the CTx521B's ones. That's why the functions of the MIFARE Ultralight® belong to the same class as the CTx521B class. But this card has to be searched with an ISO A search and not a MIFARE® search.

The communication layer of the UltraLight complies to parts 2 and 3 (but not 4!) of the ISO 14443 A standard. Anticollision and Security features are also implemented.

The 512 bit EEPROM memory is addressed by 4-bytes wide pages, but the CSC handles byte level. It is organised in 16 pages:

BYTE NUMBER	0	1	2	3	Page
<b>Serial Number</b>	SN 0	SN 1	SN 2	BCC0	0
<b>Serial Number</b>	SN 3	SN 4	SN 5	SN 6	1
<b>Internal / Lock</b>	BCC1	Internal	Lock 0	Lock 1	2
<b>OTP</b>	OTP 0	OTP 1	OTP 2	OTP 3	3
<b>DATA (read/write)</b>	Data 0	Data 1	Data 2	Data 3	4
<b>DATA (read/write)</b>	Data 4	Data 5	Data 6	Data 7	5
<b>DATA (read/write)</b>	Data 8	Data 9	Data 10	Data 11	6
<b>DATA (read/write)</b>	Data 12	Data 13	Data 14	Data 15	7
<b>DATA (read/write)</b>	Data 16	Data 17	Data 18	Data 19	8
<b>DATA (read/write)</b>	Data 20	Data 21	Data 22	Data 23	9
<b>DATA (read/write)</b>	Data 24	Data 25	Data 26	Data 27	10
<b>DATA (read/write)</b>	Data 28	Data 29	Data 30	Data 31	11
<b>DATA (read/write)</b>	Data 32	Data 33	Data 34	Data 35	12
<b>DATA (read/write)</b>	Data 36	Data 37	Data 38	Data 39	13
<b>DATA (read/write)</b>	Data 40	Data 41	Data 42	Data 43	14
<b>DATA (read/write)</b>	Data 44	Data 45	Data 46	Data 47	15

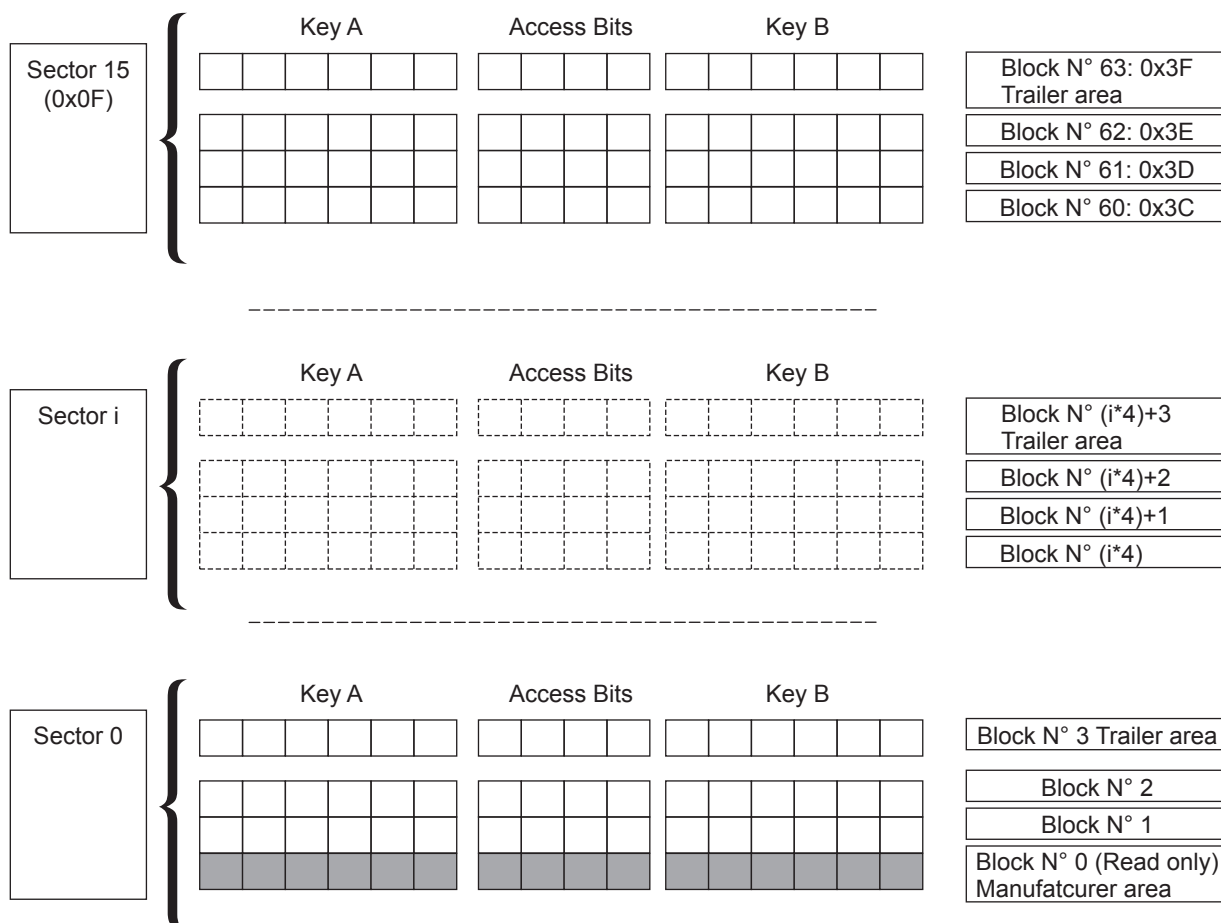
For more details refer to the MIFARE Ultralight® user manual.

# MIFARE CLASSIC® (1K/4K)

The MIFARE Classic® card is composed of 16 Sectors of 4 blocks each. Each Block is composed of 16 Bytes.

The First Block of the First Sector is a read only block that contains the manufacturer information.

The Fourth Block of each sector contains a Trailer area, which contains the key and access bits for this sector.



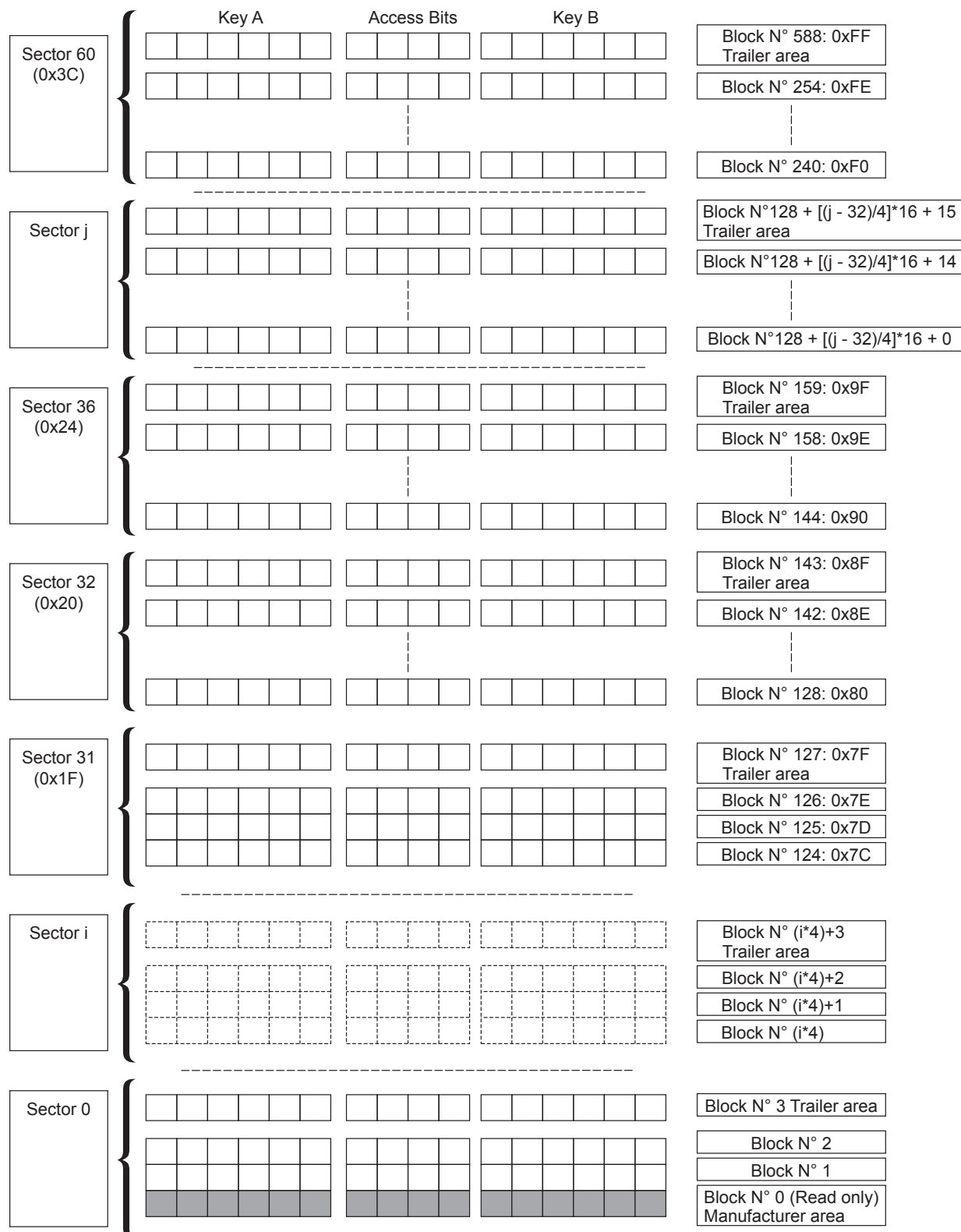
For more details refer to the MIFARE Classic® user manual.

The MIFARE Classic® 4K card is organised in 32 sectors with 4 blocks and 8 sectors with 16 blocks. Each Block is composed of 16 Bytes.

The First Block of the First Sector is a read only and contains the manufacturer information.

The Fourth Block of the first 32 sectors and the sixteenth Block of the last 8 sectors contains a Trailer area, which contains the key and access bits for this sector.

The 8<sup>th</sup> sectors after the 32<sup>nd</sup> advance 4 by 4.



