

PC-Link Reader

Reference Manual

- GemPC Twin
- GemPC USB
- GemPC Serial
- GemPC Card
- GemPC Key
- GemPC Pinpad
- GemPC Express



GEMPLUS

All information herein is either public information or is the property of and owned solely by Gemplus S.A. who shall have and keep the sole right to file patent applications or any other kind of intellectual property protection in connection with such information.

Nothing herein shall be construed as implying or granting to you any rights, by license, grant or otherwise, under any intellectual and/or industrial property rights of or concerning any of Gemplus' information.

This document can be used for informational, non-commercial, internal and personal use only provided that:

- The copyright notice below, the confidentiality and proprietary legend and this full warning notice appear in all copies.
- This document shall not be posted on any network computer or broadcast in any media and no modification of any part of this document shall be made.

Use for any other purpose is expressly prohibited and may result in severe civil and criminal liabilities.

The information contained in this document is provided "AS IS" without any warranty of any kind. Unless otherwise expressly agreed in writing, Gemplus makes no warranty as to the value or accuracy of information contained herein. The document could include technical inaccuracies or typographical errors. Changes are periodically added to the information herein. Furthermore, Gemplus reserves the right to make any change or improvement in the specifications data, information, and the like described herein, at any time.

Gemplus hereby disclaims all warranties and conditions with regard to the information contained herein, including all implied warranties of merchantability, fitness for a particular purpose, title and non-infringement. In no event shall Gemplus be liable, whether in contract, tort or otherwise, for any indirect, special or consequential damages or any damages whatsoever including but not limited to damages resulting from loss of use, data, profits, revenues, or customers, arising out of or in connection with the use or performance of information contained in this document.

Gemplus does not and shall not warrant that this product will be resistant to all possible attacks and shall not incur, and disclaims, any liability in this respect. Even if each product is compliant with current security standards in force on the date of their design, security mechanisms' resistance necessarily evolves according to the state of the art in security and notably under the emergence of new attacks. Under no circumstances, shall Gemplus be held liable for any third party actions and in particular in case of any successful attack against systems or equipment incorporating Gemplus products. Gemplus disclaims any liability with respect to security for direct, indirect, incidental or consequential damages that result from any use of its products. It is further stressed that independent testing and verification by the person using the product is particularly encouraged, especially in any application in which defective, incorrect or insecure functioning could result in damage to persons or property, denial of service or loss of privacy.

© Copyright 2005–2006 Gemplus S.A. All rights reserved. Gemplus and the Gemplus logo are trademarks and service marks of Gemplus S.A. and are registered in certain countries. All other trademarks and service marks, whether registered or not in specific countries, are the property of their respective owners. Certain Smart Cards produced by Gemplus are covered by Bull CP8 Patents.

GEMPLUS, B.P. 100, 13881 GEMENOS CEDEX, FRANCE.

Tel: +33 (0)4.42.36.50.00 Fax: +33 (0)4.42.36.50.90

Printed in France.

Document Reference: DOC111370C

Document Version: 3

March 31, 2006

Contents

Introduction		vii
	Who Should Read This Book	vii
	Conventions	viii
	Technical Support	viii
Chapter 1	The USB Interface	1
	USB Compliance	1
	USB Descriptors	1
	USB Features	2
	Endpoint Addresses and Sizes	2
	Buffer Size	2
Chapter 2	Serial Interface	3
	Physical Layer	3
	Transport Layer	3
	Message of Card Movement	4
	Card Time Request Message	4
Chapter 3	GemCore Smart Card Management	5
	Smart Card Interface	5
	Smart Card Interface Features	5
	Operating Modes	5
	GemCore2000 Feature	6
	EMV Mode Failure	6
	PS/SC-ISO Mode in GemCore2000 Management	6
	Restrictions	6
Chapter 4	PC-Link Reader Commands	9
	PC_to_RDR_IccPowerOn	10
	PC_to_RDR_IccPowerOff	12
	PC_to_RDR_GetSlotStatus	13
	PC_to_RDR_XfrBlock	14
	PC_to_RDR_SetParameters	16

PC_to_RDR_GetParameters	18
PC_to_RDR_ResetParameters	20
PC_to_RDR_Secure	21
PC_to_RDR_Escape	28
PC_to_RDR_Abort	34
Appendix A USB Descriptors	35
Descriptors for USB-Based PC-Link Readers	35
Device Descriptor	35
Configurator Descriptor	36
Smart Card Interface	36
Interface Descriptor	36
CCID Descriptor	37
EMV Mode Table	38
Smart Card Reader Endpoints	39
Endpoint 1 Descriptor	39
Endpoint 2 Descriptor	39
Endpoint 3 Descriptor	39
String Descriptors	40
Language String Descriptor	40
Unicode String Descriptor (iManufacturer)	40
Unicode String Descriptor (iProduct)	40
Appendix B Status Codes	41
Appendix C Serial Plug and Play Chains	43
For More Information	45
Standards and Specifications	45
Terminology	47
Abbreviations	47
Glossary	48
Index	49

List of Figures

Figure 1 - Descriptor Structure	1
Figure 2 - GemCore2000 Selection and Management	7

List of Tables

Table 1 - Status Codes	41
Table 2 - Descriptors of Serial-Based PC-Link Readers	43

Introduction

The PC-Link readers are designed to be cost-effective, universal, and secure for the growing home-banking, e-commerce, and computer security market.

The range of PC-Link readers is composed of the following products:

- USB-based PC-Link readers
 - GemPC USB: a PC/SC smart card reader with USB connection
 - GemPC Key: a USB reader in a key format which communicates with smart cards in a plug-in form factor
 - GemPC Express: a compact smart card reader with an ExpressCard/54 format
- Serial-based PC-Link readers
 - GemPC Card: a compact smart card reader connected to the PC Card Type II port (PCMCIA)
 - GemPC Serial: PC/SC smart card reader with USB connection
- Both USB and Serial PC-Link reader
 - GemPC Twin: a combined USB and serial smart card reader
 - GemPC Pinpad: a class 2 reader, providing a secure PIN entry interface by means of an LED and a keypad

The purpose of this document is to help customers develop their own interface or drivers on a non-Windows platform. For Windows operating systems, the required drivers are provided by Gemplus. Contact your Gemplus sales representative for further information.

Who Should Read This Book

This reference manual is designed for developers of drivers.

Familiarity with the USB protocol is recommended.

Conventions

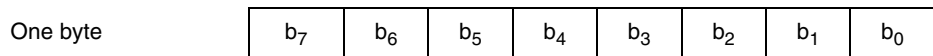
The following conventions are used in this document:

Numeric Values. By default, numeric values are expressed in decimal notation.

- Binary numbers are followed by the ‘b’ character. For example, the decimal value 13 is expressed in binary as **1101b**.
- Hexadecimal numbers are followed by the ‘h’ character. For example, the decimal value 13 is expressed in hexadecimal as **0Dh**.

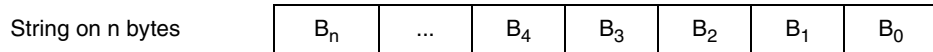
RFU Values. The value 00h is assigned to each RFU (Reserved for Future Use) byte.

Bit Numbering. A byte consists of 8 bits, b_7 to b_0 , where b_7 is the most significant bit and b_0 the least significant bit, as shown below:



Byte Numbering. A string of n bytes consists of n number of concatenated bytes: $B_{n-1} \dots B_2 B_1$.

B_n is the most significant byte and B_0 is the least significant byte:



Technical Support

If you do not find the information you need in this document, connect to the Gemplus technical support portal: <http://www.support.gemplus.com>

The USB Interface

USB Compliance

The USB-based PC-Link readers are compliant with *Universal Serial Bus Specifications, V1.1 and V2.0*. They operate at 12 Mbps at full speed.

Each USB PC-Link reader consists of a single USB interface, Interface 0, which is a smart card interface with three endpoints.

