Pro-Active PC/SC SDK

Documentation of the PC/SC API

PMDZ061 rev. AA

CONTENTS

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1. INTRODUCTION

Gallia est omnis diuisa in partes tres, quarum unam incolunt Belgae, aliam Aquitani, tertiam qui ipsorum lingua Celtae, nostra Galli appellantur. hi omnes lingua, institutis, legibus inter se differunt. Gallos ab Aquitanis Garunna flumen, a Belgis Matrona et Sequana diuidit. horum omnium fortissimi sunt Belgae, propterea quod a cultu atque humanitate prouinciae longissime absunt minimeque ad eos mercatores saepe commeant atque ea, quae ad effeminandos animos pertinent, inportant proximique sunt Germanis, quoque reliquos Gallos uirtute praecedunt, quod fere cotidianis proeliis cum Germanis contendunt, Garunna flumine, Oceano, finibus Belgarum, attingit etiam ab Sequanis et Heluetiis flumen Rhenum, uergit ad septentriones. Belgae ab extremis Galliae finibus oriuntur, pertinent ad inferiorem partem fluminis Rheni, spectant in septentrionem et orientem solem.Aquitania a Garunna flumine ad Pyrenaeos montes et eam partem Oceani, quae est ad Hispaniam, pertinet, spectat inter occasum solis et septentriones

1.1. PRODUCT BRIEF

[Reprendre ici la presentation courte du produit qui figure sur le site Web et la datasheet].

Please refer to product technical datasheet for specification and a more detailed feature list.

1.2. AUDIENCE

This reference manual It is designed for use by system integrators or application developers. He assumes that the reader has expert knowledge of electronics and computer development.

1.3. SUPPORT AND UPDATES

Interesting related materials (datasheet, application notes, sample softwares…) are available at Pro-Active's web site : www.pro-active.fr .

Updated versions of this document and others will be posted on this web site as soon as they are made available.

For technical support enquiries, please refer to Pro-Active support page, on the web at address www.pro-active.fr/support .

2. LIST OF PC/SC FUNCTIONS

Here's the list of "interesting" PC/SC functions[1].

2.1.1. Reference

Most explanations and examples have been taken from MUSCLE PC/SC Lite API, by David Corcoran & Ludovic Rousseau[2]. Their original document is located at

http://pcsclite.alioth.debian.org/pcsc-lite/pcsc-lite.html

Some over useful information come from Microsoft's MSDN site, but since their URL change very often, it is impossible to give an accurate link here. You may go to

http://msdn.microsoft.com

And search the "winscard" or "SCardTransmit" keywords.

2.1.2. Compatibility

For each function, a "compatibility" block shows whether the function is available under the 3 different platforms, according to the convention below :

Yes	Function is implemented and fully supported
No	Function is missing
Dummy	Function is implemented for convenience, but does nothing
Partial	Function is implemented, but with important limitations

[1] We've made the choice to list only the functions a developer must understand to build his smartcard-aware application. The PC/SC API (as specified by Microsoft and as implemented in pcsc-lite) contains a lot of other functions related to smartcard service providers and to the management of the smartcard subsystem, that are generally speaking not useful for the developer.

[2] No copyright is claimed on their document, but of course we acknowledge the great job they've done.

2.2. SCARDESTABLISHCONTEXT

The **SCardEstablishContext** function will instantiate a context for the application within the PC/SC Resource Manager. This must be the first function called in a PC/SC application.

Compatibility	
Winscard	**Yes**
pcsc-lite	**Yes**
SpringCard	**Yes**

Synopsis

```
LONG SCardEstablishContext(DWORD dwScope,
                           LPCVOID pvReserved1,
                           LPCVOID pvReserved2,
                           LPSCARDCONTEXT phContext);
```

Parameters

dwScope	in	*See below*
pvReserved1	in	Must be NULL.
pvReserved2	in	Must be NULL.
phContext	out	Handle to the PC/SC resource manager

Values for dwScope

Winscard specific

Parameter dwScope can take one of the following values :

- SCARD_SCOPE_USER
- SCARD_SCOPE_SYSTEM

pcsc-lite specific

Parameter dwScope must be set to SCARD_SCOPE_SYSTEM.

