



Value through Innovation

## USER MANUAL

# MiniSmart™ Insert Reader

## Intelligent Interface RS232

 Approved

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## Revision History

Revision	Description	Date
C	Revised Transport Layer section and added RS232 example code	11/04/10

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## **DESCRIPTION**

This document provides the information to incorporate and operate an Intelligent MiniSmart Card reader. The reader is a convenient means to integrate a smart card application into a product. The MiniSmart provides the operations between an ISO 7816 compatible Smart Card (ICC) and the user's application device (Host). The interface with the Host is via a serial asynchronous link. The interface with the ICC is via EMV certified operations between the MiniSmart and the ICC.

The MiniSmart reader supports 3V and 5V microprocessor or memory cards. All Host signals are available via a 10-conductor flex cable that exits the rear of the chassis. The asynchronous communications with the Host are through a UART in the MiniSmart controller. The physical layer can be RS232 or CMOS. ID TECH supplies a PC/SC or RS232 interface Demo Host software on request.

The reader chassis is very compact and has an open design that allows debris to fall away and not clog or obstruct the card contacts. The chassis is molded from a UL-94V0 rated material, which is a glass and lubricant-filled engineering plastic that serves as a guide for the card. The smart card connector has gold-plated contacts that "land" on the IC's contacts with a slight "wiping" action to ensure a dependable connection and long life. The reader has a rear "card seated" switch to detect a card fully-seated condition and to support EMV tear requirements.

Note: This manual is for reader applications employing asynchronous microprocessor cards. If the reader application uses a memory card, consult with ID TECH for specific memory cards.



**RS232 MiniSmart**

## **INSTALLATION**

The MiniSmart Partial Insert Reader can be mounted in any orientation, but the preferred orientation is with the printed circuit board facing up (top side up), so that debris will not accumulate on the smart card connector. On the top of the reader are six threaded inserts for reader mounting. The mounting screw size is M2. All the inserts are accessible from the top; the two rear inserts are also accessible from the bottom of the reader. See the mechanical outline drawing in Appendix B.

When mounting the reader using screws, the screw length is critical and dependent on location of the inserts used. The two front and two center inserts are positioned in blind holes; the screw length must be 3.75mm maximum, plus the thickness of the mounting bracket. The two rear inserts are positioned in through holes. If the reader is mounted from the bottom, the screw length must be 7.0mm minimum, plus the thickness of the mounting bracket.

Although the reader accepts cards without a bezel, one of two optional molded bezels is available. They provide an additional card guide and facilitate some bulkhead mountings. The bezel is attached to the chassis using the front or rear mounting inserts. The attached bezel increases the overall reader thickness.

The bezels are designed to mount integrally to the application bulkhead via studs at both ends. A bezel is available with either a flush mount (flat face) or extended nose (with additional card guide "lead-in"). An optional spring-loaded "gate" is available in the optional bezels. The gate minimizes the intrusion of dust, dirt, and the insertion of foreign objects into the reader. The gate easily opens to permit card insertion. See Appendix B for mechanical outline drawings of the two bezel types.

## OPERATIONS

### Smart Card Insertion & Withdrawal

A smart card insertion or withdrawal notification signal (CSEAT) is available, regardless of the current mode, ISO or EMV. By default, CSEAT will be initialized to a CMOS HIGH state after power up. CSEAT can be initialized to one of four operational settings. See the Command Section for setting information.

Smart card insertion & withdrawal notification is also implemented through a MiniSmart interface cable connection to the rear seated switch. This is the SW signals and more information is available in Flex Cable Pin-Out Assignments.

### Serial Plug and Play Enumeration Detection

For PC/SC application, the Host can signal the enumeration through the DSR line. The DSR signal connection is on the interface cable. After detecting the enumeration signal, the MiniSmart sends the identification string to the Host at 1200 bits per second, and then switches to the default transmission rate of 9600 bits per second or to the previously selected communication rate. See Flex Cable Pin-Out Assignments for more information.

### LED Operation

The MiniSmart interface cable provides a signal to control an external single color LED. The LED is not a component of the reader. The external LED functions as follows: During a first power up of the reader, the LED will flash a short time and turns off. When a card is powered on, the LED turns on. When a card is powered off, the LED turns off.

Card Power is controlled by the Host. The Host typically turns on Card Power after detecting "Card Seated". The Host should turn off Card Power after a transaction. The LED indicates this process. See Flex Cable Pin-Out Assignments for more information.

## **MiniSmart HALT MODE**

The MiniSmart can be set to Halt Mode by the Host. The MiniSmart can be put directly into Halt Mode, or a time out can be set for the Halt Mode. In Halt Mode, the card is powered-down and the reader goes into Low Power Consumption Mode. There are some general characteristics associated with Halt Mode operations. The operation given below refers to a MiniSmart configured with a CMOS communication interface.

### Mode Operation:

- The reader does not remember any state after waking up from Halt Mode. The reader goes to the default state upon waking up.
- In the default state, CSEAT is not enabled. The reader does not notify the Host of Card Seated Switch status.
- In the default state, both CSEAT and TXD are CMOS HIGH.
- In Halt Mode, Both CSEAT and TXD are CMOS LOW.
- Inserting or removing a card wakes the reader up from Halt Mode. The Host can also send a command to wake up the reader.

### Typical Scenario:

- When the Host powers up the reader, the CSEAT and TXD signals are in a HIGH CMOS level condition.
- The Host sends a command to put the reader into Halt Mode. The reader sends back an acknowledgement, and then goes into Halt Mode. CSEAT and TXD are CMOS LOW. (The Host UART must justify the TXD LOW condition.)
- When a card holder inserts a smart card, the reader wakes up. Both the CSEAT and TXD signals go to a CMOS HIGH conditions.
- The Host sees the LOW to HIGH transition on CSEAT and wakes up the UART.
- The Host sends commands to communicate with the smart card (normal data processing). When done, the Host instructs the user to remove the smart card.
- The user removes the smart card. (The Host knows this by either polling the reader for the Card Seated Switch Status, or by programming the reader to notify the Host.) The Host sends a command to put the reader into Halt Mode.

## SPECIFICATIONS

### Host Interface

Physical Layer: Serial asynchronous link at 1,200 to 115,200 baud  
Format is 8 bits, no parity, 1 stop bit

### ICC Interface

Compliance: ISO/IEC 7816-1, 2, 3, & 4  
EMV 2000 Level 1  
Mondex, Proton, ZKA, & others

ICC Support: Number of cards = 1, Asynchronous, T=0 & T=1  
Synchronous (memory) cards (Support List available)

Transmission: 9.6 Kbps to 115 Kbps speeds

Electrical: Card power supply selections: 1.8 V, 3 V or 5 V

ESD Protection: 4 KV (human body model), on card contacts

Short Circuit: Current limitation protection

### Mechanical

Media Thickness: 0.03 Nominal (0.025 minimum; 0.035 inches maximum)

Dimensions: Depth: 1.06 inches (26.9 mm)  
Width: 2.28 inches (57.9 mm)  
Height: 0.34 inches (8.7 mm)

Card Seated: Switch signal notes the ICC & connector have made contact

ICC Contacts: Contact force, position & plating per ISO7816 or EMV

Weight: 0.35 oz (10 g) without optional bezel



**Electrical**

Power Supply: 2.85 VDC to 5.4 VDC (6.0 VDC maximum)  
Current: 9 mA typical, 150 mA max with ICC powered  
Power Down: 100  $\mu$ A max in power down mode, CMOS interface  
ICC contacts: 0.5 Ohms Maximum

**Durability**

Card Connector: 1,000,000 cycles minimum\*  
Chassis & Bezel: 1,000,000 card cycles minimum\*  
MTBF: 300,000 Hours

\* All wear reliability and MTBF are based on operation in a benign environment.