USB Descriptors

The USB readers need to build all the descriptors required by the USB interface, as follows:

- The device descriptor
- The configuration descriptor
- The interface descriptor
- The endpoint descriptors
- The class descriptors
- The string descriptor

The descriptor structure is described in the following figure:

USB-Based Reader			
Device Descriptor			String Descriptor
Configuration Descriptor			
Interface #0 Descriptor			
Endpoint 1 Descriptor (#81)	Endpoint 2 Descriptor (Bulk Out) (#2)	Endpoint 2 Descriptor (Bulk In) (#82)	Class Descriptor

Figure 1 - Descriptor Structure

USB Features

For all the USB devices, the vendor identification (VID) is 08E6h.

The USB product identification (PID) depends on the reader:

- GemPC Twin & GemPC USB: 3437h
- GemPC Key: 3438h
- GemPC Pinpad: 3478h
- GemPC Express: 34ECh

Endpoint Addresses and Sizes

	Address	Size
Interrupt In	81h	8 bytes
Bulk Out	02h	64 bytes
Bulk In	82h	64 bytes

Buffer Size

The USB buffer size is 271 bytes, therefore no USB message can exceed this length.

Serial Interface

The serial-based PC-Link readers communicate with the host with a serial interface.

Physical Layer

The serial asynchronous protocol can be sent directly on the serial line.

Each character consists of the following:

- 1 start bit
- 8 bits of data with the less significant bit sent first
- 2 stop bits by default, but configurable if necessary by the host

There is no parity management.

The available baud rates are as follows:

- 9600 bps
- 19,200 bps
- 38,400 bps
- 57,600 bps
- 115,200 bps

The baud rate is determined automatically at each message sent by the host.

Transport Layer

The transport layer handles and validates each message, constructed with one of the following formats:

For messages transmitted without errors:

<SYNC > <ACK> <MESSAGE> <LRC>

Where:

SYNC	03h, the synchronization byte that allows the reader to determine the header of the message and the current baud rate.
ACK	06h, indicating that the previous message was transmitted without errors.

MESSAGE is the message.
LRC is the result of an EXCLUSIVE OR (XOR) between the SYNC, ACK and MESSAGE character.

For messages transmitted with errors:

<SYNC ><NACK> <LRC>

Where:

SYNC 03h, the synchronization byte
NACK 15h, indicating that there was an error in the message transmission
LRC 16h

When the PC-Link reader receives a NACK byte, it repeats the last sent message. If the host sends a NAK message as the first command, the reader answers with a NAK message.

The timeout between each character is 100 ms.

Message of Card Movement

This message is sent to the host when a card has been inserted or removed from the reader.

<NOTIFY> <STAT>

Where:

NOTIFY 50h, the synchronization byte
STAT 02h if no card is present
03h if a card is present

By default, the reader sends the information of the new card state as soon as the card movement is detected (asynchronous change). The reader can be configured to send the card movement after the reader responds to the host command.

Card Time Request Message

The host receives this message whenever a card is exchanging data with the reader in T=0 protocol and is sending a NULL procedure byte (60h) to ask for additional time.

<WAIT>

Where:

WAIT indicates that the answer of the card is not yet available. The value is between 80h and FFh, inclusive.

GemCore Smart Card Management

Smart Card Interface

Each PC-Link reader has the following features:

- Compatibility with asynchronous cards.
- Compatibility with the T=0 and T=1 protocols.
- Compatibility with the EMV and PC/SC modes. The PC-Link readers are compliant with EMV2000 version 4.0 specifications.
- Compliance with ISO 7816-3 and -4 and ability to supply the cards with 5 V, 3 V, or 1.8 V (class A, B, or C cards respectively).
- Resume/wake-up mode upon smart card insertion/removal on the GemPC Twin, the GemPC USB, and the GemPC Pinpad.

Smart Card Interface Features

The readers are able to communicate with smart cards up to the following maximum baud rates allowed for a clock frequency of 4 MHz:

- 500,000 bps (TA1 = 97) for the GemPC Pinpad and the GemPC Express
- 344,086 bps (TA1 = 16) for the other readers

Note: Because the size of the smart card buffer is 261 bytes, do not exceed this size during APDU exchanges when the T = 1 protocol is in use.

Operating Modes

There are two PC-Link operating modes, as follows:

- A PC/SC-ISO mode which allows the management of a smart card according to the PC/SC, ISO 7816-3 standards (this is also known as the TPDU mode). This is the default mode.
- An EMV mode, based on the EMV2000 specifications (also known as the APDU mode)

The reader is allowed to switch between the EMV and PC/SC-ISO modes.

GemCore2000 Feature

The GemCore2000 is a utility that switches the card between the EMV and PC/SC-ISO modes. When the GemCore2000 is activated, the reader tries to manage it in the EMV mode whenever a smart card is inserted. If the reading is successful, the PC/SC mode will not be available.

EMV Mode Failure

The EMV mode fails if any of the following is true:

- The smart card has not sent an EMV-compliant answer to reset (ATR).
- Negotiation of the buffer size with a T=1 card has failed.

PS/SC-ISO Mode in GemCore2000 Management

The reader switches to the PC/SC mode after the application or the driver has sent the appropriate dedicated command to the reader (with a proprietary **Escape** command). In this case, the reader remains in the PC/SC mode as long as the card remains in the reader.

Whenever the EMV mode fails, the smart card is powered off. After the host application has sent the PC/SC Switch (proprietary) **Escape** command, the application must send a new **Card Power On** command.

When the reader deals with an EMV card, the data exchanged between the reader and the host consists of short APDU messages. When the card is not EMV-compliant and the reader is set to PC/SC-ISO mode, the reader exchanges TPDU messages with the host.

Note:

- The GemCore2000 feature must be activated before any card command is invoked. Otherwise, deactivating the GemCore2000 feature is not recommended unless the reader is reset.
 - The GemCore2000 feature is not available for the GemPC Pinpad and the GemPC Express.
-

Restrictions

Character level and the extended APDU are not implemented.