SpringCard specific

Parameter dwScope is ignored, set to SCARD_SCOPE_SYSTEM for compatibilty.

Return value

SCARD_S_SUCCESS	Success
Other value	*See complete list of error codes in next chapter*

Side effects

SpringCard specific

Calling the SCardEstablishContext function implicitly powers the SpringCard reader ON, and let it powered until

- SCardReleaseContext is called,
- SCardDisconnect is called, with dwDisposition parameter set to SCARD_UNPOWER_CARD (or SCARD_EJECT_CARD), AND the card was the last one powered (on a multi-slot reader),
- A system-specific communication timeout occurs.

2.3. SCARDRELEASECONTEXT

The **SCardReleaseContext** function will destroy the application context within the PC/SC Resource Manager. This must be the last function called in a PC/SC application.

Compatibility	
Winscard	**Yes**
pcsc-lite	**Yes**
SpringCard	**Yes**

Synopsis

```
LONG SCardReleaseContext(SCARDCONTEXT hContext);
```

Parameters

hContext	in	Connection context to the be released

Return value

SCARD_S_SUCCESS	OK
Other value	*See complete list in next chapter*

Side effects

SpringCard specific

The SCardReleaseContext function powers the SpringCard reader OFF.

2.4. SCARDISVALIDCONTEXT

The **ScardIsValidContext** will determine whether a smart card context handle is still valid. After a smart card context handle has been set by SCardEstablishContext, it may become not valid if the resource manager service has been shut down.

Compatibility	
Winscard	**Yes**
pcsc-lite	**Yes**
SpringCard	**No**

Synopsis

```
LONG SCardIsValidContext(SCARDCONTEXT hContext);
```

Parameters

hContext	in	Connection context to the be checked

Return value

SCARD_S_SUCCESS	OK
SCARD_E_INVALID_HANDLE	hContext is invalid
Other value	*See complete list in next chapter*

2.5. SCARDLISTREADERS

The **ScardListReaders** functions will return a list of currently available readers on the system, optionally filtered by a set of named reader groups.

Compatibility	
Winscard	Yes
pcsc-lite	Yes
SpringCard	Yes

Synopsis

```
LONG SCardListReaders(SCARDCONTEXT hContext,
                      LPCSTR mszGroups,
                      LPSTR mszReaders,
                      LPDWORD pcchReaders);
```

Details

This function returns a list of currently available readers on the system. *mszReaders* is a pointer to a character string that is allocated by the application. If the application sends *szReaders* as NULL then this function will return the size of the buffer needed to allocate in *pcchReaders*.

If value pointed by *pcchReaders* is specified as SCARD_AUTOALLOCATE, then *mszReaders* is casted as a pointer to a pointer, and receives the address of a block of memory containing the character string, allocated by the PC/SC API. This block of memory must be deallocated by the calling application with *SCardFreeMemory*.

On success, *mszReaders* is a multi-string and separated by a null character ('\0') and ended by a double null character (e.g. `"Reader A\0Reader B\0\0"`).

pcsc-lite specific

The mszGroups parameter is ignored.

mszReaders must be allocated by called. Value SCARD_AUTOALLOCATE for pcchReaders is forbidden.

pcsc-lite and SpringCard specific

The mszGroups parameter is ignored.

Parameters

`hContext`	in	Connection context to the PC/SC Resource Manager
`mszGroups`	in	List of groups to list readers
`mszReaders`	out	Multi-string to receive the list of readers
`pcchReaders`	in	Max. length of mszReaders
	out	Actual length of mszReaders including all NULL's characters

Return value

`SCARD_S_SUCCESS`	Success
Other value	*See complete list of error codes in next chapter*

2.6. SCARDCONNECT

The **SCardConnect** function will establish a connection between the calling application and a smartcard contained inserted into a specific reader.

The first connection will power up and perform a reset of the card. If there's no card in the specified reader, an error is returned.