**Environmental**

Temperature: 32° F to 158° F (0° C to 70° C) Operating  
Temperature: -40° F to 185° F (-40° C to 85° C) Storage  
Humidity: Maximum 90% non-condensing

## **FLEX CABLE PIN-OUT ASSIGNMENTS**

The MiniSmart provides a 10-conductor flex cable for input & out put signals and power. This cable has one end directly connected to the MiniSmart PCB. The other end can be connected using a ZIF connector. There are many connector manufactures; one example is the Molex connector, P/N: 52771-1090 (RoHS P/N: 52271-1079) 1.00mm (.039") Pitch FFC/FPC Connector, Right Angle, SMT, ZIF, Bottom Contact Style, 10 Circuits.

<b>Conductor</b>	<b>Signal Name</b>	<b>Signal To</b>	<b>Signal Type</b>
1	LED	Host	CMOS only
2	SW	Host	Contact closure
3	TXD	Host	CMOS or RS232
4	VCC	Reader	+VDC
5	RXD	Reader	CMOS or RS232
6	NC		
7	CSEAT	Host	CMOS only
8	GND	Common	Ground
9	DSR	Reader	CMOS or RS232
10	NC		

**Table 1 Conductor Pin-out Assignments**

Note: See Appendix B for flex cable conductor number 1 location.

**LED** – This connection provides an open collector output. This output can be directly connected to the cathode of an LED. The typical current of the output can sink approximately 4mA.

**SW** – This output provides a direct connection to the card seated switch. When a card is fully seated in the MiniSmart, the switch is closed and provides a contact connection to power supply common (GND). Depending on the application, a pull-up resistor of no greater than 10K Ohms may be used on the Host side of the interface. (WARNING – if this connection is grounded at the Host end of the cable, the MiniSmart will assume a card is seated when a physical card may not be presents.)

**TXD** – This is the serial communication output from the MiniSmart. This output is connected to a standard UART in the MiniSmart. See the communications section for additional information. This output is factory configured at the time of order to have either RS232 or CMOS voltage levels with the associated characteristics.

**VCC** – This is the power supply connection to the MiniSmart reader.

**RXD** – This is the serial communication input to the MiniSmart. This input is connected to a standard UART in the MiniSmart. See the communications section for additional information. This input is factory configured at the time of order to have either RS232 or CMOS voltage levels with the associated characteristics.

**CSEAT** – This output provides an indication when a card is seated in the reader and the card is powered up. A CMOS level indicates a card status based on the application configuration. See the Operations and Commands sections for more information.

**GND** – This is the common (ground) connection for reader power and signals.

**DSR** – This hardware signal indicates the Host is ready to receive communications from the MiniSmart TXD Output. The only application use for this signal is the PC/SC enumeration process.

## INTRODUCTION TO COMMANDS

This document provides all necessary information about the command set. The command set is driven by the Host system and is interpreted and acted upon by the MiniSmart reader as follows:

### CONVENTIONS

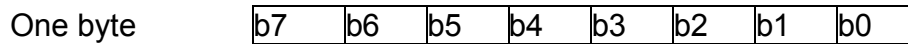
The following conventions are used in this document:

Numeric values:

- Numeric values are expressed in decimal notation unless otherwise noted.
- 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.
- The value 00h is assigned to any byte that is reserved for future use.

Bit Numbering:

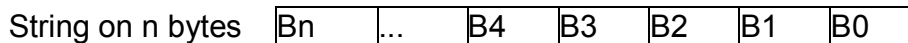
A byte consists of 8 bits, b7 to b0, where b7 is the most significant bit and b0 the least significant bit, as shown below:



Byte numbering:

A string of n bytes consists of n number of concatenated bytes:

Bn-1 ...B2, B1, where Bn is the most significant byte and B0 is the least significant byte:



## MINISmart COMMUNICATION PROTOCOLS

All exchanges with the MiniSmart are handled by three communication layers:

- **The Command Layer**
- **The Transport Layer**
- **The Physical Layer**

The Command Layer handles and interprets the MiniSmart commands. The Transport Layer handles the message addressing, specifies the transmission type, and validates each transmission. The transport layer uses a Block Protocol, which is described later in this document. The Physical Layer handles data transmission.

### The Command Layer

The command layer handles and interprets the MiniSmart commands. These commands are made up of the command code, data, and parameters.

Commands are sent in the following format:

**| CommCode | Parameters | Data|**

Where:       **CommCode** is the command code.  
              **Parameters** are the parameters sent with the command.  
              **Data** is the data accompanying the command, where appropriate.

A Status Code is returned for every command received; sent in the following format:

**| S | Data |**

Where:       **S** is the status code identifier.  
              **Data** is the data returned with the status code, where appropriate.

*Refer to Appendix A for a complete list of status codes meanings.*

## The Transport Layer

The transport layer handles message addressing, specifies the transmission type, and validates each transmission. It uses a Block Protocol.

The Block Protocol is a simplified version of the T=1 card protocol. Under this protocol, data is transmitted in blocks between the source and the destination.

The data is exchanged in the following format:

NAD	PCB	LEN	DAT	EDC
-----	-----	-----	-----	-----

Example: power down command

42	40	01	12	11
----	----	----	----	----

Where:

**NAD** is the source and destination identifier with the first nibble as the destination and the second nibble as the source.

Bit	7	6	5	4	3	2	1	0
Value = 42 or 24	<b>Destination ID</b>				<b>Source ID</b>			

The identifier for the chipset in MiniSmart is 4, while the host system is 2. Therefore, a command string starting with 42 means a command sent from the host system to the reader, and vice versa.

**PCB** indicates the block type. There are three types of PCB blocks:

1. R-Block (Receive Ready Blocks)

R-Blocks hold the positive or negative acknowledgements to transmissions.

Format:

Bit	7	6	5	4	3	2	1	0
Value = 8X or 9X	<b>1</b>	<b>0</b>	<b>0</b>	<b>S</b>	<b>0</b>	<b>0</b>	<b>E</b>	<b>V</b>

S = 1 the sequence number the error is detected in

E = 1 another error is detected

V = 1 error being verified by EDC

2. I-Block (Information Blocks)

I-Blocks hold the data to be exchanged between the source and the destination.

Format:

Bit	7	6	5	4	3	2	1	0
Value = 00 or 40	<b>0</b>	<b>S</b>	<b>0</b>	<b>Not used</b>				

S = sequence bit

The sequence bit S is set to 0 at power-up. The source sends the first I-Block transmitted with the sequence bit set to 0. It toggles the sequence bit every time it sends an information block. The MiniSmart and the Host system generate sequence bit values independently.

Example: Read 8 Bytes

42 **40** 06 15 00 B0 00 00 08 A9

3. S-Block (Send Completed Blocks)

S-Blocks indicate when the transmission is complete. There are two types of S-Block PCBs:

Format:

Bit	7	6	5	4	3	2	1	0
Re-synch Request Value = C0	1	1	0	0	0	0	0	0
Re-synch Response Value = E0	1	1	1	0	0	0	0	0

It is necessary to send Re-synch request before powering on the card.

Example: Re-synch command

42 **C0** 00 82

**LEN** specifies on one byte the number of bytes in the DAT field.

**DAT** holds the data being transmitted.

**EDC** is the result of an exclusive OR performed on NAD, PCB, LEN, and DAT bytes.

### The Physical Layer

The physical layer handles the data transmission itself. The Physical Layer uses the serial asynchronous protocol with which the data can be sent directly over the serial line. The bytes are sent over the line by an UART. The transmission speed is programmable. The default configuration is 9,600 bytes, eight bits, no parity, and one stop bit. The physical interface can be either at RS232 levels or at CMOS levels. The CMOS interface is a direct output from the controller IC's UART. The RS232 interface is obtained level shifting the CMOS signals using an RS232 converter IC.

