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USER'S MANUAL

TRIMAG III HYBRID INSERT READER MAGSTRIPE & SMART CARD

Standard & Compact chassis

**80064519-001-A
Oct 2, 2012**

SPECTRUM III HYBRID MAGSTRIPE/SMART CARD READER

IMPORTANT NOTE

This is a preliminary version of the User Manual and Tm3HIR. At this time (Sept 9, 2011), the only versions of the Tm3 HIR currently available are the RS232 version and the USB CDC and CCID versions. There have been changes from what is supported see Spectrum I, Spectrum IIa, Spectrum II and Spectrum III Differences page 12 for a list of the differences between this reader and the Sp3. Currently the Tm3HIR is only available with one SAM slot. Readers are only available in sample quantities. The Tm3HIR fully supports encrypting MSR transactions. This manual is preliminary and subject to change without notice.

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This equipment has not been tested to comply with Part 15 of the FCC Rules for a digital device. This device is designed to be incorporated into a product that will be tested to comply with all regulatory requirements.

CERTIFICATIONS

The TM3HIR reader has passed EMV 2000 Terminal Level 1 testing on July 2011 (debug passed certification still pending). The RS232 PC/SC driver was certified and signed by WHQL December 2003. The USB CDC has been certified and signed by WHQL (June 2011). These drivers were certified with Windows 2000[®], Windows XP[®] (only the 32 bit versions) and Windows CE.

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Revision History

Date	Revision	Description	By
10/02/2012	A	Initial release	Jenny W

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1. OVERVIEW AND INTRODUCTION

ID TECH's Intelligent Hybrid Insert Reader supports both magnetic stripe card reading, and smart cards or IC cards. The reader communications are RS232 or USB. The reader communicates with the host using a generic protocol. The USB and PC/SC reader versions communicate with a driver running on a Windows PC.

There are two chassis types used for the TM3 Hybrid Insert Readers. The standard chassis is generally form & fit equivalent to industry standards used typically in POS & ATM applications and a full variety of options. The compact chassis is smaller and is fitted with a single smaller sized bezel and is used typically in applications where a smaller profile is wanted. The compact chassis does not provide the card latch, front switch, and debris gate options. The same PCA design and features are used on both chassis types.

This manual is a design guide for installing and interfacing the TriMag III Hybrid Insert Reader (abbreviated TM3HIR) reader. To a PC the RS232 TM3HIR can appear as either a COM device or a PC/SC reader. If one is programming a PC/SC reader, for the most part, it will be unnecessary to know the details of the communication between the PC and the reader. This document briefly describes the standard PC/SC v1.0 interface. If one has already programmed a PC/SC reader into your application and you now wish to change readers perhaps to add triple track magnetic stripe reading or memory cards then one should study the interface to the ID TECH provided idtlib.dll. This should allow easy integration of these features into your application.

If one has programmed for an earlier RS232 version of a Spectrum reader the TM3HIR should be able to replace that reader. The TM3HIR also supports a USB interface that is compatible with an application written for an RS232 Spectrum reader.

The following sections define the required protocols for communicating with, and performing operations to an IC card. All T=0 and T=1 microprocessor cards are supported. Check with your ID TECH representative for information on the types of memory IC cards supported.

PC/SC is a standard interface between a smart card reader and a PC. The PC/SC driver converts the PC/SC commands to the commands used natively by the reader. This makes it convenient for the programmer to develop an application without being committed to a particular reader. The PC/SC interface only defines T=0 and T=1 microprocessor interface cards. For functions that access the other features of the reader beyond these cards such as magnetic stripe reading, latching, memory cards and SAM support, the PC/SC interface supports these functions with vendor specific calls. A DLL is available to aid the programmer in interfacing to these functions. This document describes the PC/SC programming and sample programs that show how to access these features. These sample programs are available on request.

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The PC/SC driver only supports Windows 2000, Windows XP (32 bit only), and XP embedded.

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1.1. General

The TM3HIR reader is an intelligent manually operated insert reader for Smart Cards (ICC) and up to three tracks of magnetic stripe data. This unit can interface with asynchronous (microprocessor) types of integrated circuit cards, which conform to ISO 7816-3. It can also interface with a variety of synchronous (memory) ICC types. Units feature a large debris opening, which allows foreign matter such as coin or paper, to fall or be forced out of the card slot.

