



Advanced Card Systems Ltd.
Card & Reader Technologies

ACR33U-A1 SmartDuo Smart Card Reader



Reference Manual V1.05



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1.0. Introduction

The ACR33U-A1 SmartDuo PC-linked Smart Card 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, which, in most cases, prevent direct communication between a smart card and a computer. The ACR33U-A1 SmartDuo Smart Card 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 particulars, it releases the computer software programmer from being responsible with smart card operations' technical details, which in many cases, are not relevant to the implementation of a smart card system.

1.1. Reference Documents

The following related documents are available from www.usb.org

- Universal Serial Bus Specification 2.0 (also referred to as the USB specification), April 27, 2000
- Universal Serial Bus Common Class Specification 1.0, December 16, 1997
- Universal Serial Bus Device Class: Smart Card CCID Specification for Integrated Circuit(s) Cards Interface Devices, Revision 1.1, April 22, 2005

The following related documents can be ordered through www.ansi.org

- ISO/IEC 7816-1; Identification Cards – Integrated circuit(s) cards with contacts - Part 1: Physical Characteristics
- ISO/IEC 7816-2; Identification Cards – Integrated circuit(s) cards with contacts - Part 2: Dimensions and Locations of the Contacts
- ISO/IEC 7816-3; Identification Cards – Integrated circuit(s) cards with contacts - Part 3: Electronic Signals and Transmission Protocols

1.2. Symbols and Abbreviations

Abbreviation	Description
ATR	Answer-to-reset
CCID	Chip/Smart Card Interface Device
ICC	Integrated Circuit Cards
IFSC	Information Field Sized for ICC for protocol T=1
IFSD	Information Field Sized for CCID for protocol T=1
NAD	Node Address
PPS	Protocol and Parameters Selection
RFU	Reserved for future use ¹
TPDU	Transport Protocol Data Unit
USB	Universal Serial Bus

Table 1: Symbols and Abbreviations

¹ Must be set to zero unless stated differently



2.0. Features

- USB Full Speed Interface
- Plug-and-Play – CCID support brings utmost compatibility
- Dual Slots for Full-sized Smart Cards
- Smart Card Reader:
 - Supports ISO 7816 Class A (5 V) smart cards
 - Supports CAC (Common Access Card)
 - Supports microprocessor cards with T=0 and T=1 protocol
 - Supports memory cards
 - Supports PPS (Protocol and Parameters Selection)
 - Features Short Circuit Protection
- SAM (Secure Access Module) Card Interface:
 - Three SAM card slots
- User controllable peripherals:
 - Tri-color LED (Green, Red, Blue)
 - Buzzer
- Application Programming Interface:
 - Supports PC/SC
 - Supports CT-API (through wrapper on top of PC/SC)
- Supports Android™ 3.1 and above²
- Compliant with the following international standards:
 - FIPS 201
 - TAA
 - EN60950/IEC 60950
 - ISO 7816
 - CE
 - FCC
 - VCCI
 - PC/SC
 - CCID
 - Microsoft® WHQL
 - RoHS 2
 - REACH

² PC/SC and CCID support are not applicable



3.0. Smart Card Support

3.1. MCU Cards

The ACR33U-A1 is a PC/SC compliant smart card reader that supports ISO 7816 Class A (5 V) smart card. It also works with MCU (MicroController Unit) cards following either the T=0 and T=1 protocol.

The card ATR indicates the specific operation mode (TA2 present; bit b5 of TA2 must be 0) and when that the particular mode is not supported by the ACR33U-A1; the reader will reset the card to a negotiable mode. If the card cannot be set to negotiable mode, the reader will then reject the card.

When the card ATR indicates the negotiable mode (TA2 not present) and communication parameters other than the default parameters, the ACR33U-A1 will execute the PPS and try to use the communication parameters that the card suggested in its ATR. If the card does not accept the PPS, the reader will use the default parameters (F=372, D=1).

Note: For the meaning of the aforementioned parameters, please refer to **ISO 7816-3**.

3.2. Memory-based Smart Cards

The ACR33U-A1 works with several memory-based smart cards such as:

- Cards following the I2C bus protocol (free memory cards) with maximum 128 bytes page with capability, including:
 - Atmel®: AT24C01/02/04/08/16/32/64/128/256/512/1024
- Cards with secure memory IC with password and authentication, including:
 - Atmel®: AT88SC153 and AT88SC1608
- Cards with intelligent 1 KB EEPROM with write-protect function, including:
 - Infineon®: SLE4418, SLE4428, SLE5518 and SLE5528
- Cards with intelligent 256 bytes EEPROM with write-protect function, including:
 - Infineon®: SLE4432, SLE4442, SLE5532 and SLE5542
- Cards with '104' type EEPROM non-reloadable token counter cards, including:
 - Infineon®: SLE4406, SLE4436, SLE5536 and SLE6636
- Cards with Security Logic with Application Zone(s), including:
 - Atmel®: AT88SC101, AT88SC102 and AT88SC1003

Note: Memory card is supported in **ICC Slot 0** only of ACR33U-A1 SmartDuo Smart Card Reader.



4.0. Smart Card Interface

The interface between the ACR33U-A1 and the inserted smart card follows the specifications of ISO 7816-3 with certain restrictions or enhancements to increase the practical functionality of the ACR33U-A1.

4.1. Smart Card Power Supply VCC (C1)

The current consumption of the inserted card must not be higher than 50 mA.

4.2. Programming Voltage VPP (C6)

According to ISO 7816-3, the smart card contact C6 (VPP) supplies the programming voltage to the smart card. Since all common smart cards in the market are EEPROM-based and do not require the provision of an external programming voltage, the contact C6 (VPP) has been implemented as a normal control signal in the ACR33U-A1. The electrical specifications of this contact are identical to those of the signal RST (at contact C2).

4.3. Card Type Selection

The controlling personal computer must always select the card type through the proper command sent to the ACR33U-A1 prior to activating the inserted card. This includes both the memory cards and MCU-based cards.

For MCU-based cards, the reader is allowed to select the preferred protocol, T=0 or T=1. However, this selection is only accepted and carried out by the reader through the PPS when the card inserted in the reader supports both protocol types. Whenever an MCU-based card supports only one protocol type, T=0 or T=1, the reader automatically uses that protocol type, regardless of the protocol type selected by the application.

4.4. Interface for Microcontroller-based Cards

For microcontroller-based smart cards only the contacts C1 (VCC), C2 (RST), C3 (CLK), C5 (GND) and C7 (I/O) are used. A frequency of 4 MHz is applied to the CLK signal (C3).