Only the communication signals can be configured for RS232. See Flex Cable Pin-Out Assignments for information on specific signals that can be configured to RS232 levels. The configuration for either CMOS or RS232 is produced during the manufacturing process and cannot be change.

## MICROPROCESSOR CARD OPERATION

The MiniSmart handles ISO 7816 T=0 and T=1 protocol microprocessor cards. The following section describes the implementation of these standards.

### Clock Signal

The MiniSmart chip transmits a clock signal to the card. The clock frequency is 3.6864 MHz. The operating mode is specified while selecting the card type and the Define Card Type command. Card type 02h should be selected for the standard mode.

### Global Interface Parameters

These parameters are returned by the microprocessor card during the ATR. For more information on these parameters, refer to the ISO 7816-3 standard document.

### TA1

The MiniSmart interprets this parameter to match its communication rate with that of the card, according to the clock rate conversion factor F. F is coded on the most significant nibble and the bit rate adjustment factor D is coded on the least significant nibble. If needed, the coding of F and D can be found in part 3 of the ISO 7816 standard.

The initial communication rate used during the ATR is 9 909.68 bps in standard mode. After receiving the ATR, the MiniSmart selects the communication rate according to TA1.

Table 1 shows the clock rate conversion factors, the bit rate conversion factors, and the selected baud according to TA1 values.

### TB1 and TB2

The Vpp option is not available. TB1 and TB2 parameters are ignored, Vpp default value is set to 5 V.

### TC1

This parameter defines the extra guard time N, required by the card. This parameter is processed when sending characters to the card, to ensure a delay of at least  $(12+N)$  etu between two characters.



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D	F	372	372	558	744	1116	1488	1860	512	768	1024	1536	2048
1	TA1	01	11	21	31	41	51	61	91	A1	B1	C1	D1
	Bps	9909.68	9909.68	6606.45	4954.84	3303.23	2477.42	1981.94	7200.00	4800.00	3600.00	2400.00	1800.00
2	TA1	02	12	22	32	42	52	62	92	A2	B2	C2	D2
	Bps	19819.35	19819.35	13212.90	9909.68	6606.45	4954.84	3963.87	14400.00	9600.00	7200.00	4800.00	3600.00
4	TA1	03	13	23	33	43	53	63	93	A3	B3	C3	D3
	Bps	39638.71	39638.71	26425.81	19819.35	13212.90	9909.68	7927.74	28800.00	19200.00	14400.00	9600.00	7200.00
8	TA1	04	14	24	34	44	54	64	94	A4	B4	C4	D4
	Bps	79277.42	79277.42	52662.86	39638.71	26425.81	19819.35	15855.48	57600.00	38400.00	28800.00	19200.00	14400.00
12	TA1	08	18	28	38	48	58	68	98	A8	B8	C8	D8
	Bps	-	-	79277.42	59458.06	39638.71	29729.03	23783.23	86738.82	57600.00	43369.41	28800.00	21621.11
16	TA1	05	15	25	35	45	55	65	95	A5	B5	C5	D5
	Bps	-	-	105325.71	79277.42	52662.86	39638.71	31779.31	115200.00	76800.00	57600.00	38400.00	28800.00
20	TA1	09	19	29	39	49	59	69	99	A9	B9	C9	D9
	Bps	-	-	-	99632.43	65828.57	49481.88	39638.71	-	95750.65	72282.35	47875.32	35964.88
32	TA1	06	16	26	36	46	56	66	96	A6	B6	C6	D6
	Bps	-	-	-	-	105325.71	79277.42	63558.62	-	-	115200.00	76800.00	57600.00

**Table 2 - TA1 Values (Frequency: 3.6864 MHz)**

Note: For a communication rate higher than 115200bps, extra card guard time is required.

### Communication Protocols

The least significant nibble of the TDI parameter in the ATR defines the protocol to be used by the reader (T=0 or T=1), according to the following table:

Value	Protocol
0	T=0
1	T=1

If the reader does not receive a TDI value, it defaults to the T=0 protocol.

#### T=0 Protocol

The specific TC2 interface parameter is interpreted to set the value of the work waiting time, W. If this parameter is absent, a maximum of 960xD etu elapses before timing-out on a character sent by the card. Otherwise a maximum of 960xDxW etu elapses before timing-out. To send instructions to a T=0 microprocessor card, the ISO Input and ISO Output or the exchange APDU commands are used.

#### T=1 Protocol

To send instructions to a T=1 microprocessor card, the Exchange APDU command is used. The T=1 specific interface bytes are interpreted as per clause 9 of the ISO 7816-3 standard. These bytes are TA3, TB3, TC3.

TA3 codes the Information Field Size of the Card (IFSC). The default value is 32 bytes.

TB3 codes the BWI (Block Writing Time Integer) and the CWI (Character Waiting Time Integer).

TC3 defines the Error Detection Code (EDC) type.

## COMMAND SET

This section describes the MiniSmart command set. For each command, it indicates the following:

- **The function performed**
- **The syntax**
- **The data returned**

## CONFIGURATION COMMANDS

Configuration commands are used to define reader settings. They are:

- **Configure SIO Line**
- **Set Delay**
- **Read Firmware Version**
- **Restart**
- **Set Reader In Halt Mode**
- **Toggle Plug And Play capability**

Each command is described in the following pages.  
See Appendix A for a description of status codes.

### Configure SIO Line

This command sets the Serial Input Output (SIO) line baud rate. After a power up, the line defaults to no parity, eight bits per character, 9,600 bps and one stop bit.

Note: The line is reconfigured as soon as this command is executed. The response is returned with the new parameters.

Format:  
0Ah CB

Where: CB is the configuration byte. The configuration flag settings are defined in the following table:

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Bit	Value	Description
7 to 3		Not used
2 to 0	XXX	000: 115,200 bps 001: 76,800 bps 010: 38,400 bps 011: 19,200 bps 100: 9,600 bps 101: 4,800 bps 110: 2,400 bps 111: 1,200 bps

Response:  
S = 00h

### Set Delay

When a slow Host computer is used, this command delays the MiniSmart's responses.

Format:  
23h 01h 00h 4Ch 01h Delay

Where: Delay is the response delay in milliseconds. Enter a value between 0 & 255.  
Upon power up, the delay time defaults to 0.

Response:  
S.

### Read Firmware Version

This command returns the version of the MiniSmart firmware.

Format:  
22h 05h 3Fh E0h 10h

Response:  
S Version

Where: Version is the installed software version in ASCII.

Example:

"GemCore-V1 .4x-Gy"

Where:           x = minor release number  
                  y = either...  
                          H for a ROM masked chip or...  
                          I for a RAM/EEPROM chip

OROS-Compatible Command:

Format:

22h 05h 3Fh F0h 10h

Response:

S <OROS-R2.99-R1.4x>

### **Restart**

This command is used to reset the MiniSmart firmware. All the parameters are initialized with the default values.

Format:

0Ch 00h 00h 00h

Response:

None.

Note: The reader is ready to receive the next command after 260 milliseconds.

### **Set Reader in Halt Mode**

This command switches the reader to halt mode. When switching to this mode, the card is powered down and the reader goes into low power consumption mode.

Format:

0Eh 00h 00h 00h

Response:

S = 00h

Note: The reader goes into halt mode approximately 2 milliseconds after sending the response.

Note: Also see the Power Control command: Reader Power Down

Note: The reader awakens upon receipt of any command from the Host. This command is ignored by the reader. The reader also awakens after a smart card insertion or withdrawal. When the reader awakens, it performs a reset sequence and stays in the default state. The reader is ready to receive the next command after 260 milliseconds.

