Advanced Card Systems Ltd.
Card & Reader Technologies

ACR38
Smart Card Reader

PC/SC Memory Card Access

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1.0. Introduction

The ACR38 PC-Linked Reader acts as an interface for the communication between a computer and a smart card. Different types of smart cards have different commands and different communication protocols that in most cases, prevents a direct communication between a smart card and a computer. The ACR38 reader establishes a uniform interface from the computer to the smart card for a wide variety of cards. By taking care of the card's specific particulars, it releases the computer software programmer from getting involved with the technical details of the smart card operation which are in many cases, not relevant in the implementation of a smart card system.

This document contains the PC/SC Memory Card Command set for ACR38 Firmware 1.12c and 1.10. The ACR38 Firmware 1.12c is backward compatible with the ACR38 Firmware 1.10 with minor changes to the Memory Card Command Set. In this document, we will refer to the ACR38 with firmware 1.12c as ACR38 FW1.12c while ACR38 with firmware 1.10 will be referred to ACR38 FW1.10.

1.1. Supported Memory Cards

The ACR38 Series supports the following memory cards:

Types of Memory Cards	Firmware 1.10	Firmware 1.12c
1. Cards following the I2Cbus protocol (free memory cards) with maximum 128 bytes page with capability, including: Atmel: AT24C01/02/04/08/16/32/64/128/256/512/1024 SGS-Thomson: ST14C02C, ST14C04C Gemplus: GFM1K, GFM2K, GFM4K, GFM8K	✓	✓
2. Cards with secure memory IC with password and authentication, including: Atmel: AT88SC153 and AT88SC1608	✓	✓
3. Cards with intelligent 1k bytes EEPROM with write-protect function, including: Infineon: SLE4418, SLE4428, SLE5518 and SLE5528	✓	✓
4. Cards with intelligent 256 bytes EEPROM with write-protect function, including: Infineon: SLE4432, SLE4442, SLE5532 and SLE5542	✓	✓
5. Cards with '104' type EEPROM non-reloadable token counter cards, including: Infineon: SLE4406, SLE4436, SLE5536 and SLE6636	✓	✓
6. Cards with Intelligent 416-Bit EEPROM with internal PIN check, including: Infineon: SLE4404	×	✓
7. Cards with Security Logic with Application Zone(s), including: Atmel: AT88SC101, AT88SC102 and AT88SC1003	×	✓

2.0. Memory Card Type Selection

2.1. Memory Card Type Selection for Firmware 1.12c

2.1.1. By Programmatic Method

The SELECT_CARD_TYPE command must be executed first before other memory card commands. This command powers down and up the selected card inserted in the card reader and performs a card reset. This command can only be used after the logical smart card reader communication has been established using the SCardConnect() API. For details of ScardConnect() API, please refer to PC/SC specification. For the Memory Card Command Set for ACR38 FW1.12c, please refer to Section 3.0.

A code snippet for the program flow is given below to demonstrate how to select the memory card type in ACR38 FW1.12c:

```
SCARDCONTEXT hContext;
SCARDHANDLE hCard;
unsigned long dwActProtocol;
SCARD_IO_REQUEST ioRequest;
DWORD size = 64, SendLen = 6, RecvLen = 255, retCode;
byte cardType;

//Establish PC/SC Connection
retCode = SCardEstablishContext (SCARD_SCOPE_USER, NULL, NULL, &hContext);

//List all readers in the system
retCode = SCardListReaders (hContext, NULL, readerName, &size);

//Connect to the reader
retCode = SCardConnect(hContext, readerName, SCARD_SHARE_SHARED,
SCARD_PROTOCOL_T0, &hCard, &dwActProtocol);

//Select Card Type
unsigned char SendBuff[] = {0xFF,0xA4,0x00,0x00,0x01,cardType};
retCode = SCardTransmit( hCard, &ioRequest, SendBuff, SendLen, NULL,
RecvBuff, &RecvLen);

//Disconnect from the reader
retCode = SCardDisconnect(hCard, SCARD_UNPOWER_CARD);

//End the established context
retCode = SCardReleaseContext(hContext);
```

2.2. Memory Card Type Selection for Firmware 1.10

2.2.1. By Property Sheet

User could invoke the reader setting property sheet by selecting “property” of “ACR38 Smart Card Reader” device under the Device Manager. Figure 1 shows the reader setting property sheet.

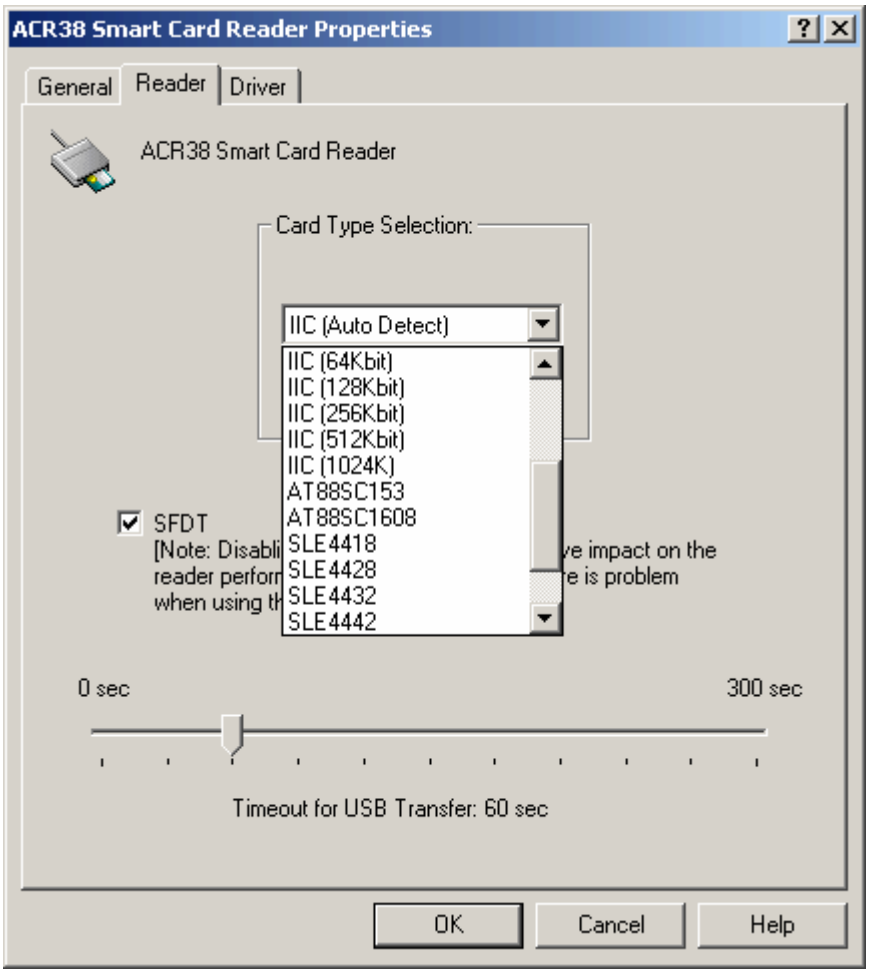


Figure 1: ACR38 Reader Setting Property Sheet

The reader needs to be removed, and then reconnected to the computer in order for the change to take effect.

2.2.2. By Programmatic Method

The card type can also be changed at program run-time using Vendor Specific extension API of PC/SC.

Application programs are required to include the following MACRO in one of the source header file.

```
#define IOCTL_SMARTCARD_SET_CARD_TYPE      SCARD_CTL_CODE(2060)
```