For more details refer to the MIFARE Classic® 4K user manual.



# MIFARE ULTRALIGHT® EV1

The 640 bit EEPROM memory is organized in 20 pages with 32 bits (4 bytes) each.

- 80 bits are reserved for manufacturer data.
- 16 bits are used for read-only locking mechanism.
- 32 bits are available as OTP area.
- 384 bits are user programmable read/write.
- 128 bits are used for configuration, password and RFUI

In addition the EEPROM memory handles 96 bits for counters.

Memory organization of MIFARE Ultralight® EV1 MF0UL11:

Table 1

Bytes Address		Page Address		Byte number within a page				Description
Decimal	Hex	Decimal	Hex	0	1	2	3	
0	0x00	0	0x00	SN0	SN1	SN2	BCC0	Manufacturer data and lock bytes
4	0x04	1	0x01	SN3	SN4	SN5	SN6	
8	0x08	2	0x02	BCC1	Internal	Lock byte 0	Lock byte 1	One Time Programmable
12	0x0C	3	0x03	OTP	OTP	OTP	OTP	
16	0x10	4	0x04	user memory				User memory pages
20	0x14	5	0x05					
...	...	...	...					
56	0x38	14	0x0E	3 one-way counters				Counter pages
60	0x3C	15	0x0F					
64	0x40	16	0x10	RFUI	RFUI	RFUI	AUTH0	Configuration pages
68	0x44	17	0x11	ACCESS	VCTID	RFUI	RFUI	
72	0x48	18	0x12	PWD				
76	0x4C	19	0x13	PACK	RFUI	RFUI		

For more details, refer to MIFARE Ultralight® EV1 (MF0ULx1) datasheet.

**NOTE:**  
 As the first 512 bits are compatible with the MIFARE Ultralight® (if configuration is not changed), the MIFARE Ultralight® EV1 can be used in compatibility mode.



# MIFARE ULTRALIGHT® EV1 MF0UL21

The 1312 bit EEPROM memory is organized in 41 pages with 32 bits (4 bytes) each.

- 80 bits are reserved for manufacturer data.
- 48 bits are used for read-only locking mechanism and RFU
- 32 bits are available as OTP area.
- 1024 bits are user programmable read/write.
- 128 bits are used for configuration and password

In addition the EEPROM memory handles 96 bits for counters.

Memory organization of MIFARE Ultralight® EV1 MF0UL21:

Table 2

Bytes Address		Page Address		Byte number within a page				Description
Decimal	Hex	Decimal	Hex	0	1	2	3	
0	0x00	0	0x00	SN0	SN1	SN2	BCC0	Manufacturer data and lock bytes
4	0x04	1	0x01	SN3	SN4	SN5	SN6	
8	0x08	2	0x02	BCC1	Internal	Lock byte 0	Lock byte 1	One Time Programmable
12	0x0C	3	0x03	OTP	OTP	OTP	OTP	
16	0x10	4	0x04	user memory				User memory pages
20	0x14	5	0x05					
...	...	...	...					
136	0x88	34	0x22	Lock bytes 2-4				Lock bytes
140	0x8C	35	0x23					
144	0x90	36	0x24	Lock byte 2	Lock byte 3	Lock byte 4	RFUI	Configuration pages
148	0x94	37	0x25	RFUI	RFUI	RFUI	AUTH0	
152	0x98	38	0x26	ACCESS	VCTID	RFUI	RFUI	Configuration pages
156	0x9C	39	0x27	PWD				
160	0xA0	40	0x28	PACK		RFUI	RFUI	Counter pages
3 one-way counters								

For more details, refer to MIFARE Ultralight® EV1 (MF0ULx1) datasheet.

**NOTE:**

As the first 512 bits are compatible with the MIFARE Ultralight® (if configuration is not changed), the MIFARE Ultralight® can be used in compatibility mode.



# MIFARE® DESFire® MEMORY

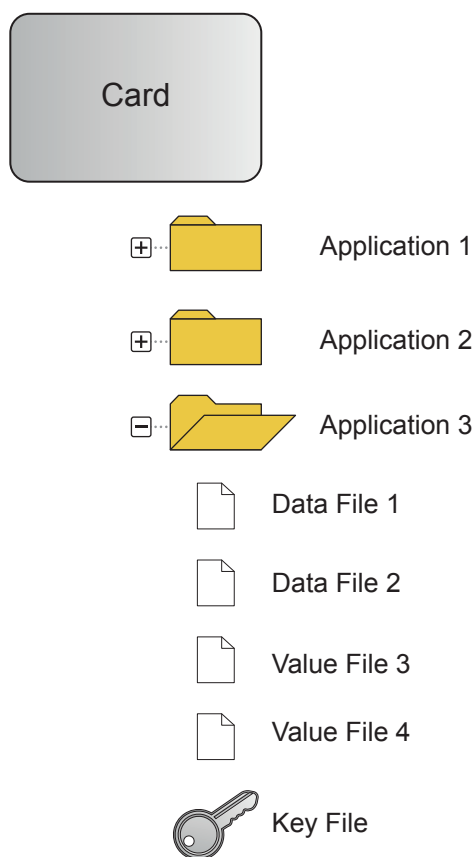
The memory of a DESFire transponder is organized as a flexible file system. The transponder can hold up to 28 applications and each application may contain up to 32 files of different type and size.

Each application can be secured by up to 14 cryptographic keys which are stored in the applications's internal key file. Applications are identified by a number, which must be unambiguous on the transponder.

The same rule applies to files within applications, these are identified by numbers which must be unambiguous within the application.

By default, there exists a root-application with the identifier 0x000000 which defines the so-called transponder level. This application cannot hold any files, it is intended to be used for basic administration of the transponder.

The following figure shown the DESFire memory layout:





# DESFire CONSTANTS DEFINITION

## CryptoEnv

n	DESCRIPTION
00	CRYPTO_ENV0
01	CRYPTO_ENV1
02	CRYPTO_ENV2
03	CRYPTO_ENV3

## KeyType

t	DESCRIPTION
00	DES_KEYTYPE_3DES
02	DES_KEYTYPE_AES
01	DESF_KEYTYPE_3K3DES

## Mode

m	DESCRIPTION
00	DESF_AUTHMODE_COMPATIBLE
01	DESF_AUTHMODE_EV1

## CommSet

c	DESCRIPTION
00	DESF_COMMSET_PLAIN
01	DESF_COMMSET_PLAIN_MACED
03	DESF_COMMSET_FULLY_ENC

## FileType

f	DESCRIPTION
00	DESF_FILETYPE_STDDATAFILE
02	DESF_FILETYPE_VALUEFILE



HF CUSTOM



# COMMANDS LISTED IN ALPHANUMERIC ORDER

0004	27
0008	28
0500	29
0501	30
0B00	31
0B01	32
0B02	33
0C00	34
0C01	35
0C02	36
0C03	37
0C04	38
0C05	39
0C06	40
0C07	41
0C08	42
0C09	43
0C0A	44
0D05	45
0D07	46
0E00	101
0E01	103
0E02	104
0F00	47
0F01	48
0F02	50



0F03	51
0F04	52
0F05	53
0F06	54
0F07	55
0F08	56
0F09	57
0F0A	58
0F0B	59
0F0C	60
0F0D	61
0F0E	62
0F0F	63
0F10	64
0F11	65
0F13	66
0F14	67
0F15	68
0F16	69
0F17	70
0F18	71
0F19	73
0F1A	75
1001	76
1002	77
1200	78



1201	79
1202	80
1203	81
1204	82
1205	83
1206	84
1207	85
1208	86
1209	87
2000	88
2001	89
2002	90
2003	91
2004	92
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2007	95
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2101	97
2200	98
2201	100



# COMMANDS LISTED BY FUNCTION

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## MIFARE CLASSIC® COMMANDS

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0B01	Read memory block	32
0B02	Write memory block	33

## MIFARE ULTRALIGHT® COMMANDS

---

0C00	Read memory page	34
0C01	Write memory page	35
0C02	MIFARE Ultralight® C Authenticate	36
0C03	MIFARE Ultralight® C SAM Authenticate	37
0C04	MIFARE Ultralight® C WriteKey from SAM	38
0C05	MIFARE Ultralight® EV1_Fast read	39



0C06	MIFARE Ultralight® EV1_Inc counter	40
0C07	MIFARE Ultralight® EV1_Read counter	41
0C08	MIFARE Ultralight® EV1_Read sig	42
0C09	MIFARE Ultralight® EV1_Get version	43
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## ISO15693 COMMANDS

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0D05	Read single block	45
0D07	Write single block	46

## DESFIRE COMMANDS

---

0F00	Get application IDs	47
0F01	Create application	48
0F02	Delete application	50
0F03	Select application	51
0F04	Authenticate	52
0F05	Get key Settings	53
0F06	Get file IDs	54
0F07	Get file Settings	55
0F08	Read Data	56
0F09	Write Data	57



0F0A	58
Get Value	
0F0B	59
Credit	
0F0C	60
Debit	
0F0D	61
Limited Credit	
0F0E	62
FreeMem	
0F0F	63
Format TAG	
0F10	64
Create data File	
0F11	65
Create value file	
0F13	66
Delete file	
0F14	67
Commit Transaction	
0F15	68
Abort Transaction	
0F16	69
Get UID	
0F17	70
Get key version	
0F18	71
Change keySettings	
0F19	73
Change key	
0F1A	75
Change FileSettings	

## ISO7816 COMMANDS

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1001	76
Icc PowerOn	
1002	77
Icc PowerOff	



## ISO14443 COMMANDS

---

1200	ISO14443A GetATS	78
1201	ISO14443A GetATQB	79
1202	ISO14443_4 CheckPresence	80
1203	ISO14443_4_TDX	81
1204	ISO14443A GetATQA	82
1205	ISO14443A GetSAK	83
1206	ISO14443B_Get answer to ATTRIB	84
1207	ISO14443_3_TDX	85
1208	ISO14443A_SearchMultiTag	86
1209	ISO14443A_SelectTag	87

## NTAG COMMANDS

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2000	Read memory page	88
2001	Write memory page	89
2002	Fast read memory pages	90
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2004	Read signature command	92
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2006	PwdAuth counter	94