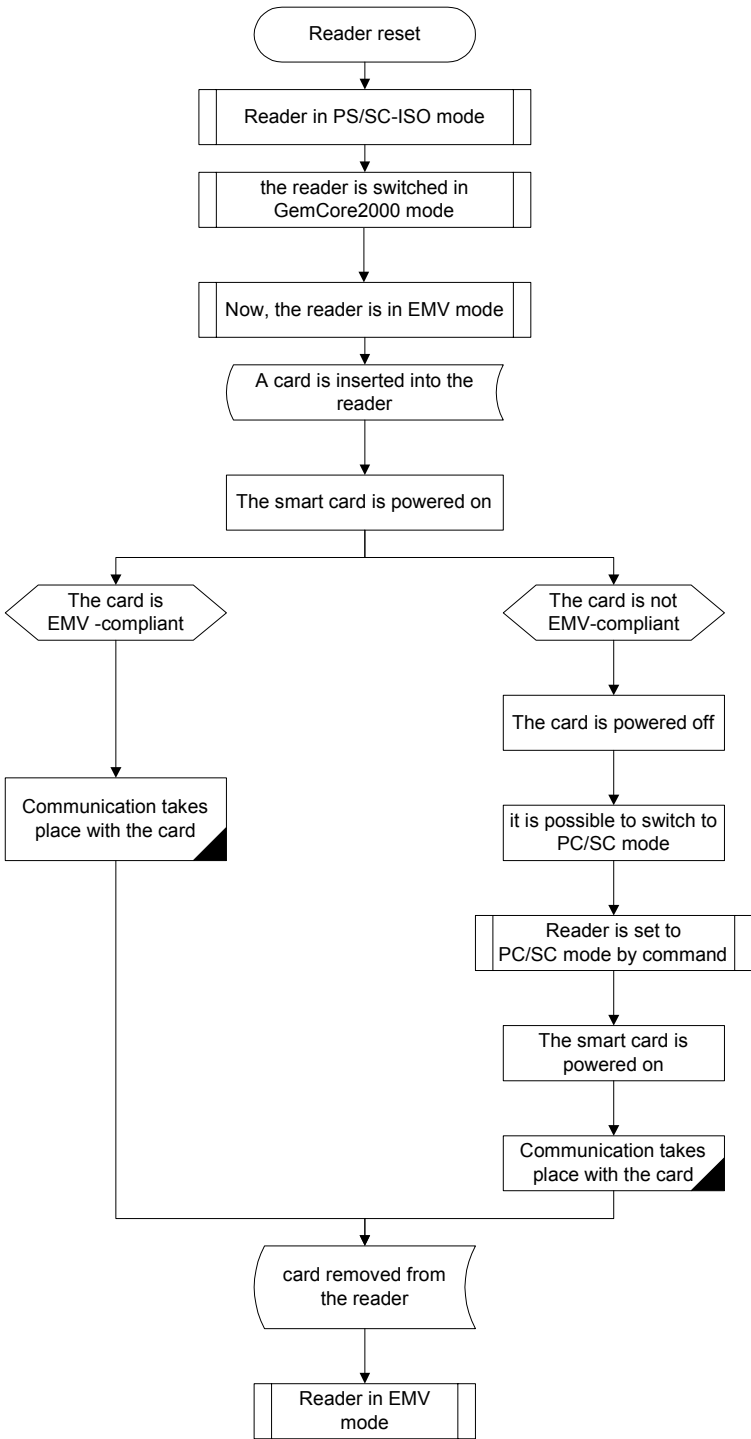


Figure 2 - GemCore2000 Selection and Management

PC-Link Reader Commands

The PC-Link reader commands are based on the *Universal Serial Bus Device Class Specification for USB Chip/Smart Card Interface Devices CCID Release 1.00 of March 2001*. This standard describes the requirements and specifications for Universal Serial Bus devices that interface with or act as interfaces with chip cards and smart cards.

The PC-Link readers are fully compliant with the USB specifications. The serial-based readers use the same format for the message as in USB-based readers, but manages the card movement and the card time extension differently when they are in the T=0 protocol.

This chapter does not describe each command. Instead, it describes the commands specific to PC-Link readers and some restrictions (if any). For a complete description of each command, refer to the *Universal Serial Bus Device Class Specification for USB Chip/Smart Card Interface Devices CCID Release 1.00 of March 2001*.

Commands implemented in the PC-Link readers are as follows:

- **PC_to_RDR_IccPowerOn** (page 10)
- **PC_to_RDR_IccPowerOff** (page 12)
- **PC_to_RDR_GetSlotStatus** (page 13)
- **PC_to_RDR_XfrBlocks** (page 14)
- **PC_to_RDR_SetParameters** (page 16)
- **PC_to_RDR_GetParameters** (page 18)
- **PC_to_RDR_ResetParameters** (page 20)
- **PC_to_RDR_Secure** (for GemPC Pinpad only) (page 21)
- **PC_to_RDR_Escape** (page 28)
- **PC_to_RDR_Abort** (page 34)

For each command sent from the host to the reader, there is a command sent in response. During the processing of a message and as long the response has not been completely transmitted to the host, the reader will not accept any other command.

Refer to “Appendix B - Status Codes” for the list of status codes.

PC_TO_RDR_IccPOWERON

This command powers on the smart card. It allows cold and warm resets.

Format

Offset	Field	Size	Value	Description		
0	bMessageType	1	62h	Message type		
1	dwLength	4	00000000h	Length of abData		
5	bSlot	1	00h	Slot number		
6	bSeq	1	00h–FFh	Sequence number		
7	bPowerSelect	1	01h, 02h, or 03h ¹	<table border="1"> <tr> <td>ISO mode 01h = 5.0 V 02h = 3.0 V 03h = 1.8 V</td> <td>EMV mode 01h = 5.0 V</td> </tr> </table>	ISO mode 01h = 5.0 V 02h = 3.0 V 03h = 1.8 V	EMV mode 01h = 5.0 V
ISO mode 01h = 5.0 V 02h = 3.0 V 03h = 1.8 V	EMV mode 01h = 5.0 V					
8	abRFU	2	00h	RFU bytes – Must be set to 0.		
10	abData	0		Not present.		

¹ The reader does not support automatic selection.

Response

RDR_to_PC_DataBlock

Offset	Field	Size	Value	Description
0	bMessageType	1	80h	Message type
1	dwLength	4	TBD	ATR length
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
7	bStatus	1	00h	Command performed successfully (card present and powered on).
			40h–42h	Command failed.
8	bError	1	00h–FFh	If bStatus = 4Xh, see “Appendix B - Status Codes”.
9	RFU	1	00h	
10	abData	1	TBD	Card response (ATR)

The command processing depends on the reader mode (EMV mode or PC/SC-ISO mode):

- Reader in the EMV Mode

In the EMV mode, the reader powers on the card; it also checks that the ATR is compliant with the EMV standard and sets the smart card interface transmission parameters according to the response from the card.

Because it is required by the EMV specifications, if the reader succeeds in retrieving the response from the card (no timeout error, parity error, or TCK error), but the ATR does not meet EMV specifications, the reader tries a warm reset.

If the ATR does not comply with EMV requirements, the reader deactivates the card.

If the reader encounters a transmission error, it deactivates the card and makes no further attempts to obtain a response from the card.

- Reader in the PC/SC-ISO Mode

The command is compliant with the ISO7816-3 standard. If the command fails, the card is powered off.

Because it does not parse the ATR, the reader does not store parameters.

To meet card requirements, the host must send a **PC_to_RDR_SetParameters** command to set the baud rate and the protocol. Refer to “PC_to_RDR_SetParameters” on page 16 for more information.

PC_to_RDR_IccPOWEROFF

This command powers off the smart card.

Format

Offset	Field	Size	Value	Description
0	bMessageType	1	63h	Message type
1	dwLength	4	00000000h	Length of abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
7	abRFU	3	000000h	RFU bytes – Must be set to 0.
10	abData	0		Not present.

Response

RDR_to_PC_GetSlotStatus

Offset	Field	Size	Value	Description
0	bMessageType	1	81h	Message type
1	dwLength	4	00h	Length of abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
7	bStatus	1	01h–02h 40h–42h	Command performed successfully. 01h: Card present but powered off. 02h: No card present. Command failed.
8	bError	1	00h–FFh	If bStatus = 4Xh, see “Appendix B - Status Codes”.
9	RFU	1	00h	RFU bytes - Must be set to 0.
10	abData	0		Not present.

PC_TO_RDR_GETSLOTSTATUS

This command retrieves information about the state of the slot, indicating:

- Whether a smart card is present
- If a card is present, whether this card is powered on

Format

Offset	Field	Size	Value	Description
0	bMessageType	1	65h	Message type
1	dwLength	4	00000000h	Length of abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
8	abRFU	3	000000h	RFU bytes – Must be set to 0.
10	abData	0		Not present.

Response

RDR_to_PC_GetSlotStatus

Offset	Field	Size	Value	Description
0	bMessageType	1	81h	Message type
1	dwLength	4	000000h	Length of abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
7	bStatus	1	00h–02h	Command successfully performed 00h: Card powered on, 01h: Card present but powered off. 02h: No card present.
			40h–42h	Command failed.
8	bError	1	00h–FFh	If bStatus = 4Xh, see “Appendix B - Status Codes”.
9	RFU	1	00h	RFU bytes – Must be set to 0.
10	abData	0		Not present.

PC_TO_RDR_XFRBLOCK

Format

Offset	Field	Size	Value	Description
0	bMessageType	1	6Fh	Message type
1	dwLength	4	TBD	Length of abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
7	bWI	1	00h–FFh	To extend the waiting timeout in the T=1 protocol and reader at the TPDU level.
8	wLevelParameters	2	0000h	For the TPDU level and the short APDU level, must be set to 0.
10	abData	TBD	TBD	Data block sent to the card.