4.5. Card Tearing Protection

The ACR33U-A1 provides a mechanism to protect the inserted card when it is suddenly withdrawn while it is powered up. The power supply to the card and the signal lines between the ACR33U-A1 and the card is immediately deactivated when the card is removed. However, as a rule to avoid any electrical damage, a card should only be removed from the reader while it is powered down.

Note: ACR33U-A1 does not switch on the power supply to the inserted card by itself. This can be done by the controlling computer through the proper command sent to the reader.



5.0. Power Supply

The ACR33U-A1 requires a voltage of 5 V DC, 100 mA, regulated, power supply. The ACR33U-A1 gets the power supply from the computer (through the cable supplied along with each type of reader).

5.1. Status LED

The LED indicates the activation status of the smart card interface:

- **Flashing slowly (turns on 200 ms every 2 seconds)**
Indicates ACR33U-A1 is powered up and in the standby state. Either the smart card has not been inserted or the smart card has not been powered up (if it is inserted).
- **Lighting up**
Indicates power supply to the smart card is switched on (e.g. the smart card is activated).
- **Flashing quickly**
Indicates there are communications between ACR33U-A1 and smart card.

The different LED colors indicate the different states of the ACR33U-A1, where:

- **Red LED**
Power status
- **Green LED**
Main card slot status (ICC Slot 0)
- **Blue LED**
Slave card slot status (ICC Slot 1)



6.0. USB Interface

6.1. Communication Parameters

The ACR33U-A1 is connected to a computer through USB as specified in the USB Specification 2.0. The ACR33U-A1 is working in full speed mode (e.g. 12 Mbps).

Pin	Signal	Function
1	V _{BUS}	+5 V power supply for the reader.
2	D-	Differential signal transmits data between ACR33U-A1 and PC.
3	D+	Differential signal transmits data between ACR33U-A1 and PC.
4	GND	Reference voltage level for power supply.

Table 2: USB Interface Wiring

Note: In order for the ACR33U-A1 to function properly through USB interface, either ACS proprietary device driver or ACS PC/SC device driver has to be installed.

6.2. Endpoints

The ACR33U-A1 uses the following endpoints to communicate with the host computer:

Control Endpoint	For setup and control purpose
Bulk OUT	For command to be sent from host to ACR33U-A1 (data packet size is 64 bytes)
Bulk IN	For response to be sent from ACR33U-A1 to host (data packet size is 64 bytes)
Interrupt IN	For card status message to be sent from ACR33U-A1 to host (data packet size is 8 bytes)



7.0. Communication Protocol

ACR33U-A1 shall interface with the host through the USB connection. A specification, namely CCID, has been released within the industry defining such a protocol for the USB chip-card interface devices. CCID covers all the protocols required for operating smart cards.

Note: The configurations and usage of USB endpoints on ACR33U-A1 shall follow **CCID Section 3**.

An overview is summarized below:

1. **Control Commands** are sent on control pipe (default pipe). These include class-specific requests and USB standard requests. Commands that are sent on the default pipe report information back to the host on the default pipe.
2. **CCID Events** are sent on the interrupt pipe.
3. **CCID Commands** are sent on BULK-OUT endpoint. Each command sent to ACR33U-A1 has an associated ending response. Some commands can also have intermediate responses.
4. **CCID Responses** are sent on BULK-IN endpoint. All commands sent to ACR33U-A1 have to be sent synchronously (e.g. *bMaxCCIDBusySlots* is equal to 01h for ACR33U-A1).

The ACR33U-A1 supported CCID features are indicated in its Class Descriptor:

Offset	Field	Size	Value	Description
0	<i>bLength</i>	1	36h	Size of this descriptor, in bytes.
1	<i>bDescriptorType</i>	1	21h	CCID Functional Descriptor type.
2	<i>bcdCCID</i>	2	0100h	CCID Specification Release Number in Binary-Coded decimal.
4	<i>bMaxSlotIndex</i>	1	05h	2 big slots and 3 SAM slots are available on ACR33U-A1.
5	<i>bVoltageSupport</i>	1	01h	ACR33U-A1 can supply 5 V to its slot.
6	<i>dwProtocols</i>	4	00000003h	ACR33U-A1 supports T=0 and T=1 protocol.
10	<i>dwDefaultClock</i>	4	00000FA0h	Default ICC clock frequency is 4 MHz.
14	<i>dwMaximumClock</i>	4	00000FA0h	Maximum supported ICC clock frequency is 4 MHz.
18	<i>bNumClockSupported</i>	1	00h	Does not support manual setting of clock frequency.
19	<i>dwDataRate</i>	4	00002A00h	Default ICC I/O data rate is 10752 bps.
23	<i>dwMaxDataRate</i>	4	00054024h	Maximum supported ICC I/O data rate is 344100 bps.
27	<i>bNumDataRatesSupported</i>	1	00h	Does not support manual setting of data rates.
28	<i>dwMaxIFSD</i>	4	00000FEh	Maximum IFSD supported by ACR33U-A1 for protocol T=1 is 254.
32	<i>dwSynchProtocols</i>	4	00000000h	ACR33U-A1 does not support synchronous card.
36	<i>dwMechanical</i>	4	00000000h	ACR33U-A1 does not support special mechanical characteristics.



Offset	Field	Size	Value	Description
40	<i>dwFeatures</i>	4	000204B0h	ACR33U-A1 supports the following features: <ul style="list-style-type: none">• Automatic ICC clock frequency change according to parameters• Automatic baud rate change according to frequency and FI,DI parameters• Automatic PPS made by the CCID according to the active parameters• Automatic IFSD exchange as first exchange (T=1 protocol in use)• Short APDU level exchange with CCID
44	<i>dwMaxCCIDMessageLength</i>	4	0000010Fh	Maximum message length accepted by ACR33U-A1 is 271 bytes.
48	<i>bClassGetResponse</i>	1	00h	Insignificant for TPDU level exchanges.
49	<i>bClassEnvelope</i>	1	00h	Insignificant for TPDU level exchanges.
50	<i>wLCDLayout</i>	2	0000h	No LCD.
52	<i>bPINSupport</i>	1	03h	With PIN verification and modification.
53	<i>bMaxCCIDBusySlots</i>	1	01h	Only 1 slot can be simultaneously busy.



8.0. Memory Card Type Selection

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.

Note: For details of SCardConnect() API, please refer to PC/SC specifications.

