

ACR38 PCSC Memory Card Access Reference Manual

(Draft Version 2)

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Memory Card Type Selection:

By Property Sheet:

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

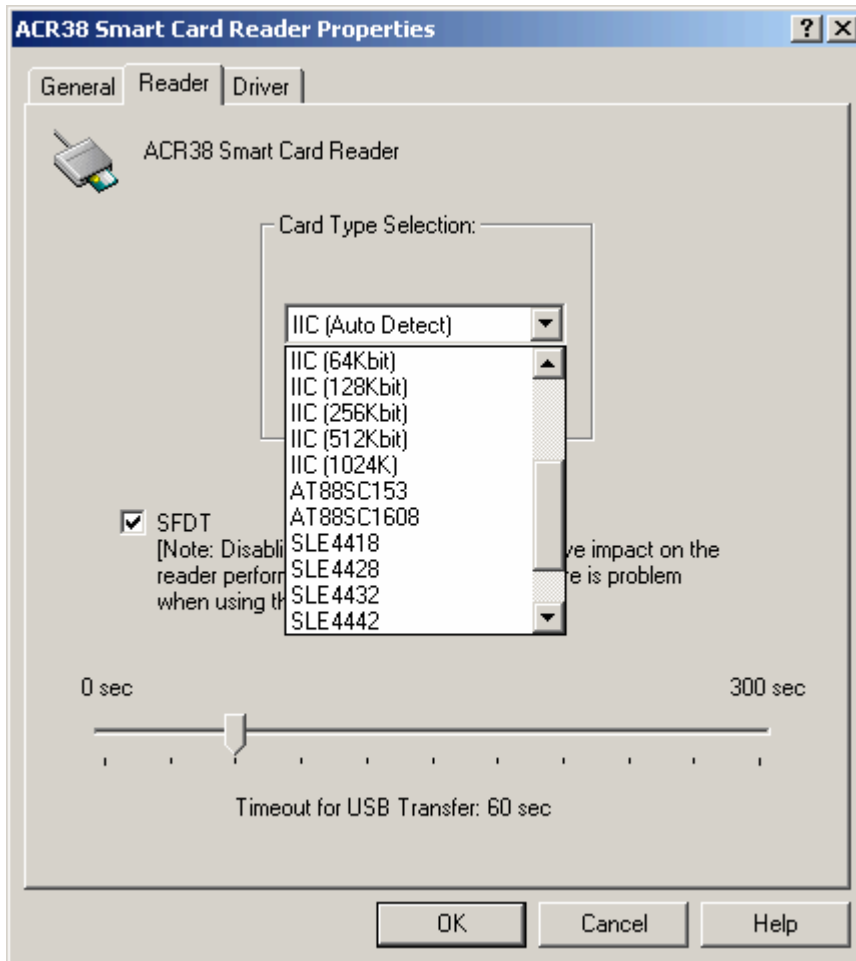


Figure 1. ACR38 reader setting property sheet.

The reader needs to be removed and re-connect to the computer in order for the change to take effect.

By Programmatic Method:

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

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

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

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

Example:

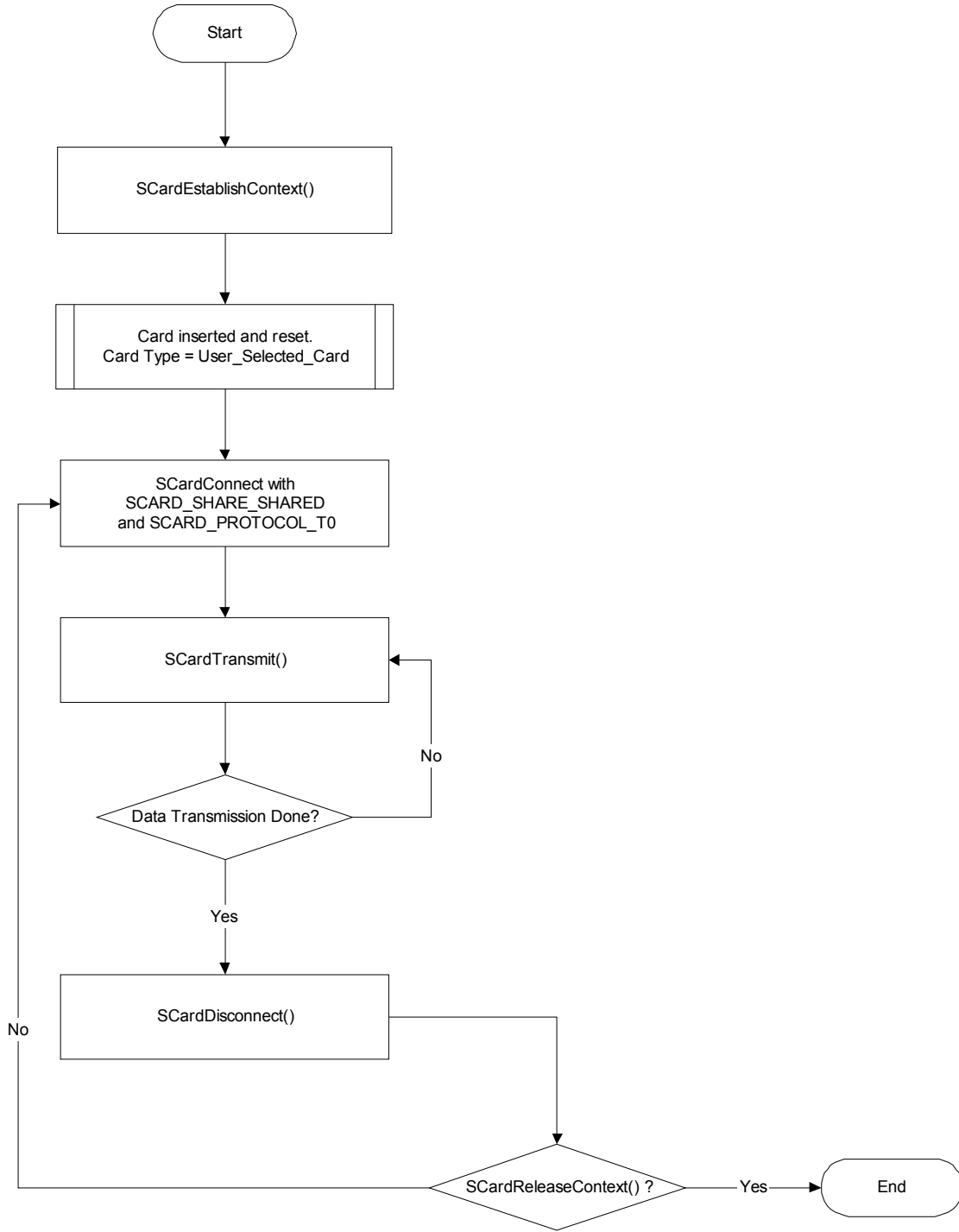
```
int main()
{
    long rv;
    long nCardType = 15;    // SLE4418 - refer to inf for more info
    BYTE cbOutBuffer[10];
    SCARDCONTEXT hctx;
    SCARDHANDLE hsc;
    DWORD dwActiveProtocol;
    DWORD dwBytesRet;

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

    rv = SCardConnect(
        hctx,
        "ACS ACR38U 0",
        SCARD_SHARE_DIRECT,    // This allows apps to connect to
                               // PC/SC even without card inserted
        0,
        &hsc,
        &dwActiveProtocol);
    if (rv != SCARD_S_SUCCESS) {
        // error handling ...
        return rv;
    }

    rv = SCardControl(hsc, IOCTL_SMARTCARD_SET_CARD_TYPE,
        &nCardType, sizeof(nCardType), cbOutBuffer, 10,
        &dwBytesRet);
    if ( rv == SCARD_S_SUCCESS &&
        cbOutBuffer[0] == 0x90 && cbOutBuffer[1] == 0x00) {
        // OK
    } else . . . // other error handling
    . . .
}
```

Logical Flow of Memory Card Functions:



ACR38 Command Set for Memory Card Access:

The set of memory card commands is used to define the operations to be performed on the target memory card.

1. Memory Card – 1,2,4,8,16 kbit I2C card

SELECT_PAGE_SIZE

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

Send Buffer Format

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

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

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

READ_MEMORY_CARD

Send Buffer Format

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

Byte Address Memory address location of the memory card.