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Read memory block	

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## SAMAVX COMMANDS

---

2200 .....	98
Authenticate host command	

2201 .....	100
Get key entry	

## CRYPTO COMMANDS

---

0E00 .....	101
Init CRYPTO	

0E01 .....	103
Encrypt	

0E02 .....	104
Decrypt	





# SYSTEM COMMANDS

## 0004

### Get version string

---

Valid for	all devices with RFID reader/writer		
[Format]	ASCII	0004FF	<CR>
[Range]			
[Description]	Returns an ASCII string that indicates the version of RFID module.		
[Notes]	<ul style="list-style-type: none"><li>• The answer format is: [00][ASCII string: Version]</li><li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li></ul> <CR> is the non printable character 0x0D.		
[Default]			
[Reference]			
[Example]	To know the rfid module version send command 0004FF		
	The command returns		
	001D54574E342F42312E30332F434346312E35372F505253312E30332F5049		
	where:		
	00	byte that reflects execution of the command	
	1D	the number of the following bytes	
	54574E342F	TWN4/	
	42312E30332F	B1.03/	
	434346312E35372F	CCF1.57/	
	505253312E30332F	PRS1.03/	
	5049	PI	



## 0008

### Get device UID

---

Valid for	all devices with RFID reader/writer		
[Format]	ASCII	0008	<CR>
[Range]			
[Description]	Returns an ASCII string that indicates the device UID.		
[Notes]	<ul style="list-style-type: none"><li>• The answer format is: [00][Byte Array(12): UID]</li><li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li><li>• The UID device is a unique value that define an encoder.</li></ul> <CR> is the non printable character 0x0D.		
[Default]			
[Reference]			
[Example]	To know the device UID send command 0008		
	The command returns		
	002D002F000B47303531353233		
	where		
	00		byte that reflects execution of the command
	2D002F000B47303531353233		UID



# RF COMMANDS

## 0500

### Search tag

---

Valid for	all devices with RFID reader/writer		
-----------	-------------------------------------	--	--

---

[Format]	ASCII	0500FF	<CR>
----------	-------	--------	------

[Range]

[Description] Returns informations about tag that are present in the antenna field.

[Notes]

- The answer format is: [00][Bool: Result][Byte: TagType][Byte: IDBitCount][Byte Array(Var): ID]
- See paragraph [DATA TYPES](#) at the beginning of this manual for the response format and command structure.
- See paragraph [RFID TAG TYPES](#) at the beginning of this manual to get informarion about RFID tag types.
- This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.

<CR> is the non printable character 0x0D.

[Default]

[Reference]

[Example] To search tag send command: 050010

```

where
0500      command
10       nbyte parameter

```

The command returns  
000180200466CF4DC2

```

where:
00      byte that reflects execution of the command
01      result true
80      byte that defined RFID TAG TYPES
20      number of bits of the UID
04      number of bytes of the UID
66CF4DC2  UID of the tag

```



## 0501

### Set RF off

---

Valid for	all devices with RFID reader/writer
-----------	-------------------------------------

---

[Format]	ASCII	0501	<CR>
----------	-------	------	------

[Range]

[Description] Sets power off of the RF antenna.

[Notes]

- The answer format is: [00]
- If it is different from 00, than the operation is not ok.
- The antenna is automatically switched on with the command 0500 to search tag.

<CR> is the non printable character 0x0D.

[Default]

[Reference]

[Example] To power off antenna send command 0501

The command returns 00



# MIFARE CLASSIC® COMMANDS

## 0B00

### Login

Valid for all devices with RFID reader/writer

[Format] ASCII 0B00 k1...k6 kt ss <CR>

[Range] 00 ≤ k1...k6 ≤ FF [Byte Array(6): Key]  
kt = 00, kt = 01 [Byte: KeyType]  
0 ≤ ss ≤ 0F (for MIFARE Classic® 1K) [Byte: Sector]  
0 ≤ ss ≤ 27 (for MIFARE Classic® 4K) [Byte: Sector]

[Description] Authentication of a memory sector for MIFARE Classic® RFID tag.  
k1...k6 are the 6 bytes of the key  
kt is the type of the key as follows:

kt value	key type
00	key A
01	key B

ss is the number of memory sector to authenticate

[Notes] • The answer format is: [00][Bool: Result]  
• See paragraph [DATA TYPES](#) at the beginning of this manual for the response format and command structure.  
• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.  
<CR> is the non printable character 0x0D.

[Default]

[Reference]

[Example] To authenticate the sector 1 send command 0B00A0A1A2A3A4A50000  
where:

0B00	command
FFFFFFFFFFFF	6 bytes of the key (k1...k6)
00	kt = key A
01	authentication of sector 1

The command returns  
0001

where  
00 byte that reflects execution of the command  
01 Result: true





## 0B02

### Write memory block

Valid for	all devices with RFID reader/writer				
[Format]	ASCII	0B02	bb	d1...d16	<CR>
[Range]	00 ≤ bb ≤ 3F		(for MIFARE Classic® 1K)		[Byte: Block]
	00 ≤ bb ≤ FF		(for MIFARE Classic® 4K)		[Byte: Block]
	00 ≤ d1...d16 ≤ FF				[Byte Array(16): Data]
[Description]	Write memory block of authenticated sector for MIFARE Classic® RFID tag.				
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.				
[Default]					
[Reference]					
[Example]	To write the 4th memory send command 0B02040000000000000000000000000000				
	where:				
	0B02		command		
	04		block number (bb)		
	00000000000000000000000000000000		16 bytes of data of the block (d1...d16)		
	The command returns				
	0001				
	where				
	00		byte that reflects execution of the command		
	01		Result: true		



# MIFARE ULTRALIGHT® COMMANDS

## 0C00

### Read memory page

---

Valid for	all devices with RFID reader/writer		
-----------	-------------------------------------	--	--

---

[Format]	ASCII	0C00 pp	<CR>
----------	-------	---------	------

[Range]	00 ≤ pp ≤ 0F	[Byte: Page]
---------	--------------	--------------

[Description]	Reads MIFARE Ultralight® page.
---------------	--------------------------------

[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][Byte Array(16): Data]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	---

[Default]	
-----------	--

[Reference]	
-------------	--

[Example]	To read the 4th memory page send command 0C0004
-----------	---

where:

0C00	command
04	page number

The command returns

000100010203147870672E636F6D3A636172

where

00	byte that reflects execution of the command
01	Result: true
00010203147870672E636F6D3A636172	16 bytes of data of the page (d1...d16)



## 0C01

### Write memory page

---

Valid for	all devices with RFID reader/writer		
[Format]	ASCII	0C01 pp	d1...d4 <CR>
[Range]	00 ≤ pp ≤ 0F		[Byte: Page]
[Description]	Writes MIFARE Ultralight® page. d1...d4 4 bytes of data of the page		
[Notes]	<ul style="list-style-type: none"><li>• The answer format is: [00][Bool: Result]</li><li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li><li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li></ul> <CR> is the non printable character 0x0D.		
[Default]			
[Reference]			
[Example]	To write the 4th memory page send command 0C010400010203		
	where:		
	0C01	command	
	04	page number	
	00010203	4 bytes of data of the page (d1...d4)	
	The command returns		
	0001		
	where		
	00	byte that reflects execution of the command	
	01	Result: true	



## 0C02

### MIFARE Ultralight® C Authenticate

Valid for	all devices with RFID reader/writer		
[Format]	ASCII	0C02 d1...d16	<CR>
[Range]	00 ≤ d1...d16 ≤ FF		[Byte Array(16): Key]
[Description]	Command for authenticate MIFARE Ultralight® C tag d1...d16 16 bytes key		
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.		
[Default]			
[Reference]			
[Example]	To authenticate MIFARE Ultralight® C tag send command 0C0249454D4B41455242214E4143554F5946  where: 0C02 command 49454D4B41455242214E4143554F5946 16 bytes key(d1...d16)  The command returns 0001  where 00 byte that reflects execution of the command 01 Result: true		



## 0C03

### MIFARE Ultralight® C SAM Authenticate

Valid for	all devices with RFID reader/writer					
[Format]	ASCII	0C03	n	k	d1...dz	<CR>
[Range]	00 ≤ n ≤ FF					[Byte: KeyNo]
	00 ≤ k ≤ FF					[Byte: KeyVersion]
	00 ≤ d1...dz ≤ FF					[Byte Array(z): DIVInput]
[Description]	Command for authenticate MIFARE Ultralight® C tag using SAM module.					
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.					
[Default]						
[Reference]						
[Example]	To authenticate MIFARE Ultralight® C tag using SAM send command 0C03010000					
	where:					
	0C03	command				
	01	key number (n)				
	00	Key version (k)				
	00	DIVInput				
	The command returns					
	0001					
	where					
	00	byte that reflects execution of the command				
	01	Result: true				



## 0C04

### MIFARE Ultralight® C WriteKey from SAM

---

Valid for	all devices with RFID reader/writer					
-----------	-------------------------------------	--	--	--	--	--

---

[Format]	ASCII	0C04	n	k	d1...dz	<CR>
----------	-------	------	---	---	---------	------

[Range]	00 ≤ n ≤ FF	[Byte: KeyNo]
	00 ≤ k ≤ FF	[Byte: KeyVersion]
	00 ≤ d1...dz ≤ FF	[Byte Array(z): DIVInput]

[Description]	Write key into MIFARE Ultralight® C tag from SAM module.
---------------	--

[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	---

[Default]	
-----------	--

[Reference]	
-------------	--

[Example]	To write a key into MIFARE Ultralight® C from SAM send command 0C04010000
-----------	---

where:

0C04	command
01	key number (n)
00	Key version (k)
00	DIVInput

The command returns

0000

where

00	byte that reflects execution of the command
00	Result: fail



## 0C05

### MIFARE Ultralight® EV1\_Fast read

Valid for	all devices with RFID reader/writer				
[Format]	ASCII	0C05	sp	np	<CR>
[Range]	00 ≤ sp ≤ FF				[Byte: StartPage]
	00 ≤ np ≤ FF				[Byte: NumberOfPages]
[Description]	Perform fast read for MIFARE Ultralight® EV1 tag				
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][Byte Array(Var): Data]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.				
[Default]					
[Reference]					
[Example]	To perform fast read for MIFARE Ultralight® EV1 tag send command 0C050401				
	where: 0C05            command 04            sp a byte that indicates the start page 01            np a byte that indicates the number of pages to read				
	The command returns 00010400000000				
	where 00            byte that reflects execution of the command 01            Result: true 04            the number of the following bytes 00000000    4 bytes of data (d1...d4)				