Compatibility	
Winscard	**Yes**
pcsc-lite	**Yes**
SpringCard	**Yes**

Synopsis

```
LONG SCardConnect(SCARDCONTEXT hContext,
                  LPCSTR szReader,
                  DWORD dwShareMode,
                  DWORD dwPreferredProtocols,
                  LPSCARDHANDLE phCard,
                  LPDWORD pdwActiveProtocol);
```

Parameters

hContext	in	Connection context to the PC/SC Resource Manager
szReader	in	The name of the reader that contains the target card.
dwShareMode	in	Exclusive or shared connection
dwPreferredProtocols	in	Bit-mask specifying the list of acceptable card protocols
phCard	out	Handle to the smartcard
pdwActiveProtocol	out	Actual protocol selected by the reader

Values for dwShareMode

- SCARD_SHARE_SHARED : the application allows others to share the smartcard.
- SCARD_SHARE_EXCLUSIVE : the application requests exclusive access to the smartcard.
- SCARD_SHARE_DIRECT : the application requests direct (and exclusive) control of the reader, even without a smartcard in it.

SpringCard specific

dwShareMode must be set to SCARD_SHARE_EXCLUSIVE. Specifying another value is unsupported and will return an error.

Values for dwPreferredProtocols

- SCARD_PROTOCOL_T0 : use the T=0 protocol.
- SCARD_PROTOCOL_T1 : use the T=1 protocol.

- SCARD_PROTOCOL_T0| SCARD_PROTOCOL_T1 : use either protocol.
- SCARD_PROTOCOL_RAW : for memory cards.
- 0 : allowed only if *dwShareMode* is set to SCARD_SHARE_DIRECT. In this case, no protocol negociation will be performed with the smartcard.

Winscard & pcsc-lite specific

Value SCARD_PROTOCOL_RAW is no longer available.

SpringCard specific

SpringCard allows other values for dwPreferredProtocols. Please refer to SpringCard reader documentation for details.

Values for pdwActiveProtocol

- SCARD_PROTOCOL_T0 : T=0 protocol activated.
- SCARD_PROTOCOL_T1 : T=1 protocol activated.
- SCARD_PROTOCOL_RAW : for memory cards.
- SCARD_PROTOCOL_UNDEFINED : SCARD_SHARE_DIRECT has been specified. It is possible that there is no card in the reader.

Return value

SCARD_S_SUCCESS	Success
Other value	*See complete list of error codes in next chapter*

Side effects

SpringCard specific

Calling the SCardConnect function implicitly powers the SpringCard reader ON, if it wasn't.

2.7. SCARDRECONNECT

The **SCardReconnect** function will re-establish an existing connection between the calling application and smartcard. This function can be useful to move a card handle from direct access to general access, or to acknowledge and clear an error condition that is preventing further access to a smartcard.

Compatibility	
Winscard	Yes
pcsc-lite	Yes
SpringCard	Yes

Synopsis

```
LONG SCardReconnect(SCARDHANDLE hCard,
                    DWORD dwShareMode,
                    DWORD dwPreferredProtocols,
                    DWORD dwInitialization,
                    LPDWORD pdwActiveProtocol);
```

Parameters

hCard	in	Card context as returned by SCardConnect
dwShareMode	in	Exclusive or shared connection
dwPreferredProtocols	in	Bit-mask specifying the list of acceptable card protocols
dwInitialization	in	Type of initialization that should be performed on the card.
pdwActiveProtocol	out	Actual protocol selected by the reader

Values for dwShareMode

See SCardConnect paragraph.

Values for dwPreferredProtocols

See SCardConnect paragraph.

Values for dwInitialization

- SCARD_LEAVE_CARD : Do nothing.
- SCARD_RESET_CARD : Keep the card powered, and reset it (warm reset).
- SCARD_UNPOWER_CARD : Power down the card, then reset it (cold reset).

Values for pdwActiveProtocol

See SCardConnect paragraph.

Return value

SCARD_S_SUCCESS	Success
Other value	*See complete list of error codes in next chapter*

Side effects

SpringCard specific

Calling the SCardReconnect function implicitly powers the SpringCard reader ON, if it wasn't.

2.8. SCARDDISCONNECT

The **SCardDisconnect** function will terminate a connection previously opened between the calling application and a smartcard.