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

Response data format

SCardTransmit Receive Buffer					
BYTE 1	BYTE N	SW1	SW2

BYTE x Data read from memory card
SW1,SW2= 90_H 00_H if no error

WRITE_MEMORY_CARD

Send Buffer Format

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

Byte Address Memory address location of the memory card.
MEM_L Length of data to be written to the memory card.
Byte x Data to be written to the memory card.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

2. Memory Card – 32,64,128,256,512,1024 kbit I2C card

SELECT_PAGE_SIZE

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

Send Buffer Format

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

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

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1, SW2 = 90_H 00_H if no error

READ_MEMORY_CARD

Send Buffer Format

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

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

Byte Address Memory address location of the memory card.

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

Response Buffer Format

SCardTransmit Receive Buffer					
BYTE 1	BYTE N	SW1	SW2

BYTE x Data read from memory card
 SW1,SW2= 90_H 00_H if no error

WRITE_MEMORY_CARD

Send Buffer Format

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

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

Byte Address Memory address location of the memory card.

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

Byte x Data to be written to the memory card.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

3. Memory Card – ATMEL AT88SC153

READ_MEMORY_CARD

Send Buffer Format

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

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

Byte Address Memory address location of the memory card.

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

Response Buffer Format

SCardTransmit Receive Buffer					
BYTE 1	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1,SW2= 90_H 00_H if no error

WRITE_MEMORY_CARD

Send Buffer Format

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

- INS = D0_H for writing zone 00_b
 = D1_H for writing zone 01_b
 = D2_H for writing zone 10_b
 = D3_H for writing zone 11_b
 = D4_H for writing fuse

Byte Address Memory address location of the memory card.

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

MEM_D Data to be written to the memory card.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

VERIFY_PASSWORD

Send Buffer Format

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

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

P2 = 0000 00rp_b

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

r = 0 : Write password,

r = 1: Read password,

p: Password set number,

rp = 01 for the secure code.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

INITIALIZE_AUTHENTICATION

Send Buffer Format

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

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

Response Buffer format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

VERIFY_AUTHENTICATION

Send Buffer Format

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

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

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

4. Memory Card – ATMEL AT88SC1608

READ_MEMORY_CARD

Send Buffer Format

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

INS = B0_H for reading user zone

= B1_H for reading configuration zone or reading fuse

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

= don't care for reading fuse

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

= 1000 0000_b for reading fuse

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

Response Buffer Format

SCardTransmit Receive Buffer					
BYTE 1	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1,SW2= 90_H 00_H if no error

WRITE_MEMORY_CARD

Send Buffer Format

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

INS = D0_H for writing user zone

= D1_H for writing configuration zone or writing fuse

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

= don't care for writing fuse

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

= 1000 0000_b for writing fuse

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

Byte x Data to be written to the memory card.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

VERIFY_PASSWORD

Send Buffer Format

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

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

RP = 0000 rp₂p₁p₀_b

where the four bits “rp₂p₁p₀” indicate the password to compare:

r = 0: Write password,

r = 1: Read password,

p₂p₁p₀: Password set number.

(rp₂p₁p₀ = 0111 for the secure code).

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

INITIALIZE_AUTHENTICATION

Send Buffer Format

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

Byte Address Memory address location of the memory card.

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

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

VERIFY_AUTHENTICATION

Send Buffer Format

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

Byte Address Memory address location of the memory card.

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

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

5. Memory Card – SLE4418/4428

READ_MEMORY_WITH_PROTECT_BIT_CARD

Send Buffer Format

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

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

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

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

Response Buffer Format

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

BYTE x Data read from memory card

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

SW1,SW2 = 90_H 00_H if no error

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

$$L = 1 + \text{INT}(N/8)$$

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

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

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

'0' byte is write protected

'1' byte can be written

READ_MEMORY_WITHOUT_PROTECT_BIT_CARD

Send Buffer Format

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

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

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

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

Response Buffer Format

SCardTransmit Receive Buffer					
BYTE 1	BYTE N	SW1	SW2

BYTE x Data read from memory card

SW1,SW2 = 90_H 00_H if no error

WRITE_MEMORY_CARD

Send Buffer Format

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

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

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

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

Byte x Data to be written to the memory card.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