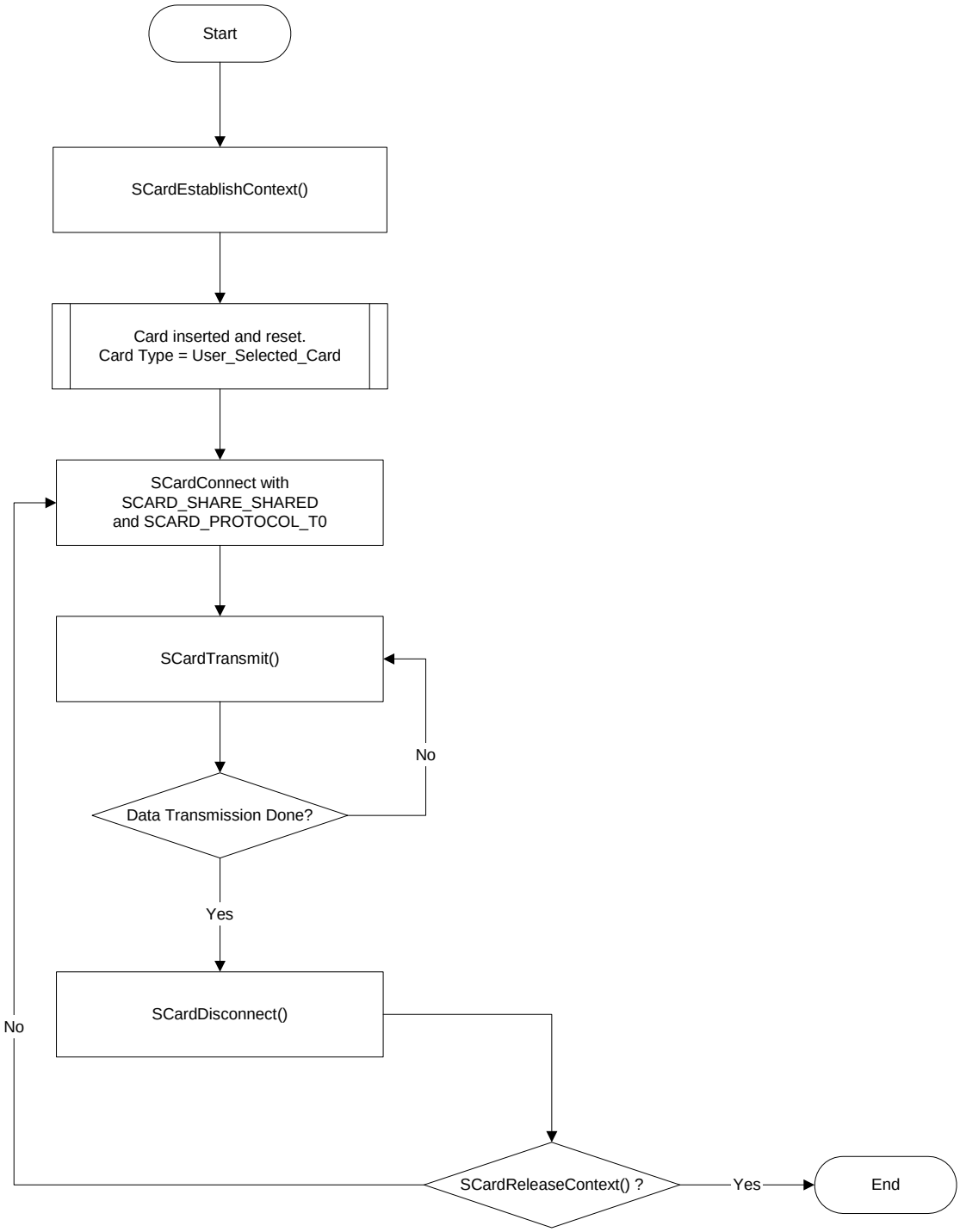
Applications should connect to PC/SC using a `SCARD_SHARE_DIRECT` protocol. After which, invoke the `SCardControl()` and use `IOCTL_SMARTCARD_SET_CARD_TYPE` for the `dwControlCode` parameter to inform the driver of new card type. The input buffer will be a LONG variable storing the desired card type. The return value is either `SCARD_S_SUCCESS` or a WIN32 Error (`ERROR_INSUFFICIENT_BUFFER`).

Example:

```
int main()
{
      long rv;
      long nCardType = 15;    // SLE4418 – refer to inf for more info
      BYTE cbOutBuffer[10];
      SCARDCONTEXT hctx;
      SCARDHANDLE hsc;
      DWORD dwActievProtocol;
      DWORD dwBytesRet;
```

```
        rv = SCardEstablishContext(SCARD_SCOPE_SYSTEM,NULL,NULL,&hctx);
        if (rv != SCARD_S_SUCCESS)
              return rv;

        rv = SCardConnect(
              hctx,
              ”ACS ACR38U 0”,
              SCARD_SHARE_DIRECT,      // This allows apps to connect to
                                       // PC/SC even without card inserted
              0,
              &hsc,
              &dwActiveProtocol);

        if (rv != SCARD_S_SUCCESS)
        {
              // error handling …
              return rv;
        }

        rv = SCardControl(hsc, IOCTL_SMARTCARD_SET_CARD_TYPE,
        &nCardType, sizeof(nCardType), cbOutBuffer, 10,
        &dwBytesRet);

        if ( rv == SCARD_S_SUCCESS && cbOutBuffer[0] == 0x90 &&
        cbOutBuffer[1] == 0x00)
        {
        // OK
        }
        else . . .  // other error handling
        . . .

}
```

2.2.3. Logical Flow of Memory Card Functions



3.0. ACR38 Firmware 1.12c Memory Card Command Set

This section contains the Memory Card Command Set for ACR38 FW1.12c.

3.1. Recollection card – 1, 2, 4, 8 and 18 Kbit I2C Card

3.1.1. SELECT_CARD_TYPE

This command powers down and up the selected card inserted in the card reader and performs a card reset.

> **Note:** This command can only be used after the logical smart card reader communication has been established using the SCardConnect( ) API. For details of ScardConnect( ) API, please refer to PC/SC specification.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FF $_H$	A4 $_H$	00 $_H$	00 $_H$	01 $_H$	01 $_H$

Response Data Format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.1.2. SELECT_PAGE_SIZE

This command will choose the page size to read the smart card. The default value is 8-byte page write. It will reset to default value whenever the card is removed or the reader is powered off.

Command Format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Page Size
FF $_H$	01 $_H$	00 $_H$	00 $_H$	01 $_H$	

Page size = 03 $_H$ for 8-byte page write

= 04 $_H$ for 16-byte page write

= 05 $_H$ for 32-byte page write

= 06 $_H$ for 64-byte page write

= 07 $_H$ for 128-byte page write

Response Data Format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.1.3. READ_MEMORY_CARD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	Byte Address		MEM_L
		MSB	LSB	
FF_H	$B0_H$			

Byte Address Memory address location of the memory card.

MEM_L Length of data to be read from the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1, SW2 = 90_H 00_H if no error

3.1.4. WRITE_MEMORY_CARD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	Byte Address		MEM_L	Byte 1	....	....	Byte n
		MSB	LSB					
FF_H	$D0_H$							

Byte Address Memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

Byte x Data to be written to the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.2. Memory Card – 32, 64, 128, 256, 512, and 1024 Kbit I2C Card

3.2.1. SELECT_CARD_TYPE

This command powers down and up the selected card inserted in the card reader and performs a card reset.

Note: This command can only be used after the logical smart card reader communication has been established using the SCardConnect( ) API. For details of ScardConnect( ) API, please refer to PC/SC specification.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FF_H	$A4_H$	00_H	00_H	01_H	02_H

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.2.2. SELECT_PAGE_SIZE

This command will choose the page size to read the smart card. The default value is 8-byte page write. It will reset to default value whenever the card is removed or the reader is powered off.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Page size
FF_H	01_H	00_H	00_H	01_H	

Data TPDU to be sent to the card

Page size = 03_H for 8-byte page write

= 04_H for 16-byte page write

= 05_H for 32-byte page write

= 06_H for 64-byte page write

= 07_H for 128-byte page write

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.2.3. READ_MEMORY_CARD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	Byte Address		MEM_L
		MSB	LSB	
FF_H				

INS = $B0_H$ for 32,64,128,256,512kbit iic card
= $1011\ 000*_b$ for 1024kbit iic card,
where * is the MSB of the 17 bit addressing

Byte Address Memory address location of the memory card.

MEM_L Length of data to be read from the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1, SW2 = 90_H 00_H if no error

3.2.4. WRITE_MEMORY_CARD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	Byte Address		MEM_L	Byte 1	....	....	Byte n
		MSB	LSB					
FF_H								

INS = $D0_H$ for 32,64,128,256,512kbit iic card
= $1101\ 000*_b$ for 1024kbit iic card,
where * is the MSB of the 17 bit addressing

Byte Address Memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

Byte x Data to be written to the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.3. Memory Card – ATMEL AT88SC153

3.3.1. SELECT_CARD_TYPE

This command powers down and up the selected card inserted in the card reader and performs a card reset. It will also select the page size to be 8-byte page write.

Note: This command can only be used after the logical smart card reader communication has been established using the SCardConnect( ) API. For details of ScardConnect( ) API, please refer to PC/SC specification.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FF_H	$A4_H$	00_H	00_H	01_H	03_H

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.3.2. READ_MEMORY_CARD

Command Format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	P1	Byte Address	MEM_L
FF_H		00_H		

INS = $B0_H$ for reading zone 00_b
= $B1_H$ for reading zone 01_b
= $B2_H$ for reading zone 10_b
= $B3_H$ for reading zone 11_b
= $B4_H$ for reading fuse

Byte Address Memory address location of the memory card.

MEM_L Length of data to be read from the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1, SW2 = 90_H 00_H if no error

3.3.3. WRITE_MEMORY_CARD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	P1	Byte Address	MEM_L	Byte 1	....	....	Byte n
FF_H		00_H						

INS = $D0_H$ for writing zone 00_b

= $D1_H$ for writing zone 01_b

= $D2_H$ for writing zone 10_b

= $D3_H$ for writing zone 11_b

= $D4_H$ for writing fuse

Byte Address Memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

MEM_D Data to be written to the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.3.4. VERIFY_PASSWORD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU							
CLA	INS	P1	P2	Lc	Pw(0)	Pw(1)	Pw(2)
FF_H	20_H	00_H		03_H			

Pw(0),Pw(1),Pw(2) Passwords to be sent to memory card.

P2 = $0000\ 00rp_b$

where the two bits “rp” indicate the password to compare

r = 0 : Write password,

r = 1: Read password,

p: Password set number,

rp = 01 for the secure code.

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2 ErrorCnt
90 H	

SW1 = 90 H

SW2 (ErrorCnt) = Error Counter. FF_H indicates the verification is correct. 00_H indicates the password is locked (exceed maximum number of retries). Other values indicate the current verification is failed.

3.3.5. INITIALIZE_AUTHENTICATION

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	P1	P2	Lc	Q(0)	Q(1)	…	Q(7)
FF H	84 H	00 H	00 H	08 H				

Q(0),Q(1)…Q(7) Host random number, 8 bytes.

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 H 00 H if no error

3.3.6. VERIFY_AUTHENTICATION

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	P1	P2	Lc	Ch(0)	Ch(1)	…	Ch(7)
FF H	82 H	00 H	00 H	08 H				

Ch(0),Ch(1)…Ch(7) Host challenge, 8 bytes.