Compatibility	
Winscard	**Yes**
pcsc-lite	**Yes**
SpringCard	**Yes**

Synopsis

```
LONG SCardDisconnect(SCARDHANDLE hCard,
                     DWORD dwDisposition);
```

Parameters

`hCard`	in	Card context as returned by SCardConnect
`dwDisposition`	in	Action to perform on the smartcard

Values for dwDisposition

- SCARD_LEAVE_CARD : Do nothing (the card remains powered).
- SCARD_RESET_CARD : Reset the card (warm reset).
- SCARD_UNPOWER_CARD : Power down the card.
- SCARD_EJECT_CARD : Physically eject the card *(if reader is able to do so ☺).*

Return value

`SCARD_S_SUCCESS`	Success
Other value	*See complete list of error codes in next chapter*

Side effects

SpringCard specific

Calling the SCardDisconnect function implicitly powers the SpringCard reader OFF if dwDisposition parameter set to SCARD_UNPOWER_CARD (or SCARD_EJECT_CARD), AND the card was the last one powered (on a multi-slot reader).

2.9. SCARDSTATUS

The **SCardStatus** function will return the current status of a smartcard previously connected with SCardConnect.

Compatibility	
Winscard	Yes
pcsc-lite	Yes
SpringCard	Yes

Synopsis

```
LONG SCardStatus(SCARDHANDLE hCard,
                 LPSTR szReaderName,
                 LPDWORD pcchReaderLen,
                 LPDWORD pdwState,
                 LPDWORD pdwProtocol,
                 LPBYTE pbAtr,
                 LPDWORD pcbAtrLen);
```

Parameters

hCard	in	Card context as returned by SCardConnect
szReaderName	out	Friendly name of the reader the card is in
pcchReaderLen	in	Length of szReaderName
	out	Actual length of szReaderName, including terminating NULL character
pdwState	out	Current state of the reader
pdwProtocol	out	Current protocol of the smartcard
pbAtr	in	Current ATR of the smartcard[3]
pcbAtrLen	in	Max. length of pbAtr
	out	Actual length of pbAtr

Values for pdwState

- SCARD_ABSENT : No card in the reader.
- SCARD_PRESENT : There is a card in the reader, but it has not been moved into position for use *(if reader does support it ☺)*..
- SCARD_SWALLOWED : There is a card in the reader in position for use. The card is not powered.
- SCARD_POWERED : Power is being provided to the card, but the reader driver is unaware of the mode of the card.
- SCARD_NEGOTIABLE : The card has been reset and is awaiting PTS negotiation.

[3] ISO 7816-3 says that the ATR has 32 bytes or less, there's no need to allocate more.

- SCARD_SPECIFIC : The card has been reset and specific communication protocols have been established.

Values for pdwProtocol

See SCardConnect paragraph. Value is accurate only if pdwState value is SCARD_SPECIFIC.

Winscard & SpringCard specific

If the value pointed by pcchReaderLen is specified as SCARD_AUTOALLOCATE, then szReaderName is casted as a pointer to a pointer, and receives the address of a block of memory containing the character string, allocated by the PC/SC API. This block of memory must be deallocated by the calling application with SCardFreeMemory.

Return value

SCARD_S_SUCCESS	Success
Other value	*See complete list of error codes in next chapter*

2.10. SCARDSETTIMEOUT

The **SCardSetTimeout** function will define the timeout value for SCardTransmit. This is useful for instance when card operation takes a long time, during which the reader may appear as "frozen".

Not that this function has never been supported by Winscard, and has been deprecated from pcsc-lite. We continue to support it in SpringCard.

Compatibility	
Winscard	**No**
pcsc-lite	**dummy**
SpringCard	**Yes**

Synopsis

```
LONG SCardSetTimeout(SCARDCONTEXT hContext,
                     DWORD dwTimeout);
```

Parameters

hCard	in	Card context as returned by SCardConnect
dwTimeout	In	New value for SCardTransmit timeout (in seconds)

SpringCard specific

Default value for dwTimeout is 60 (1 minute).

Return value

SCARD_S_SUCCESS	Success
Other value	*See complete list of error codes in next chapter*

2.11. SCARDTRANSMIT

The **SCardTransmit** function will send an APDU to the smartcard, and retrieve its response.