## 0C06

### MIFARE Ultralight® EV1\_Inc counter

---

Valid for	all devices with RFID reader/writer			
-----------	-------------------------------------	--	--	--

---

[Format]	ASCII	0C06	n	d	<CR>
----------	-------	------	---	---	------

[Range]	00 ≤ n ≤ FF	[Byte: CounterAddr]
	00000000 ≤ d ≤ FFFFFFFF	[UInt32: IncrValue]

[Description]	Increase counter of MIFARE Ultralight® EV1 tag. d1...d4            4 bytes that define value to increase
---------------	---

[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	---

[Default]	
-----------	--

[Reference]	
-------------	--

[Example]	To increase counter number 0 by one send command 0C060001000000
-----------	---

where:

0C06	command
00	n that specifies the counter address
01000000	4 bytes that specifies the IncrValue

The command returns

0001

where

00	byte that reflects execution of the command
01	Result: true



## 0C07

### MIFARE Ultralight® EV1\_Read counter

Valid for	all devices with RFID reader/writer		
[Format]	ASCII	0C07 n	<CR>
[Range]	00 ≤ n ≤ FF		[Byte: CounterAddr]
[Description]	Read counter of MIFARE Ultralight® EV1 tag.		
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: Response: [00][Bool: Result][UInt32: CounterValue]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.		
[Default]			
[Reference]			
[Example]	To read counter number 0 send command 0C0700		
	where: 0C07            command 00             the counter address (n)		
	The command returns 000102000000		
	where 00             byte that reflects execution of the command 01             Result: true 02000000     4 bytes that specifies the counter value = 2		



## 0C08

### MIFARE Ultralight® EV1\_Read sig

---

Valid for	all devices with RFID reader/writer	
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---

[Format]	ASCII	0C08 <CR>
----------	-------	-----------

[Range]

[Description] Read signature of MIFARE Ultralight® EV1 tag

[Notes]

- The answer format is: [00][Bool: Result][Byte Array(32): ECCSig]
- See paragraph [DATA TYPES](#) at the beginning of this manual for the response format and command structure.
- This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.

<CR> is the non printable character 0x0D.

[Default]

[Reference]

[Example] To read signature of MIFARE Ultralight® EV1 tag send command 0C08

where:

0C08	command
------	---------

The command returns

00013A4F2622AF2039E47F8AA1BF84C52EE949860DD07125BEF75EC417833B80C105

where

00	byte that reflects execution of the command
01	Result: true
...	32 bytes that indicate ECCSig



## 0C09

### MIFARE Ultralight® EV1\_Get version

---

Valid for	all devices with RFID reader/writer	
[Format]	ASCII	0C09 <CR>
[Range]		
[Description]	Get version of MIFARE Ultralight® EV1 tag	
[Notes]	<ul style="list-style-type: none"><li>• The answer format is: Response: [00][Bool: Result][Byte Array(8): Version]</li><li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li><li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li></ul> <CR> is the non printable character 0x0D.	
[Default]		
[Reference]		
[Example]	To get version of MIFARE Ultralight® EV1 tag send command 0C09	
	where:	
	0C09	command
	The command returns 00010004030101000E03	
	where	
	00	byte that reflects execution of the command
	01	Result: true
	0004030101000E03	8 bytes that indicates the version



## 0C0A

### MIFARE Ultralight® EV1\_Pwd Auth

---

Valid for	all devices with RFID reader/writer		
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---

[Format]	ASCII	0C0A	pw	pa	<CR>
----------	-------	------	----	----	------

[Range]	$00000000 \leq pw \leq FFFFFFFF$	[UInt32: Password]
	$0000 \leq pa \leq FFFF$	[UInt16: PwdAck]

[Description]	Authentication of MIFARE Ultralight® EV1 tag with password.
---------------	---

[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	---

[Default]	
-----------	--

[Reference]	
-------------	--

[Example]	To authenticate MIFARE Ultralight® EV1 tag send command 0C0AFFFFFFFF0000
-----------	--

where:

0C0A	command
FFFFFFFF	4 bytes that specifies the password
0000	2 bytes that specifies the PwdAck

The command returns  
0001

where

00	byte that reflects execution of the command
01	(Result: true)



# ISO15693 COMMANDS

## 0D05

### Read single block

---

Valid for	all devices with RFID reader/writer
-----------	-------------------------------------

---

[Format]	ASCII	0D05	n	FF	<CR>
----------	-------	------	---	----	------

[Range]	$0000 \leq n \leq FFFF$	[UInt16: BlockNumber]
---------	-------------------------	-----------------------

[Description]	Read single block of ISO15693 tag.
---------------	------------------------------------

[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][Byte Array(Var): BlockData]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	---

[Default]	
-----------	--

[Reference]	
-------------	--

[Example]	To read 5th memory block send command 0D050500FF
-----------	--

where:

0D05	command
0500	2 bytes the indicates the block number
FF	1 byte that indicates the buffer size

The command returns

00010400000000

where

00	byte that reflects execution of the command
01	Result: true
04	the number of the following bytes
00000000	4 bytes of data of the block



## 0D07

### Write single block

Valid for	all devices with RFID reader/writer				
[Format]	ASCII	0D07	n	d1...d4	<CR>
[Range]	0000 ≤ n ≤ FFFF		[UInt16: BlockNumber]		
	00 ≤ d1...d4 ≤ FF		[Byte Array(4): BlockData]		
[Description]	Write single block of ISO15693 tag				
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.				
[Default]					
[Reference]					
[Example]	To write 5th memory block send command 0D0705000411223344				
	where: 0D07            command 0500            2 bytes the indicates the block number 11223344       4 bytes of data of the block (d1...d4)				
	The command returns 0001				
	where 00                byte that reflects execution of the command 01                Result: true				



# DES FIRE COMMANDS

## 0F00

### Get application IDs

Valid for	all devices with RFID reader/writer																		
[Format]	ASCII	0F00 n	1C <CR>																
[Range]	00 ≤ n ≤ 03		[Byte: CryptoEnv]																
[Description]	DESFire GetApplicationIDs																		
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][variable number of UInt32: AIDs]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> <li>• Application ID number is received with LSB first. For example, application ID number 00123456 will be received as 56341200.</li> <li>• &lt;CR&gt; is the non printable character 0x0D.</li> </ul>																		
[Default]																			
[Reference]																			
[Example]	To get Application IDs send command 0F0000FF																		
	<p>where:</p> <table> <tr> <td>0F00</td> <td>command</td> </tr> <tr> <td>00</td> <td>1 byte that specifies the CryptoEnv (n)</td> </tr> <tr> <td>1C</td> <td>fixed character</td> </tr> </table> <p>The command returns 0001025634120033221100</p> <p>where:</p> <table> <tr> <td>00</td> <td>byte that reflects execution of the command</td> </tr> <tr> <td>01</td> <td>Result: true</td> </tr> <tr> <td>02</td> <td>number of applications on your tag (ex. 2 applications)</td> </tr> <tr> <td>56341200</td> <td>Application ID 00123456</td> </tr> <tr> <td>33221100</td> <td>Application ID 00112233</td> </tr> </table>			0F00	command	00	1 byte that specifies the CryptoEnv (n)	1C	fixed character	00	byte that reflects execution of the command	01	Result: true	02	number of applications on your tag (ex. 2 applications)	56341200	Application ID 00123456	33221100	Application ID 00112233
0F00	command																		
00	1 byte that specifies the CryptoEnv (n)																		
1C	fixed character																		
00	byte that reflects execution of the command																		
01	Result: true																		
02	number of applications on your tag (ex. 2 applications)																		
56341200	Application ID 00123456																		
33221100	Application ID 00112233																		



# 0F01

## Create application

Valid for	all devices with RFID reader/writer											
[Format]	ASCII	0F01	n	d	c1	c2	c3	c4	c5	k	t	<CR>
[Range]	00 ≤ n ≤ 03					[Byte: CryptoEnv]						
	00000000 ≤ d ≤ FFFFFFFF					[UInt32: AID]						
	0 ≤ c1 ≤ F					[4 Bit: ChangeKeyAccessRights]						
	0 ≤ c2 ≤ 1					[1 Bit: ConfigurationChangeable][						
	0 ≤ c3 ≤ 1					[1 Bit: FreeCreateDelete]						
	0 ≤ c4 ≤ 1					[1 Bit: FreeDirectoryList]						
	0 ≤ c5 ≤ 1					[1 Bit: AllowChange-MasterKey]						
	00000000 ≤ k ≤ FFFFFFFF					[UInt32: NumberOfKeys]						
	t = 00000000, t = 02000000, t = 01000000					[UInt32: KeyType]						
[Description]	DESFire CreateApplication											
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.											
[Default]												
[Reference]												



[Example]

To create application send command 0F010056341200F010000000000000

where:

- 0F01            command
- 00             1 byte that specifies the CryptoEnv (n)
- 56341200      4 bytes that specifies the Application ID 00123456
- 0F             1 byte see table below:

BIT	ON	ASCII	DESCRIPTION
0	Off	00	AllowChange-MasterKey = False
	On	01	AllowChange-MasterKey = True
1	Off	00	FreeDirectoryList = False
	On	02	FreeDirectoryList = True
2	Off	00	FreeCreateDelete = False
	On	04	FreeCreateDelete = True
3	Off	00	ConfigurationChangeable = False
	On	08	ConfigurationChangeable = True
4, 5, 6, 7	Off	00	ChangeKeyAccessRights = False
	On	F0	ChangeKeyAccessRights = True

- 01000000      4 bytes that specifies the NumberOfKeys
- 00000000      4 bytes that specifies the KeyType

The command returns

0001

where:

- 00             byte that reflects execution of the command
- 01             Result: true



## 0F02

### Delete application

---

Valid for	all devices with RFID reader/writer		
-----------	-------------------------------------	--	--