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 H 00 H if no error

3.4. Memory Card – ATMEL AT88C1608

3.4.1. SELECT_CARD_TYPE

This command powers down and up the selected card inserted in the card reader and performs a card reset. It will also select the page size to be 16-byte page write.

Note: This command can only be used after the logical smart card reader communication has been

established using the `SCardConnect( )` API. For details of `ScardConnect( )` API, please refer to PC/SC specification.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FF $_H$	A4 $_H$	00 $_H$	00 $_H$	01 $_H$	04 $_H$

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.4.2. READ_MEMORY_CARD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	Zone Address	Byte Address	MEM_L
FF $_H$				

INS = B0 $_H$ for reading user zone

= B1 $_H$ for reading configuration zone or reading fuse

Zone Address = 0000 $0A_{10}A_9A_{8\ b}$, where A_{10} is the MSB of zone address

= don't care for reading fuse

Byte Address = $A_7A_6A_5A_4\ A_3A_2A_1A_{0\ b}$ is the memory address location of the memory card.

= 1000 0000 $_b$ for reading fuse

MEM_L Length of data to be read from the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.4.3. WRITE_MEMORY_CARD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	Zone Address	Byte Address	MEM_L	Byte 1	…	…	Byte n
FF $_H$								

INS = D0 $_H$ for writing user zone

= D1 $_H$ for writing configuration zone or writing fuse

Zone Address = 0000 $0A_{10}A_9A_8$ $_b$, where A_{10} is the MSB of zone address

= don't care for writing fuse

Byte Address = $A_7A_6A_5A_4$ $A_3A_2A_1A_0$ $_b$ is the memory address location of the memory card.

= 1000 0000 $_b$ for writing fuse

MEM_L Length of data to be written to the memory card.

Byte x Data to be written to the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.4.4. VERIFY_PASSWORD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	P1	P2	Lc	Data			
FF $_H$	20 $_H$	00 $_H$	00 $_H$	04 $_H$	RP	Pw(0)	Pw(1)	Pw(2)

Pw(0),Pw(1),Pw(2) Passwords to be sent to memory card.

RP = 0000 $rp_2p_1p_0$ $_b$

where the four bits "$rp_2p_1p_0$" indicate the password to compare:

r = 0: Write password,

r = 1: Read password,

$p_2p_1p_0$: Password set number.

($rp_2p_1p_0$ = 0111 for the secure code).

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2 ErrorCnt
90 $_H$	

SW1 = 90 $_H$

SW2 (ErrorCnt) = Error Counter. FF_H indicates the verification is correct. 00 $_H$ indicates the

password is locked (exceed maximum number of retries). Other values indicate the current verification is failed.

3.4.5. INITIALIZE_AUTHENTICATION

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	P1	P2	Lc	Q(0)	Q(1)	…	Q(7)
FF $_H$	84 $_H$	00 $_H$	00 $_H$	08 $_H$				

Byte Address Memory address location of the memory card.

Q(0),Q(1)…Q(7) Host random number, 8 bytes.

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.4.6. VERIFY_AUTHENTICATION

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	P1	P2	Lc	Q1(0)	Q1(1)	…	Q1(7)
FF $_H$	82 $_H$	00 $_H$	00 $_H$	08 $_H$				

Byte Address Memory address location of the memory card.

Q1(0),Q1(1)…Q1(7) Host challenge, 8 bytes.

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.5. Memory Card – SLE 4418 / SLE 4428 / SLE 5518 / SLE 5528

3.5.1. SELECT_CARD_TYPE

This command powers down and up the selected card inserted in the card reader and performs a card reset.

Note: This command can only be used after the logical smart card reader communication has been established using the `SCardConnect( )` API. For details of `ScardConnect( )` API, please refer to PC/SC specification

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FF $_H$	A4 $_H$	00 $_H$	00 $_H$	01 $_H$	05 $_H$

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.5.2. READ_MEMORY_CARD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	Byte Address		MEM_L
		MSB	LSB	
FF $_H$	B0 $_H$			

MSB Byte Address = 0000 00A_9A_8 $_b$ is the memory address location of the memory card.

LSB Byte Address = $A_7A_6A_5A_4$ $A_3A_2A_1A_0$ $_b$ is the memory address location of the memory card.

MEM_L Length of data to be read from the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.5.3. READ_PRESENTATION_ERROR_COUNTER_MEMORY_CARD (SLE 4428 and SLE 5528)

To read the presentation error counter for the secret code.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	P1	P2	MEM_L
FF $_H$	B1 $_H$	00 $_H$	00 $_H$	03 $_H$

Response data format (abData field in the RDR_to_PC_DataBlock)

ERRCNT	DUMMY 1	DUMMY 2	SW1	SW2

ERRCNT The value of the presentation error counter. FF_H indicates the last verification is correct. 00_H indicates the password is locked (exceed maximum number of retries). Other values indicate the last verification is failed.

DUMMY Two bytes dummy data read from the card.

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.5.4. READ_PROTECTION_BIT

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	Byte Address		MEM_L
		MSB	LSB	
FF $_H$	B2 $_H$			

MSB Byte Address = 0000 00A_9A_8 $_b$ is the memory address location of the memory card.

LSB Byte Address = $A_7A_6A_5A_4$ $A_3A_2A_1A_0$ $_b$ is the memory address location of the memory card.

MEM_L Length of protection bits to be read from the card, in multiples of 8 bits. Maximum value is 32.

MEM_L = 1 + INT((number of bits-1)/8)

For example, to read eight protection bits starting from memory 0x0010, the following pseudo-APDU should be issued:

```
0xFF 0xB2 0x00 0x10 0x01
```

Response data format (abData field in the RDR_to_PC_DataBlock)

PROT 1	…	…	PROT L	SW1	SW2

PROT y Bytes containing the protection bits

SW1,SW2 = 90 $_H$ 00 $_H$ if no error

The arrangement of the protection bits in the PROT bytes is as follows:

PROT 1								PROT 2								…							
P8	P7	P6	P5	P4	P3	P2	P1	P16	P15	P14	P13	P12	P11	P10	P9	..	..	..	..	..	..	P18	P17

Px is the protection bit of BYTE x in the response data

'0' byte is write protected

'1' byte can be written

3.5.5. WRITE_MEMORY_CARD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	Byte Address		MEM_L	Byte 1	....	....	Byte N
		MSB	LSB					
FF_H	$D0_H$							

MSB Byte Address = $0000\ 00A_9A_8{}_b$ is the memory address location of the memory card.

LSB Byte Address = $A_7A_6A_5A_4\ A_3A_2A_1A_0{}_b$ is the memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

Byte x Data to be written to the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = $90_H\ 00_H$ if no error

3.5.6. WRITE_PROTECTION_MEMORY_CARD

Each of the bytes specified in the command is internally in the card compared with the byte stored at the specified address and if the data match, the corresponding protection bit is irreversibly programmed to '0'.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	Byte Address		MEM_L	Byte 1	....	....	Byte N
		MSB	LSB					
FF_H	$D1_H$							

MSB Byte Address = $0000\ 00A_9A_8{}_b$ is the memory address location of the memory card.

LSB Byte Address = $A_7A_6A_5A_4\ A_3A_2A_1A_0{}_b$ is the memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

Byte x Byte values to be compared with the data in the card starting at Byte Address. BYTE 1 is compared with the data at Byte Address; BYTE N is compared with the data at (Byte Address+N-1).

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.5.7. PRESENT_CODE_MEMORY_CARD (SLE 4428 and SLE 5528)

To submit the secret code to the memory card to enable the write operation with the SLE 4428 and SLE 5528 card, the following actions are executed:

1. Search a '1' bit in the presentation error counter and write the bit to '0'
2. Present the specified code to the card
3. Try to erase the presentation error counter

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU						
CLA	INS	P1	P2	MEM_L	CODE	
					Byte 1	Byte 2
FF_H	20_H	00_H	00_H	02_H		

CODE Two bytes secret code (PIN)

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2 ErrorCnt
90_H	

SW1 = 90_H

SW2 (ErrorCnt) = Error Counter. FF_H indicates the verification is correct. 00_H indicates the password is locked (exceed maximum number of retries). Other values indicate the current verification is failed.

3.6. Memory Card – SLE 4432 / SLE 4442 / SLE 5532 / SLE 5542

3.6.1. SELECT_CARD_TYPE

This command powers down and up the selected card inserted in the card reader and performs a card reset.

Note: This command can only be used after the logical smart card reader communication has been established using the `SCardConnect( )` API. For details of `ScardConnect( )` API, please refer to PC/SC specification.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FF_H	$A4_H$	00_H	00_H	01_H	06_H

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.6.2. READ_MEMORY_CARD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	P1	Byte Address	MEM_L
FF_H	$B0_H$	00_H		

Byte Address = $A7A6A5A4\ A3A2A1A0_b$ is the memory address location of the memory card.

MEM_L Length of data to be read from the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1, SW2 = 90_H 00_H if no error

3.6.3. READ_PRESENTATION_ERROR_COUNTER_MEMORY_CARD (SLE 4442 and SLE 5542)

This command is used to read the presentation error counter for the secret code.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	P1	P2	MEM_L
FF_H	$B1_H$	00_H	00_H	04_H

Response data format (abData field in the RDR_to_PC_DataBlock)

ERRCNT	DUMMY 1	DUMMY 2	DUMMY 3	SW1	SW2

ERRCNT The value of the presentation error counter. 07_H indicates the last verification is correct. 00_H indicates the password is locked (exceed maximum number of retries). Other values indicate the last verification is failed.

DUMMY Three bytes dummy data read from the card.