A code snippet for the program flow is given below to demonstrate how to select the memory card type:

```
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);
```



9.0. Commands

9.1. CCID Command Pipe Bulk-OUT Messages

ACR33U-A1 shall follow the CCID Bulk-OUT Messages as specified in CCID Section 4. In addition, this specification defines some extended commands for operating additional features.

This section lists the CCID Bulk-OUT Messages to be supported by ACR33U-A1.

9.1.1. PC_to_RDR_IccPowerOn

This command is used to activate the card slot and return ATR from the card.

Offset	Field	Size	Value	Description
0	<i>bMessageType</i>	1	62h	
1	<i>dwLength</i>	4	00000000h	Size of extra bytes of this message.
2	<i>bSlot</i>	1	00-05h	Identifies the slot number for this command.
5	<i>bSeq</i>	1	00-FFh	Sequence number for command.
6	<i>bPowerSelect</i>	1	01h	Voltage that is applied to the ICC: 01h = 5 volts
7	<i>abRFU</i>	2		Reserved for future use.

The response to this command message is the *RDR_to_PC_DataBlock* response message and the data returned is the Answer-to-Reset (ATR) data.

9.1.2. PC_to_RDR_IccPowerOff

This command is used to deactivate the card slot.

Offset	Field	Size	Value	Description
0	<i>bMessageType</i>	1	63h	
1	<i>dwLength</i>	4	00000000h	Size of extra bytes of this message.
5	<i>bSlot</i>	1	00-05h	Identifies the slot number for this command.
6	<i>bSeq</i>	1	00-FFh	Sequence number for command.
7	<i>abRFU</i>	3		Reserved for future use.

The response to this message is the *RDR_to_PC_SlotStatus* message.

9.1.3. PC_to_RDR_GetSlotStatus

This command is used to get current status of the slot.

Offset	Field	Size	Value	Description
0	<i>bMessageType</i>	1	65h	
1	<i>dwLength</i>	4	00000000h	Size of extra bytes of this message.
5	<i>bSlot</i>	1	00-05h	Identifies the slot number for this command.
6	<i>bSeq</i>	1	00-FFh	Sequence number for command.
7	<i>abRFU</i>	3		Reserved for future use.

The response to this message is the *RDR_to_PC_SlotStatus* message.



9.1.4. PC_to_RDR_XfrBlock

This command is used to transfer data block to the ICC.

Offset	Field	Size	Value	Description
0	<i>bMessageType</i>	1	6Fh	
1	<i>dwLength</i>	4		Size of <i>abData</i> field of this message.
5	<i>bSlot</i>	1	00-05h	Identifies the slot number for this command.
6	<i>bSeq</i>	1	00-FFh	Sequence number for command.
7	<i>bBWI</i>	1	00-FFh	Used to extend the CCIDs Block Waiting Timeout for this current transfer. The CCID will timeout the block after "this number multiplied by the Block Waiting Time" has expired.
8	<i>wLevelParameter</i>	2	0000h	RFU (TPDU exchange level).
10	<i>abData</i>	Byte array		Data block sent to the CCID. Data is sent "as is" to the ICC (TPDU exchange level).

The response to this message is the *RDR_to_PC_DataBlock* message.

9.1.5. PC_to_RDR_GetParameters

This command is used to get the slot parameters.

Offset	Field	Size	Value	Description
0	<i>bMessageType</i>	1	6Ch	
1	<i>dwLength</i>	4	00000000h	Size of extra bytes of this message.
5	<i>bSlot</i>	1	00-05h	Identifies the slot number for this command.
6	<i>bSeq</i>	1	00-FFh	Sequence number for command.
7	<i>abRFU</i>	3		Reserved for future use.

The response to this message is the *RDR_to_PC_Parameters* message.

9.1.6. PC_to_RDR_SetParameters

This command is used to set the slot parameters.

Offset	Field	Size	Value	Description
0	<i>bMessageType</i>	1	61h	
1	<i>dwLength</i>	4		Size of extra bytes of this message.
5	<i>bSlot</i>	1	00-05h	Identifies the slot number for this command.
6	<i>bSeq</i>	1	00-FFh	Sequence number for command.



Offset	Field	Size	Value	Description
7	<i>bProtocolNum</i>	1	00h, 01h	Specifies what protocol data structure follows. 00h = Structure for protocol T=0 01h = Structure for protocol T=1 The following values are reserved for future use: 80h = Structure for 2-wire protocol 81h = Structure for 3-wire protocol 82h = Structure for I2C protocol
8	<i>abRFU</i>	2		Reserved for future use.
10	<i>abProtocolDataStructure</i>	Byte array		Protocol Data Structure.

The response to this message is the *RDR_to_PC_Parameters* message.

Protocol Data Structure for Protocol T=0 (*dwLength*=00000005h)

Offset	Field	Size	Value	Description
10	<i>bmFindexDindex</i>	1		B7-4 – FI - Index into the Table 7 in ISO/IEC 7816-3:1997 selecting a clock rate conversion factor B3-0 – DI - Index into the Table 8 in ISO/IEC 7816-3:1997 selecting a baud rate conversion factor
11	<i>bmTCKKST0</i>	1		B0 – 0b, B7-2 – 000000b B1 – Convention used (b1=0 for direct, b1=1 for inverse) Note: The CCID ignores this bit.
12	<i>bGuardTimeT0</i>	1	00-FFh	Extra guard time between two characters. Add 0 to 254etu to the normal guard time of 12etu. FFh is the same as 00h.
13	<i>bWaitingIntegerT0</i>	1	00-FFh	WI for T=0 used to define WWT
14	<i>bClockStop</i>	1	00-03h	ICC Clock Stop Support: 00h = Stopping the Clock is not allowed 01h = Stop with Clock signal Low 02h = Stop with Clock signal High 03h = Stop with Clock either High or Low

The response to this message is the *RDR_to_PC_Parameters* message.