---

[Format]	ASCII	0F02	n	d	<CR>
----------	-------	------	---	---	------

[Range]	00 ≤ n ≤ 03	[Byte: CryptoEnv]
	00000000 ≤ d ≤ FFFFFFFF	[UInt32: AID]

[Description]	DESFire Delete application
---------------	----------------------------

[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	---

[Default]	
-----------	--

[Reference]	
-------------	--

[Example]	To delete application with ID 00123456 send command 0F020056341200
-----------	--

where:

0F02	command
00	1 byte that specifies the CryptoEnv (n)
56341200	4 bytes that specifies the Application ID 00123456 (d)

The command returns

0001

where

00	byte that reflects execution of the command
01	Result: true



## 0F03

### Select application

Valid for	all devices with RFID reader/writer		
[Format]	ASCII	0F03 n d	<CR>
[Range]	00 ≤ n ≤ 03 00000000 ≤ d ≤ FFFFFFFF	[Byte: CryptoEnv] [UInt32: AID]	
[Description]	DESFire Select application		
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.		
[Default]			
[Reference]			
[Example]	To select application with ID 00123456 send command 0F030056341200  where: 0F03            command 00             1 byte that specifies the CryptoEnv (n) 56341200      4 bytes that specifies the Application ID 00123456 (d)  The command returns 0001  where 00             byte that reflects execution of the command 01             Result: true		



## 0F05

### Get key Settings

Valid for	all devices with RFID reader/writer		
[Format]	ASCII	0F05 n	<CR>
[Range]	00 ≤ n ≤ 03		[Byte: CryptoEnv]
[Description]	DESFire GetKeySettings		
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][Byte: KeySettings][UInt32: NumberOfKeys][UInt32: KeyType]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.		
[Default]			
[Reference]			
[Example]	To get key settings send command 0F0500		

where:

0F05            command  
00              1 byte that specifies the CryptoEnv (n)

The command returns  
00010F0100000000000000

where:

00              byte that reflects execution of the command  
01              Result: true  
0F              1 byte that indicates the KeySettings, see table below:

BIT	ON	ASCII	DESCRIPTION
0	Off	00	AllowChange-MasterKey = False
	On	01	AllowChange-MasterKey = True
1	Off	00	FreeDirectoryList = False
	On	02	FreeDirectoryList = True
2	Off	00	FreeCreateDelete = False
	On	04	FreeCreateDelete = True
3	Off	00	ConfigurationChangeable = False
	On	08	ConfigurationChangeable = True
4, 5, 6, 7	Off	00	ChangeKeyAccessRights = False
	On	F0	ChangeKeyAccessRights = True

01000000        4 bytes that specifies the NumberOfKeys  
00000000        4 bytes that specifies the KeyType (t)



## 0F06

### Get file IDs

Valid for	all devices with RFID reader/writer			
[Format]	ASCII	0F06	n	FF <CR>
[Range]	00 ≤ n ≤ 03		[Byte: CryptoEnv]	
[Description]	DESFire GetFileIDs			
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][variable number of Bytes: FileIDList]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.			
[Default]				
[Reference]				
[Example]	To get file IDs of selected application send command 0F0600FF  where: 0F06            command 00             1 byte that specifies the CryptoEnv (n) FF             fixed character  The command returns 00010101  where: 00             byte that reflects execution of the command 01             Result: true 01             number of files in the selected application 01             file ID			





# 0F08

## Read Data

Valid for	all devices with RFID reader/writer							
[Format]	ASCII	0F08	n	m	s1	k	c	<CR>
[Range]	00 ≤ n ≤ 03			[Byte: CryptoEnv]				
	00 ≤ m ≤ 20			[Byte: FileNo]				
	0000 ≤ s1 ≤ FFFF			[UInt16: Offset]				
	0 ≤ k ≤ FF			[Byte: Length]				
	c = 00, c = 01, c = 03			[Byte: CommSet]				
[Description]	DESFire ReadData							
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][Byte Array(Var): Data]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.							
[Default]								
[Reference]								
[Example]	To read data from a Data File send command 0F08000000000300							
	where: 0F08            command 00             1 byte that specifies the CryptoEnv (n) 00             1 byte that specifies the FileNo (m) 0000          2 bytes that specifies the Offset (s1) 03             1 byte that specifies the Length (k) 00             1 byte that specifies the CommSet (c)							
	The command returns 000103001122							
	where: 00             byte that reflects execution of the command 01             Result: true 03             the number of the following bytes 001122        3 bytes that specifies the Data							



## 0F09

### Write Data

Valid for	all devices with RFID reader/writer								
[Format]	ASCII	0F08	n	m	s1	k	d1...dk	c	<CR>
[Range]	00 ≤ n ≤ 03								[Byte: CryptoEnv]
	00 ≤ m ≤ 20								[Byte: FileNo]
	0000 ≤ s1 ≤ FFFF								[UInt16: Offset]
	00 ≤ k ≤ FF								[Byte: Length]
	00 ≤ d1...dk ≤ FF								[Byte Array(k): Data]
	c = 00, c = 01, c = 03								[Byte: CommSet]
[Description]	DESFire WriteData								
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.								
[Default]									
[Reference]									
[Example]	To write data into a Data File send command 0F09000000000300112200								
	where:								
	0F09	command							
	00	1 byte that specifies the CryptoEnv (n)							
	00	1 byte that specifies the FileNo (m)							
	0000	2 bytes that specifies the Offset (s1)							
	03	1 byte that specifies the Length (k)							
	001122	3 bytes that specifies the Data (d1...d3)							
	00	1 byte that specifies the CommSet (c)							
	The command returns								
	0001								
	where:								
	00	byte that reflects execution of the command							
	01	Result: true							



# 0F0A

## Get Value

Valid for	all devices with RFID reader/writer					
[Format]	ASCII	0F0A	n	m	c	<CR>
[Range]	00 ≤ n ≤ 03					[Byte: CryptoEnv]
	00 ≤ m ≤ 20					[Byte: FileNo]
	c = 00, c = 01, c = 03					[Byte: CommSet]
[Description]	DESFire GetValue					
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][UInt32: Value]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.					
[Default]						
[Reference]						
[Example]	To get value from a Value File send command 0F0A000000					
	where: 0F0A            command 00             1 byte that specifies the CryptoEnv (n) 00             1 byte that specifies the FileNo (m) 00             1 byte that specifies the CommSet (c)					
	The command returns 000100000000					
	where: 00             byte that reflects execution of the command 01             Result: true 00000000     4 bytes that indicates the value					



# 0F0B

## Credit

Valid for	all devices with RFID reader/writer						
[Format]	ASCII	0F0B	n	m	d	c	<CR>
[Range]	00 ≤ n ≤ 03						[Byte: CryptoEnv]
	00 ≤ m ≤ 20						[Byte: FileNo]
	00000000 ≤ d ≤ FFFFFFFF						[UInt32: Value]
	c = 00, c = 01, c = 03						[Byte: CommSet]
[Description]	DESFire Credit						
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This operation is confirmed after sending the command Commit Transaction and it is cancelled after sending the command Abort Transaction.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.						
[Default]							
[Reference]	0F14, 0F15						
[Example]	To increase value of a value file send command 0F0B00010100000000 where: 0F0B            command 00              1 byte that specifies the CryptoEnv (n) 01              1 byte that specifies the FileNo (m) 01000000      4 bytes that specifies the value 00              1 byte that specifies the CommSet (c)						
	The command returns 0001  where: 00              byte that reflects execution of the command 01              Result: true						



# 0F0C

## Debit

Valid for	all devices with RFID reader/writer																				
[Format]	ASCII	0F0C	n	m	d	c	<CR>														
[Range]	00 ≤ n ≤ 03						[Byte: CryptoEnv]														
	00 ≤ m ≤ 20						[Byte: FileNo]														
	00000000 ≤ d ≤ FFFFFFFF						[UInt32: Value]														
	c = 00, c = 01, c = 03						[Byte: CommSet]														
[Description]	DESFire Debit																				
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This operation is confirmed after sending the command Commit Transaction and it is cancelled after sending the command Abort Transaction.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.																				
[Default]																					
[Reference]	0F14, 0F15																				
[Example]	To decrease value of a Value File send command 0F0C00010100000000 where: <table border="0" style="margin-left: 20px;"> <tr> <td>0F0C</td> <td>command</td> </tr> <tr> <td>00</td> <td>1 byte that specifies the CryptoEnv (n)</td> </tr> <tr> <td>01</td> <td>1 byte that specifies the FileNo (m)</td> </tr> <tr> <td>01000000</td> <td>4 bytes that specifies the value</td> </tr> <tr> <td>00</td> <td>1 byte that specifies the CommSet (c)</td> </tr> </table> The command returns 0001  where: <table border="0" style="margin-left: 20px;"> <tr> <td>00</td> <td>byte that reflects execution of the command</td> </tr> <tr> <td>01</td> <td>Result: true</td> </tr> </table>							0F0C	command	00	1 byte that specifies the CryptoEnv (n)	01	1 byte that specifies the FileNo (m)	01000000	4 bytes that specifies the value	00	1 byte that specifies the CommSet (c)	00	byte that reflects execution of the command	01	Result: true
0F0C	command																				
00	1 byte that specifies the CryptoEnv (n)																				
01	1 byte that specifies the FileNo (m)																				
01000000	4 bytes that specifies the value																				
00	1 byte that specifies the CommSet (c)																				
00	byte that reflects execution of the command																				
01	Result: true																				



# 0F0D

## Limited Credit

Valid for	all devices with RFID reader/writer						
[Format]	ASCII	0F0D	n	m	d	c	<CR>
[Range]	00 ≤ n ≤ 03						[Byte: CryptoEnv]
	00 ≤ m ≤ 20						[Byte: FileNo]
	00000000 ≤ d ≤ FFFFFFFF						[UInt32: Value]
	c = 00, c = 01, c = 03						[Byte: CommSet]
[Description]	DESFire LimitedCredit						
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.						
[Default]							
[Reference]							
[Example]	To set limit credit of a Value File send command 0F0D00040000000000						
	where:						
	0F0D	command					
	00	1 byte that specifies the CryptoEnv (n)					
	04	1 byte that specifies the FileNo (m)					
	00000000	4 bytes that specifies the value					
	00	1 byte that specifies the CommSet (c)					
	The command returns						
	0001						
	where:						
	00	byte that reflects execution of the command					
	01	Result: true					



# 0F0E

## FreeMem

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Valid for	all devices with RFID reader/writer
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[Format]            ASCII            0F0E n            <CR>

[Range]            00 ≤ n ≤ 03                            [Byte: CryptoEnv]

[Description]        DESFire FreeMem

[Notes]

- The answer format is: [00][Bool: Result][UInt16: FreeMemory]
- See paragraph [DATA TYPES](#) at the beginning of this manual for the response format and command structure.
- See paragraph [DESFire CONSTANTS DEFINITION](#) at the beginning of this manual to get information about DESFire constants.
- This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.