SW1, SW2 = 90_H 00_H if no error

3.6.4. READ_PROTECTION_BITS

To read the protection bits for the first 32 bytes.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	P1	P2	MEM_L
FF $_H$	B2 $_H$	00 $_H$	00 $_H$	04 $_H$

Response data format (abData field in the RDR_to_PC_DataBlock)

PROT 1	PROT 2	PROT3	PROT 4	SW1	SW2

PROT y Bytes containing the protection bits from protection memory

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

The arrangement of the protection bits in the PROT bytes is as follows:

PROT 1								PROT 2								...							
P8	P7	P6	P5	P4	P3	P2	P1	P16	P15	P14	P13	P12	P11	P10	P9	..	..	..	..	..	..	P18	P17

Px is the protection bit of BYTE x in the response data

'0' byte is write protected

'1' byte can be written

3.6.5. WRITE_MEMORY_CARD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	P1	Byte Address	MEM_L	Byte 1	....	....	Byte N
FF $_H$	D0 $_H$	00 $_H$						

Byte Address = A7A6A5A4 A3A2A1A0 $_b$ is the memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

Byte x Data to be written to the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.6.6. WRITE_PROTECTION_MEMORY_CARD

Each of the bytes specified in the command is internally in the card compared with the byte stored at the specified address and if the data match, the corresponding protection bit is irreversibly programmed to '0'.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	P1	Byte Address	MEM_L	Byte 1	....	....	Byte N
FF $_H$	D1 $_H$	00 $_H$						

Byte Address = 000A4 A3A2A1A0 $_b$ (00 $_H$ to 1F $_H$) is the protection memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

Byte x Byte values to be compared with the data in the card starting at Byte Address. BYTE 1 is compared with the data at Byte Address; BYTE N is compared with the data at (Byte Address+N-1).

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.6.7. PRESENT_CODE_MEMORY_CARD (SLE 4442 and SLE 5542)

To submit the secret code to the memory card to enable the write operation with the SLE 4442 and SLE 5542 card, the following actions are executed:

1. Search a '1' bit in the presentation error counter and write the bit to '0'
2. Present the specified code to the card
3. Try to erase the presentation error counter

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU							
CLA	INS	P1	P2	MEM_L	CODE		
					Byte 1	Byte 2	Byte 3
FF $_H$	20 $_H$	00 $_H$	00 $_H$	03 $_H$			

CODE Three bytes secret code (PIN)

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2 ErrorCnt
90 $_H$	

SW1 = 90 $_H$

SW2 (ErrorCnt) = Error Counter. 07 $_H$ indicates the verification is correct. 00 $_H$ indicates the password is locked (exceed maximum number of retries). Other values indicate the current verification is failed.

3.6.8. CHANGE_CODE_MEMORY_CARD (SLE 4442 and SLE 5542)

This command is used to write the specified data as new secret code in the card.

The current secret code must have been presented to the card with the PRESENT_CODE command prior to the execution of this command.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU							
CLA	INS	P1	P2	MEM_L	CODE		
					Byte 1	Byte 2	Byte 3
FF $_H$	D2 $_H$	00 $_H$	01 $_H$	03 $_H$			

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.7. Memory Card – SLE 4406 / SLE 4436 / SLE 5536 / SLE 6636

3.7.1. SELECT_CARD_TYPE

This command powers down and up the selected card inserted in the card reader and performs a card reset.

Note: This command can only be used after the logical smart card reader communication has been established using the SCardConnect( ) API. For details of ScardConnect( ) API, please refer to PC/SC specification.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FF $_H$	A4 $_H$	00 $_H$	00 $_H$	01 $_H$	07 $_H$

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.7.2. READ_MEMORY_CARD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	P1	Byte Address	MEM_L
FF $_H$	B0 $_H$	00 $_H$		

Byte Address = Memory address location of the memory card.

MEM_L Length of data to be read from the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1, SW2 = 90_H 00_H if no error

3.7.3. WRITE_ONE_BYTE_MEMORY_CARD

To write one byte to the specified address of the inserted card. The byte is written to the card with LSB first, i.e., the bit at card address 0 is regarded as the LSB of byte 0.

Four different WRITE modes are available for this card type, which are distinguished by a flag in the command data field:

a) Write

The byte value specified in the command is written to the specified address. This command can be used for writing personalization data and counter values to the card.

b) Write with carry

The byte value specified in the command is written to the specified address and the command is sent to the card to erase the next lower counter stage. This write mode can therefore only be used for updating the counter value in the card.

c) Write with backup enabled (SLE 4436, SLE 5536 and SLE 6636 only)

The byte value specified in the command is written to the specified address. This command can be used for writing personalization data and counter values to the card. Backup bit is enabled to prevent data loss when card tearing occurs.

d) Write with carry and backup enabled (SLE 4436, SLE 5536 and SLE 6636 only)

The byte value specified in the command is written to the specified address and the command is sent to the card to erase the next lower counter stage. This write mode can therefore only be used for updating the counter value in the card. Backup bit is enabled to prevent data loss when card tearing occurs.

With all write modes, the byte at the specified card address is not erased prior to the write operation and, hence, memory bits can only be programmed from '1' to '0'.

The backup mode available in the SLE 4436 and SLE 5536 card can be enabled or disabled in the write operation.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU						
CLA	INS	P1	Byte Address	MEM_L	MODE	BYTE
FF_H	$D0_H$	00_H		02_H		

Byte Address = Memory address location of the memory card.

MODE Specifies the write mode and backup option

00_H : write

01_H : write with carry

02_H : write with backup enabled (SLE 4436, SLE 5536 and SLE 6636 only)

03_H : write with carry and with backup enabled (SLE 4436, SLE 5536 and SLE 6636 only)

BYTE Byte value to be written to the card

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.7.4. PRESENT_CODE_MEMORY_CARD

To submit the secret code to the memory card to enable the card personalization mode, the following actions are executed:

1. Search a '1' bit in the presentation counter and write the bit to '0'
2. Present the specified code to the card

The ACR38 does not try to erase the presentation counter after the code submission! This must be done by the application software through a separate 'Write with carry' command.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	P1	P2	MEM_L	CODE			
					ADDR	Byte 1	Byte 2	Byte 3
FF_H	20_H	00_H	00_H	04_H	09_H			

ADDR Byte address of the presentation counter in the card

CODE Three bytes secret code (PIN)

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.7.5. AUTHENTICATE_MEMORY_CARD (SLE 4436, SLE 5536 and SLE 6636)

To read a card authentication certificate from a SLE 5536 or SLE 6636 card, the following actions are executed by the ACR38:

1. Select Key 1 or Key 2 in the card as specified in the command
2. Present the challenge data specified in the command to the card
3. Generate the specified number of CLK pulses for each bit of authentication data computed by the card
4. Read 16 bits of authentication data from the card
5. Reset the card to normal operation mode

The authentication has to be performed in two steps. The first step is to send the Authentication Certificate to the card. The second step is to get back two bytes of authentication data calculated by the card.

Step 1: Send Authentication Certificate to the Card

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU											
CLA	INS	P1	P2	MEM_L	CODE						
					KEY	CLK_CNT	Byte 1	Byte 2	……	Byte 5	Byte 6
FF H	84 H	00 H	00 H	08 H							

KEY Key to be used for the computation of the authentication certificate:

00_H : key 1 with no cipher block chaining

01_H : key 2 with no cipher block chaining

80_H : key 1 with cipher block chaining (SLE 5536 and SLE 6636 only)

81_H : key 2 with cipher block chaining (SLE 5536 and SLE 6636 only)

CLK_CNT Number of CLK pulses to be supplied to the card for the computation of each bit of the authentication certificate. Typical value is 160 clocks ($A0_H$)

BYTE 1...6 Card challenge data

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2
61 H	02 H

SW1, SW2 = 61_H 02_H if no error, meaning two bytes of authentication data are ready. The authentication data can be retrieved by "Get_Response" command.

Step 2: Get back the Authentication Data (Get_Response)

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	P1	P2	MEM_L
FF H	C0 H	00 H	00 H	02 H

Response data format (abData field in the RDR_to_PC_DataBlock)

CERT		SW1	SW2

CERT 16 bits of authentication data computed by the card. The LSB of BYTE 1 is the first authentication bit read from the card.

SW1, SW2 = 90_H 00_H if no error

3.8. Memory Card – SLE 4404

3.8.1. SELECT_CARD_TYPE

This command powers down and up the selected card inserted in the card reader and performs a card reset.

Note: This command can only be used after the logical smart card reader communication has been established using the `SCardConnect( )` API. For details of `ScardConnect( )` API, please refer to PC/SC specification.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FF $_H$	A4 $_H$	00 $_H$	00 $_H$	01 $_H$	08 $_H$

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.8.2. READ_MEMORY_CARD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	P1	Byte Address	MEM_L
FF $_H$	B0 $_H$	00 $_H$		

Byte Address = Memory address location of the memory card.

MEM_L Length of data to be read from the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.8.3. WRITE_MEMORY_CARD

This command is used to write data to the specified address of the inserted card. The byte is written to the card with LSB first, i.e., the bit at card address 0 is regarded as the LSB of byte 0.

The byte at the specified card address is not erased prior to the write operation and, hence, memory bits can only be programmed from '1' to '0'.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	P1	Byte Address	MEM_L	Byte 1	…	…	Byte N
FF $_H$	D0 $_H$	00 $_H$						

Byte Address = Memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

BYTE Byte value to be written to the card

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.8.4. ERASE_SCRATCH_PAD_MEMORY_CARD

This command is used to erase the data of the scratch pad memory of the inserted card. All memory bits inside the scratch pad memory will be programmed to the state of '1'.