### Toggle PNP Capability

This command disables the Plug And Play enumeration detection if it was enabled. It enables this capability if it was disabled

Format:  
5Ah

Response:  
SPNP

Where: PNP is the current stat of Plug And Play enumeration detection capability:  
00h: Detection is disabled  
01h: Detection is enabled

## POWER CONTROL COMMANDS SET

Power Control Commands are:

- **Set Timeout**
- **Refresh**
- **Reader Power Down**
- **Status**

See Appendix A for a description of the status codes.

### Set Timeout

This command modifies the silent timeout value. This timeout is reset upon receipt of a command. If this timeout ends, the reader is set to Halt mode, as with the Set Reader In Halt Mode command or the Reader Power Down command. The default value for timeout is infinite.

Format:  
52hT

Where: T is the silent timeout value in seconds. Value 00h sets an infinite timeout (The timeout never ends).

Response:  
S

### Refresh

This command is not an operational command. Its sole purpose consists of resetting the silent timeout.

Format:  
53h

Response:

S

### **Reader Power Down**

This command sets the reader to Halt mode. It has the same effect as the Set Reader In Halt Mode command.

Format:

54h

Response:

S=00h

Note: The reader goes into Halt mode in less than 2 milliseconds after sending the command.

Note: Also see the Set Reader in Halt Mode command.

Note: The reader wakes up upon receipt of any command from the Host. This command is ignored by the reader. The reader also wakes up after a smart card insertion or withdrawal. When the reader wakes up, it performs a reset sequence and stays in the default state. The reader is ready to receive the next command after around 260 milliseconds.

### **Status**

This command returns the current silent timeout value.

Format:

56h

Response:

S 0h T

Where: T is the current silent timeout value.

## **CARD INTERFACE COMMAND SET**

The card interface commands manage the communication with smart cards.

The behavior of certain commands changes depending on the selected card type. Therefore, some commands are common to all types while others are redefined or disabled according to the card type.

Four groups of commands are defined:

- **Common card interface commands**
- **Specific commands for asynchronous cards, generic ISO operating mode**
- **Specific commands for asynchronous cards, EMV-compliant operating mode**
- **Specific command for synchronous cards**

### **Common Card Interface Commands**

These commands are valid regardless of the selected type. Common card interface commands are:

- **Power Down**
- **Define Card Type and Card Presence Detection**
- **Directory**
- **Set Operating Mode**

Each command is described in the following pages.  
See Appendix A for a description of status codes.

### **Power Down**

This command powers down the card. The MiniSmart also powers down the card as soon as it detects a withdrawal.

Format:  
11h

Response:  
S

The Power Down command always ends normally if a card is present in the reader (S=00h). If no card is inserted, the command returns the FBh "card missing" error.



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### Define Card Type and Card Presence Detection

The MiniSmart does not have a smart card recognition algorithm. It therefore is necessary to define the type of card used. This command sets the card type.

Note: When the MiniSmart is reset or powered up, the card type defaults to standard microprocessor card mode (type 2).

Format:  
17h T [00h [P]]

Where: T is the card type selection byte. The card type codes are as follows:

Card Type	Description
01h	Synchronous smart card, contact ID TECH for more information on memory cards if the application is required.
02h	Standard speed mode (clock frequency = 3.6864 MHz) ISO 7816-3 T=0 and T=1 microprocessor cards.
0EFh	Standard speed mode microprocessor card. Transparent protocol, the protocol management is not handled by the reader.

If the command is sent with a family number which does not match one of the current card types, the current card is powered down:

P is the card presence byte. This optional parameter is used to modify the card presence indication options. When this parameter is not specified, the card presence is not indicated. See the following table for further information.

After the power up, the card presence is not indicated CSEAT (7) signal on the interface flexible is set to its default state (1).

Card Presence Byte	Description
0000XX0	CSEAT = 1 means a card is present. If the CSEAT = 0, no card is present.
0000XX1	CSEAT = 0 means a card is present. If the CSEAT = 1, no card is present.
00001XX0	On CSEAT, a (5 msec) positive pulse occurs upon card insertion/withdrawal
00001XX1	On CSEAT, a (5 msec) negative pulse occurs upon card insertion/withdrawal

Response:  
S

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Note: When it switches from microprocessor to synchronous smart card and vice versa, the MiniSmart automatically powers down the card. When EMV operating mode is selected, it is not possible to select the transparent protocol type. The MiniSmart rejects such a command.

### Directory

This command is used to obtain the types of cards handled, the release number and the characteristics for each card driver.

Format:  
17h 00h

Response:  
S <TYPE, CMD, REV> ... <TYPE, CMD, REV>

Where:

Type	Card Type (for example: 02h = Asynchronous Card)
CMD	00h: ISO IN/OUT 01h: APDU 02h: ISO IN/OUT and APDU
REV	Card driver release (2 bytes)

### Set Operating Mode

This command selects the operating mode of treatment of an asynchronous card. Two modes exist:

- **Generic ISO mode**
- **EMV-compliant mode**

Some commands are not allowed in EMV mode, while others undergo changes in their behavior.

Format:  
17h 00h Mode

Where: Mode is the operating mode to be selected  
47h selects the generic ISO mode  
45h selects the EMV-compliant mode  
00h requests the mode currently selected

Response:  
SMode

Where: Mode is the mode currently selected  
47h = generic ISO mode  
45h = EMV-compliant mode

Note: The default operating mode is ISO.

## **SPECIFIC COMMANDS FOR ASYNCHRONOUS CARDS**

### **GENERIC OPERATING MODE**

These commands, which are used with a card selected as asynchronous (type = 02h), have a specific behavior.

Commands that are valid with these types are:

- **Power Up - Asynchronous Cards**
- **Change Card Communication Parameters - Asynchronous Cards**
- **ISO Output - Asynchronous Cards**
- **ISO Input - Asynchronous Cards**
- **Exchange APDU - Asynchronous Cards**
- **Card Status - Asynchronous Cards**

See Appendix A for a description of status codes.

### **Power Up – Asynchronous Cards**

This command powers up and resets a card.

Format:

12h [CFG][PPS0,PPS1,PPS2,PPS3][PCK]

If the CFG parameter is not specified, the card is powered with 5 V, there is no PTS management and the operating mode is compatible with OROS2.2X.

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If the CFG parameter is specified:

CFG	Description
X0XXX001	Class A: Vcc for Card is 5V
X0XXX010	Class B: Vcc for Card is 3V
X0XXX100	Class C: Vcc for Card is 1.8V
X0XXX011	Class AB: Vcc for Card is 5V or 3V
X0XXX110	Class BC: Vcc for Card is 3V or 1.8V
X0XXX111	Class ABC: Vcc for Card is 5V, 3V or 1.8V
0000XXXX	Operation is compatible with OROS2.2X
0001XXXX	Reset and no PPS management. The reader stays at 9,600 bps if the card is in negotiable mode.
0010XXXX	Reset and automatic PPS management. The reader uses the highest speed proposed by the card. Change to T=1 protocol if there is a choice between T=0 and T=1.
1111XXXX	Manual PPS management. This command does not reset the card. It must be preceded by a Power Up command with the CFG parameter set to 0001XXXX. The parameters from PPS0 to PCK are sent to the card at 9,600 bps. If PCK is omitted, it is computed and added by the MiniSmart. If the card responds with PPS RESPONSE, the reader is configured using the parameters returned.
00001000	Valid only if T=1 is the current protocol, otherwise no action occurs. An S-IFS block exchange is initiated by the MiniSmart. The IFSD (maximum length of INF field accepted by the MiniSmart) sent to the card is the value of parameter PPS0. No other parameters are allowed.
X0XX1XXX or 11111XXX	If the selected protocol after the ATR or the PPS exchange is T=1, the MiniSmart initiates an S-IFS block exchange. The IFSD value indicated to the card is FEh. After a command reset with no PPS and with IFSD exchange, a command of manual PPS management is invalid.