<CR> is the non printable character 0x0D.

[Default]

[Reference]

[Example]            To get the quantity of free memrory send the command 0F0E00

where:

0F0E            command  
00                1 byte that specifies the CryptoEnv (n)

The command returns  
0001601E

where:

00                byte that reflects execution of the command  
01                (Result: true)  
601E             2 bytes that specifies the amount of free memory (ex. 1E60 = FreeMemory is 7776)



## 0F0F

### Format TAG

Valid for	all devices with RFID reader/writer		
[Format]	ASCII	0F0F n	<CR>
[Range]	00 ≤ n ≤ 03		[Byte: CryptoEnv]
[Description]	DESFire FormatTag		
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.		
[Default]			
[Reference]			
[Example]	To format TAG send command 0F0F		
	where		
	0F0F	Command	
	00	1 byte that specifies the CryptoEnv (n)	
	The command returns		
	0001		
	where:		
	00	byte that reflects execution of the command	
	01	Result: true	





## 0F11

### Create value file

Valid for	all devices with RFID reader/writer											
[Format]	ASCII	0F11	n	m	02	c	r	L	U	d	g	<CR>
[Range]	00 ≤ n ≤ 03											[Byte: CryptoEnv]
	00 ≤ m ≤ 20											[Byte: FileNo]
	02											[Byte: FileType]
	c = 00, c = 01, c = 03											[Byte: CommSet]
	0000 ≤ r ≤ FFFF											[UInt16: Access-Rights]
	00000000 ≤ L ≤ FFFFFFFF											[UInt32: LowerLimit]
	00000000 ≤ U ≤ FFFFFFFF											[UInt32: UpperLimit]
	00000000 ≤ d ≤ FFFFFFFF											[UInt32: LimitedCreditValue]
	g = 01000000, g = 00000000											[UInt32: LimitedCreditEnabled]
[Description]	DESFire CreateValueFile											
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.											
[Default]												
[Reference]												
[Example]	To create value file send command 0F1100010200EEEE000000000F0000000F00000001000000											
	where:											
	0F11	command										
	00	1 byte that specifies the CryptoEnv (n)										
	01	1 byte that specifies the FileNo (m)										
	02	1 byte fixed value that specifies the FileType										
	00	1 byte that specifies the CommSet (c)										
	EEEE	2 bytes that specifies the Access-Rights (r)										
	00000000	4 bytes that specifies the LowerLimit (L)										
	0F000000	4 bytes that specifies the UpperLimit (U)										
	0F000000	4 bytes that specifies the LimitedCreditValue (d)										
	01000000	4 bytes that specifies the LimitedCreditEnabled (g)										
	The command returns											
	0001											
	where											
	00	byte that reflects execution of the command										
	01	Result: true										



# 0F13

## Delete file

Valid for	all devices with RFID reader/writer				
[Format]	ASCII	0F13	n	m	<CR>
[Range]	00 ≤ n ≤ 03				[Byte: CryptoEnv]
	00 ≤ m ≤ 20				[Byte: FileNo]
[Description]	DESFire DeleteFile				
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.				
[Default]					
[Reference]					
[Example]	To delete file of selected application send command 0F130001				
	where 0F13            command 00            1 byte that specifies the CryptoEnv (n) 01            1 byte that specifies the FileNo (m)				
	The command returns 0001  where 00            byte that reflects execution of the command 01            Result: true				



## 0F14

### Commit Transaction

Valid for	all devices with RFID reader/writer		
[Format]	ASCII	0F14 n	<CR>
[Range]	00 ≤ n ≤ 03		[Byte: CryptoEnv]
[Description]	DESFire Commit transaction		
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.		
[Default]			
[Reference]			
[Example]	To commit transaction for a Value File send command 0F1400		
	where		
	0F14	Command	
	00	1 byte that specifies the CryptoEnv (n)	
	The command returns		
	0001		
	where:		
	00	byte that reflects execution of the command	
	01	Result: true	



# 0F15

## Abort Transaction

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Valid for	all devices with RFID reader/writer		
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[Format]	ASCII	0F15	n	<CR>
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[Range]	00 ≤ n ≤ 03	[Byte: CryptoEnv]
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[Description]	DESFire AbortTransaction
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[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	---

[Default]	
-----------	--

[Reference]	
-------------	--

[Example]	To abort transaction of a Value File send command 0F1500
-----------	--

where	
0F15	Command
00	1 byte that specifies the CryptoEnv (n)

The command returns  
0001

where:	
00	byte that reflects execution of the command
01	Result: true



# 0F16

## Get UID

Valid for	all devices with RFID reader/writer				
[Format]	ASCII	0F16	n	FF	<CR>
[Range]	00 ≤ n ≤ 03		[Byte: CryptoEnv]		
[Description]	DESFire GetUID				
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][Byte Array(Var): UID]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.				
[Default]					
[Reference]					
[Example]	To get UID of the tag send command 0F1600FF				
	where 0F16                      Command 00                        1 byte that specifies the CryptoEnv (n) FF                        fixed character				
	The command returns 000107043515B2F13680				
	where: 00                        byte that reflects execution of the command 01                        Result: true 07                        the number of the following bytes 043515B2F13680        7 bytes that specifies the UID				



## 0F17

### Get key version

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Valid for	all devices with RFID reader/writer				
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[Format]	ASCII	0F17	n	k	<CR>
----------	-------	------	---	---	------

[Range]	00 ≤ n ≤ 03	[Byte: CryptoEnv]
	00 ≤ k ≤ 0E	[Byte: KeyNo]

[Description]	DESFire GetKeyVersion
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[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][Byte Array(1): KeyVersion]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	--

[Default]	
-----------	--

[Reference]	
-------------	--

[Example]	To get the key version send command 0F170000
-----------	--

where

0F17	command
00	1 byte that specifies the CryptoEnv (n)
00	1 byte that specifies the KeyNo (k)

The command returns  
000100

where

00	byte that reflects execution of the command
01	Result: true
00	1 byte that specifies the KeyType (t)



# 0F18

## Change keySettings

Valid for all devices with RFID reader/writer

[Format] ASCII 0F18 n c1 c2 c3 c4 c5 k t <CR>

[Range]

00 ≤ n ≤ 03	[Byte: CryptoEnv]
0 ≤ c1 ≤ F	[4 Bit: ChangeKeyAccessRights]
0 ≤ c2 ≤ 1	[1 Bit: ConfigurationChangeable]
0 ≤ c3 ≤ 1	[1 Bit: FreeCreateDelete]
0 ≤ c4 ≤ 1	[1 Bit: FreeDirectoryList]
0 ≤ c5 ≤ 1	[1 Bit: AllowChange-MasterKey]
00000000 ≤ k ≤ FFFFFFFF	[UInt32: NumberOfKeys]
t = 00000000, t = 02000000, t = 01000000	[UInt32: KeyType]

[Description] DESFire Change Key settings

[Notes]

- The answer format is: [00][Bool: Result]
- See paragraph [DATA TYPES](#) at the beginning of this manual for the response format and command structure.
- See paragraph [DESFire CONSTANTS DEFINITION](#) at the beginning of this manual to get information about DESFire constants.
- This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.

<CR> is the non printable character 0x0D.

[Default]

[Reference]

[Example] To change key settings send command 0F1800F00000000000000000

where

0F18	Command
00	1 byte that specifies the CryptoEnv (n)
0F	1 byte see table below:

BIT	ON	ASCII	DESCRIPTION
0	Off	00	AllowChange-MasterKey = False
	On	01	AllowChange-MasterKey = True
1	Off	00	FreeDirectoryList = False
	On	02	FreeDirectoryList = True
2	Off	00	FreeCreateDelete = False
	On	04	FreeCreateDelete = True
3	Off	00	ConfigurationChangeable = False
	On	08	ConfigurationChangeable = True
4, 5, 6, 7	Off	00	ChangeKeyAccessRights = False
	On	F0	ChangeKeyAccessRights = True

00000000	4 bytes that specifies the NumberOfKeys (k)
00000000	4 bytes that specifies the KeyType (t)



The command returns

0001

where:

00

byte that reflects execution of the command

01

Result: true





where:

00

byte that reflects execution of the command

01

Result: true



## 0F1A

### Change FileSettings

Valid for	all devices with RFID reader/writer							
[Format]	ASCII	0F1A	n	m	c	r1	r2	<CR>
[Range]	00 ≤ n ≤ 03			[Byte: CryptoEnv]				
	00 ≤ m ≤ 20			[Byte: FileNo]				
	c = 00, c = 01, c = 03			[Byte: CommSet]				
	0000 ≤ r1 ≤ FFFF			[UInt16: OldAccess-Rights]				
	0000 ≤ r2 ≤ FFFF			[UInt16: NewAccessRights]				
[Description]	DESFire ChangeFileSettings							
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• See paragraph <a href="#">DESFire CONSTANTS DEFINITION</a> at the beginning of this manual to get information about DESFire constants.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.							
[Default]								
[Reference]								
[Example]	To change file setting of File number 1 send command 0F1A000100EEEE0000							
	where 0F1A            Command 00             1 byte that specifies the CryptoEnv (n) 01             1 byte that specifies the FileNo (m) 00             1 byte that specifies the CommSet (c) EEEE          2 bytes that specifies the OldAccess-Rights (r1) 0000          2 bytes that specifies the NewAccessRights (r2)							
	The command returns 0001							
	where: 00                            byte that reflects execution of the command 01                            Result: true							



# ISO7816 COMMANDS

## 1001

### Icc PowerOn

Valid for all devices with RFID reader/writer

[Format] ASCII 1001 c FF 00 <CR>

[Range]  $20 \leq c \leq 21$  [Byte: Channel]

[Description] Power on SAM channel where c is the channel number as follows:

c value	channel number
20	SAM 1
21	SAM 2

[Notes]

- The answer format is: [00][Bool: Result][Byte Array(Var): ATR][Byte: bStatus][Byte: bError]
- See paragraph [DATA TYPES](#) at the beginning of this manual for the response format and command structure.
- This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.