To erase error counter or user area, please use the VERIFY_USER_CODE command as specified in the Section 3.8.5.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	P1	Byte Address	MEM_L
FF_H	$D2_H$	00_H		00_H

Byte Address = Memory byte address location of the scratch pad.

Typical value is 0x02.

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.8.5. VERIFY_USER_CODE

This command is used to submit User Code (2 bytes) to the inserted card. User Code is to enable the memory access of the card.

The following actions are executed:

1. Present the specified code to the card
2. Search a '1' bit in the presentation error counter and write the bit to '0'
3. Erase the presentation error counter. The User Error Counter can be erased when the submitted code is correct.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU						
CLA	INS	Error Counter LEN	Byte Address	MEM_L	CODE	
					Byte 1	Byte 2
FF_H	20_H	04_H	08_H	02_H		

Error Counter LEN Length of presentation error counter in bits.

Byte Address Byte address of the key in the card.

CODE 2 bytes User Code

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error.

= 63_H 00_H if there is no more retry chance

Note: After SW1SW2 = 0x9000 has been received, read back the User Error Counter can check whether the VERIFY_USER_CODE is correct. If User Error Counter is erased and equals to "0xFF", the previous verification is success.

3.8.6. VERIFY_MEMORY_CODE

This command is used to submit Memory Code (4 bytes) to the inserted card. Memory Code is used to authorize the reloading of the user memory, together with the User Code.

The following actions are executed:

1. Present the specified code to the card
2. Search a '1' bit in the presentation error counter and write the bit to '0'
3. Erase the presentation error counter. Please note that Memory Error Counter cannot be erased.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	Error Counter LEN	Byte Address	MEM_L	CODE			
					Byte 1	Byte 2	Byte 3	Byte 4
FF_H	20_H	40_H	28_H	04_H				

Error Counter LEN Length of presentation error counter in bits.

Byte Address Byte address of the key in the card.

CODE 4 bytes Memory Code

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

= 63_H 00_H if there is no more retry chance

Note: After SW1SW2 = 0x9000 has been received, read back the Application Area can check whether the VERIFY_MEMORY_CODE is correct. If all data in Application Area is erased and equals to "0xFF", the previous verification is success.

3.9. Memory Card – AT88SC101 / AT88SC102 / AT88SC1003

3.9.1. SELECT_CARD_TYPE

This command powers down and up the selected card inserted in the card reader and performs a card reset.

Note: This command can only be used after the logical smart card reader communication has been established using the SCardConnect( ) API. For details of ScardConnect( ) API, please refer to PC/SC specification.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FF $_H$	A4 $_H$	00 $_H$	00 $_H$	01 $_H$	09 $_H$

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.9.2. READ_MEMORY_CARD

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	P1	Byte Address	MEM_L
FF $_H$	B0 $_H$	00 $_H$		

Byte Address = Memory address location of the memory card.

MEM_L Length of data to be read from the memory card.

Response data format (abData field in the RDR_to_PC_DataBlock)

BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1, SW2 = 90 $_H$ 00 $_H$ if no error

3.9.3. WRITE_MEMORY_CARD

This command is used to write data to the specified address of the inserted card. The byte is written to the card with LSB first, i.e., the bit at card address 0 is regarded as the LSB of byte 0.

The byte at the specified card address is not erased prior to the write operation and, hence, memory bits can only be programmed from '1' to '0'.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	P1	Byte Address	MEM_L	Byte 1	....	....	Byte N
FF $_H$	D0 $_H$	00 $_H$						

Byte Address = Memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

BYTE Byte value to be written to the card

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.9.4. ERASE_NON_APPLICATION_ZONE

This command is used to erase the data in Non-Application Zones. The EEPROM memory is organized into 16 bit words. Although erases are performed on single bits the ERASE operation clears an entire word in the memory. Therefore, performing an ERASE on any bit in the word will clear ALL 16 bits of that word to the state of '1'.

To erase Error Counter or the data in Application Zones, please refer to:

1. ERASE_APPLICATION_ZONE_WITH_ERASE command as specified in Section 3.9.5
2. ERASE_APPLICATION_ZONE_WITH_WRITE_AND_ERASE command as specified in Section 3.9.6
3. VERIFY_SECURITY_CODE commands as specified in Section 3.9.7

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	P1	Byte Address	MEM_L
FF_H	$D2_H$	00_H		00_H

Byte Address = Memory byte address location of the word to be erased.

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.9.5. ERASE_APPLICATION_ZONE_WITH_ERASE

This command can be used in the following cases:

1. AT88SC101: To erase the data in Application Zone with EC Function Disabled
2. AT88SC102: To erase the data in Application Zone 1
3. AT88SC102: To erase the data in Application Zone 2 with EC2 Function Disabled
4. AT88SC1003: To erase the data in Application Zone 1
5. AT88SC1003: To erase the data in Application Zone 2 with EC2 Function Disabled
6. AT88SC1003: To erase the data in Application Zone 3

The following actions are executed for this command:

1. Present the specified code to the card
2. Erase the presentation error counter. The data in corresponding Application Zone can be erased when the submitted code is correct.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU									
CLA	INS	Error Counter LEN	Byte Address	MEM_L	CODE				
					Byte 1	Byte 2	…	…	Byte N
FF $_H$	20 $_H$	00 $_H$							

Error Counter LEN Length of presentation error counter in bits. The value should be `0x00` always.

Byte Address Byte address of the Application Zone Key in the card. Please refer to the table below for the correct value.

	Byte Address	LEN
AT88SC101: Erase Application Zone with EC function disabled	96 $_H$	04 $_H$
AT88SC102: Erase Application Zone 1	56 $_H$	06 $_H$
AT88SC102: Erase Application Zone 2 with EC2 function disabled	9C $_H$	04 $_H$
AT88SC1003: Erase Application Zone 1	36 $_H$	06 $_H$
AT88SC1003: Erase Application Zone 2 with EC2 function disabled	5C $_H$	04 $_H$
AT88SC1003: Erase Application Zone 3	C0 $_H$	06 $_H$

MEM_L Length of the Erase Key. Please refer to the table above for the correct value.

CODE N bytes of Erase Key

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = `90` $_H$ `00` $_H$ if no error.

Note: After SW1SW2 = `0x9000` has been received, read back the data in Application Zone can check whether the `ERASE_APPLICATION_ZONE_WITH_ERASE` is correct. If all data in Application Zone is erased and equals to "`0xFF`", the previous verification is success.

3.9.6. ERASE_APPLICATION_ZONE_WITH_WRITE_AND_ERASE

This command can be used in the following cases:

1. AT88SC101: To erase the data in Application Zone with EC Function Enabled
2. AT88SC102: To erase the data in Application Zone 2 with EC2 Function Enabled
3. AT88SC1003: To erase the data in Application Zone 2 with EC2 Function Enabled

With EC or EC2 Function Enabled (that is, ECEN or EC2EN Fuse is unblown and in "1" state), the following actions are executed:

1. Present the specified code to the card
2. Search a '1' bit in the presentation error counter and write the bit to '0'
3. Erase the presentation error counter. The data in corresponding Application Zone can be erased when the submitted code is correct.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	Error Counter LEN	Byte Address	MEM_L	CODE			
					Byte 1	Byte 2	Byte 3	Byte 4
FF $_H$	20 $_H$	80 $_H$		04 $_H$				

Error Counter LEN Length of presentation error counter in bits. The value should be 0x80 always.

Byte Address Byte address of the Application Zone Key in the card.

	Byte Address
AT88SC101	96 $_H$
AT88SC102	9C $_H$
AT88SC1003	5C $_H$

CODE 4 bytes Erase Key

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90 $_H$ 00 $_H$ if no error.

= 63 $_H$ 00 $_H$ if there is no more retry chance

Note: After SW1SW2 = `0x9000` has been received, read back the data in Application Zone can check whether the `ERASE_APPLICATION_ZONE_WITH_WRITE_AND_ERASE` is correct. If all data in Application Zone is erased and equals to "`0xFF`", the previous verification is success.

3.9.7. VERIFY_SECURITY_CODE

This command is used to submit Security Code (2 bytes) to the inserted card. Security Code is to enable the memory access of the card.

The following actions are executed:

1. Present the specified code to the card
2. Search a '1' bit in the presentation error counter and write the bit to '0'
3. Erase the presentation error counter. The Security Code Attempts Counter can be erased when the submitted code is correct.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU						
CLA	INS	Error Counter LEN	Byte Address	MEM_L	CODE	
					Byte 1	Byte 2
FF $_H$	20 $_H$	08 $_H$	0A $_H$	02 $_H$		

Error Counter LEN Length of presentation error counter in bits.

Byte Address Byte address of the key in the card.

CODE 2 bytes Security Code

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error.

= 63_H 00_H if there is no more retry chance

Note: After SW1SW2 = 0x9000 has been received, read back the Security Code Attempts Counter (SCAC) can check whether the VERIFY_USER_CODE is correct. If SCAC is erased and equals to "0xFF", the previous verification is success.

3.9.8. BLOWN_FUSE

This command is used to blow the fuse of the inserted card. The fuse can be EC_EN Fuse, EC2EN Fuse, Issuer Fuse or Manufacturer's Fuse.

Note: The blowing of Fuse is an irreversible process.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU								
CLA	INS	Error Counter LEN	Byte Address	MEM_L	CODE			
					Fjuse Bit Addr (High)	Fuse Bit Addr (Low)	State of FUS Pin	State of RST Pin
FF_H	05_H	00_H	00_H	04_H			01_H	00_H or 01_H

Fuse Bit Addr (2 bytes) Bit address of the fuse. Please refer to the table below for the correct value.