Protocol Data Structure for Protocol T=1 (*dwLength*=00000007h)

Offset	Field	Size	Value	Description
10	<i>bmFindexDindex</i>	1		B7-4 – FI - Index into the Table 7 in ISO/IEC 7816-3:1997 selecting a clock rate conversion factor B3-0 – DI - Index into the Table 8 in ISO/IEC 7816-3:1997 selecting a baud rate conversion factor
11	<i>BmTCKST1</i>	1		B7-2 – 000100b B0 – Checksum type (b0=0 for LRC, b0=1 for CRC) B1 – Convention used (b1=0 for direct, b1=1 for inverse) Note: The CCID ignores this bit.
12	<i>BGuardTimeT1</i>	1	00-FFh	Extra guard time (0 to 254etu between two characters). If value is FFh, then guard time is reduced by 1etu.
13	<i>BwaitingIntegerT1</i>	1	00-9Fh	B7-4 = BWI values 0-9 valid B3-0 = CWI values 0-Fh valid
14	<i>bClockStop</i>	1	00-03h	ICC Clock Stop Support: 00h = Stopping the Clock is not allowed 01h = Stop with Clock signal Low 02h = Stop with Clock signal High 03h = Stop with Clock either High or Low
15	<i>bIFSC</i>	1	00-FFh	Size of negotiated IFSC.
16	<i>bNadValue</i>	1	00h	Only support NAD = 00h

The response to this message is the *RDR_to_PC_Parameters* message.

9.1.7. PC_to_RDR_Escape

This command is used to define and access extended features.

Offset	Field	Size	Value	Description
0	<i>bMessageType</i>	1	6Bh	
1	<i>dwLength</i>	4		Size of <i>abData</i> field of this message.
5	<i>bSlot</i>	1	00-05h	Identifies the slot number for this command.
6	<i>bSeq</i>	1	00-FFh	Sequence number for command.
7	<i>abRFU</i>	3		Reserved for future use.
10	<i>abData</i>	Byte array		Data block sent to the CCID.



9.1.7.1. LED

Offset	Field	Size	Value	Description
10	<i>bcmdCode</i>	1	01h	
11	<i>wcmdLength</i>	2	0001h	
13	<i>abRFU</i>	2		Reserved for future use.
15	<i>abData</i>	1	00000 XYZb	00000xxx for 3 LED, XYZ: 000 => 3 LEDs off XYZ: 001 => LED1 on, green for 1 Sec XYZ: 010 => LED2 on, red for 1 Sec XYZ: 100 => LED3 on, blue for 1 Sec

The response to this command message is the *RDR_to_PC_Escape* response message.

9.1.7.2. Buzzer

Offset	Field	Size	Value	Description
10	<i>bcmdCode</i>	1	08h	
11	<i>wcmdLength</i>	2	0001h	
13	<i>abRFU</i>	2		Reserved for future use.
15	<i>abData</i>	1	XXh	XX for buzzer on or off, YZ: 5A = buzzer on for 1 Sec YZ: A5 = buzzer off

The response to this command message is the *RDR_to_PC_Escape* response message.

9.1.7.3. Get Firmware Version

Offset	Field	Size	Value	Description
10	<i>bcmdCode</i>	1	04h	
11	<i>wcmdLength</i>	2	0000h	
13	<i>abRFU</i>	2		Reserved for future use.

The response to this command message is the *RDR_to_PC_Escape* response message.



9.2. CCID Bulk-IN Messages

The Bulk-IN messages are used in response to the Bulk-OUT messages. ACR33U-A1 shall follow the CCID Bulk-IN Messages as specified in CCID Section 4.

This section lists the CCID Bulk-IN Messages to be supported by ACR33U-A1.

Note: The values of *bSlot* and *bSeq* are the same as Bulk-OUT message.

9.2.1. RDR_to_PC_DataBlock

This message is sent by ACR33U-A1 in response to the command message: *PC_to_RDR_IccPowerOn* and *PC_to_RDR_XfrBlock*.

Offset	Field	Size	Value	Description
0	<i>bMessageType</i>	1	80h	Indicates that a data block is being sent from the CCID.
1	<i>dwLength</i>	4	-	Size of extra bytes of this message.
5	<i>bSlot</i>	1	-	Same value as in Bulk-OUT message.
6	<i>bSeq</i>	1	-	Same value as in Bulk-OUT message.
7	<i>bStatus</i>	1	-	Slot status register as defined in CCID Section 4.2.1.
8	<i>bError</i>	1	-	Slot error register as defined in CCID Section 4.2.1.
9	<i>bChainParameter</i>	1	00h	RFU (TPDU exchange level).
10	<i>abData</i>	Byte array	-	This field contains the data returned by the CCID.

9.2.2. RDR_to_PC_SlotStatus

This message is sent by ACR33U-A1 in response to *PC_to_RDR_IccPowerOff*, *PC_to_RDR_GetSlotStatus*.

Offset	Field	Size	Value	Description
0	<i>bMessageType</i>	1	81	
1	<i>dwLength</i>	4	00000000h	Size of extra bytes of this message.
5	<i>bSlot</i>	1		Same value as in Bulk-OUT message.
6	<i>bSeq</i>	1		Same value as in Bulk-OUT message.
7	<i>bStatus</i>	1		Slot status register as defined in CCID Section 4.2.1.
8	<i>bError</i>	1		Slot error register as defined in CCID Section 4.2.1.
9	<i>bClockStatus</i>	1		Value: 00h = Clock running 01h = Clock stopped in state L 02h = Clock stopped in state H 03h = Clock stopped in an unknown state All other values are RFU.



9.2.3. RDR_to_PC_Parameters

This message is sent by ACR33U-A1 in response to *PC_to_RDR_GetParameters* and *PC_to_RDR_SetParameters* messages.

Offset	Field	Size	Value	Description
0	<i>bMessageType</i>	1	82h	
1	<i>dwLength</i>	4		Size of extra bytes of this message.
5	<i>bSlot</i>	1		Same value as in Bulk-OUT message.
6	<i>bSeq</i>	1		Same value as in Bulk-OUT message.
7	<i>bStatus</i>	1		Slot status register as defined in CCID Section 4.2.1.
8	<i>bError</i>	1		Slot error register as defined in CCID Section 4.2.1.
9	<i>bProtocolNum</i>	1		Specifies what protocol data structure follows: 00h = Structure for protocol T=0 01h = Structure for protocol T=1 The following values are reserved for future use. 80h = Structure for 2-wire protocol 81h = Structure for 3-wire protocol 82h = Structure for I2C protocol
10	<i>abProtocolDataStructure</i>	Byte array		Protocol Data Structure as summarized in CCID Section 10.1.6.