Response:  
S <card response>

Where: <card response> is the card Answer To Reset (ATR).

**Change Card Communication Parameters – Asynchronous Cards**

This command dynamically changes the parameters of the communication with the card. This command is mainly used to switch the speed or the protocol when the card uses a proprietary mode to switch these parameters.

Format:

12h PRT CNF1 CNF2 CNF3 CNF4

Where: PRT Selects the protocol. The format of this byte is:

0	1	0	C	P	E	S	R
---	---	---	---	---	---	---	---

C = 0; bits P E S R are significant.  
 1; bits P E S R are not taken into account.

P selects the protocol to be used.  
 When P = 0, the protocol is T=0.  
 When P = 1, the protocol is T=1.

E selects the computing mode for EDC. It is significant only if T=1 is selected.  
 When E = 0,EDCisLRC.  
 When E=1,EDCisCRC.

S initializes the sequence number of the last I-block sent.  
 When S = 0, the next I-block will be sent with sequence number 1.  
 When S = 1, the next I-block will be sent with sequence number 0.

R is the sequence number for the next I-block to be received. When R = 0, the next I block is expected to have sequence number 0. When R = 1, the next I block is expected to have sequence number 1.

- CNF1        Selects the new TA1 (FI/DI=speed) to be used.
- CNF2        Selects the new TCI (N=extra guard time) to be used.
- CNF3        If protocol T=0 is selected, this indicates the new TC2 (WI= waiting time) to be used. If protocol T=1 is selected, this indicates the new TA3 (TFSC= maximum length of information field of blocks which can be received by the card) to be used.
- CNF4        If protocol T=0 is selected, reserved for future use. If protocol T=1 is selected, indicates the new TB3 (BWI/CWI= block and character waiting time) to be used.

Response:

S

Note: No check is performed on parameters PRT, CNF1, CNF2, CNF3, and CNF4.

### **ISO Output – Asynchronous Card**

This command sends ISO Out commands, that is, commands which retrieve data from the asynchronous card.

This command can return up to 252 data bytes in one operation. Consequently, two operations are required to obtain the minimum of 256 data bytes.

Format:

13h CLA INS AI A2 LN

Where: CLA, INS, AI, A2 and LN are the five ISO header bytes. For more details about ISO header contents, refer to the documentation concerning the card being used. The ISO header is transmitted directly to asynchronous cards.

Response:

S <data> SW1 SW2

Where: <data> Is the data returned by the card.

If a smart card error or a MiniSmart error is detected (S<>00h and S<>E7h), the MiniSmart does not return any valid data. The card may return any number of bytes up to LN.

If the number of data bytes to be returned is greater than 252, the first 253 bytes are contained in the <data> field. The SW1 and SW2 bytes follow the second response, not the first one. In order to obtain the rest of the response, the following command must be sent:  
SW1 SW2Status Word 1, Status Word 2

Format:

13h FFh FFh FFh FFh FFh

Note: The description of SW1 and SW2 is given in the ISO 7816 standard.

Response:

S <data> SW1 SW2

Where: <data> Is the remainder of the response (LN-253 bytes).  
SW1 SW2 Status Word 1, Status Word 2

Note: The MiniSmart returns error code 1Bh if a card interface command other than the above is sent.

### **ISO Input – Asynchronous Card**

This command sends ISO In commands, that is, commands which send data to an asynchronous card. This command can send up to 248 data bytes in one operation. Consequently, two operations are required to send 255 data bytes.

Format:

14h CLA INS AI A2 LN <data>

Where:

CLA, INS, AI, A2 and LN

Are the five ISO header bytes. For more details about the ISO header contents, refer to the documentation concerning the card being used. The ISO header is transmitted directly to microprocessor cards (asynchronous cards).

<data>

Represents the LN data bytes transmitted to the card after the ISO header. The maximum length of the data is 248 bytes.

Response:

S SW1 SW2

The SW1 and SW2 bytes hold the standard status codes returned by the card. Their respective values are 90h and 00h if the operation is successful.

If the number of data bytes to be transmitted is greater than 248, the command below containing the last data bytes must be sent before the 'normal' ISO Input command containing the first 248 data bytes.

Format:

14h FFh FFh FFh FFh (LN-248) <data249.dataLN>

Where:

<data 249.dataLN> Are bytes number 249 through LN.

Response:

S SW1 SW2

The SW1 and SW2 bytes hold the standard status codes returned by the card. Their respective values are 90h and 00h if the operation is successful.

### **Exchange APDU – Asynchronous Cards**

This command sends a command Application Data Protocol Unit (APDU) to the card, and retrieves the response APDU. Only the short APDU format is supported.

Format:

15h APDU

Where: APDU is the command APDU.

If the T=1 protocol is selected and the APDU command length is greater than the card information field size, it is truncated and sent to the card in several chained blocks. If the T=0 protocol is selected, the APDU transportation in T=0 TPDU (Transport Protocol Data Unit) is handled by the MiniSmart. Please refer to the documentation concerning the card currently used for APDU command details. Up to three operations are required to perform a maximum length ISO short APDU exchange (261 bytes for APDU and 258 bytes for APDU responses).

Response:

S Response APDU

Where: Response APDU is the response APDU to the command.

If the T=1 protocol is selected and the card replies in chained blocks, they are concatenated. If the T=0 protocol is selected, the T=0 TPDU of the response is mapped in the APDU response format by the MiniSmart. Refer to the documentation concerning the card currently used for APDU response details. If the command APDU length (LA) exceeds 254 bytes, the command below containing the last part of the command APDU must be sent before the "normal" APDU exchange command containing the first 254 bytes.

Format:

15h FFh FFh FFh FFh (LA-254) <apdu255.apduLA>

If the response APDU length (Lr) exceeds 254 bytes, the first 254 bytes of the response are returned with the status code 1Bh indicating that the command below must be sent to retrieve the last bytes of the response.

Where: <apdu255.apduLA> Are bytes number 255 through LA.

Format:

15h FFh FFh FFh FFh XX

Where: XX Can be any dummy byte value

APDU Format:

The APDU format is defined by the ISO 7816-4 standard.



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APDUs can belong to one of several cases, depending on the length and contents of the APDU. MiniSmart handles the following cases:

Case 1 No command or response data.

Case 2 Short format: no command data, response data between 1 and 256 bytes.

Case 3 Short format: command data between 1 and 255 bytes and no response data.

Case 4 Short format: command data between 1 and 255 bytes, response data between 1 and 256 bytes. These cases are referred to as 1, 2S, 3S and 4S respectively.

### Command Format:

Commands are sent in the following format:

Header	Body		
CLA INS P1 P2	Lc	Parameters/data	Le

The fields are described below.

### Header Fields:

Header fields are mandatory. They are as follows:

Field Name	Length	Description
CLA	1	Instruction class
INS	1	Instruction code. This is given in the command descriptions.
P1	1	Parameter 1
P2	1	Parameter 2

### Body Fields:

The command body is optional. It includes the following fields:

Field Name	Length	Description
Lc	1	Length of the data field
Data	Lc	Command parameters or data
Le	1	Expected length of data to be returned

For full details about the header and body field contents, refer to the documentation concerning the card currently used.

### Response Format:

Responses to commands are received in the following format.

Body	Trailer
Data	SW1, SW2

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The body is optional and holds any data returned by the card.