State of FUS Pin State of the FUS pin. Should always be 0x01.

State of RST Pin State of the RST pin. Please refer to below table for the correct value.

		Fuse Bit Addr (High)	Fuse Bit Addr (Low)	State of RST Pin
AT88SC101	Manufacturer Fuse	05_H	80_H	01_H
	EC_EN Fuse	05_H	$C9_H$	01_H
	Issuer Fuse	05_H	$E0_H$	01_H
AT88SC102	Manufacturer Fuse	05_H	$B0_H$	01_H
	EC2EN Fuse	05_H	$F9_H$	01_H
	Issuer Fuse	06_H	10_H	01_H
AT88SC1003	Manufacturer Fuse	03_H	$F8_H$	00_H
	EC2EN Fuse	03_H	FC_H	00_H
	Issuer Fuse	03_H	$E0_H$	00_H

Response data format (abData field in the RDR_to_PC_DataBlock)

SW1	SW2

SW1, SW2 = 90_H 00_H if no error

3.10. Other Commands Access via PC_to_RDR_XfrBlock

3.10.1. GET_READER_INFORMATION

This command returns relevant information about the particular ACR38 Firmware 1.12c model and the current operating status, such as, the firmware revision number, the maximum data length of a command and response, the supported card types, and whether a card is inserted and powered up.

> **Note:** This command can only be used after the logical smart card reader communication has been established using the SCardConnect( ) API. For details of ScardConnect( ) API, please refer to PC/SC specification.

Command format (abData field in the PC_to_RDR_XfrBlock)

Pseudo-APDU				
CLA	INS	P1	P2	Lc
FF $_H$	09 $_H$	00 $_H$	00 $_H$	10 $_H$

Response data format (abData field in the RDR_to_PC_DataBlock)

FIRMWARE	MAX_C	MAX_R	C_TYPE	C_SEL	C_STAT

FIRMWARE 10 bytes data for firmware version

MAX_C The maximum number of command data bytes.

MAX_R The maximum number of data bytes that can be requested to be transmitted in a response.

C_TYPE The card types supported by the ACR38U-112c. This data field is a bitmap with each bit representing a particular card type. A bit set to '1' means the corresponding card type is supported by the reader and can be selected with the SELECT_CARD_TYPE command. The bit assignment is as follows:

Byte	1								2							
card type	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0

Refer to the next section for the correspondence between these bits and the respective card types.

C_SEL The currently selected card type. A value of 00H means that no card type has been selected.

C_STAT Indicates whether a card is physically inserted in the reader and whether the card is powered up:

- 00 $_H$: no card inserted
- 01 $_H$: card inserted, not powered up
- 03 $_H$: card powered up

3.11. Supported Card Types

The following table summarizes the card type returned by `GET_READER_INFORMATION` correspond with the respective card type.

Byte	Card Type
00_H	Auto-select T=0 or T=1 communication protocol
01_H	I2C memory card (1k, 2k, 4k, 8k and 16k bits)
02_H	I2C memory card (32k, 64k, 128k, 256k, 512k and 1024k bits)
03_H	Atmel AT88SC153 secure memory card
04_H	Atmel AT88SC1608 secure memory card
05_H	Infineon SLE 4418 and SLE 4428
06_H	Infineon SLE 4432 and SLE 4442
07_H	Infineon SLE 4406, SLE 4436 and SLE 5536
08_H	Infineon SLE 4404
09_H	Atmel AT88SC101, AT88SC102 and AT88SC1003
$0C_H$	MCU-based cards with T=0 communication protocol
$0D_H$	MCU-based cards with T=1 communication protocol

3.12. Response Error Codes

The following table summarizes the possible error code returned by the ACR38 (FW 1.12c)

Error Code	Status
FF_h	`SLOTERROR_CMD_ABORTED`
FE_h	`SLOTERROR_ICC_MUTE`
FD_h	`SLOTERROR_XFR_PARITY_ERROR`
FC_h	`SLOTERROR_XFR_OVERRUN`
FB_h	`SLOTERROR_HW_ERROR`
$F8_h$	`SLOTERROR_BAD_ATR_TS`
$F7_h$	`SLOTERROR_BAD_ATR_TCK`
$F6_h$	`SLOTERROR_ICC_PROTOCOL_NOT_SUPPORTED`
$F5_h$	`SLOTERROR_ICC_CLASS_NOT_SUPPORTED`
$F4_h$	`SLOTERROR_PROCEDURE_BYTE_CONFLICE`
$F3_h$	`SLOTERROR_DEACTIVATED_PROTOCOL`
$F2_h$	`SLOTERROR_BUSY_WITH_AUTO_SEQUENCE`
$E0_h$	`SLOTERROR_CMD_SLOT_BUSY`

4.0. ACR38 Firmware 1.10 Memory Card Command Set

4.1. Memory Card – 1, 2, 4, 8, and 16 Kbit I2C Card

4.1.1. SELECT_PAGE_SIZE

This command will choose the page size to read the smart card. The default value is 8-byte page write. It will reset to default value whenever the card is removed or the reader is powered off.

Send Buffer Format

SCardTransmit Send Buffer					
CLA	INS	P1	P2	Lc (P3)	Page size
FF $_H$	01 $_H$	00 $_H$	00 $_H$	01 $_H$	

Page size = 03 $_H$ for 8-byte page write
= 04 $_H$ for 16-byte page write
= 05 $_H$ for 32-byte page write
= 06 $_H$ for 64-byte page write
= 07 $_H$ for 128-byte page write

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90 $_H$ 00 $_H$ if no error

4.1.2. READ_MEMORY_CARD

Send Buffer Format

SCardTransmit Send Buffer				
CLA	INS	Byte Address		MEM_L (P3)
		MSB (P1)	LSB (P2)	
FF $_H$	B0 $_H$			

Byte Address Memory address location of the memory card.

MEM_L Length of data to be read from the memory card.

Response data Format

SCardTransmit Receive Buffer					
BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1,SW2 = 90_H 00_H if no error

4.1.3. WRITE_MEMORY_CARD

Send Buffer Format

SCardTransmit Send Buffer								
CLA	INS	Byte Address		MEM_L (P3)	Byte 1	....	....	Byte n
		MSB (P1)	LSB (P2)					
FF_H	$D0_H$							

Byte Address Memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

Byte x Data to be written to the memory card.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90_H 00_H if no error

4.2. Memory Card – 32, 64, 128, 256, 512, and 1024 Kbit I2C Card

4.2.1. SELECT_PAGE_SIZE

This command will choose the page size to read the smart card. The default value is 8-byte page write. It will reset to default value whenever the card is removed or the reader is powered off.

Send Buffer Format

SCardTransmit Send Buffer					
CLA	INS	P1	P2	Lc (P3)	Page size
FF_H	01_H	00_H	00_H	01_H	

Data TPDU to be sent to the card

Page size = 03_H for 8-byte page write

= 04_H for 16-byte page write

= 05_H for 32-byte page write

= 06_H for 64-byte page write

= 07_H for 128-byte page write

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1, SW2 = 90_H 00_H if no error

4.2.2. READ_MEMORY_CARD

Send Buffer Format

SCardTransmit Send Buffer				
CLA	INS	Byte Address		MEM_L (P3)
		MSB (P1)	LSB (P2)	
FF_H				

INS = $B0_H$ for 32,64,128,256,512kbit iic card

= $1011\ 000*_b$ for 1024kbit iic card, where * is the MSB of the 17 bit addressing

Byte Address Memory address location of the memory card.

MEM_L Length of data to be read from the memory card.

Response Buffer Format

SCardTransmit Receive Buffer					
BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1,SW2 = $90_H\ 00_H$ if no error

4.2.3. WRITE_MEMORY_CARD

Send Buffer Format

SCardTransmit Send Buffer								
CLA	INS	Byte Address		MEM_L (P3)	Byte 1	....	....	Byte n
		MSB (P1)	LSB (P2)					
FF_H								

INS = $D0_H$ for 32,64,128,256,512kbit iic card

= $1101\ 000*_b$ for 1024kbit iic card, where * is the MSB of the 17 bit addressing

Byte Address Memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

Byte x Data to be written to the memory card.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = $90_H\ 00_H$ if no error

4.3. Memory Card – ATMEL AT88SC153

4.3.1. READ_MEMORY_CARD

Send Buffer Format

SCardTransmit Send Buffer				
CLA	INS	P1	Byte Address (P2)	MEM_L (P3)
FF $_H$		00 $_H$		

INS = B0 $_H$ for reading zone 00 b
= B1 $_H$ for reading zone 01 b
= B2 $_H$ for reading zone 10 b
= B3 $_H$ for reading zone 11 b
= B4 $_H$ for reading fuse

Byte Address Memory address location of the memory card.

MEM_L Length of data to be read from the memory card.

Response Buffer Format

SCardTransmit Receive Buffer					
BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1,SW2 = 90 $_H$ 00 $_H$ if no error

4.3.2. WRITE_MEMORY_CARD

Send Buffer Format

SCardTransmit Send Buffer								
CLA	INS	P1	Bye Address (P2)	MEM_L (P3)	Byte 1	....	....	Byte n
FF $_H$		00 $_H$						

INS = D0 $_H$ for writing zone 00 b
= D1 $_H$ for writing zone 01 b
= D2 $_H$ for writing zone 10 b
= D3 $_H$ for writing zone 11 b
= D4 $_H$ for writing fuse

Byte Address Memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

MEM_D Data to be written to the memory card.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90_H 00_H if no error

4.3.3. VERIFY_PASSWORD

Send Buffer Format

SCardTransmit Send Buffer							
CLA	INS	P1	P2	Lc (P3)	Pw(0)	Pw(1)	Pw(2)
FF_H	20_H	00_H		03_H			

Pw(0),Pw(1),Pw(2) Passwords to be sent to memory card.