Compatibility	
Winscard	Yes
pcsc-lite	Yes
SpringCard	Yes

Synopsis

```
LONG SCardTransmit(SCARDHANDLE hCard,
                   LPCSCARD_IO_REQUEST pioSendPci,
                   LPCBYTE pbSendBuffer,
                   DWORD cbSendLength,
                   LPSCARD_IO_REQUEST pioRecvPci,
                   LPBYTE pbRecvBuffer,
                   LPDWORD pcbRecvLength);
```

Parameters

hCard	in	Card context as returned by SCardConnect
pioSendPci	in/out	*See below*
pbSendBuffer	in	APDU to send to the card
cbSendLength	in	Length of the APDU
pioRecvPci	in/out	*See below*
pbRecvBuffer	out	Response from the card
pcbRecvLength	in	Max. length of pbRecvBuffer
	out	Actual length of response in pbRecvBuffer

Values for pioSendPci and pioRecvPci

Both parameters are pointer to structure telling the driver which protocol shall be used to send the APDU, and receive card's response.

In most cases, you may use one of the pre-defined global values for both parameters :

- SCARD_PCI_T0 if current card protocol T=0.
- SCARD_PCI_T1 if current card protocol T=1.

Alternatively, you may set both values to NULL, and let the PC/SC API verify which protocol is actually in use.

SpringCard specific

Parameters pioSendPci and pioRecvPci are ignored. SCARD_PCI_T0 and SCARD_PCI_T1 are provided for convenience only.

Return value

SCARD_S_SUCCESS	Success
Other value	*See complete list of error codes in next chapter*

2.12. SCARDCONTROL

The **SCardControl** function gives you direct control on the reader (even when there's no card in it).

Compatibility	
Winscard	Yes
pcsc-lite	Yes
SpringCard	partial

Synopsis

```
LONG SCardControl(SCARDHANDLE hCard,
                  DWORD dwControlCode,
                  LPCVOID pbSendBuffer,
                  DWORD cbSendLength,
                  LPVOID pbRecvBuffer,
                  DWORD pcbRecvLength,
                  LPDWORD lpBytesReturned);
```

Parameters

hCard	in	Card context as returned by SCardConnect
dwControlCode	in	Control code for the operation to be performed
pbSendBuffer	in	Data required to perform the operation. This parameter can be NULL if the operation takes no data.
cbSendLength	in	Length of the data
pbRecvBuffer	out	Response from the reader. This parameter can be NULL if the operation returns nothing.
pcbRecvLength	in	Max. length of pbRecvBuffer
lpBytesReturned	out	Actual length of response in pbRecvBuffer

Remark 1

The list of available commands, together with their control codes, are proprietary (e.g. vendor-specific and most of the time product-specific).

Always refer to the vendor-supplied documentation of the reader to get the list of actually supported operations (plus specification of parameters and responses).

SpringCard specific

The dwControlCode value is ignored, and pbSendBuffer is forwared "as is" to the GemCore chipset that is inside the SpringCard reader.

Please refer to GemAlto's GemCore host API documentation in this case.

Remark 2

Depending on the implementation, calling SCardControl may require that the hCard connection has been created with either the SCARD_SHARE_DIRECT or SCARD_SHARE_EXCLUSIVE value for SCardConnect or SCardReconnect dwShareMode parameter.

Return value

SCARD_S_SUCCESS	Success
Other value	*See complete list of error codes in next chapter*

2.13. SCARDGETATTRIB

The **SCardGetAttrib** function reads current value of a reader attribute, for the given smartcard handle.

Compatibility	
Winscard	Yes
pcsc-lite	Yes
SpringCard	No

Synopsis

```
LONG SCardGetAttrib(SCARDHANDLE hCard,
                    DWORD dwAttrId,
                    LPBYTE pbAttr,
                    LPDWORD pcbAttrLen);
```

Parameters

hCard	in	Card context as returned by SCardConnect
dwAttrId	in	Identifier of the attribute to get. A list of possible attributes is given in next chapter.
pbAttr	out	Value of the attribute
pcbAttrLen	in	Max. length of pbAttr
	out	Actual length of data in pbAttr

Remark

Note that vendors may not support all attributes. The list of attributes –given in next chapter– may also be completed by vendor-specific (or product-specific) attributes.

Always refer to the vendor-supplied documentation of the reader, to get the list of actually supported attributes (plus specifications of pbAttr length and content).