WRITE_PROTECTION_MEMORY_CARD

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

Send Buffer Format

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

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

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

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

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

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

PRESENT_CODE_MEMORY_CARD (only SLE 4428)

To submit the secret code to the memory card to enable the write operation with the SLE4428 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

Send Buffer Format

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

CODE Two bytes secret code (PIN)

Response Buffer Format

ERRCNT	CODE		SW 1	SW 2
	Byte 1	Byte 2		

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

CODE The two bytes secret code read from the card.

SW1,SW2= 90_H 00_H if no error

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

READ_PRESENTATION_ERROR_COUNTER_MEMORY_CARD (only SLE 4428)

To read the presentation error counter for the secret code.

Send Buffer Format

SCardTransmit Send Buffer				
CLA	INS	P1	P2	MEM_L (P3)
FF _H	B1 _H	00 _H	00 _H	00 _H

Response Buffer Format

SCardTransmit Receive Buffer				
ERRCNT	DUMMY 1	DUMMY 2	SW1	SW2

ERRCNT The value of the presentation error counter.

DUMMY Three bytes dummy data read from the card.

SW1,SW2= 90_H 00_H if no error

6. Memory Card – SLE4432/4442

READ_MEMORY_CARD

Send Buffer Format

SCardTransmit Send Buffer				
CLA	INS	P1	Byte Address (P2)	MEM_L (P3)
FF _H	B0 _H	00 _H		

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

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

Response Buffer Format

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

BYTE x Data read from memory card

PROT y Bytes containing the protection bits from protection memory

SW1,SW2 = 90_H 00_H if no error

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

PROT 1								PROT 2								...								
P ₈	P ₇	P ₆	P ₅	P ₄	P ₃	P ₂	P ₁	P ₁₆	P ₁₅	P ₁₄	P ₁₃	P ₁₂	P ₁₁	P ₁₀	P ₉	P ₈	P ₁₇

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

'0' byte is write protected

'1' byte can be written

WRITE_MEMORY_CARD

Send Buffer Format

SCardTransmit Send Buffer									
CLA	INS	P1	Byte Address (P2)	MEM_L (P3)	Byte 1	...	...	Byte N
FF _H	D0 _H	00 _H							

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

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

Byte x Data to be written to the memory card.

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

WRITE_PROTECTION_MEMORY_CARD

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

Send Buffer Format

SCardTransmit Send Buffer								
CLA	INS	P1	Byte Address (P2)	MEM_L (P3)	Byte 1	...	...	Byte N
FF _H	D1 _H	00 _H						

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

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

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

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error

PRESENT_CODE_MEMORY_CARD (only SLE 4442)

To submit the secret code to the memory card to enable the write operation with the SLE4442 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

Send Buffer Format

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

CODE Three bytes secret code (PIN)

Response Buffer Format

ERRCNT	CODE			SW1	SW2
	Byte 1	Byte 2	Byte 3		

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

CODE The three bytes secret code read from the card.

SW1,SW2= 90_H 00_H if no error

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

READ_PRESENTATION_ERROR_COUNTER_MEMORY_CARD (only SLE 4442)

To read the presentation error counter for the secret code.

Send Buffer Format

SCardTransmit Send Buffer					
CLA	INS	P1	P2	MEM_L (P3)	
FF _H	B1 _H	00 _H	00 _H	00 _H	

Response Buffer Format

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

ERRCNT The value of the presentation error counter.

DUMMY Three bytes dummy data read from the card.

SW1,SW2= 90_H 00_H if no error

CHANGE_CODE_MEMORY_CARD (only SLE 4442)

To write the specified data as new secret code in the card.

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

Send Buffer Format

SCardTransmit Send Buffer							
CLA	INS	P1	P2	MEM_L (P3)	CODE		
					Byte 1	Byte 2	Byte 3
FF _H	D2 _H	00 _H	01 _H	03 _H			

Response Buffer Format

SCardTransmit Receive Buffer	
SW1	SW2

SW1,SW2= 90_H 00_H if no error