The trailer includes the following two mandatory bytes:

SW1: Status byte 1 which returns the command processing status

SW2: Status byte 2 which returns the command processing qualification

For full details about the response field contents refer to the documentation concerning the card currently used.

### T=1 IFSC/IFSD.

If the T=1 protocol is used, when block chaining occurs, the buffers' length is determined by IFSC and IFSD parameters.

The default values for the MiniSmart buffer (IFSD) and the card buffer (IFSC) are 32 bytes.

The smart card can indicate a specific value of IFSC during the ATR. MiniSmart takes into account this new value instead of the default one.

To specify an IFSD value other than the default one to the card, see the Power Up - Asynchronous Card command.

### **Card Status – Asynchronous Card**

This command is used to obtain the status of the card interface. It returns information indicating:

- The type of card currently used
- Card presence
- The power supply value
- The card power status
- The communication protocol (T=0 or T=1)
- The speed parameters between the card and the reader

Format:

17h

Response:

S STAT TYPE CNFI CNF2 CNF3 CNF4

Where:

STAT	0000X000	Card not inserted
	0000X100	Card inserted but not powered
	0000X101	Card inserted, power supply = 1.8V
	0000X110	Card inserted, power supply = 5V
	0000X111	Card inserted, power supply = 3V
	00000XXX	T=0 protocol

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	00001XXX	T=1 protocol
TYPE	Activated Card type	
CNF1 CNF2 CNF3 CNF4	CNF1=TA1 (FI/DI) CNF2=TC1 (EGT) CNF3=WI CNF4=00h	T=0 Card as per ISO 7816-3
	CNF1=TA1 (FI/DI) CNF2=TC1 (EGT) CNF3=IFSC CNF4=TB3 (BWI/CWI)	T=1 Card as per ISO 7816/3

### Asynchronous Cards - Generic Operating Mode - Transparent Protocol

These commands are designed for use with an asynchronous card in transparent protocol (type=EFh). They have a specific behavior.

Note: It is not possible to select the transparent protocol in EMV mode.

Valid commands for the transparent protocol are:

- Change Transparent Protocol Parameters
- Power Up - Transparent Protocol
- Exchange Block - Transparent Protocol
- Card Status - Transparent Protocol

See Appendix A for a description of status codes.

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### Change Transparent Protocol Parameters

This command is used to set the working parameters of the transparent protocol.

Format:

12h CFG ETU EGT CWT BWT

Where:

CFG Specifies the card characteristics and selects the operating mode.

CFG	Description
XXXXXX00 or XXXXXX10	Vcc for the card is 5V.
XXXXXX01	Vcc for the card is 3V.
XXXXXX11	Vcc for the card is 1.8V.
XXXX0XXX	The format of the blocks received is not defined: the end of a received block is determined by the CWT timeout.
XXXX1XXX	The format of the blocks received is comparable to that of the T=1 protocol. The third byte of the block indicates the length of the data to be received before the EDC field.
XX0XXXXX	The direct convention is used to transfer byte.
XX1XXXXX	The inverse convention is used to transfer byte.
X0XXXXXX	During the ATR, a check is performed for the T0 and TDi characters to compute the number of characters to be received.
X1XXXXXX	No check of computation is performed during the ATR. The ATR is complete upon CWT timeout.
0XXXXXXX	Significant only if bit 3 of the CFG is set. EDC is one byte long.
1XXXXXXX	Significant only if bit 3 of the CFG is set. EDC is two bytes long.

ETU is the etu duration, coded in clock period number minus one and divided by three:  $[(FI/DI)-1]/3$ .

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### Samples for Common TA1:

TA1	FI/DI	ETU Parameter
0x11	372	123 = 7Bh
0x12	186	61 = 3Dh
0x13	96	30 = 1 Eh
0x14	41.5	15 = 0Fh
0x18	31	10 = 0Ah
0x58	124	41 = 29h
0x95	32	10 = 0Ah

EGT Defines the extra guard time etus between characters sent by the MiniSmart. The total duration of this character is  $(12+EGT) \times (\text{etu duration})$ . The value 255 for EGT has a special meaning; the character duration is 11 etus.

CWT Defines the maximum waiting time between the leading edges of two consecutive characters in the same direction.  
 Timeout duration is  $(11+2^{\wedge}CWT) \times (\text{etu duration})$ .  
 The maximum value for CWT is 15.

BWT Defines the maximum waiting time between the leading edges of two consecutive characters sent in opposite directions.  
 Timeout duration is  $[(11+960 \times 2^{\wedge}BWT)] \times [\text{etu duration}]$ .

Response:  
S

Default parameter values:   CFG   = 04h  
                                   ETU   = 7Bh  
                                   EGT   = 02h  
                                   CWT   = 0Dh  
                                   BWT   = 04h                   Power Up - Transparent Protocol

This command powers up and resets an asynchronous card in transparent mode.

Format:  
12h

Response:  
S <card response>                   <card response> is the card Answer To Reset (ATR).

*Note: No verification is performed on characters returned by the card, in particular with respect to TS and TCK.*

### **Exchange Block - Transparent Protocol**

This command sends a block to a card and receives a block back in response.

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Format:  
15h BLOCK

Where: BLOCK Is the block to be sent.

Response:  
S Response BLOCK

Where: Response BLOCK Is the block received in response.  
Up to three operations are required in order to perform an exchange of blocks of maximum length (259 bytes). If the length (LB) of the block to be sent to the card exceeds 254 bytes, the command below containing the last part of the block must be sent before the "normal" exchange block command containing the first 254 bytes.

14h<block255.blockLB>

Where: <block255.blockLB> Are bytes 255 through LB

Note: If the length of the block received in response (LR) exceeds 254 bytes, the first 254 bytes are returned with the status code 1Bh, indicating that the command below must be sent to retrieve the last bytes of the response.

Format:  
13h.

Note: If no block is given in the command, the MiniSmart waits for the response block.

### Card Status - Transparent Protocol

This command is used to obtain the current transparent protocol parameters. It returns information regarding:

- The transparent protocol selected
- The card presence
- The power supply value
- The card power status
- The speed and timeout parameters

Format:  
17h

Response:  
S STAT TYPE ETU EGT CWT BWT Where:

STAT	0000X000	Card not inserted
	0000X100	Card inserted but not powered
	0000X101	Card inserted, power supply = 1.8V

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	0000X110	Card inserted, power supply = 5V
	0000X111	Card inserted, power supply = 3V
	00000XXX	T=0 protocol
	00001XXX	T=1 protocol
TYPE		Activated card type  EFh = Transparent protocol
ETU		etu duration
EGT		Extra guard time requested
CWT		Character waiting time
BWT		Response block waiting time

### Synchronous Cards – EMV Compliant Operating Mode

These commands behave specifically when the EMV-compliant mode is selected.

- Power Up - EMV-compliant
- Exchange APDU - EMV-compliant
- Card Status - EMV-compliant

When in EMV-compliant operating mode, MiniSmart rejects the following commands:

- Change Card Communication Parameters - Asynchronous cards
- ISO Output - Asynchronous cards

ISO Input - Asynchronous cards

See "Appendix A – Status Codes" for a description of status codes.

### **Power Up – EMV Compliant**

This command powers up and resets the card.

The card response is transmitted using the EMV criteria, and the card behavior is EMV-compliant.

The card can be:

Accepted

- Accepted after a warm reset

Rejected

If protocol T=1 is selected, an automatic IFSD exchange is performed.

Format:

12h

Response:

S <card response>

Where: <card response> is the card Answer To Reset (ATR)

### **Exchange APDU – EMV Compliant**

Sends a command Application Data Protocol Unit (APDU) to a card, and retrieves the response APDU. This command's behavior obeys EMV requirements. For example, deactivation on timeout.

Format:

15h APDU

Where: APDU is the command APDU.