Winscard specific

If the value pointed by *pcbAttrLen* is specified as SCARD_AUTOALLOCATE, then *pbAttr* is casted as a pointer to a pointer, and receives the address of a block of memory containing the value, allocated by the PC/SC API. This block of memory must be deallocated by the calling application with *SCardFreeMemory*.

Return value

SCARD_S_SUCCESS	Success
Other value	*See complete list of error codes in next chapter*

2.14. SCARDSETATTRIB

The **SCardSetAttrib** function defines a new value of a reader attribute, for the given smartcard handle.

Compatibility	
Winscard	Yes
pcsc-lite	Yes
SpringCard	No

Synopsis

```
LONG SCardSetAttrib(SCARDHANDLE hCard,
                    DWORD dwAttrId,
                    LPCBYTE pbAttr,
                    DWORD cbAttrLen);
```

Parameters

hCard	in	Card context as returned by SCardConnect
dwAttrId	in	Identifier of the attribute to set. A list of possible attributes is given in next chapter. The attribute must be defined as writable.
pbAttr	in	Value of the attribute
pcbAttrLen	in	Length of value in pbAttr

Remark 1

Note that vendors may not support all attributes. The list of attributes –given in next chapter– may also be completed by vendor-specific (or product-specific) attributes.

Always refer to the vendor-supplied documentation of the reader, to get the list of actually supported attributes (plus specifications of pbAttr length and content).

Remark 2

Depending on the implementation, calling SCardSetAttrib may require that the hCard connection has been created with either the SCARD_SHARE_DIRECT or SCARD_SHARE_EXCLUSIVE value for SCardConnect or SCardReconnect dwShareMode parameter.

Return value

SCARD_S_SUCCESS	Success
Other value	*See complete list of error codes in next chapter*

2.15. SCARDGETSTATUSCHANGE

The **SCardGetStatusChange** function blocks execution until the current availability of the cards in a specific set of readers changes.

Compatibility	
Winscard	**Yes**
pcsc-lite	**Yes**
SpringCard	**No**

SpringCard specific

This function is not available under SpringCard PC/SC API, since SpringCard reader hardware doesn't provide the card detection facility.

Synopsis

```
LONG SCardGetStatusChange(SCARDCONTEXT hContext,
                          DWORD dwTimeout,
                          LPSCARD_READERSTATE rgReaderStates,
                          DWORD cReaders);
```

Parameters

hContext	in	Connection context to the PC/SC Resource Manager
dwTimeout	in	Maximum waiting time (in miliseconds) for status change, zero (or INFINITE) for infinite.
rgReaderStates	inout	Array of SCARD_READERSTATE structures (one for each reader)
cReader	in	Number of SCARD_READERSTATE structures in rgReaderStates

Usage note

The caller supplies a list of readers to be monitored by an SCARD_READERSTATE array and the maximum amount of time (in milliseconds) that it is willing to wait for an action to occur on one of the listed readers.

Note that SCardGetStatusChange uses the user-supplied value in the dwCurrentState members of the rgReaderStates SCARD_READERSTATE array as the definition of the current state of the readers.

The function returns when there is a change in availability (e.g. card inserted or card removed), having filled in the dwEventState members of rgReaderStates appropriately.

If rgReaderStates is NULL, and cReader is equal to 0, then the function will block until a reader is added to the system (requires hot-plupging support).

SCARD_READERSTATE structure

```
typedef struct {
    LPCSTR szReader;      /* Reader name */
    LPVOID pvUserData;    /* User defined data */
    DWORD dwCurrentState; /* Current state of reader */
    DWORD dwEventState;   /* New state after a state change */
    DWORD cbAtr;          /* ATR length */
    BYTE rgbAtr[MAX_ATR_SIZE]; /* ATR of the card */
} SCARD_READERSTATE;

typedef SCARD_READERSTATE *PSCARD_READERSTATE,
                          **LPSCARD_READERSTATE;
```

Values of dwCurrentState and dwEventState

- SCARD_STATE_UNAWARE :

The application is unaware of the current state, and would like to know. The use of this value results in an immediate return from state transition monitoring services. This is represented by all bits set to zero.

- SCARD_STATE_IGNORE :

This reader should be ignored.

- SCARD_STATE_CHANGED :

There is a difference between the state believed by the application, and the state known by the resource manager. When this bit is set, the application may assume a significant state change has occurred on this reader.