Protocol Data Structure for Protocol T=0 (*bProtocolNum*=0, *dwLength*=00000005h)

Offset	Field	Size	Value	Description
10	<i>bmFindexDindex</i>	1	-	B7-4 – FI - Index into the Table 7 in ISO/IEC 7816-3:1997 selecting a clock rate conversion factor B3-0 – DI - Index into the Table 8 in ISO/IEC 7816-3:1997 selecting a baud rate conversion factor
11	<i>bmTCKKST0</i>	1	00h, 02h	For T=0, B0 – 0b, B7-2 – 000000b B1 – Convention used (b1=0 for direct, b1=1 for inverse)
12	<i>bGuardTimeT0</i>	1	00-FFh	Extra guard time between two characters. Add 0 to 254etu to the normal guard time of 12etu. FFh is the same as 00h.
13	<i>bWaitingIntegerT0</i>	1	00-FFh	WI for T=0 used to define WWT
14	<i>bClockStop</i>	1	00-03h	ICC Clock Stop Support: 00h = Stopping the Clock is not allowed 01h = Stop with Clock signal Low 02h = Stop with Clock signal High 03h = Stop with Clock either High or Low



Protocol Data Structure for Protocol T=1 (*bProtocolNum=1, dwLength=00000007h*)

Offset	Field	Size	Value	Description
10	<i>bmFindexDindex</i>	1		B7-4 – FI - Index into the Table 7 in ISO/IEC 7816-3:1997 selecting a clock rate conversion factor B3-0 – DI - Index into the Table 8 in ISO/IEC 7816-3:1997 selecting a baud rate conversion factor
11	<i>bmTCKKST1</i>	1	10h, 11h, 12h, 13h	For T-1, B7-2 – 000100b B0 – Checksum type (b0=0 for LRC, b0=1 for CRC) B1 – Convention used (b1=0 for direct, b1=1 for inverse)
12	<i>bGuardTimeT1</i>	1	00-FFh	Extra guard time (0 to 254etu between two characters). If value is FFh, then guard time is reduced by 1h.
13	<i>bwaitingIntegerT1</i>	1	00-9Fh	B7-4 = BWI B3-0 = CWI
14	<i>bClockStop</i>	1	00-03h	ICC Clock Stop Support: 00h = Stopping the Clock is not allowed 01h = Stop with Clock signal Low 02h = Stop with Clock signal High 03h = Stop with Clock either High or Low
15	<i>bIFSC</i>	1	00-FFh	Size of negotiated IFSC.
16	<i>bNadValue</i>	1	00h	Only support NAD = 00h



9.2.4. RDR_to_PC_Escape

This message is sent by ACR33U-A1 in response to *PC_to_RDR_Escape* messages.

Offset	Field	Size	Value	Description
0	<i>bMessageType</i>	1	83h	
1	<i>dwLength</i>	4		Size of <i>abData</i> field of this message.
5	<i>bSlot</i>	1		Same value as in Bulk-OUT message.
6	<i>bSeq</i>	1		Same value as in Bulk-OUT message.
7	<i>bStatus</i>	1		Slot status register as defined in CCID Section 4.2.1.
8	<i>bError</i>	1		Slot error register as defined in CCID Section 4.2.1.
9	<i>bRFU</i>	1	00h	RFU (TPDU exchange level).
10	<i>abData</i>	Byte array		This field contains the data returned by the CCID.

9.2.4.1. LED

This message is sent by ACR33U-A1 in response to *PC_to_RDR_Escape* LED messages.

Offset	Field	Size	Value	Description
10	<i>bcmdCode</i>	1	81	
11	<i>wcmdLength</i>	2	0000	
13	<i>abStatus</i>	2	00XX	XXh for SW2: 00h: Success 01h: Bad parameter

9.2.4.2. Buzzer

This message is sent by ACR33U-A1 in response to *PC_to_RDR_Escape* buzzer messages.

Offset	Field	Size	Value	Description
10	<i>bcmdCode</i>	1	88h	
11	<i>wcmdLength</i>	2	0000h	
13	<i>abStatus</i>	2	00XXh	XXh: 00h = Success 01h = Bad parameter



9.2.4.3. Get Firmware Version

This message is sent by ACR33U-A1 in response to *PC_to_RDR_Escape* Get Firmware Version messages.

Offset	Field	Size	Value	Description
10	<i>bcmdCode</i>	1	84h	
11	<i>wcmdLength</i>	2	0004h	
13	<i>abStatus</i>	2	00XXh	XXh: 00h = Success 01h = Bad parameter
15	<i>abData</i>	13	41h 43h 52h 33h 33h 2Dh 41h 31h 20h XXh XXh XXh XXh	XX XX XX XX: Firmware Version



9.3. Memory Card Command Set

Memory cards can be accessed via *PC_to_RDR_XfrBlock* command. All memory card functions are mapped into pseudo-APDUs.

9.3.1. Memory Card – 1, 2, 4, 8, 16 kilobit I2C Card

9.3.1.1. 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 specifications.

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FFh	A4h	00h	00h	01h	01h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.



9.3.1.2. 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 down.

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Page size
FFh	01h	00h	00h	01h	

Where:

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

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

- SW1 SW2** = 90 00h if no error.



9.3.1.3. READ_MEMORY_CARD

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU				
CLA	INS	Byte Address		MEM_L
		MSB	LSB	
FFh	B0h			

Where:

- 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

Where:

- BYTE x** Data read from memory card.
- SW1 SW2** = 90 00h if no error.



9.3.1.4. 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					
FFh	D0h							

Where:

- 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

Where:

- SW1 SW2** = 90 00h if no error.



9.3.2. Memory Card – 32, 64, 128, 256, 512, 1024 kilobit I2C Card

9.3.2.1. 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 specifications.

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FFh	A4h	00h	00h	01h	02h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.



9.3.2.2. 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
FFh	01h	00h	00h	01h	

Where:

- Data** TPDU to be sent to the card
- Page size** = 03h for 8-byte page write
- = 04h for 16-byte page write
- = 05h for 32-byte page write
- = 06h for 64-byte page write
- = 07h for 128-byte page write

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

- SW1 SW2** = 90 00h if no error.



9.3.2.3. READ_MEMORY_CARD

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU				
CLA	INS	Byte Address		MEM_L
		MSB	LSB	
FFh				

Where:

- INS** = B0h for 32, 64, 128, 256, 512 kilobit iic card
= 1011 000*b for 1024 kilobit 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

Where:

- BYTE x** Data read from memory card.
- SW1 SW2** = 90 00h if no error.



9.3.2.4. 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					
FFh								

Where:

- INS** = D0h for 32, 64, 128, 256, 512 kilobit iic card
= 1101 000*b for 1024 kilobit 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

Where:

- SW1 SW2** = 90 00h if no error.



9.3.3. Memory Card – ATMEL AT88SC153

9.3.3.1. 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 specifications.