Response

RDR_to_PC_DataBlock

Offset	Field	Size	Value	Description
0	bMessageType	1	80h	Message type
1	dwLength	4	TBD	Length of the abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
7	bStatus	1	00h	Command performed successfully. Card present and powered on.
			40h–42h	Command failed.
8	bError	1	00h–FFh	If bStatus = 4Xh, see “Appendix B - Status Codes”.
9	RFU	1	00h	RFU bytes - Must be set to 0.
10	abData	TBD	TBD	Card response

This command is handled differently depending on which mode the reader is in:

- Reader in the EMV Mode

The command is exchanged between the reader and the host, using APDU commands. As the reader exchanges TPDU commands with the card, it formats the command using the T=0 or T=1 protocol, depending on the fields of the ATR. If necessary, the reader chains the data in T=1; it attempts recovery in the event of a problem. The host receives the result of the command in the APDU format.

- Reader in the PC/SC-ISO Mode

The command is sent in TPDU mode. The data is sent to the card as it was received by the reader. The reader returns the card response to the PC in TPDU format.

When the command follows an ATR and its format is a PPS exchange, the reader starts a sequence of PPS exchanges.

PC_to_RDR_SetPARAMETERS

This command is used to change the parameters of data exchanges, such as the baud rate and the protocol.

Note: The **PC_to_RDR_SetParameters** command is only allowed with the reader in TPDU mode. If the reader is in APDU mode, the command is rejected.

Format

Offset	Field	Size	Value	Description
0	bMessageType	1	61h	Message type
1	dwLength	4	00000005h or 00000007h	Length of abData. 05h under the T=0 protocol 07h under the T=1 protocol
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
7	bProtocolNum	1	00h–01h	Specifies the protocol used (T=0 or T=1).
8	abRFU	2	0000h	RFU bytes – Must be set to 0.
10	abData	5 or 7		See the following sections.

Format of the abData Structure for the T=0 Protocol

Offset	Field	Size	Value	Description
10	bmFindexDIndex	1		Selects a baud rate conversion factor FI/DI of Table 7/8 of ISO 7816-3.
11	bmTCKKST0	1	00h or 02h	000000b ₁ 0 where: b ₁ defines the convention used. ¹
12	bGuardTimeT0	1	00h–FFh	Extra guardtime between two characters.
13	bWaitingIntegerT0	1	00h–FFh	Wi for T=0 to define WWT.
14	bClockStop	1	00h	ICC Clock Stop Support. Must be set to 0.

¹ Refer to the *Universal Serial Bus Device Class Specification for USB Chip/Smart Card Interface Devices CCID Release 1.00 of March 2001*.

Format of the abData Structure for the T=1 Protocol

Offset	Field	Size	Value	Description
10	bmFindexDIndex	1		To select a baud conversion factor FI/DI of Table 7/8 of ISO 7816-3.
11	bmTCKST1	1	10h, 11h, 12h, or 13h	If = 000000b ₁ b ₀ b ₁ defines the convention used. b ₀ defines the checksum type (0=LRC/1= CRC)
12	bGuardTimeT1	1	00h–FFh	Extra guardtime between two characters.
13	bWaitingIntegerT1	1	00h–9Fh	B7–4 = BWI values 0 – 9 valid B3–0 = CWI values 0–F valid
14	bClockStop	1	00h	ICC Clock Stop Support. Must be set to 0.
15	bIFSC	1	00h–FEh	Size of negotiated values
16	bNadValue	1	00h–FFh	The value is ignored by the reader. It is therefore not stored.

Response**RDR_to_PC_Parameters**

Offset	Field	Size	Value	Description
0	bMessageType	1	82h	Message type
1	dwLength	4	00000005h or 00000007h	Length of the abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
7	bStatus	1	00h	Command performed successfully. 01h: Card present but powered off. 02h: No card present.
			40h–42h	Command failed
8	bError	1	00h–FFh	If bStatus = 4Xh, see “Appendix B - Status Codes”.
9	RFU	1	00h	RFU bytes – Must be set to 0.
10	abData	5 or 7		Card parameters (see “PC_to_RDR_GetParameters” on page 18 for more information).

This command verifies the following:

- The ICC clock has stopped.
- The FI/DI combination is valid.
- The **bmWaitingIntegersT1** field is in the authorized interval.

PC_TO_RDR_GETPARAMETERS

This command gets parameters. It is always accepted.

Format

Offset	Field	Size	Value	Description
0	bMessageType	1	6Ch	Message type
1	dwLength	4	00000000h	Length of abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
7	bProtocolNum	1	00h–01h	Specifies the protocol used (T=0 or T=1).
8	abRFU	2	0000h	RFU bytes – Must be set to 0.

Response

RDR_to_PC_Parameters

Offset	Field	Size	Value	Description
0	bMessageType	1	82h	Message type
1	dwLength	4	00000005h or 00000007h	Length of abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
7	bStatus	1	00h	Command performed successfully. 01h: Card present but powered off. 02h: No card present.
			40h–42h	Command failed.
8	bError	1	00h–FFh	If bStatus = 4Xh, see “Appendix B - Status Codes”.
9	RFU	1	00h	RFU bytes – Must be set to 0.

Format of the abData Response for the T=0 Protocol

Offset	Field	Size	Value	Description
10	bmFindexDIndex	1		To select a baud rate conversion factor FI/DI of Table 7/8 of ISO 7816-3
11	bmTCCKST0	1	00h or 02h	If = 000000b ₁ 0b b ₁ defines the convention used 0= direct convention 1= inverse convention
12	bGuardTimeT0	1	00h–FFh	Extra guardtime between two characters.
13	bWaitingIntegerT0	1	00h–FFh	Wi for T=0 to define WWT
14	bClockStop	1	00h	ICC Clock Stop Support: not supported

Format of the abData Response for the T=1 Protocol

Offset	Field	Size	Value	Description
10	bmFindexDIndex	1		To select a baud rate conversion factor FI/DI of Table 7/8 of ISO 7816-3
11	bmTCCKST0	1	10h, 11h, 12h, or 13h	If = 000000b ₁ b ₀ b b ₁ defines the convention used. • 0 = Direct convention • 1 = Inverse convention. b ₀ defines the checksum type • 0 = LRC • 1 = CRC)
12	bGuardTimeT1	1	00h–FFh	Extra guardtime
13	bWaitingIntegerT1	1	00h–9Fh	B7–4 = BWI values 0–9. B3–0 = CWI values 0–F.
14	bClockStop	1	00h	ICC Clock Stop Support.
15	bIFSC	1	00h–FEh	Size of negotiated values
16	bNadValue	1	00h	NAD value used by CCID.

PC_TO_RDR_RESETPARAMETERS

This command resets parameters.

The command is allowed with the reader in TPDU mode. If the reader is in APDU mode, the command is rejected.

The reader resets the T=0 and T=1 parameters, but the reader is set to T=0 protocol.

Format

Offset	Field	Size	Value	Description
0	bMessageType	1	6Dh	Message type
1	dwLength	4	00000000h	Length of abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
7	abRFU	3	0000h	RFU bytes – Must be set to 0.

Response

RDR_to_PC_Parameters

Offset	Field	Size	Value	Description
0	bMessageType	1	82h	Message type
1	dwLength	4	00000005h	Length of abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
7	bStatus	1	00h	Command performed successfully. 00h: Card powered on. 01h: Card present but powered off. 02h: No card present.
			40h–42h	Command failed.
8	bError	1	00h–FFh	If bStatus = 4Xh, see “Appendix B - Status Codes”.
9	RFU	1	00h	RFU bytes – Must be set to 0.