P2 = 0000 00rp$_b$

where the two bits “rp” indicate the password to compare

r = 0 : Write password,

r = 1: Read password,

p: Password set number,

rp = 01 for the secure code.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90_H 00_H if no error

4.3.4. INITIALIZE_AUTHENTICATION

Send Buffer Format

SCardTransmit Send Buffer								
CLA	INS	P1	P2	Lc (P3)	Q(0)	Q(1)	…	Q(7)
FF_H	84_H	00_H	00_H	08_H				

Q(0),Q(1)…Q(7) Host random number, 8 bytes.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90_H 00_H if no error

4.3.5. VERIFY_AUTHENTICATION

Send Buffer Format

SCardTransmit Send Buffer								
CLA	INS	P1	P2	Lc (p3)	Ch(0)	Ch(1)	…	Ch(7)
FF $_H$	82 $_H$	00 $_H$	00 $_H$	08 $_H$				

Ch(0),Ch(1)…Ch(7) Host challenge, 8 bytes.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90 $_H$ 00 $_H$ if no error

4.4. Memory Card – ATMEL AT88SC1608

4.4.1. READ_MEMORY_CARD

Send Buffer Format

SCardTransmit Send Buffer				
CLA	INS	Zone Address (P1)	Byte Address (P2)	MEM_L (P3)
FF $_H$				

INS = B0 $_H$ for reading user zone

= B1 $_H$ for reading configuration zone or reading fuse

Zone Address = 0000 0A10A9A8 $_b$, where A10 is the MSB of zone address

= don't care for reading fuse

Byte Address = A7A6A5A4 A3A2A1A0 $_b$ is the memory address location of the memory card.

= 1000 0000 b for reading fuse

MEM_L Length of data to be read from the memory card.

Response Buffer Format

SCardTransmit Receive Buffer					
BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1,SW2 = 90 $_H$ 00 $_H$ if no error

4.4.2. WRITE_MEMORY_CARD

Send Buffer Format

SCardTransmit Send Buffer								
CLA	INS	Zone Address (P1)	Byte Address (P2)	MEM_L (P3)	Byte 1	....	....	Byte n
FF $_H$								

INS = D0 $_H$ for writing user zone

= D1 $_H$ for writing configuration zone or writing fuse

Zone Address = 0000 0A10A9A8 $_b$, where A10 is the MSB of zone address

= don't care for writing fuse

Byte Address = A7A6A5A4 A3A2A1A0 $_b$ is the memory address location of the memory card.

= 1000 0000 $_b$ for writing fuse

MEM_L Length of data to be written to the memory card.

Byte x Data to be written to the memory card.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90 $_H$ 00 $_H$ if no error

4.4.3. VERIFY_PASSWORD

Send Buffer Format

SCardTransmit Send Buffer								
CLA	INS	P1	P2	Lc (P3)	Data			
FF $_H$	20 $_H$	00 $_H$	00 $_H$	04 $_H$	RP	Pw(0)	Pw(1)	Pw(2)

Pw(0),Pw(1),Pw(2) Passwords to be sent to memory card.

RP = 0000 rp2p1p0 $_b$

where the four bits "rp2p1p0" indicate the password to compare:

r = 0: Write password

r = 1: Read password

p2p1p0: Password set number

(rp2p1p0 = 0111 for the secure code).

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90 $_H$ 00 $_H$ if no error

4.4.4. INITIALIZE_AUTHENTICATION

Send Buffer Format

SCardTransmit Send Buffer								
CLA	INS	P1	P2	Lc (P3)	Q(0)	Q(1)	…	Q(7)
FF $_H$	84 $_H$	00 $_H$	00 $_H$	08 $_H$				

Byte Address Memory address location of the memory card.

Q(0),Q(1)…Q(7) Host random number, 8 bytes.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90 $_H$ 00 $_H$ if no error

4.4.5. VERIFY_AUTHENTICATION

Send Buffer Format

SCardTransmit Send Buffer								
CLA	INS	P1	P2	Lc (P3)	Q1(0)	Q1(1)	…	Q1(7)
FF $_H$	82 $_H$	00 $_H$	00 $_H$	08 $_H$				

Byte Address Memory address location of the memory card.

Q1(0),Q1(1)…Q1(7) Host challenge, 8 bytes.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90 $_H$ 00 $_H$ if no error

4.5. Memory Card – SLE 4418 / SLE 4428 / SLE 5518 / SLE5528

4.5.1. READ_MEMORY_WITH_PROTECT_BIT_CARD

Send Buffer Format

SCardTransmit Send Buffer				
CLA	INS	Byte Address		MEM_L (P3)
		MSB (P1)	LSB (P2)	
FF $_H$	B0 $_H$			

MSB Byte Address = 0000 00A9A8 $_b$ is the memory address location of the memory

card.

LSB Byte Address = A7A6A5A4 A3A2A1A0 $_b$ is the memory address location of the memory card.

MEM_L Length of data to be read from the memory card. (Max. allowable size is EC $_H$.)

Response Buffer Format

SCardTransmit Receive Buffer									
BYTE 1	…	…	BYTE N	PROT 1	…	…	PROT L	SW1	SW2

BYTE x Data read from memory card

PROT y Bytes containing the protection bits of the data bytes read

SW1,SW2 = 90 $_H$ 00 $_H$ if no error

The number L of protection bytes returned in the response is determined by the number N of data bytes read from the card as follows:

L = 1 + INT(N/8)

The arrangement of the protection bits in the PROT bytes is as follows:

PROT 1								PROT 2								…							
P8	P7	P6	P5	P4	P3	P2	P1	P16	P15	P14	P13	P12	P11	P10	P9	..	..	..	..	..	..	P18	P17

Px is the protection bit of BYTE x in the response data

'0' byte is write protected

'1' byte can be written

4.5.2. READ_MEMORY_WITHOUT_PROTECT_BIT_CARD

Send Buffer Format

SCardTransmit Send Buffer				
CLA	INS	Byte Address		MEM_L (P3)
		MSB (P1)	LSB (P2)	
FF $_H$	B2 $_H$			

MSB Byte Address = 0000 00A9A8 $_b$ is the memory address location of the memory card.

LSB Byte Address = A7A6A5A4 A3A2A1A0 $_b$ is the memory address location of the memory card.

MEM_L Length of data to be read from the memory card.

Response Buffer Format

SCardTransmit Receive Buffer					
BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1,SW2 = 90 H 00 H if no error

4.5.3. WRITE_MEMORY_CARD

Send Buffer Format

SCardTransmit Send Buffer								
CLA	INS	Byte Address		MEM_L (P3)	Byte 1	....	....	Byte N
		MSB (P1)	LSB (P2)					
FF H	D0 H							

MSB Byte Address = 0000 00A9A8 b is the memory address location of the memory card.

LSB Byte Address = A7A6A5A4 A3A2A1A0 b is the memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

Byte x Data to be written to the memory card.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90 H 00 H if no error

4.5.4. WRITE_PROTECTION_MEMORY_CARD

Each of the bytes specified in the command is internally in the card compared with the byte stored at the specified address and if the data matches, the corresponding protection bit is irreversibly programmed to '0'.

Send Buffer Format

SCardTransmit Send Buffer								
CLA	INS	Byte Address		MEM_L (P3)	Byte 1	....	....	Byte N
		MSB (P1)	LSB (P2)					
FF H	D1 H							

MSB Byte Address = 0000 00A9A8 b is the memory address location of the memory card.

LSB Byte Address = A7A6A5A4 A3A2A1A0 b is the memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

Byte x Byte values to be compared with the data in the card starting at Byte Address. BYTE 1 is compared with the data at Byte Address; BYTE N is compared with the data at (Byte Address+N-1).

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90_H 00_H if no error

4.5.5. PRESENT_CODE_MEMORY_CARD (SLE 4428 and SLE 5528)

To submit the secret code to the memory card to enable the write operation with the SLE 4428 card. The following actions are executed:

1. Search a '1' bit in the presentation error counter and write the bit to '0'
2. Present the specified code to the card
3. Try to erase the presentation error counter

Send Buffer Format

SCardTransmit Send Buffer						
CLA	INS	P1	P2	MEM_L (P3)	CODE	
					Byte 1	Byte 2
FF_H	20_H	00_H	00_H	02_H		

CODE Two bytes secret code (PIN)

Response Buffer Format

ERRCNT	CODE		SW1	SW2
	Byte 1	Byte 2		

ERRCNT The value of the presentation error counter after the code presentation.

CODE The two bytes secret code read from the card.

SW1,SW2 = 90_H 00_H if no error

If the correct code has been presented to the card, the value of ERRCNT is FF_H and the value of CODE is identical to the code data specified in the command.

4.5.6. READ_PRESENTATION_ERROR_COUNTER_MEMORY_CARD (SLE 4428 and SLE 5528)

To read the presentation error counter for the secret code.

Send Buffer Format

SCardTransmit Send Buffer				
CLA	INS	P1	P2	MEM_L (P3)
FF_H	$B1_H$	00_H	00_H	00_H

Response Buffer Format

SCardTransmit Receive Buffer				
ERRCNT	DUMMY 1	DUMMY 2	SW1	SW2

ERRCNT The value of the presentation error counter.

DUMMY Three bytes dummy data read from the card.