If the T=1 protocol is selected and the APDU command length is greater than the card information field size, it is truncated and sent to the card in several chained blocks. If the T=0 protocol is selected, the APDU transportation in T=0 TPDU (Transport Protocol Data Unit) is handled by the MiniSmart. Please refer to the documentation concerning the card currently used for APDU command details.

Up to two commands are required to perform a maximum length ISO short APDU exchange (261 bytes for APDU and 258 bytes for APDU responses).

Response:

S Response APDU

Where: Response APDU is the response APDU to the command.

If the T=1 protocol is selected and the card replies in chained blocks, they are concatenated. If the T=0 protocol is selected, the T=0 TPDU of the response is mapped in the APDU response



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format by the MiniSmart. Refer to the documentation concerning the card currently used for APDU response details. If the command APDU length (LA) exceeds 254 bytes, the command below containing the last part of the command APDU must be sent before the "normal" APDU exchange command containing the first 254 bytes.

Format:

15h FFh FFh FFh FFh (LA-254) <apdu255.apduLA>

Where: <apdu255.apduLA> are bytes 255 through LA.

If the response APDU length (Lr) exceeds 254 bytes, the first 254 bytes of the response are returned with the status code 1Bh indicating that the command below must be sent to retrieve the last bytes of the response.

Format:

15h FFh FFh FFh FFh XX

Where: XX Can be any dummy byte value.

### APDU Format:

The APDU format is defined by the ISO 7816-4 standard.

APDUs can belong to one of several cases, depending on the length and contents of the APDU. MiniSmart handles the following cases:

Case 1 No command or response data.

Case 2 Short format: no command data, response data between 1 and 256 bytes.

Case 3 Short format: command data between 1 and 255 bytes and no response data.

Case 4 Short format: command data between 1 and 255 bytes, response data between 1 & 256 bytes.

These cases are referred to as 1, 2S, 3S and 4S respectively.

### Command Format:

Commands are sent in the following format:

Header	Body		
CLA INS P1 P2	Lc	Parameters/data	Le

The fields are described below.

### Header Fields:

Header fields are mandatory. They are as follows:

Field Name	Length	Description
CLA	1	Instruction class
INS	1	Instruction code. This is given in the command descriptions.
P1	1	Parameter 1
P2	1	Parameter 2

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### Body Fields:

The command body is optional. It includes the following fields:

Field Name	Length	Description
Lc	1	Length of the data field
Data	Lc	Command parameters or data
Le	1	Expected length of data to be returned

For full details about the header and body field contents, refer to the documentation concerning the card currently used.

### Response Format:

Responses to commands are received in the following format.

Body	Trailer
Data	SW1, SW2

The body is optional and holds any data returned by the card.

The trailer includes the following two mandatory bytes:

SW1: Status byte 1 which returns the command processing status

SW2: Status byte 2 which returns the command processing qualification

For full details about the response field contents refer to the documentation concerning the card currently used.

### T=1 IFSC/IFSD.

If the T=1 protocol is used, when block chaining occurs, the buffers' length is determined by IFSC and IFSD parameters.

The default values for the MiniSmart buffer (IFSD) and the card buffer (IFSC) are 32 bytes.

The smart card can indicate a specific value of IFSC during the ATR. MiniSmart takes into account this new value instead of the default one.

### **Card Status – EMV Compliant**

This command is used to obtain the status of the main card interface or of the auxiliary card. It returns information indicating:

- The type of card currently used

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- Card presence
- The power supply value
- The card power status
- The communication protocol (T=0 or T= 1)
- The speed parameters between the card and the reader

Format:

17h

Response:

S STAT TYPE CNF1 CNF2 CNF3 CNF4

Where:

STAT	0000X000	Card not inserted
	0000X100	Card inserted, but not powered
	0000X101	Card inserted, power supply = 1.8V
	0000X110	Card inserted, power supply = 5V
	0000X111	Card inserted, power supply = 3V
	00000XXX	T=0 protocol
	00001XXX	T=1 protocol
TYPE	Activated Card type	
CNF1 CNF2 CNF3 CNF4	CNF1=TA1 (FI/DI) CNF2=TC1 (EGT) CNF3=WI CNF4=00	T=0 Card as per ISO 7816/3
	CNF1=TA1 (FI/DI) CNF2=TC1 (EGT) CNF3=IFSC CNF4=TB3 (BWI/CWI)	T=1 Card as per ISO 7816/3