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FFh	A4h	00h	00h	01h	03h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.



9.3.3.2. READ_MEMORY_CARD

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU				
CLA	INS	P1	Byte Address	MEM_L
FFh		00h		

Where:

- INS**
 - = B0h for reading zone 00b
 - = B1h for reading zone 01b
 - = B2h for reading zone 10b
 - = B3h for reading zone 11b
 - = B4h 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

Where:

- BYTE x** Data read from memory card.
- SW1 SW2** = 90 00h if no error.



9.3.3.3. 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
FFh		00h						

Where:

- INS** = D0h for writing zone 00b
= D1h for writing zone 01b
= D2h for writing zone 10b
= D3h for writing zone 11b
= D4h 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

Where:

- SW1 SW2** = 90 00h if no error.



9.3.3.4. 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)
FFh	20h	00h		03h			

Where:

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

P2 = 0000 00rp

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
90h	

Where:

SW1 = 90h

SW2 (ErrorCnt) = Error Counter. FFh indicates the verification is correct. 00h indicates the password is locked (exceeded the maximum number of retries). Other values indicate the current verification has failed.



9.3.3.5. 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)
FFh	84h	00h	00h	08h				

Where:

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

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.



9.3.3.6. 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)
FFh	82h	00h	00h	08h				

Where:

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

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.



9.3.4. Memory Card – ATMEL AT88SC1608

9.3.4.1. 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 specifications.

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FFh	A4h	00h	00h	01h	04h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.



9.3.4.2. READ_MEMORY_CARD

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU				
CLA	INS	Zone Address	Byte Address	MEM_L
FFh				

Where:

- INS** = B0h for reading user zone
= B1h for reading configuration zone or reading fuse
- Zone Address** = 0000 0A₁₀A₉A₈b, 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 0000b 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

Where:

- BYTE x** Data read from memory card.
- SW1 SW2** = 90 00h if no error.



9.3.4.3. 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
FFh								

Where:

- INS** = D0h for writing user zone
= D1h for writing configuration zone or writing fuse
- Zone Address** = 0000 0A₁₀A₉A₈b, where A₁₀ is the MSB of zone address
= don't care for writing fuse
- Byte Address** = A₇A₆A₅A₄ A₃A₂A₁A₀b 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

Where:

- SW1 SW2** = 90 00h if no error.



9.3.4.4. VERIFY_PASSWORD

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU								
CLA	INS	P1	P2	Lc	Data			
FFh	20h	00h	00h	04h	RP	Pw(0)	Pw(1)	Pw(2)

Where:

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

RP = 0000 rp₂p₁p₀b

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 data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2 ErrorCnt
90h	

Where:

SW1 = 90h

SW2 (ErrorCnt) = Error Counter. FFh indicates the verification is correct. 00h indicates the password is locked (exceeded the maximum number of retries). Other values indicate the current verification has failed.



9.3.4.5. 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)
FFh	84h	00h	00h	08h				

Where:

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

Where:

SW1 SW2 = 90 00h if no error.



9.3.4.6. 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)
FFh	82h	00h	00h	08h				

Where:

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

Where:

SW1 SW2 = 90 00h if no error.



9.3.5. Memory Card – SLE4418/SLE4428/SLE5518/SLE5528

9.3.5.1. 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 specifications.

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FFh	A4h	00h	00h	01h	05h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.



9.3.5.2. READ_MEMORY_CARD

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU				
CLA	INS	Byte Address		MEM_L
		MSB	LSB	
FFh	B0h			

Where:

- MSB Byte Address** = 0000 00A₉A₈b is the memory address location of the memory card.
- LSB Byte Address** = A₇A₆A₅A₄ A₃A₂A₁A₀b 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

Where:

- BYTE x** Data read from memory card.
- SW1 SW2** = 90 00h if no error.



9.3.5.3. READ_PRESENTATION_ERROR_COUNTER_MEMORY_CARD (only SLE4428 and SLE5528)

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
FFh	B1h	00h	00h	03h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

ERRCNT	DUMMY 1	DUMMY 2	SW1	SW2

Where:

- ERRCNT** The value of the presentation error counter. FFh indicates the last verification is correct. 00h indicates the password is locked (exceeded the maximum number of retries). Other values indicate the last verification has failed.
- DUMMY** Two bytes dummy data read from the card.
- SW1 SW2** = 90 00h if no error.



9.3.5.4. READ_PROTECTION_BIT

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU				
CLA	INS	Byte Address		MEM_L
		MSB	LSB	
FFh	B2h			

Where:

MSB Byte Address = 0000 00A₉A₈b is the memory address location of the memory card.

LSB Byte Address = A₇A₆A₅A₄ A₃A₂A₁A₀b 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.

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

Example: To read eight protection bits starting from memory 0010h, the following pseudo-APDU should be issued:

FF B1 00 10 01h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

PROT 1	PROT L	SW1	SW2

Where:

PROT y Bytes containing the protection bits.

SW1 SW2 = 90 00h 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

Where:

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

'0' byte is write protected

'1' byte can be written



9.3.5.5. 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					
FFh	D0h							

Where:

MSB Byte Address = 0000 00A₉A₈b is the memory address location of the memory card.

LSB Byte Address = A₇A₆A₅A₄ A₃A₂A₁A₀b 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

Where:

SW1 SW2 = 90 00h if no error.



9.3.5.6. 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 is matched, 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					
FFh	D1h							

Where:

- MSB Byte Address** = 0000 00A₉A₈b is the memory address location of the memory card
- LSB Byte Address** = A₇A₆A₅A₄ A₃A₂A₁A₀b 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

Where:

- SW1 SW2** = 90 00h if no error.



9.3.5.7. PRESENT_CODE_MEMORY_CARD (only SLE 4428 and SLE5528)

This command is used to submit the secret code to the memory card to enable the write operation with the SLE4428 and SLE5528 card, the following actions are executed:

- Search a '1' bit in the presentation error counter and write the bit to '0'
- Present the specified code to the card
- 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
FFh	20h	00h	00h	02h		

Where:

CODE Two bytes secret code (PIN).

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2 ErrorCnt
90h	

Where:

SW1 = 90h

SW2 (ErrorCnt) = Error Counter. FFh indicates the verification is correct. 00h indicates the password is locked (exceeded the maximum number of retries). Other values indicate the current verification has failed.



9.3.6. Memory Card – SLE4432/SLE4442/SLE5532/SLE5542

9.3.6.1. 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 specifications.*

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FFh	A4h	00h	00h	01h	06h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.