<CR> is the non printable character 0x0D.

[Default]

[Reference]

[Example] To power on the SAM 1 channel send command 100120FF00

where:

1000	command
20	1 byte Byte: Channel (c)
FF	1 byte MaxATRByteCnt (n)
00	1 byte bPowerSelect (s)

The command returns

00010F3B959680B1FE551FC74772616365130000

where

00	byte that reflects execution of the command
01	Result: true
0F	1 byte that indicates the number of following bytes
3B959680B1FE551FC7477261636513	15 bytes that indicates ATR
0	1 bit that indicates bStatus
0	1 bit that indicates bError



# 1002

## Icc PowerOff

---

Valid for            all devices with RFID reader/writer

---

[Format]            ASCII            1000    c            <CR>

[Range]             $20 \leq c \leq 21$                             [Byte: Channel]

[Description]      Power off SAM channel where c is the channel number as follows:

c value	channel number
20	SAM 1
21	SAM 2

[Notes]

- The answer format is: [00][Bool: Result][Byte Array(3): SlotStatus]
- See paragraph [DATA TYPES](#) at the beginning of this manual for the response format and command structure.
- This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.

<CR> is the non printable character 0x0D.

[Default]

[Reference]

[Example]            To power off the SAM 1 channel send command 100020

where:  
 1000                            command  
 20                                1 byte Byte: Channel (c)

The command returns  
 0001010000

where  
 00                                byte that reflects execution of the command  
 01                                Result: true  
 010000                         3 bytes that indicates the SlotStatus



# ISO14443 COMMANDS

## 1200

### ISO14443A GetATS

---

Valid for	all devices with RFID reader/writer		
-----------	-------------------------------------	--	--

---

[Format]	ASCII	1200	20	<CR>
----------	-------	------	----	------

[Range]

[Description]	ISO14443A GetATS
---------------	------------------

[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][Byte Array(Var): ATS]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	---

[Default]

[Reference]

[Example]	To perform ISO14443A GetATS send command 120020
-----------	---

where:

1200	command
20	1 byte MaxATSByteCnt (c)

The command returns  
000106067577810280

where

00	byte that reflects execution of the command
01	Result: true
06	1 byte that indicates the number of following bytes
067577810280	6 bytes that indicates the ATS



# 1201

## ISO14443A GetATQB

---

Valid for	all devices with RFID reader/writer
-----------	-------------------------------------

---

[Format]	ASCII	1201	FF	<CR>
----------	-------	------	----	------

[Range]

[Description] ISO14443A GetATQB

[Notes]

- The answer format is: [00][Bool: Result][Byte Array(Var): ATQB]
- See paragraph [DATA TYPES](#) at the beginning of this manual for the response format and command structure.
- This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.

<CR> is the non printable character 0x0D.

[Default]

[Reference]

[Example] To perform ISO14443 GetATQB send command 1201FF

where:

1201	command
FF	1 byte MaxATQBByteCnt (c)

The command returns  
00010C5077FB135400000000B37171

where	
00	byte that reflects execution of the command
01	Result: true
0C	1 byte that indicates the number of following bytes
5077FB135400000000B37171	12 bytes that indicates the ATQB



## 1202

### ISO14443\_4 CheckPresence

---

Valid for	all devices with RFID reader/writer		
[Format]	ASCII	1202	<CR>
[Range]			
[Description]	ISO14443_4 CheckPresence		
[Notes]	<ul style="list-style-type: none"><li>• The answer format is: [00][Bool: Result]</li><li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li><li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li></ul> <CR> is the non printable character 0x0D.		
[Default]			
[Reference]			
[Example]	To perform ISO14443_4 CheckPresence send command 1202		
	where:		
	1202		command
	The command returns		
	0001		
	where		
	00		byte that reflects execution of the command
	01		Result: true



# 1203

## ISO14443\_4\_TDX

---

Valid for all devices with RFID reader/writer

---

[Format] ASCII 1203 n c <CR>

[Range] 00 ≤ n ≤ FF [Byte Array(Var): TX]  
 00 ≤ c ≤ FF [Byte: MaxRXByteCnt]

[Description] ISO14443\_4\_TDX

[Notes]

- The answer format is: [00][Bool: Result][Byte Array(Var): RX]
- See paragraph [DATA TYPES](#) at the beginning of this manual for the response format and command structure.
- This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.

<CR> is the non printable character 0x0D.

[Default]

[Reference]

[Example] To perform ISO14443\_4\_TDX send command 1203016020

where:

1203	command
01	1 byte that indicates the number of following bytes
60	1 byte that indicates TX (n)
20	1 byte that indicates the MaxRXByteCnt (c)

The command returns  
0001026F00

where

00	byte that reflects execution of the command
01	Result: true
02	1 byte that indicates the number of following bytes
6F00	2 bytes that indicates the RX





## 1205

### ISO14443A GetSAK

---

Valid for	all devices with RFID reader/writer		
[Format]	ASCII	1205	<CR>
[Range]			
[Description]	ISO14443A GetSAK		
[Notes]	<ul style="list-style-type: none"><li>• The answer format is: [00][Bool: Result][Byte Array(1): SAK]</li><li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li><li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li></ul> <CR> is the non printable character 0x0D.		
[Default]			
[Reference]			
[Example]	To perform ISO14443A GetSAK send command 1205		
	where:		
	1205		command
	The command returns		
	000120		
	where		
	00		byte that reflects execution of the command
	01		Result: true
	20		1 byte that indicates the SAK



# 1206

## ISO14443B\_Get answer to ATTRIB

---

Valid for	all devices with RFID reader/writer
-----------	-------------------------------------

---

[Format]	ASCII	1206	FF	<CR>
----------	-------	------	----	------

[Range]

[Description]	ISO14443B_GetAnswerToATTRIB
---------------	-----------------------------

[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][Byte Array(Var): AnswerToATTRIB]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	--

[Default]

[Reference]

[Example]	To perform ISO14443B_GetAnswerToATTRIB send command 1206FF
-----------	--

where:

1206	command
FF	1 byte MaxAnswerToATTRIBByteCnt (c)

The command returns  
00010100

where

00	byte that reflects execution of the command
01	Result: true
01	1 byte that indicates the number of following bytes
00	1 byte that indicates the AnswerToATTRIB



# 1207

## ISO14443\_3\_TDX

---

Valid for                    all devices with RFID reader/writer

---

[Format]                    ASCII                    1207    n            d1...dn            FF    FF00    <CR>

[Range]                    01 ≤ n ≤ FF                    [Byte: number of bytes of TX]  
 00 ≤ d1...dn ≤ FF                    [Byte Array(Var): TX]

[Description]            ISO14443\_3\_TDX  
 d1...dn                    n bytes of data

[Notes]                    • The answer format is: [00][Bool: Result][Byte Array(Var): RX]  
 • See paragraph [DATA TYPES](#) at the beginning of this manual for the response format and command structure.  
 • This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.  
 <CR> is the non printable character 0x0D.

[Default]

[Reference]

[Example]                    To perform ISO14443\_3\_TDX send command 1207041A004176FFFF00

where:

1207	command
04	1 byte that indicates the number of following bytes
1A004176	4 bytes that indicates the TX (n)
FF	1 byte that indicates the MaxRXByteCnt (c)
FF00	2 bytes that indicates the Timeout (t)

The command returns  
 00010104

where

00	byte that reflects execution of the command
01	Result: true
01	1 byte that indicates the number of following bytes
04	6 bytes that indicates the RX



# 1208

## ISO14443A\_SearchMultiTag

---

Valid for	all devices with RFID reader/writer
-----------	-------------------------------------

---

[Format]	ASCII	1208	FF	<CR>
----------	-------	------	----	------

[Range]

[Description]	ISO14443A_SearchMultiTag
---------------	--------------------------

[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][Byte: UIDCnt][variable number of Bytes: UIDList]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	--

[Default]

[Reference]

[Example]	To perform ISO14443A_SearchMultiTag send command 1208FF
-----------	---

where:

1208	command
FF	1 byte MaxUIDListByteCnt (c)

The command returns

000103180704D7A79A97378007042DA79A973780070450A79A973780

where

00	byte that reflects execution of the command
01	Result: true
031807	3 bytes that indicates the UIDCnt 3
04D7A79A973780, 042DA79A973780,0450A79A973780	3 groups of 7 bytes each that indicates the UIDList



# 1209

## ISO14443A\_SelectTag

---

Valid for	all devices with RFID reader/writer				
-----------	-------------------------------------	--	--	--	--

---

[Format]	ASCII	1209	n	d1...dn	<CR>
----------	-------	------	---	---------	------

[Range]	01 ≤ n ≤ FF	[Byte: number of bytes of UID]
	00 ≤ d1...dn ≤ FF	[Byte Array(Var): UID]

[Description]	ISO14443A_SelectTag d1...dn
---------------	--------------------------------

[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	---

[Default]	
-----------	--

[Reference]	
-------------	--

[Example]	To perform ISO14443A_SelectTag send command 12090704D7A79A973780
-----------	--

where:

1209	command
07	1 byte that indicates the number of following bytes
04D7A79A973780	7 bytes that indicates the UID

The command returns  
0001

where

00	byte that reflects execution of the command
01	Result: true



# NTAG COMMANDS

## 2000

### Read memory page

---

Valid for all devices with RFID reader/writer

---

[Format] ASCII 2000 p <CR>

[Range] 00 ≤ p ≤ FF [Byte: Page]

[Description] Reads NTAG memory page

[Notes]

- The answer format is: [00][Bool: Result][Byte Array(16): Page]
- See paragraph [DATA TYPES](#) at the beginning of this manual for the response format and command structure.
- This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.