- SCARD_STATE_UNKNOWN :

The given reader name is not recognized by the resource manager. If this bit is set, then SCARD_STATE_CHANGED and SCARD_STATE_IGNORE will also be set.

- SCARD_STATE_UNAVAILABLE :

The actual state of this reader is not available. If this bit is set, then all the following bits are clear.

- SCARD_STATE_EMPTY :

There is no card in the reader. If this bit is set, all the following bits will be clear.

- SCARD_STATE_EXCLUSIVE :

The card in the reader is allocated for exclusive use by another application. If this bit is set, SCARD_STATE_PRESENT will also be set.

- SCARD_STATE_INUSE :

The card in the reader is in use by one or more other applications, but may be connected to in shared mode. If this bit is set, SCARD_STATE_PRESENT will also be set.

- SCARD_STATE_MUTE :

There is an unresponsive card in the reader.

Return value

SCARD_S_SUCCESS	Success
Other value	*See complete list of error codes in next chapter*

2.16. SCARDCANCEL

The **SCardCancel** function cancels all pending blocking requests on the SCardGetStatusChange() function.

Compatibility	
Winscard	**Yes**
pcsc-lite	**Yes**
SpringCard	**No**

Synopsis

```
LONG SCardCancel(SCARDCONTEXT hContext);
```

Parameters

hContext	in	Connection context

Return value

SCARD_S_SUCCESS	OK
Other value	*See complete list in next chapter*

2.17. SCARDBEGINTRANSACTION

The **SCardBeginTransaction** function establishes a temporary exclusive access mode, for doing a series of commands or transaction into the card.

You might want to use this when you are selecting a few files and then writing a large file, so you can make sure that another application will not change the current file.

If another application has already started a transaction with the same smartcard, then function will block until the transaction is finished.

Compatibility	
Winscard	**Yes**
pcsc-lite	**Yes**
SpringCard	**dummy**

SpringCard specific

This function does nothing, as only one application can access the reader in the same time. Transaction isolation must be implemented by the developer in case of a multi-threaded application.

Synopsis

```
LONG SCardBeginTransaction(SCARDHANDLE hCard);
```

Parameters

`hCard`	in	Card context as returned by SCardConnect

Return value

`SCARD_S_SUCCESS`	Success
Other value	*See complete list of error codes in next chapter*

2.18. SCARDENDTRANSACTION

The **SCardEndTransaction** exits the exclusive access mode gained after a successful call to SCardBeginTransaction.

Compatibility	
Winscard	Yes
pcsc-lite	Yes
SpringCard	dummy

Synopsis

```
LONG SCardEndTransaction(SCARDHANDLE hCard,
                         DWORD dwDisposition);
```

Parameters

hCard	in	Card context as returned by SCardConnect
dwDisposition	in	Action to perform on the smartcard

Values for dwDisposition

See SCardDisconnect paragraph.

pcsc-list specific

dwDisposition must be set to SCARD_LEAVE_CARD only.

Return value

SCARD_S_SUCCESS	Success
Other value	*See complete list of error codes in next chapter*

3. LIST OF PC/SC CONSTANTS

3.1. RETURN VALUES

Note Some return values may have the same value as existing Windows return values that signify a similar condition.