SW1,SW2 = 90_H 00_H if no error

4.6. Memory Card – SLE 4432 / SLE 4442 / SLE 5532 / SLE 5542

4.6.1. READ_MEMORY_CARD

Send Buffer Format

SCardTransmit Send Buffer				
CLA	INS	P1	Byte Address (P2)	MEM_L (P3)
FF_H	$B0_H$	00_H		

Byte Address = A7A6A5A4 A3A2A1A0 $_b$ is the memory address location of the memory card.

MEM_L Length of data to be read from the memory card.

Response Buffer Format

SCardTransmit Send Buffer									
BYTE 1	…	…	BYTE N	PROT 1	PROT 2	PROT3	PROT 4	SW1	SW2

BYTE x Data read from memory card

PROT y Bytes containing the protection bits from protection memory

SW1,SW2 = 90_H 00_H if no error

The arrangement of the protection bits in the PROT bytes is as follows:

PROT 1								PROT 2								…							
P8	P7	P6	P5	P4	P3	P2	P1	P16	P15	P14	P13	P12	P11	P10	P9	..	..	..	..	..	..	P18	P17

Px is the protection bit of BYTE x in the response data

'0' byte is write protected

'1' byte can be written

4.6.2. WRITE_MEMORY_CARD

Send Buffer Format

SCardTransmit Send Buffer								
CLA	INS	P1	Byte Address (P2)	MEM_L (P3)	Byte 1	....	....	Byte N
FF_H	$D0_H$	00_H						

Byte Address = A7A6A5A4 A3A2A1A0 $_b$ is the memory address location of the memory

card.

MEM_L Length of data to be written to the memory card.

Byte x Data to be written to the memory card.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90_H 00_H if no error

4.6.3. WRITE_PROTECTION_MEMORY_CARD

Each of the bytes specified in the command is internally in the card compared with the byte stored at the specified address and if the data match, the corresponding protection bit is irreversibly programmed to '0'.

Send Buffer Format

SCardTransmit Send Buffer								
CLA	INS	P1	Byte Address (P2)	MEM_L (P3)	Byte 1	....	....	Byte N
FF_H	$D1_H$	00_H						

Byte Address = $000A4\ A3A2A1A0_b$ (00_H to $1F_H$) is the protection memory address location of the memory card.

MEM_L Length of data to be written to the memory card.

Byte x Byte values to be compared with the data in the card starting at Byte Address. BYTE 1 is compared with the data at Byte Address; BYTE N is compared with the data at (Byte Address+N-1).

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90_H 00_H if no error

4.6.4. PRESENT_CODE_MEMORY_CARD (SLE 4442 and SLE 5542)

This command is used to submit the secret code to the memory card to enable the write operation with the SLE 4442 and SLE 5542 card. The following actions are executed:

1. Search a '1' bit in the presentation error counter
2. Write the bit to '0' present the specified code to the card try to erase the presentation error counter

Send Buffer Format

SCardTransmit Send Buffer							
CLA	INS	P1	P2	MEM_L (P3)	CODE		
					Byte 1	Byte 2	Byte 3
FF_H	20_H	00_H	00_H	03_H			

CODE Three bytes secret code (PIN)

Response Buffer Format

ERRCNT	CODE			SW1	SW2
	Byte 1	Byte 2	Byte 3		

ERRCNT The value of the presentation error counter after the code presentation.

CODE The three bytes secret code read from the card.

SW1,SW2 = 90_H 00_H if no error

If the correct code has been presented to the card, the value of ERRCNT is 07_H and the value of CODE is identical to the code data specified in the command.

4.6.5. READ_PRESENTATION_ERROR_COUNTER_MEMORY_CARD (SLE 4442 and SLE 5542)

To read the presentation error counter for the secret code.

Send Buffer Format

SCardTransmit Send Buffer				
CLA	INS	P1	P2	MEM_L (P3)
FF_H	$B1_H$	00_H	00_H	00_H

Response Buffer Format

SCardTransmit Receive Buffer					
ERRCNT	DUMMY 1	DUMMY 2	DUMMY 3	SW1	SW2

ERRCNT The value of the presentation error counter.

DUMMY Three bytes dummy data read from the card.

SW1,SW2 = 90_H 00_H if no error

4.6.6. CHANGE_CODE_MEMORY_CARD (SLE 4442 and SLE 5542)

This command is used to write the specified data as new secret code in the card.

The current secret code must have been presented to the card with the PRESENT_CODE command prior to the execution of this command.

Send Buffer Format

SCardTransmit Send Buffer							
CLA	INS	P1	P2	MEM_L (P3)	CODE		
					Byte 1	Byte 2	Byte 3
FF_H	$D2_H$	00_H	01_H	03_H			

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2 = 90_H 00_H if no error

4.7. Memory Card – SLE 4406 / SLE 4436 / SLE 5536 / SLE 6636

4.7.1. READ_MEMORY_CARD

Send Buffer Format

SCardTransmit Send Buffer				
CLA	INS	P1	Byte Address (P2)	MEM_L (P3)
FF_H	$B0_H$	00_H		

Byte Address = Memory address location of the memory card.

MEM_L Length of data to be read from the memory card.

Response Buffer Format

SCardTransmit Receive Buffer					
BYTE 1	…	…	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1,SW2 = 90_H 00_H if no error

4.7.2. WRITE_ONE_BYTE_MEMORY_CARD

This command is used to write one byte to the specific address of the inserted card. The byte is written to the card with LSB first, i.e. the bit at card address 0 is regarded as the LSB of byte 0.

Four different WRITE modes are available for this card type, which are distinguished by a flag in the command data field:

a) Write

The byte value specified in the command is written to the specified address. This command can be used for writing personalization data and counter values to the card.

b) Write with carry

The byte value specified in the command is written to the specified address and the command is sent to the card to erase the next lower counter stage. This write mode can therefore only be used for updating the counter value in the card.

c) Write with backup enabled (SLE 4436, SLE 5536 and SLE 6636 only)

The byte value specified in the command is written to the specified address. This command can be used for writing personalization data and counter values to the card. Backup bit is enabled to prevent data loss when card tearing occurs.

d) Write with carry and backup enabled (SLE 4436, SLE 5536 and SLE 6636 only)

The byte value specified in the command is written to the specified address and the command is sent to the card to erase the next lower counter stage. This write mode can therefore only be

used for updating the counter value in the card. Backup bit is enabled to prevent data loss when card tearing occurs.

With all write modes, the byte at the specified card address is not erased prior to the write operation and, hence, memory bits can only be programmed from '1' to '0'.

The backup mode available in the SLE 4436 and SLE 5536 card can be enabled or disabled in the write operation.

Command format

SCardTransmit SendBuffer						
CLA	INS	P1	Byte Address	MEM_L	MODE	BYTE
FF $_H$	D0 $_H$	00 $_H$		02 $_H$		

Byte Address = Memory address location of the memory card.

LEN = 5 + MEM_L

MODE Specifies the write mode and backup option

00_H : write

01_H : write with carry

02_H : write with backup enabled (SLE 4436, SLE 5536 and SLE 6636 only)

03_H : write with carry and with backup enabled (SLE 4436, SLE 5536 and SLE 6636 only)

BYTE Byte value to be written to the card

Response data format

SCardTransmit Receive Buffer	
SW1	SW2

SW1, SW2 = 90_H 00_H if no error

4.7.3. PRESENT_CODE_MEMORY_CARD

This command is used to submit the secret code to the memory card to enable the card personalization mode. The following actions are executed:

1. Search a '1' bit in the presentation counter and write the bit to '0'
2. Present the specified code to the card

The ACR38 does not try to erase the presentation counter after the code submission! This must be done by the application software through a separate 'Write with carry' command.

Command format

SCardTransmit Send Buffer								
CLA	INS	P1	P2	MEM_L	CODE			
					ADDR	Byte 1	Byte 2	Byte 3
FF $_H$	20 $_H$	00 $_H$	00 $_H$	04 $_H$				

ADDR Byte address of the presentation counter in the card

CODE Three bytes secret code (PIN)

Response data format

SCardTransmit Receive Buffer	
SW1	SW2

SW1, SW2 = 90_H 00_H if no error

4.7.4. AUTHENTICATE_MEMORY_CARD (SLE 4436, SLE 5536 and SLE 6636)

This command is used to read a card authentication certificate from an SLE 5536 or SLE 6636 card. The following actions are executed by the ACR38:

Select Key 1 or Key 2 in the card as specified in the command present the challenge data specified in the command to the card generate the specified number of CLK pulses for each bit of authentication data computed by the card read 16 bits of authentication data from the card reset the card to normal operation mode

The ACR38 returns the 16 bits of authentication data calculated by the card in the response.

Command format

SCardTransmit Send Buffer											
CLA	INS	P1	P2	MEM_L	CODE						
					KEY	CLK_CNT	Byte1	Byte 2	……	Byte 5	Byte 6
FF_H	84_H	00_H	00_H	08_H							

KEY Key to be used for the computation of the authentication certificate:

00_H : key 1 with no cipher block chaining

01_H : key 2 with no cipher block chaining

80_H : key 1 with cipher block chaining (SLE 5536 and SLE 6636 only)

81_H : key 2 with cipher block chaining (SLE 5536 and SLE 6636 only)

CLK_CNT Number of CLK pulses to be supplied to the card for the computation of each bit of the authentication certificate.

BYTE 1...6 Card challenge data

Response data format

SCardTransmit Receive Buffer			
CERT		SW1	SW2

CERT 16 bits of authentication data computed by the card. The LSB of BYTE 1 is the first authentication bit read from the card.

SW1, SW2 = 90_H 00_H if no error