Format of the abData Structure

Offset	Field	Size	Value	Description
10	bmFindexDIndex	1	11h	Baud rate conversion factor
11	bmTCKKST0	1	00h or 02h	If = 000000b ₁ 0b b ₁ defines the convention used. • 0 = Direct convention • 1 = Inverse convention
12	bGuardTimeT0	1	00h	No extra guardtime between two characters.
13	bWaitingIntegerT0	1	0Ah	Wi for T=0 to define WWT.
14	bClockStop	1	00h	ICC Clock Stop Support: not supported.

PC_to_RDR_SECURE

The **PC_to_RDR_Secure** command sets the GemPC Pinpad to secure PIN code mode. The GemPC Pinpad then captures one or two PIN codes—depending if it is a PIN verification or a PIN modification— inserts them in the data field of the card (“adDataCard”), and exchanges them with a card in a very secure transaction, because the PIN code is neither returned to the host nor displayed on the screen.

Note: This command is used with GemPC Pinpad only. Otherwise, the command is rejected.

When the secure PIN code mode is disabled, the keypad is deactivated and the LED adjacent to the padlock (the Secure LED) is off.

When the secure PIN code mode is enabled because a valid command was received, the the Secure LED lights up.

- Keys **0** to **9** are used for the PIN code.
- The **Cancel** key which stops the entry of the PIN code and ends the command.
- The **Clear** key which erases the last digit.
- The **Enter** key.

The first digit must be entered within a period specified in the secure command in the range of 15 to 40 seconds. Each following digit must be entered within 5 seconds.

When the PIN code has been entered and validated, the reader writes this PIN code in the data field according to command parameters **bmFormatString**, **bmPINBlockString**, **bmPINLengthFormat**, and the command is sent to the card.

When the reader is in the EMV mode with an EMV smart card (terminal in APDU mode), it maps the data to a TPDU message in the normal way, using reader features (for example, NAD = 0, calculation of the length).

When the reader is in TPDU mode and the T=1 protocol is in use, the command is mapped to a TPDU T=1 message using the **bTeoPrologue** field.

Mandatory Conditions for the Processing of a Secure Command

- If the smart card is not powered on, the command is rejected.
- The maximum PIN size is 8 digits.
- The minimum PIN size is 4 digits.
- The reader verifies that the command is consistent; for example the minimum PIN does not exceed the maximum PIN size.
- When the command is received by the reader, all keys must be released. Otherwise, the command is rejected.

Exiting the Secure PIN Code Mode

The GemPC Pinpad exits the secure PIN code mode in the following situations:

- Timeout is exceeded.
- The **Cancel** key has been pressed.

Format

Offset	Field	Size	Value	Description
0	bMessageType	1	69h	Message type
1	dwLength	4	TBD	Length of abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h FFh	Sequence number
7	bWI	1	00 FFh	Used to extend the block waiting time.
8	wLevelParameter	2	0000h	RFU

Format of the abData Structure for the PIN Verification

Offset	Field	Size	Value	Description
10	bmFindxDIndex	1		Selects a baud rate conversion factor FI/DI of Table 7/8 of ISO 7816-3.
11	bmTCKCKST0	1	00h or 02h	000000b ₁ 0 where: b ₁ defines the convention used. ¹
12	bGuardTimeT0	1	00h FFh	Extra guardtime between two characters
13	bWaitingIntegerT0	1	00h FFh	Wi for T=0 to define WWT.
14	bClockStop	1	00h	ICC Clock Stop Support. Must be set to 0.

¹ Refer to the *Universal Serial Bus Device Class Specification for USB Chip/Smart Card Interface Devices CCID Release 1.00 of March 2001*.

Offset	Field	Size	Value	Description
10	bPINOperation	1	00h	PIN verification
11	bTimeOut	1	00h–FFh	Number of seconds. To set the timeout for the entry of the first digit of the PIN code. The minimum value is 15 s (if the value is less than 15 s, the reader applies automatically 15 s). If the value is greater than 40 s, the GemPC Pinpad applies 40 s. The timeout for the following digits is 5 s.
12	bmFormatString	1	00h–FFh	Several parameters for the PIN format options. ¹
13	bmPINBlockString	1	00h–FFh	Defines the length in bytes of the PIN block to present in the APDU command. ¹

Offset	Field	Size	Value	Description
14	bmPINLengthFormat	1	00h–FFh	Allows the insertion of the PIN length in the APDU command. ¹
15	wPINMaxExtraDigit	2	XXYYh	XX: Minimum PIN size in digit. YY: Maximum PIN size in digit. The minimum value must not be less than 4. The maximum value must not be greater than 8.
17	bEntryValidationCondition	1	02h	The condition of the PIN validation (1 to 3 conditions => bit wise OR operation). Only entry via the Validation key (02h) is allowed. Other combinations - Maximum size reached (01h) and timeout occurred (04h) are rejected.
18	bNumberMessage	1	01h	Number of messages to display. Set to 1 because one message has to be displayed. Others values - no string (00h) and default CCID message (FFh) are rejected.
19	wLangId	2	0000h–FFFFh	Language used to display the messages. Not used by the GemPC Pinpad.
21	bMsgIndex	1	0000h–FFFFh	Message index in the Reader CCID message table. Not used by the GemPC Pinpad.
22	bTeoPrologue	3		bTeoPrologue T=1 I-Block prologue field to use. Significant only if protocol in use is T=1 and reader in TPDU mode.
25	abData	TBD		APDU sent to the card.

¹ Refer to the *Universal Serial Bus Device Class Specification for USB Chip/Smart Card Interface Devices CCID Release 1.00 of March 2001*.

Format of the abData Structure for the PIN Modification

Offset	Field	Size	Value	Description
10	bmFindexDIndex	1		Selects a baud rate conversion factor F/DI of Table 7/8 of ISO 7816-3.
11	bmTCKKST0	1	00h or 02h	000000b ₁ 0 where: b ₁ defines the convention used. ¹

¹ Refer to the *Universal Serial Bus Device Class Specification for USB Chip/Smart Card Interface Devices CCID Release 1.00 of March 2001*.

Offset	Field	Size	Value	Description
10	bPINOperation	1	01h	PIN modification
11	bTimeOut	1	00h–FFh	Number of seconds. To set the timeout for the entry of the first digit of the PIN code. The minimum value is 15 s (if the value is less than 15 s, the reader applies automatically 15 s). If the value is greater than 40 s, the GemPC Pinpad applies 40 s. The timeout for the following digits is 5 s.
12	bmFormatString	1	00h–FFh	Several parameters for the PIN format options. ¹
13	bmPINBlockString	1	00h–FFh	Defines the length in bytes of the PIN block to present in the APDU command. ¹
14	bmPINLengthFormat	1	00h–FFh	Allows the insertion of the PIN length in the APDU command. ¹
15	bInsertionOffsetOld	1	00h–FFh	Insertion position offset in byte for the current PIN.
16	bInsertionOffsetNew	1	00h–FFh	Insertion position offset in byte for the new PIN.
17	wPINMaxExtraDigit	2	XXYYh	XX: Minimum PIN size in digit YY: Maximum PIN size in digit The minimum value must not be less than 4. The maximum value must not be greater than 8.
19	bConfirmPIN	1	00,01h, 02h,03h	b0 : (0/1) If 0 = No confirmation requested If 1 = Confirmation requested b1 :(0/1) If 0 = No current PIN entry requested If 1 = Current PIN entry requested

Offset	Field	Size	Value	Description
20	bEntryValidationCondition	1	02h	The condition of the PIN validation (1 up to 3 conditions => bit wise OR operation) Only entry via the Validation key (02h) is allowed. Other combinations - Maximum size reached (01h) and timeout occurred (04h) are rejected.
21	bNumberMessage	1	01h,02h,03h	Number of messages to display for the PIN modify command, as follows: 1: No confirmation and no current PIN. 2: No current PIN but confirmation or the current PIN is required and no confirmation. 3: Current PIN and confirmation.
22	wLangId	2	0000h–FFFFh	Language used to display the messages. Not used by the GemPC Pinpad.
24	bMsgIndex1	1	00h–FFh	Message index in the Reader CCID message table. Not used by the GemPC Pinpad.
25	bMsgIndex2	1	00h–FFh	Message index in the Reader CCID message table. Not used by the GemPC Pinpad.
26	bMsgIndex3	1	00h–FFh	Message index in the Reader CCID message table. Not used by the GemPC Pinpad.
27	bTeoPrologue	3	00h–FFh	bTeoPrologue T=1 I-Block prologue field to use. Significant only if protocol in use is T=1 and reader in TPDU mode.
30	abData	Bytes		APDU sent to the card.