Value	Description
SCARD_E_BAD_SEEK	An error occurred in setting the smart card file object pointer.
SCARD_E_CANCELLED	The action was canceled by an SCardCancel request.
SCARD_E_CANT_DISPOSE	The system could not dispose of the media in the requested manner.
SCARD_E_CARD_UNSUPPORTED	The smart card does not meet minimal requirements for support.
SCARD_E_CERTIFICATE_UNAVAILABLE	The requested certificate could not be obtained.
SCARD_E_COMM_DATA_LOST	A communications error with the smart card has been detected.
SCARD_E_DIR_NOT_FOUND	The specified directory does not exist in the smart card.
SCARD_E_DUPLICATE_READER	The reader driver did not produce a unique reader name.
SCARD_E_FILE_NOT_FOUND	The specified file does not exist in the smart card.
SCARD_E_ICC_CREATEORDER	The requested order of object creation is not supported.
SCARD_E_ICC_INSTALLATION	No primary provider can be found for the smart card.
SCARD_E_INSUFFICIENT_BUFFER	The data buffer for returned data is too small for the returned data.
SCARD_E_INVALID_ATR	An ATR string obtained from the registry is not a valid ATR string.
SCARD_E_INVALID_CHV	The supplied PIN is incorrect.
SCARD_E_INVALID_HANDLE	The supplied handle was not valid.
SCARD_E_INVALID_PARAMETER	One or more of the supplied parameters could not be properly interpreted.
SCARD_E_INVALID_TARGET	Registry startup information is missing or not valid.
SCARD_E_INVALID_VALUE	One or more of the supplied parameter values could not be properly interpreted.
SCARD_E_NO_ACCESS	Access is denied to the file.
SCARD_E_NO_DIR	The supplied path does not represent a smart card directory.
SCARD_E_NO_FILE	The supplied path does not represent a smart card file.
SCARD_E_NO_MEMORY	Not enough memory available to complete this command.
SCARD_E_NO_READERS_AVAILABLE	No smart card reader is available.
SCARD_E_NO_SERVICE	The smart card resource manager is not running.
SCARD_E_NO_SMARTCARD	The operation requires a smart card, but no smart card is currently in the device.
SCARD_E_NO_SUCH_CERTIFICATE	The requested certificate does not exist.
SCARD_E_NOT_READY	The reader or card is not ready to accept commands.

SCARD_E_NOT_TRANSACTED	An attempt was made to end a nonexistent transaction.
SCARD_E_PCI_TOO_SMALL	The PCI receive buffer was too small.
SCARD_E_PROTO_MISMATCH	The requested protocols are incompatible with the protocol currently in use with the card.
SCARD_E_READER_UNAVAILABLE	The specified reader is not currently available for use.
SCARD_E_READER_UNSUPPORTED	The reader driver does not meet minimal requirements for support.
SCARD_E_SERVICE_STOPPED	The smart card resource manager has shut down.
SCARD_E_SHARING_VIOLATION	The smart card cannot be accessed because of other outstanding connections.
SCARD_E_SYSTEM_CANCELLED	The action was canceled by the system, presumably to log off or shut down.
SCARD_E_TIMEOUT	The user-specified time-out value has expired.
SCARD_E_UNEXPECTED	An unexpected card error has occurred.
SCARD_E_UNKNOWN_CARD	The specified smart card name is not recognized.
SCARD_E_UNKNOWN_READER	The specified reader name is not recognized.
SCARD_E_UNKNOWN_RES_MNG	An unrecognized error code was returned from a layered component.
SCARD_E_UNSUPPORTED_FEATURE	This smart card does not support the requested feature.
SCARD_E_WRITE_TOO_MANY	An attempt was made to write more data than would fit in the target object.
SCARD_F_COMM_ERROR	An internal communications error has been detected.
SCARD_F_INTERNAL_ERROR	An internal consistency check failed.
SCARD_F_UNKNOWN_ERROR	An internal error has been detected, but the source is unknown.
SCARD_F_WAITED_TOO_LONG	An internal consistency timer has expired.
SCARD_P_SHUTDOWN	The operation has been aborted to allow the server application to exit.
SCARD_S_SUCCESS	No error was encountered.
SCARD_W_CANCELLED_BY_USER	The action was canceled by the user.
SCARD_W_CHV_BLOCKED	The card cannot be accessed because the maximum number of PIN entry attempts has been reached.
SCARD_W_EOF	The end of the smart card file has been reached.
SCARD_W_REMOVED_CARD	The smart card has been removed, so further communication is not possible.
SCARD_W_RESET_CARD	The smart card has been reset, so any shared state information is not valid.
SCARD_W_SECURITY_VIOLATION	Access was denied because of a security violation.
SCARD_W_UNPOWERED_CARD	Power has been removed from the smart card, so that further communication is not possible.
SCARD_W_UNRESPONSIVE_CARD	The smart card is not responding to a reset.
SCARD_W_UNSUPPORTED_CARD	The reader cannot communicate with the card, due to ATR string configuration conflicts.
SCARD_W_WRONG_CHV	The card cannot be accessed because the wrong PIN was presented.

3.2. ATTRIBUTES

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