9.3.6.2. READ_MEMORY_CARD

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU				
CLA	INS	P1	Byte Address	MEM_L
FFh	B0h	00h		

Where:

Byte Address = $A_7A_6A_5A_4 A_3A_2A_1A_0b$ 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

Where:

BYTE x Data read from memory card.

SW1 SW2 = 90 00h if no error.



9.3.6.3. READ_PRESENTATION_ERROR_COUNTER_MEMORY_CARD (only SLE4442 and SLE5542)

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
FFh	B1h	00h	00h	04h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

ERRCNT	DUMMY 1	DUMMY 2	DUMMY 3	SW1	SW2

Where:

- ERRCNT** The value of the presentation error counter. 07h indicates the last verification is correct. 00h indicates the password is locked (exceeded the maximum number of retries). Other values indicate the last verification has failed.
- DUMMY** Three bytes dummy data read from the card.
- SW1 SW2** = 90 00h if no error.



9.3.6.4. READ_PROTECTION_BITS

This command is used 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
FFh	B2h	00h	00h	04h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

PROT 1	PROT 2	PROT3	PROT 4	SW1	SW2

Where:

PROT y Bytes containing the protection bits from protection memory.

SW1 SW2 = 90 00h 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

Where:

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

'0' byte is write protected

'1' byte can be written



9.3.6.5. 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
FFh	D0h	00h						

Where:

Byte Address = $A_7A_6A_5A_4 A_3A_2A_1A_0b$ 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

Where:

SW1 SW2 = 90 00h if no error.



9.3.6.6. 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 is matched, 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
FFh	D1h	00h						

Where:

Byte Address = $000A_4 A_3A_2A_1A_0b$ (00h to 1Fh) 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

Where:

SW1 SW2 = 90 00h if no error.



9.3.6.7. PRESENT_CODE_MEMORY_CARD (only SLE 4442 and SLE5542)

This command is used to submit the secret code to the memory card to enable the write operation with the SLE4442 and SLE5542 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
FFh	20h	00h	00h	03h			

Where:

CODE Three bytes secret code (PIN).

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2 ErrorCnt
90h	

Where:

SW1 = 90h.

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



9.3.6.8. CHANGE_CODE_MEMORY_CARD (only SLE 4442 and SLE5542)

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

The current secret code must be 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
FFh	D2h	00h	01h	03h			

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.



9.3.7. Memory Card – SLE4406/SLE4436/SLE5536/SLE6636

9.3.7.1. 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 specifications.

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FFh	A4h	00h	00h	01h	07h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.



9.3.7.2. READ_MEMORY_CARD

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU				
CLA	INS	P1	Byte Address	MEM_L
FFh	B0h	00h		

Where:

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

Where:

BYTE x Data read from memory card.

SW1 SW2 = 90 00h if no error.



9.3.7.3. WRITE_ONE_BYTE_MEMORY_CARD

This command is used 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:

1. 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.

2. 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.

3. Write with backup enabled (SLE4436, SLE5536 and SLE6636 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.

4. Write with carry and backup enabled (SLE4436, SLE5536 and SLE6636 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 SLE4436 and SLE5536 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
FFh	D0h	00h		02h		

Where:

Byte Address = Memory address location of the memory card.

MODE Specifies the write mode and backup option.

00h: write

01h: write with carry

02h: write with backup enabled (SLE4436, SLE5536 and SLE6636 only)

03h: write with carry and with backup enabled (SLE4436, SLE5536 and SLE6636 only)

BYTE Byte value to be written to the card.



Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.



9.3.7.4. 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 ACR33U-A1 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
FFh	20h	00h	00h	04h	09h			

Where:

- 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

Where:

- SW1 SW2** = 90 00h if no error.



9.3.7.5. AUTHENTICATE_MEMORY_CARD (SLE4436, SLE5536 and SLE6636 only)

This command is used to read a card authentication certificate from a SLE5536 or SLE6636 card, the following actions are executed by the ACR33U-A1:

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	Byte1	Byte 2	.....	Byte 5	Byte 6
FFh	84h	00h	00h	08h							

Where:

- KEY:** Key to be used for the computation of the authentication certificate:
- 00h: key 1 with no cipher block chaining
 - 01h: key 2 with no cipher block chaining
 - 80h: key 1 with cipher block chaining (SLE5536 and SLE6636 only)
 - 81h: key 2 with cipher block chaining (SLE5536 and SLE6636 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 (A0h).
- BYTE 1...6:** Card challenge data.

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2
61h	02h

Where:

- SW1 SW2** = 61 02h 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
FFh	C0h	00h	00h	02h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

CERT	SW1	SW2

Where:

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 00h if no error.



9.3.8. Memory Card – SLE4404

9.3.8.1. 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 specifications.

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FFh	A4h	00h	00h	01h	08h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.



9.3.8.2. READ_MEMORY_CARD

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU				
CLA	INS	P1	Byte Address	MEM_L
FFh	B0h	00h		

Where:

- 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

Where:

- BYTE x** Data read from memory card.
- SW1 SW2** = 90 00h if no error.



9.3.8.3. 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
FFh	D0h	00h						

Where:

- 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

Where:

- SW1 SW2** = 90 00h if no error.



9.3.8.4. 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 4.8.5**.

Command format (*abData field in the PC_to_RDR_XfrBlock*)

Pseudo-APDU				
CLA	INS	P1	Byte Address	MEM_L
FFh	D2h	00h		00h

Where:

Byte Address = Memory byte address location of the scratch pad.
Typical value is 02h.

Response data format (*abData field in the RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error



9.3.8.5. VERIFY_USER_CODE

This command is used to submit User Code (2 bytes) to the inserted card. User Code is used 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
FFh	20h	04h	08h	02h		

Where:

- 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

Where:

- SW1 SW2** = 90 00h if no error.
- = 63 00h if there is no more retry chance

Note: After SW1 SW2 = 9000h has been received, read back the User Error Counter to check whether the VERIFY_USER_CODE is correct. If User Error Counter is erased and equals to FFh, the previous verification is a success.



9.3.8.6. 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
FFh	20h	40h	28h	04h				

Where:

- 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

Where:

- SW1 SW2** = 90 00h if no error.
- = 63 00h if there is no more retry chance.

Note: After SW1 SW2 = 90 00h has been received, read back the Application Area to check whether the VERIFY_MEMORY_CODE is correct. If all data in Application Area is erased and equals to FFh, the previous verification is a success.