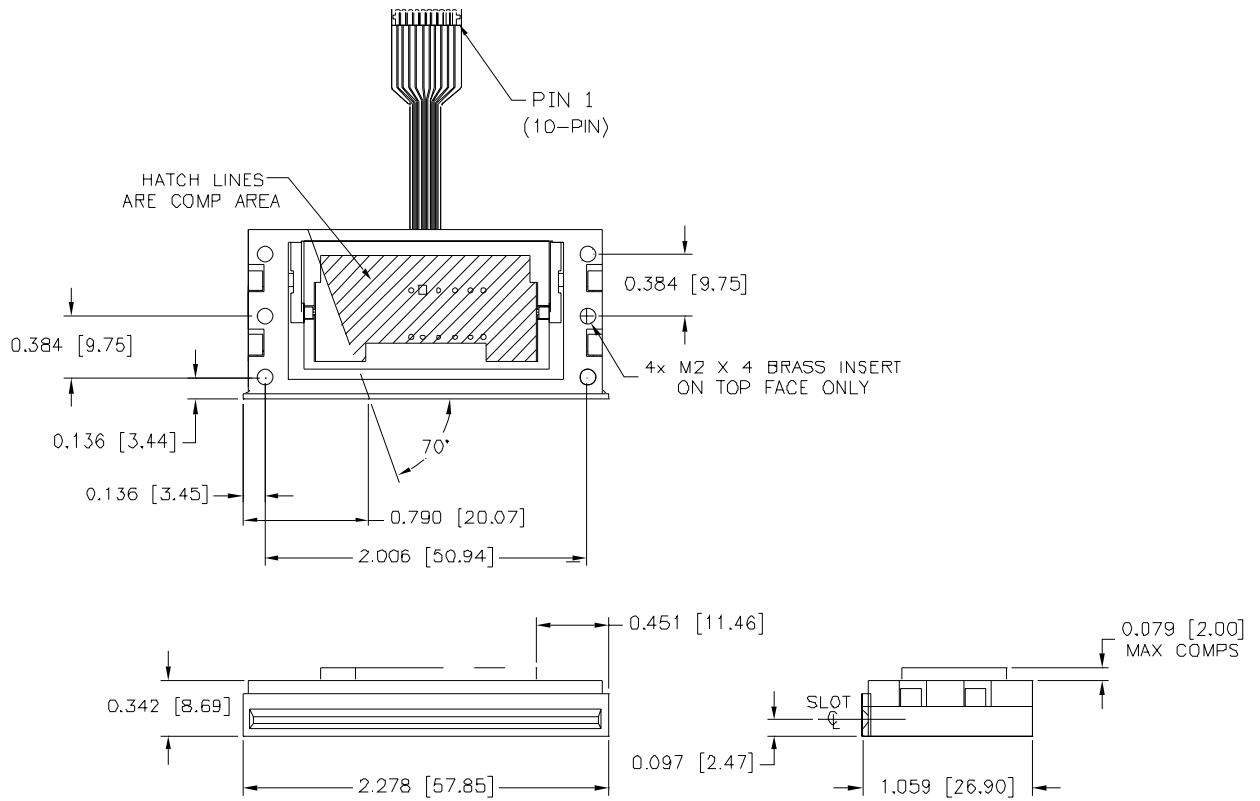
## **APPENDIX A – STATUS CODES**

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

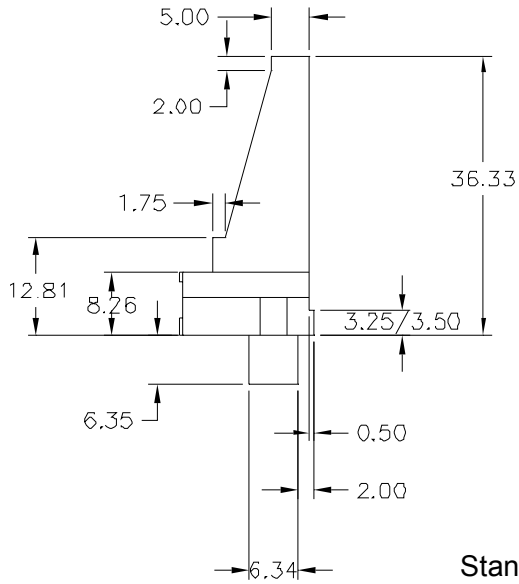
### **Code Description**

00h	Successful command.
01h	Unknown driver or command.
02h	Operation impossible with this driver.
03h	Incorrect number of arguments.
04h	Reader command unknown. The first byte of the command is an invalid command code.
05h	Response exceeds buffer capacity.
10h	Wrong response upon card reset. The first byte of the response (TS) is invalid.
12h	Message is too long. The buffer is limited to 254 bytes, 248 of which are for data exchanged with the card.
13h	Byte reading error returned by an asynchronous card.
15h	Card powered down. A Power Up command must be sent to the card before any other operation.
1 Bh	A command with an incorrect number of parameters has been sent.
1 Dh	The TCK check byte is incorrect in a microprocessor card ATR.
A0h	Error in the card reset response, such as unknown exchange protocol, or TA1 byte not recognized. The card is not supported. The card ATR is returned nonetheless.
A1h	Card protocol error (T=0/T=1).
A2h	Card malfunction. The card does not respond to the reset or has interrupted an exchange by timing out.
A3h	Parity error during a microprocessor exchange. This error only occurs after several unsuccessful attempts to resend.
A4h	Card has aborted chaining (T=1).
A5h	Reader has aborted chaining (T=1).
A6h	RESYNCH successfully performed by MiniSmart.
A7h	Protocol Parameter Selection error.
A8h	Card already powered on.
B0h	PC-Link command not supported.
E4h	The card has just sent an invalid "Procedure Byte" (see ISO 7816-3).
E5h	The card has interrupted an exchange (the card sends an SW1byte but more data remains to be sent or received).
E7h	Error returned by the card. The SW1 and SW2 bytes returned by the card are other than 90h 00h.
F7h	Card removed. The card has been withdrawn during the execution of a command. Check that the card instruction is not partially completed.
F8h	The card is consuming too much electricity or is short-circuiting.
FBh	Card missing. There is no card in the smart card interface. The card may have been removed when it was powered up, but no command has been interrupted.

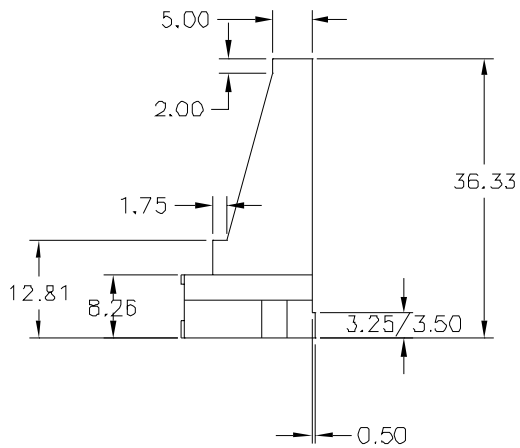
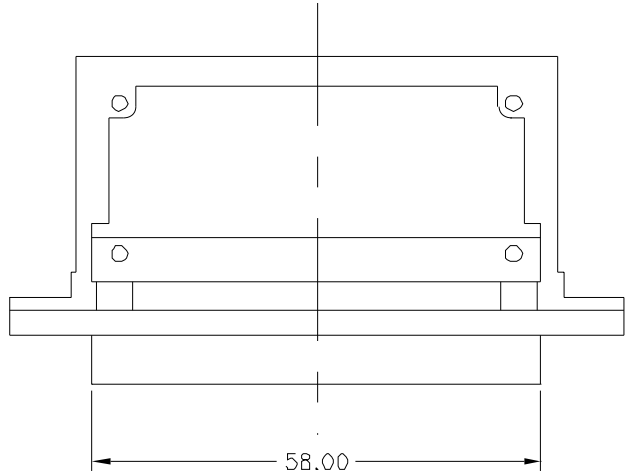
APPENDIX B – READER OUTLINE DRAWING



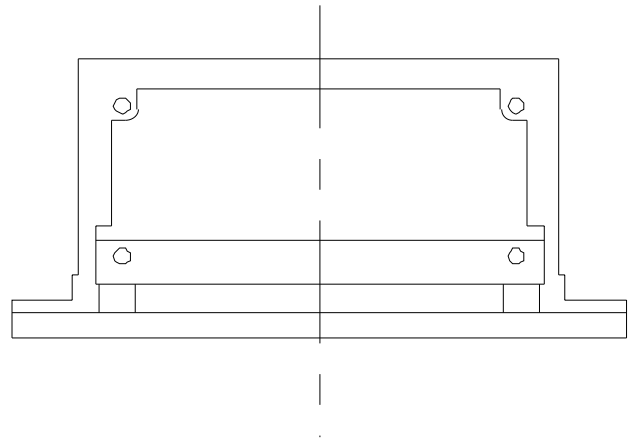
APPENDIX C – BEZEL OUTLINE DRAWINGS



Standard Bezel



Flush Mount Bezel



## APPENDIX D – REFERENCES & ABBREVIATIONS

### REFERENCES

EMV CCS	Europay-MasterCard-VISA, Chip Card Specifications
ISO 7816	ISO Standards for ICC (Smart Cards)

### ABBREVIATIONS

bps	Bits per second
CMOS	Complimentary Metal Oxide technology that replaced TTL
EMV	Europay-MasterCard-VISA (technical consortium)
etu	Elemental time unit
g	grams
IC	Integrated Circuit
ICC	Integrated Circuit Card (Smart Card or Memory Card)
in	Inches
ISO	International Standards Organization
LED	Light Emitting Diode
MTBF	Mean Time Between Failure
mA	milliAmpere
mm	millimeters
msec	millisecond
oz	Ounces
μA	microAmpere
UART	Universal Asynchronous Transmitter & Receiver (serial Comm)
VDC	Volts Direct Current

## APPENDIX E – RS232 EXAMPLE CODE

**1. Re-synch ..... Please reference to page 15**

Request: 42 C0 00 82  
Response: 24 E0 00 C4

**2. Get Card Status ..... Please reference to page 34**

Request: 42 00 01 17 54  
Response: 24 00 07 00 06 02 11 00 0A 00 3C

**3. Power on ..... Please reference to page 37**

Request: 42 40 01 12 11  
Response: 24 40 14 00 3B 6F 00 00 80 25 A0 00 00 00 68 54 08 00 0D 40 82  
90 00 4A

**4. Read Firmware Version..... Please reference to page 20**

Request: 42 00 05 22 05 3F E0 10 AF  
Response: 24 00 11 00 47 65 6D 43 6F 72 65 2D 52 31 2E 34 34 2D 47 48 03

**5. Read 8 Bytes ..... Please reference to page 38**

Request: 42 40 06 15 00 B0 00 00 08 A9  
Response: 24 40 03 E5 69 86 6D

**6. Power Down..... Please reference to page 24**

Request: 42 00 01 11 52  
Response: 24 00 01 00 25