<CR> is the non printable character 0x0D.

[Default]

[Reference]

[Example] To read the 4th page send command 200004

where:

2000  
04

command  
1 byte that indicates the page p to read

The command returns

000103B691028C537091016855016E78702E

where

00  
01

byte that reflects execution of the command  
Result: true

03B691028C537091016855016E78702E

16 bytes that indicates the page read



## 2001

### Write memory page

Valid for	all devices with RFID reader/writer				
[Format]	ASCII	2001	n	d1...d4	<CR>
[Range]	00 ≤ n ≤ FF				[Byte: Page]
	00 ≤ d1...d4 ≤ FF				[Byte Array(4): Data]
[Description]	Write NTAG memory page.				
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.				
[Default]					
[Reference]					
[Example]	To write the 4th memory page send command 20010400000000				
	where: 2001                                    command 04                                        1 byte that indicates the page to write (n) 00000000                                4 bytes that indicates the data of the page (d1...d4)				
	The command returns 0001				
	where 00                                        byte that reflects execution of the command 01                                        Result: true				



## 2002

### Fast read memory pages

Valid for	all devices with RFID reader/writer			
[Format]	ASCII	2002	sp	n <CR>
[Range]	00 ≤ sp ≤ FF			[Byte: StartPage]
	01 ≤ n ≤ FF			[Byte: NumberOfPages]
[Description]	Performs NTAG Fast Read command			
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][Byte Array(Var): Data]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.			
[Default]				
[Reference]				
[Example]	To performs NTAG Fast Read command of the 4th memory page send command 20020401			
	where: 2002                                    command 04                                     1 byte that indicates the Start page (sp) 01                                     1 byte that indicates the Number of pages (n)			
	The command returns 00010403B69102  where 00                                    byte that reflects execution of the command 01                                    Result: true 04                                    1 byte that indicates the number of following bytes 03B69102                            4 byte that indicates the data page read			



## 2003

### Read counter

---

Valid for	all devices with RFID reader/writer		
[Format]	ASCII	2003	<CR>
[Range]			
[Description]	Read counter of NTAG RFID tag		
[Notes]	<ul style="list-style-type: none"><li>• The answer format is: [00][Bool: Result][UInt32: CounterValue]</li><li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li><li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li></ul> <CR> is the non printable character 0x0D.		
[Default]			
[Reference]			
[Example]	To read counter of NTAG RFID tag send command 2003		
	where:		
	2003		command
	The command returns		
	000101000000		
	where		
	00		byte that reflects execution of the command
	01		Result: true
	01000000		4 bytes that indicates the counter value = 1





## 2005

### Get version command

Valid for	all devices with RFID reader/writer		
[Format]	ASCII	2005	<CR>
[Range]			
[Description]	Get version of NTAG RFID		
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][Byte Array(8): Version]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.		
[Default]			
[Reference]			
[Example]	To get version of NTAG RFID send command 2005		
	where:	2005	command
	The command returns 00010004040502011503		
	where	00	byte that reflects execution of the command
		01	Result: true
		0004040502011503	8 bytes that indicates the Version



## 2006

### PwdAuth counter

---

Valid for	all devices with RFID reader/writer				
-----------	-------------------------------------	--	--	--	--

---

[Format]	ASCII	2006	s1	s2	<CR>
----------	-------	------	----	----	------

[Range]	00 ≤ s1 ≤ FF	4 bytes (Password)
	00 ≤ s2 ≤ FF	2 bytes (PwdAck)

[Description]	Authentication of NTAG RFID tag with password.
---------------	--

[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	---

[Default]	
-----------	--

[Reference]	
-------------	--

[Example]	To authenticate NTAG RFID tag send command 2006FFFFFFFF0000
-----------	---

where:

2006	command
FFFFFFFF	4 bytes that indicates the Password
0000	2 bytes that indicates the PwdAck

The command returns

0001

where

00	byte that reflects execution of the command
01	Result: true



## 2007

### Sector select

---

Valid for	all devices with RFID reader/writer		
[Format]	ASCII	2007 n	<CR>
[Range]	00 ≤ n ≤ FF		[Byte: Sector]
[Description]	NTAG Sector select		
[Notes]	<ul style="list-style-type: none"><li>• The answer format is: [00][Bool: Result]</li><li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li><li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li></ul> <CR> is the non printable character 0x0D.		
[Default]			
[Reference]			
[Example]	To select memory sector number 0 send command 200700		
	where:		
	2007		command
	00		1 byte that indicates the Sector (n)
	The command returns		
	0001		
	where		
	00		byte that reflects execution of the command
	01		Result: true



# SRX COMMANDS

## 2100

### Read memory block

---

Valid for	all devices with RFID reader/writer		
-----------	-------------------------------------	--	--

---

[Format]	ASCII	2006	n	<CR>
----------	-------	------	---	------

[Range]	00 ≤ n ≤ FF	[Byte: Block]
---------	-------------	---------------

[Description]	Read memory block for SRX RFID tag
---------------	------------------------------------

[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][Byte Array(4): Data]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	--

[Default]	
-----------	--

[Reference]	
-------------	--

[Example]	To read memory block number 0 send command 210000
-----------	---

where:

2100	command
00	1 byte that indicates the Block (n parameter)

The command returns  
000100000000

where	
00	byte that reflects execution of the command
01	Result: true
00000000	4 bytes that indicates the data of the read block



## 2101

### Write memory block

Valid for	all devices with RFID reader/writer				
[Format]	ASCII	2101	n	d1...d4	<CR>
[Range]	00 ≤ n ≤ FF				[Byte: Block]
	00 ≤ d1...d4 ≤ FF				[Byte Array(4): Data]
[Description]	Write memory block for SRX RFID tag				
[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: 00][Bool: Result]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <CR> is the non printable character 0x0D.				
[Default]					
[Reference]					
[Example]	To write memory block number 0 send command 21010000000000				
	where: 2101                                    command 00                                        1 byte that indicates the Block (n parameter) 00000000                                4 bytes that indicates the data of the block to write (d1...d4)				
	The command returns 0001				
	where 00                                        byte that reflects execution of the command 01                                        Result: true				



# SAMAVX COMMANDS

## 2200

### Authenticate host command

---

Valid for           all devices with RFID reader/writer

---

[Format]            ASCII            2200   n       k       d1...dk       t       <CR>

[Range]            00 ≤ n ≤ 03                           [Byte: CryptoEnv]  
                     00 ≤ k ≤ FF                           [Byte: KeyNo]  
                     00 ≤ d1...dk ≤ FF                   [Byte Array(Var): Key]  
                     t = 00, t = 02                       [Byte: KeyType]

[Description]      SAMAVX AuthenticateHost.

n	DESCRIPTION
00	CRYPTO_ENV0
01	CRYPTO_ENV1
02	CRYPTO_ENV2
03	CRYPTO_ENV3

t	DESCRIPTION
00	DES_KEYTYPE_3DES
02	DES_KEYTYPE_AES

[Notes]            • The answer format is: [00][Bool: Result]  
                     • See paragraph [DATA TYPES](#) at the beginning of this manual for the response format and command structure.  
                     • This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.  
                     <CR> is the non printable character 0x0D.

[Default]

[Reference]        0E00, 0E01, 0E02





# 2201

## Get key entry

---

Valid for	all devices with RFID reader/writer		
-----------	-------------------------------------	--	--

---

[Format]	ASCII	2201	n	<CR>
----------	-------	------	---	------

[Range]	00 ≤ n ≤ FF	[Byte: KeyNo]
---------	-------------	---------------

[Description]	SAMAVX Get key entry
---------------	----------------------

[Notes]	<ul style="list-style-type: none"> <li>• The answer format is: [00][Bool: Result][Byte Array(13): TSAMAVxKeyEntryData]</li> <li>• See paragraph <a href="#">DATA TYPES</a> at the beginning of this manual for the response format and command structure.</li> <li>• This command return True (01) if command is successful, otherwise return False (00) if the operation is not ok.</li> </ul> <p>&lt;CR&gt; is the non printable character 0x0D.</p>
---------	--

[Default]	
-----------	--

[Reference]	
-------------	--

[Example]	To get key from SAM send command 220101
-----------	---

where:	
2201	command
01	1 byte that indicates the KeyNo = 1 (n)

The command returns  
000100010200000000000000FF0C00

where	
00	byte that reflects execution of the command
01	Result: true
00010200000000000000FF0C00	13 bytes that indicates the TSAMAVxKeyEntryData



# CRYPTO COMMANDS

## 0E00

### Init CRYPTO

---

Valid for           all devices with RFID reader/writer

---

[Format]            ASCII            0E00 n        k        d1...d16            <CR>

[Range]            00 ≤ n ≤ 03                            [Byte: CryptoEnv]  
                     00 ≤ k ≤ FF                            [Byte: CryptoMode]  
                     00 ≤ d1...d16 ≤ FF                    [Byte Array(Var): Key]

[Description]      Init CRYPTO variables.

n	DESCRIPTION
00	CRYPTO_ENV0
01	CRYPTO_ENV1
02	CRYPTO_ENV2
03	CRYPTO_ENV3

k	DESCRIPTION
00	CRYPTOMODE_AES128
03	CRYPTOMODE_3DES
04	CRYPTOMODE_3K3DES
05	CRYPTOMODE_CBC_DES
06	CRYPTOMODE_CBC_DFN_DES
07	CRYPTOMODE_CBC_3DES
08	CRYPTOMODE_CBC_DFN_3DES
09	CRYPTOMODE_CBC_3K3DES
0A	CRYPTOMODE_CBC_AES_128

[Notes]            • The answer format is: [00]  
                     • See paragraph [DATA TYPES](#) at the beginning of this manual for the response format and command structure.  
                     <CR> is the non printable character 0x0D.

[Default]

[Reference]



[Example]

To init CRYPTO variables send command 0E0000001000000000000000000000000000000000000000

where:

0E00	command
00	1 byte CryptoEnv (n)
00	1 byte CryptoMode (k)
10	number of following bytes
00	16 bytes of key (d1...d16)

The command returns

00

where

00 byte that reflects execution of the command











# CUSTOM<sup>®</sup>

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