¹ Refer to the *Universal Serial Bus Device Class Specification for USB Chip/Smart Card Interface Devices CCID Release 1.00 of March 2001*.

If the new PIN code needs a confirmation, the reader verifies that it matches with its confirmation. If it is not the case, the reader discards the new PIN and its confirmation and restarts the process of asking for a new PIN and the confirmation PIN. The old PIN, if entered, is saved.

bmFormatString

The **bmFormatString** field has the following format:

Bit(s)	Description
7	The system units' type indicator. <ul style="list-style-type: none"> • 0: the system units are bits • 1: the system units are bytes This bit quantifies the next parameter.
6–3	Defines the PIN position after format in the APDU command (relative to the first data after Lc). The position is based on the system units' type indicator (maximum 1111 for 15 system units).
2	Bit mask for PIN justification <ul style="list-style-type: none"> • 0: left-justifies data • 1: right-justifies data
1–0	PIN format type <ul style="list-style-type: none"> • 00: binary • 01: BCD • 10: ASCII

bmPINBlockString

The **bmPINBlockString** field has the following format:

Bit(s)	Description
7–4	Size in bits of the PIN length inserted in the APDU command (if 0, the PIN length is not inserted in the command).
6–3	PIN length information: PIN block size in bytes after justification and formatting.

bmPINLengthFormat

The **bmPINLengthFormat** field has the following format:

Bit(s)	Description
7–5	RFU
4	The system units' type indicator. <ul style="list-style-type: none"> • 0: the system units are bits • 1: the system units are bytes This bit quantifies the next parameter.
3–0	Indicates the placement of the PIN length in the APDU command according to the previous parameters (maximum 1111 for 15 system units).

Response

The **RDR_to_PC_DataBlock** response has the following format:

Offset	Field	Size	Value	Description
0	bMessageType	1	80h	Message type
1	dwLength	4	TBD	Length of the abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h FFh	Sequence number
7	bStatus	1	00h	Command performed successfully (card present and powered on).
			40h 42h	Command failed
8	bError	1	00h FFh	If bStatus = 4Xh, see "Appendix B - Status Codes".
9	RFU	1	00h	RFU bytes - Must be set to 0.
10	abData	TBD	TBD	Card response

PC_TO_RDR_ESCAPE

This command is used to implement Gemplus-proprietary sub-commands. The initial format and response are generic. The following sections describe the specific sub-commands.

Format

Offset	Field	Size	Value	Description
0	bMessageType	1	6Bh	Message type
1	dwLength	4	TBD	Length of abData – depends on the command.
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
8	abRFU	3	0000h	RFU bytes – Must be set to 0.
10	abData	TBD	TBD	Proprietary command

Response

RDR_to_PC_Escape

Offset	Field	Size	Value	Description
0	bMessageType	1	83h	Message type
1	dwLength	4	TBD	Length of the abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
7	bStatus	1	00h	Command performed successfully. 00h: Card powered on. 01h: Card present but powered off. 02h: No card present.
			40h–42h	Command failed.
8	bError	1	00h–FFh	If bStatus = 4Xh, see “Appendix B - Status Codes”.
9	RFU	1	00h	
10	abData	TBD	TBD	Proprietary response

The following sub-commands correspond to different values of abData.

Firmware Version Request

This sub-command enables the user to determine the reader firmware version.

Format of the abData Structure

Offset	Field	Size	Value	Description
10	bCommandEscape	1	02h	Firmware version

Response to the abData Structure

Offset	Field	Size	Value	Description
10	abData	XX		String firmware version

The firmware version depends on the reader and its version.

Configuration Management

This sub-command initializes the reader in TPDU mode or in GemCore2000 mode.

Note: If this command is used, it will be executed once and first before any card command or card configuration command.

Format of the abData Structure

Offset	Field	Size	Value	Description
10	bCommandEscape	1	A0h	Reader mode
11	bTypeLevel	1	01h, 02h	01h: Reader starts in TPDU mode.
				02h: Reader starts in GemCore2000 mode.

Reader Level Management (TPDU or APDU Mode)

This sub-command switches the reader between the PC/ISC-ISO (TPDU) and EMV (APDU) modes.

Note: When the GemCore2000 feature is enabled, this sub-command switches the reader to the PC/SC-ISO mode (TPDU level), provided that the card is not EMV-compliant. Hence, it is impossible to switch to the EMV mode. If the GemCore2000 feature is not activated, all the switches are authorized.

Format of the abData Structure

Offset	Field	Size	Value	Description
10	bCommandEscape	1	1Fh	Switch mode
11	bTypeLevel	1	00h, 01h, or 02h	00h: Request for the present level of the reader.
				01h: Request to switch to TPDU mode.
				02h: Request to switch to APDU mode.

Response to the abData Structure

Offset	Field	Size	Value	Description
10	abData	1	01h, 02h	01h: Reader in TPDU mode.
				02h: Reader in APDU mode.

Card Parameter Management

This sub-command allows user to set a card parameter in the TPDU, APDU or GemCore 2000 mode. The parameters managed by this command are the same as those in the **PC_to_RDR_SetParameters** command. The parameters are accepted or rejected according the same requirements as for the **PC_to_RDR_SetParameters** command.

Note: Unlike the standardized CCID command, only one parameter can be set at a time.

Format of the abData Structure

Offset	Field	Size	Value	Description
10	bCommandEscape	1	95h	Card parameter management
11	bProtocol	1	00h or 01h	Protocol used at the present time by the card
12	bParamater	1	00h–05h	00h: bmFindexDIndex ¹
				01h: bmTCCCKST0 or bmTCCCKST1 ^{1,2}
				02h: bGuardTimeT0 or bGuardTimeT1 ^{1,2}
				03h: bWaitingIntegerT0 or bmWaitingIntegersT1 ^{1,2}
				04h: bClockStop ¹
				05h: bIFSC ³
13	bValue	1	XXh	New value for the parameter

¹ As defined in the CCID for the **PC_to_RDR_SetParameters** command.

² Depending on the protocol T=0 or T=1.

³ For T=1 only.

Response to the abData Structure

The **abData** field of the Card Parameter Management answer is the same as that of the **RDR_to_PC_Parameters** response.

This command verifies the following:

- The ICC clock has stopped.
- The FI/DI combination is valid.
- The **bmWaitingIntegersT1** field is within the authorized interval.

Reset of the Card Parameter

This sub-command is identical to the **PC_to_RDR_ResetParameters** command but this command is always accepted in APDU or GemCore2000 mode.

Format of the abData Structure

Offset	Field	Size	Value	Description
10	bCommandEscape	1	96h	Card parameter Reset

Response to the abData Structure

The **abData** field of **Reset of the Card Parameters** command is the same as that of the **RDR_to_PC_Parameters** response.

Checksum Calculation

This sub-command calculates the checksum of the microcontroller's memory.

Format of the abData Structure

Offset	Field	Size	Value	Description
10	bCommandEscape	1	94h	Checksum required

Response to the abData Structure

Offset	Field	Size	Value	Description
10	Value	3	XXYYZZ	Checksum calculated

Note: This command is not available for the GemPC Pinpad and the GemPC Express.

Card Movement Notification

This sub-command allows the host to change the notification of the card movement:

- **Asynchronous mode**
The reader sends the card movement to the host as soon as the change is detected.
- **Synchronous mode**
The host is notified of the card movement after the host command and before the card answers.