9.3.9. Memory Card – AT88SC101/AT88SC102/AT88SC1003

9.3.9.1. 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 specifications.

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU					
CLA	INS	P1	P2	Lc	Card Type
FFh	A4h	00h	00h	01h	09h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.



9.3.9.2. READ_MEMORY_CARD

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU				
CLA	INS	P1	Byte Address	MEM_L
FFh	B0h	00h		

Where:

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

Where:

BYTE x Data read from memory card.

SW1 SW2 = 90 00h if no error.



9.3.9.3. 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
FFh	D0h	00h						

Where:

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

Where:

SW1 SW2 = 90 00h if no error.



9.3.9.4. 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:

- ERASE_APPLICATION_ZONE_WITH_ERASE command as specified in **Section 8.3.8.5**
- ERASE_APPLICATION_ZONE_WITH_WRITE_AND_ERASE command as specified in **Section 8.3.8.6**
- VERIFY_SECURITY_CODE commands as specified in **Section 8.3.8.7**

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU				
CLA	INS	P1	Byte Address	MEM_L
FFh	D2h	00h		00h

Where:

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

Where:

SW1 SW2 = 90 00h if no error.



9.3.9.5. ERASE_APPLICATION_ZONE_WITH_ERASE

This command can be used in the following cases:

- AT88SC101: To erase the data in Application Zone with EC Function Disabled
- AT88SC102: To erase the data in Application Zone 1
- AT88SC102: To erase the data in Application Zone 2 with EC2 Function Disabled
- AT88SC1003: To erase the data in Application Zone 1
- AT88SC1003: To erase the data in Application Zone 2 with EC2 Function Disabled
- 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
FFh	20h	00h							

Where:

Error Counter LEN Length of presentation error counter in bits. The value should be 00h always.

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

Case	Byte Address	LEN
AT88SC101: Erase Application Zone with EC function disabled	96h	04h
AT88SC102: Erase Application Zone 1	56h	06h
AT88SC102: Erase Application Zone 2 with EC2 function disabled	9Ch	04h
AT88SC1003: Erase Application Zone 1	36h	06h
AT88SC1003: Erase Application Zone 2 with EC2 function disabled	5Ch	04h
AT88SC1003: Erase Application Zone 3	C0h	06h

Where:

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

CODE N bytes of Erase Key



Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.

Note: After SW1 SW2 = 90 00h has been received, read back the data in Application Zone to check whether the *ERASE_APPLICATION_ZONE_WITH_ERASE* is correct. If all data in Application Zone is erased and equals to FFh, the previous verification is a success.



9.3.9.6. ERASE_APPLICATION_ZONE_WITH_WRITE_AND_ERASE

This command can be used in the following cases:

- AT88SC101: To erase the data in Application Zone with EC Function Enabled
- AT88SC102: To erase the data in Application Zone 2 with EC2 Function Enabled
- 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 undamaged 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
FFh	20h	80h		04h				

Where:

Error Counter LEN Length of presentation error counter in bits. The value should be 80h always.

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

	Byte Address
AT88SC101	96h
AT88SC102	9Ch
AT88SC1003	5Ch

CODE 4 bytes Erase Key.

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.
= 63 00h if there is no more retry chance.

Note: After SW1 SW2 = 90 00h has been received, read back the data in Application Zone to check whether the ERASE_APPLICATION_ZONE_WITH_ERASE is correct. If all data in Application Zone is erased and equals to FFh, the previous verification is a success.



9.3.9.7. 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
FFh	20h	08h	0Ah	02h		

Where:

- 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

Where:

- SW1 SW2** = 90 00h if no error.
- = 63 00h if there is no more retry chance.

Note: After SW1 SW2 = 90 00h has been received, read back the Security Code Attempts Counter (SCAC) to check whether the VERIFY_USER_CODE is correct. If SCAC is erased and equals to FFh, the previous verification is a success.



9.3.9.8. 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: Blowing of the 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			
					Fuse Bit Addr (High)	Fuse Bit Addr (Low)	State of FUS Pin	State of RST Pin
FFh	05h	00h	00h	04h			01h	00h or 01h

Where:

- 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 01h.
- 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	05h	80h	01h
	EC_EN Fuse	05h	C9h	01h
	Issuer Fuse	05h	E0h	01h
AT88SC102	Manufacturer Fuse	05h	B0h	01h
	EC2EN Fuse	05h	F9h	01h
	Issuer Fuse	06h	10h	01h
AT88SC1003	Manufacturer Fuse	03h	F8h	00h
	EC2EN Fuse	03h	FCh	00h
	Issuer Fuse	03h	E0h	00h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

SW1	SW2

Where:

SW1 SW2 = 90 00h if no error.



9.4. Other Commands Access via PC_to_RDR_XfrBlock

9.4.1. GET_READER_INFORMATION

This command returns relevant information about the particular ACR33U-A1 SmartDuo 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 specifications.

Command format (*abData* field in the *PC_to_RDR_XfrBlock*)

Pseudo-APDU				
CLA	INS	P1	P2	Lc
FFh	09h	00h	00h	10h

Response data format (*abData* field in the *RDR_to_PC_DataBlock*)

FIRMWARE										MAX_C	MAX_R	C_TYPE	C_SEL	C_STAT	

Where:

- 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 ACR33U-A1 SmartDuo. 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:
 - 00h: no card inserted
 - 01h: card inserted, not powered up
 - 03h: card powered up



Appendix A. Supported Card Types

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

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

Table 3: Supported Card Types



Appendix B. CCID Response Error Codes

The following table summarizes the possible error code returned by the ACR33U-A1:

Error Code	Status
FFh	SLOTERROR_CMD_ABORTED
FEh	SLOTERROR_ICC_MUTE
FDh	SLOTERROR_XFR_PARITY_ERROR
FCh	SLOTERROR_XFR_OVERRUN
FBh	SLOTERROR_HW_ERROR
F8h	SLOTERROR_BAD_ATR_TS
F7h	SLOTERROR_BAD_ATR_TCK
F6h	SLOTERROR_ICC_PROTOCOL_NOT_SUPPORTED
F5h	SLOTERROR_ICC_CLASS_NOT_SUPPORTED
F4h	SLOTERROR_PROCEDURE_BYTE_CONFLICE
F3h	SLOTERROR_DEACTIVATED_PROTOCOL
F2h	SLOTERROR_BUSY_WITH_AUTO_SEQUENCE
E0h	SLOTERROR_CMD_SLOT_BUSY

Table 4: CCID Response Error Codes

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