Note: This command is available for serial-based PC-Link readers only.

Format of the abData Structure

Offset	Field	Size	Value	Description
10	bSerialFeature	1	01h	For serial readers only.
11	bCardNotification	1	01h	
12	bTypeNotification	1	00h or 01h	00h: Asynchronous mode 01h: Synchronous mode

Response to the abData Structure

Offset	Field	Size	Value	Description
10	bTypeNotification	1	00h or 01h	

Stop Bit Management

This sub-command allows the host to change the number of stop bits of the messages sent by the reader.

Note: This command is available for the serial-based PC-Link readers only.

Format of the abData Structure

Offset	Field	Size	Value	Description
10	bSerialFeature	1	01	For serial readers only.
11	bSTopBitFeat	1	02	
11	bStopBitsNber	1	00–FFh	The number of stops bits = 2 + bStopBitsNber modulo 256

Screen Display Management

This command allows the host to customize the chains displayed on the GemPC Pinpad screen.

Note: This command is available for the GemPC Pinpad only.

There are ten default messages in the GemPC Pinpad, as follows:

Message	Description
Enter PIN	The user is to enter the current PIN. Each digit is replaced by a star on the GemPC Pinpad screen. For the “modification command”, the PIN to enter is the old one.
New PIN	For PIN modification only. The user is to enter the new PIN.
Confirm PIN	For PIN modification only. The user is to re-enter the new PIN.
PIN OK	If the card accepts the PIN verification or the PIN modification (status code = 90 00), the reader displays “PIN OK”.
Incorrect PIN	Access condition not fulfilled. The PIN code is incorrect.
Time Out	Timeout occurs if too much time has elapsed since the last key entered or if there is no validation.
Retries left	The reader succeeds in retrieving the number of retries – that is not 0. The number of retries is displayed at the first position. This message reserves at least two blank digits at the beginning of the strings to allow the GemPC Pinpad to insert the number of PIN tries remaining.
Insert Card	There is no card in the reader.
Card Error	Failure happens during data exchange with the card.
Card Blocked	The reader succeeds in retrieving the number of retries and the number of tries remaining is 0.

Note: Each message is 16 characters in length. If the message is shorter, it is padded with blanks. Meaning of the messages.

Format of the abData Structure

Offset	Field	Size	Value	Description
10	bCommandEscape	1	B2h	Message modification
11	bParam	2	A000h	mandatory
13	bValidation	2		Validation code 0000h to activate the default messages 4D4Ch to activate the customized messages. In this case, the following field (offsets 15 to 159) is present.
15	bMessage1	10h		Message 1 to replace the default message "Enter PIN".
31	bMessage2	10h		Message 2 to replace the default message "New PIN".
47	bMessage3	10h		Message 3 to replace the default message "Confirm PIN".
63	bMessage4	10h		Message 4 to replace the default message "PIN OK".
79	bMessage5	10h		Message 5 to replace the default message "Incorrect PIN".
95	bMessage6	10h		Message 6 to replace the default message "Time Out".
111	bMessage7	10h		Message 7 to replace the default message "retries left".
127	bMessage8	10h		Message 8 to replace the default message "Insert Card".
143	bMessage9	10h		Message 9 to replace the default message "Card Error".
159	bMessage10	10h		Message 10 to replace the default message "Card Blocked".

PC_TO_RDR_ABORT

This command is used with a control pipe and it has a particular handle. The command is implemented as described in the USB specification for smart cards. Refer to the *Universal Serial Bus Device Class Specification for USB Chip/Smart Card Interface Devices CCID Release 1.00 of March 2001* for more information.

Format

Offset	Field	Size	Value	Description
0	bMessageType	1	72h	Message type
1	dwLength	4	00000000h	Length of abData
5	bSlot	1	00h	Slot number
6	bSeq	1	00h–FFh	Sequence number
7	RFU	3	000000h	RFU



USB Descriptors

Descriptors for USB-Based PC-Link Readers

Device Descriptor

Offset	Value	Device Descriptor
0	12h	bLength (18 bytes)
1	01h	bDescriptorType (device)
2	XXYYh	bcdUSB release number For GemPC Twin, GemPC USB, and GemPC Key: 1.10 For GemPC Pinpad and GemPC Express: 2.00
4	00h	bDevice Class
5	00h	bDevice SubClass
6	00h	bDeviceProtocol
7	08h	bMaxPacketSize0
8	E6h 08h	IdVendor = 08E6h
10	XXYYh	IdProduct of the USB-based USB reader. <ul style="list-style-type: none">• GemPC Twin = 3437h• GemPC USB = 3437h• GemPC Key = 3438h• GemPC Pinpad = 3478h• GemPC Express = 34ECh
12	00h 10h	BcdDevice = 1.00
14	01h	iManufacturer
15	02h	iProduct
16	00h	iSerialNumber (ignored)
17	01h	bNumConfigurations

Configurator Descriptor

Offset	Value	Configuration Descriptor
0	09h	bLength (9 bytes)
1	02h	bDescriptorType (configuration)
2	5Dh 00h	wTotalLength
4	01h	bNumInterfaces
5	01h	bConfigurationValue
6	00h	iConfiguration (ignored)
7	A0h	bmAttributes (bus powered, remote wake up)
8	32h or 64h	MaxPower (100mA or 200 mA). <ul style="list-style-type: none">• 32h for the ROM microcontroller or for the latest version of the flash microcontrollers• 64h for the flash microcontroller only

Smart Card Interface

Interface Descriptor

Offset	Value	Interface Descriptor
0	09h	bLength (9 bytes)
1	04h	bDescriptorType (interface)
2	00h	bInterfaceNumber (interface 0)
3	00h	bAlternateSetting
4	03h	bNumEndpoints (3 endpoints)
5	0Bh	bInterfaceClass
6	00h	bInterfaceSubClass (no subclass)
7	00h	bInterfaceProtocol (none)
8	00h	iInterface

CCID Descriptor

Offset	Value	CCID Descriptor
0	36h	bLength
1	21h	bDescriptorType
2	00h 01h	bcdCCID CCID (1.00 Class release number)
4	00h	bMaxSlotIndex
5	See "EMV Mode Table" on page 38.	bVoltageSupport
6	03h 00h 00h 00h	dwProtocols (supports T=0 and T=1)
10	A0h 0Fh 00h 00h	dwDefaultClock (4 MHz = 00000FA0h)
14	A0h 0Fh 00h 00h	dwMaximumClock (4 MHz = 00000FA0h)
18	00h	bNumClockSupported (Manual setting not allowed)
19	00h 2Ah 00h 00h	dwDataRate (30752 bps = 00002A00h)
23	WWXXYY ZZh	dwMaxDataRate <ul style="list-style-type: none"> • GemPC Twin, GemPC USB, and GemPC Key: 344086 bps = 00054016h • GemPC Pinpad and GemPC Express: 500000 bps = 0007A120h
27	00h	bNumDataRatesSupported (manual setting not allowed)
28	FEh 00h 00h 00h	dwMaxIFSD (254)
32	00h 00h 00h 00h	dwSynchProtocols

Offset	Value	CCID Descriptor
36	00h 00h 00h 00h	dwMechanical (no special characteristics)
40	See “EMV Mode Table” on page 38	dwFeatures
44	0Fh 01h 00h 00h	dwMaxCCIDMessageLength (271 bytes)
48	00h	bClassGetResponse
49	00h	bClassEnvelope
50	00h 00h	wLcdLayout (0 line, 0 character per line)
52	00h or 03h	bPINSupport <ul style="list-style-type: none"> GemPC Twin, GemPC USB, GemPC Key, and GemPC Express: 00h = Not supported GemPC Pinpad: 03h = PIN verification and PIN modification supported
53	01h	bMaxCCIDBusySlots

EMV Mode Table

Field	EMV Off	Description
bVoltageSupport	07h	5 V, 3 V, and 1.8 V
dwFeatures	30h 02h 01h 00h	TPDU level exchanges with CCID NAD value other than 00 accepted Automatic baud rate according to parameters Automatic ICC clock according to parameters
Field	EMV On	Description
bVoltageSupport	01h	5 V
dwFeatures	72h 04h 02h 00h	Short APDU Automatic IFSD Automatic parameter negotiation made by CCID according to proprietary algorithm Automatic baud rate according to parameters Automatic ICC clock according to parameters Automatic parameter configuration based on ATR data

Smart Card Reader Endpoints

Endpoint 1 Descriptor

Offset	Value	Field
0	07h	bLength (7 bytes)
1	05h	bDescriptorType
2	02h	bEndpointAddress (Out)
3	02h	bmAttributes (Bulk endpoint)
4	40h 00h	wMaxPacketSize (64 bytes maximum)
6	00h	bInterval (ignored)

Endpoint 2 Descriptor

Offset	Value	Field
0	07h	bLength (7 bytes)
1	05h	bDescriptorType
2	82h	bEndpointAddress (In)
3	02h	bmAttributes (Bulk endpoint)
4	40h 00h	wMaxPacketSize (64 bytes maximum)
6	00h	bInterval (ignored)

Endpoint 3 Descriptor

Offset	Value	Field
0	07h	bLength (7 bytes)
1	05h	bDescriptorType
2	81h	bEndpointAddress (In)
3	03h	bmAttributes (Interrupt endpoint)
4	08h 00h	wMaxPacketSize (8 bytes maximum)
6	12h	bInterval (polling interval=18 ms)

String Descriptors

Language String Descriptor

Offset	Value	Field
0	04h	bLength
1	03h	bDescriptorType (String)
2	09h 04h	wLangID[0] (U.S. English = 0409h)

Unicode String Descriptor (iManufacturer)

Offset	Value	Field
0	10h	bLength (7 bytes)
1	03h	bDescriptorType
2	XXh	bString = name of vendor

Unicode String Descriptor (iProduct)

Offset	Value	Field
0	4Ch	bLength
1	03h	bDescriptorType (string)
2	XXh	bString = name of the product

Status Codes

The status codes returned by the card are listed in the following table:

Status Code	Description
00h	The command is not supported or not allowed.
01h	Wrong command length.
02h	The reader detects an excessive current. The card is powered off.
03h	The reader detects a defective voltage. The card is powered off.
05h	The slot number is invalid (it must be set to 0).
07h, 08h, 09h	The byte displayed is invalid.
0Ah, 15h	The byte displayed is invalid.
A2h	The card is short-circuiting. The card is powered off.
A3h	The ATR is too long (the number of bytes is greater than 33).
B0h	The reader is in EMV mode and the T=1 message sent by the card is too long. The buffer is limited to 254 bytes under the T=1 protocol.
BBh	The reader has encountered a protocol error in EMV mode (for example, erroneous first byte of the ATR, bad checksum (TCK) character, parity error, timeout during reception of the ATR, ATR is not EMV compliant).
BDh	Card protocol error during a T=1 exchange.
BEh	The APDU command length is wrong.
EFh	For GemPC Pinpad only: PIN code capture is cancelled.
F0h	For GemPC Pinpad: timeout occurred during PIN code capture.
F1h	For GemPC Pinpad: not all key released when secure command received.
F2h	For GemPC Pinpad: number of retries is 0.
F7h	The checksum byte (TCK) of the ATR is invalid (reader in PC/SC - ISO mode).
F8h	The first byte (TS) of the ATR is invalid (reader in PC/SC - ISO mode).
FDh	Parity error during a microprocessor exchange.
FEh	The card is not present or it is mute.

Table 1 - Status Codes



Serial Plug and Play Chains

The descriptors for serial-based PC-link readers are listed in the following table:

Field Name	Size	Required	Short Description	Value
Other ID	<17	No	Reserved for short PnP ID	
Begin PnP	1	Yes	Begin PnP ID "("	"("
PnP rev	2	Yes	Plug and play revision	0124
EISA ID	3	Yes	EISA determined unique mfr identifier	GEM
Product ID	4	Yes	Mfr determined unique product identifier	GemPC Serial and GemPC Twin: "3417" GemPC Pinpad: "3499" GemPC Card: "0403"
Extend	1	No	"\"	\
Serial Number	8	No	Optional device serial number	
Extern	1	No	\	\
Driver ID	<33	No	PnP class identifier	SmartCardReader
Extend	1	No	\	\
Driver ID	<41	No	Compatible device IDs	
Externd	1	No	\	\
USer Name	<41	No	End-user legible product description	GemPC Serial, GemPC Twin, and GemPC Pinpad: "Serial Smart Card Reader" GemPC Card: "GemPC Card SmartCard Reader"
Checksum	2	Depends	Checksum	GemPC Serial and GemPC Twin: D6 GemPC Pinpad: E0 GemPC Card: B4
End PnP	1	Yes	End PnP ID)

Table 2 - Descriptors of Serial-Based PC-Link Readers

For More Information

Standards and Specifications

- Universal Serial Bus Device Class Specification for USB Chip/Smart Card Interface Devices CCID Release 1.00 of March 2001
- Universal Serial Bus Specification, V2.0.
- EMV2000, Integrated Circuit Card, Specification for Payment System Book 1 version 4.0, December 2000
- *ISO 7816-1, -2, -3, -4*

Terminology

Abbreviations

APDU	asynchronous protocol data unit
ATR	answer to reset
BCD	binary coded decimal
BWI	block waiting time integer
CCID	card chip interface device
CWI	card waiting integer
EMV	Europay-MasterCard-Visa
ICC	integrated circuit card
HID	human interface device
IFSC	information field size for the card
ISO	International Standards Organization
KB	keyboard
LRC	longitudinal redundancy check
NAD	node address
PC/SC	personal computer/smart card
PID	product identification
PIN	personal identification number
PPS	protocol and parameter selection
RFU	reserved for future use
TBD	to be determined
TCK	check character
TPDU	transport protocol data unit
USB	Universal Serial Bus
VID	vendor identification
WI	waiting time integer
WWT	work waiting time

Glossary

APDU	Data exchange protocol between a card and a reader. The APDU can be changed to ensure that it meets the requirements of readers installed upon the end user's site.
Character Level	The reader sends the characters in the command. It then waits for the number of characters (if not null) indicated in the command.
Descriptor	USB devices report their attributes using a data structure with a defined format.
EMV Mode	Default mode. This mode is compliant with EMV specifications.
Endpoint	A uniquely addressable portion of a USB device that is the source or sink of information in a communication flow between the host and the device.
Extended APDU	APDU command with a length coded over 2 bytes.
GemCore 2000	Gemplus-proprietary reader mode management software.
PC/SC-ISO Mode	This mode can only be selected if the card is not EMV-compatible. This mode is compliant with ISO 7816-3 specifications.

Index

B

baud rates 3, 5
buffer size 2

D

descriptor
 CCID 37
 configurator 36
 device 35
 interface 36
 language string 40
 unicode string 40

E

EMV mode table 38
endpoint
 addresses 2
 sizes 2

I

identification
 product 2
 vendor 2

O

operating modes 5

P

PC_to_RDR_Abort 34
PC_to_RDR_Escape 28
PC_to_RDR_GetParameters 18
PC_to_RDR_GetSlotStatus 13
PC_to_RDR_IccPowerOff 12

PC_to_RDR_IccPowerOn 10
PC_to_RDR_ResetParameters 20
PC_to_RDR_Secure 21
PC_to_RDR_SetParameters 16
PC_to_RDR_XfrBlock 14
physical layer 3
product identification 2
PS/SC Mode 6

S

serial interface 3
smart card
 buffer 5
 interface 5, 36
 reader endpoints 39
string descriptors 40

T

transport layer 3

U

USB
 buffer size 2
 compliance 1
 descriptors 1, 35
 interface 1
 specification 9

V

vendor identification 2

W

wake-up mode 5