1.2. Features

- ISO 7816 and EMV 2000 compliant. Supports microprocessor cards requiring a variety of f/d ratios (speeds). Supports ICC speeds from 9600 bps to 76.8k bps.
- PC/SC Certified on Windows 2000 and Windows XP operating systems.
- Reads and writes microprocessor cards using both T=0 and T=1 protocols.
- RS232 or USB 2.0 full speed compatible.
- Uses turbo TLP-224 communication protocol to talk with the host.
- Allows the host to interrogate the device about current status and configuration information and can notify the host automatically when a status change occurs.
- 3 and 5-Volt ICCs support (including SAM support). 1.8-Volt ICCs supported, but we could not find any cards that support this voltage.
- Supports memory card types: 3-byte I²C, 4-byte I²C, SLE4404 SLE4406, SLE4418, SLE4428, SLE4432, SLE4442, AT88SC101, et al.¹
- Large debris slot
- Supports LED control; control either by the reader or by host commands
- Supports buffered and un-buffered modes and formatted or raw data magnetic read.

¹ Contact ID TECH sales for a complete list of memory cards supported.

1.3. *Factory Installed Options*

- A dual color, single bulb LED is available.
- Various bezel options available on the standard chassis.
- A compact chassis option is available for a smaller profile
- Conformal coating (on active electrical components).
- Latching mechanism to secure a card in the reader.
- SAM (Secure Application Module),
- If more than one SAM is required, a 4 SAM daughter board is in development.
- Gate—this prevents foreign objects from easily entering the reader.
- 12V supply support with separate supply board (only one SAM supported).

1.4. *Optional Accessories*

- DB9 serial cable assembly with female plug for AC/DC adapter (for RS232).
- USB adaptor cables of various standard lengths (for USB).
- AC/DC power adapter complying with your specified power requirements.
- PC/SC sample demonstration programs in Visual C++ and Visual Basic.
- Smart card demonstration software for exhibiting the capabilities of the Spectrum 3 reader in non-PC/SC mode.
- A configuration program to configure the reader's optional capabilities.
- A sample initialized T=0 microprocessor smart card. P/N 8005206-002
- A sample initialized 2K byte memory smart card. P/N 8005205-001

1.5. *Spectrum I, Spectrum IIa, Spectrum II and Spectrum III Differences*

- Successor to the Spectrum I, Spectrum IIa, and Spectrum II series hybrid readers. This reader supports nearly all features of the earlier readers and is backwards compatible with the Spectrum I, II and III readers.
- A Spectrum III Reader supports RS232 or USB 2.0 full speed.
- Restored support for certain memory card types removed in some intermediate versions due to hardware limitations.
- Host controlled and flashing LED support
- Code space available for additional features as the need arises.

1.6. *Tm3 HIR vs. Sp3 Differences list*

The following sections define the design features required for the Tm3 HIR as compared to the Spectrum I, IIa, II, and III readers. Existing features currently residing in Spectrum III shall remain, unless specifically changed by this document. To some extent differences between the Sp3 and Tm3 HIR is a moving target because features originally set to be included in the Tm3 HIR have been included in the Sp3 as well. Note The Sp3 has had features removed over time usually because of lack of resources to support them. It is not believed that any removed features are required. A list of the changes between these readers follows.

NOTE: refer to specification number 800500029-001 for a detailed description of the Spectrum II intelligent reader's features.

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- The Sp3 stored the program code in Flash and was upgradeable, the Tm3HIR stores the code in OTP and is not upgradeable.
- The Sp3 did not support encrypting MSR transactions and Tm3HIR does.
- The Sp3 supported decoding CA Driver's License format the Tm3 does not, this is an obsolete feature.
- The Tm3 is near instant on the Sp3 takes 4+ seconds between power up and ready for operation.
- The Sp3 supports PC/SC the Tm3HIR supports PC/SC and PC/SC2
- The USB Sp3 used an in-house driver the USB Tm3HIR uses a standard CCID driver.
- The Tm3HIR is lower power than the Sp3 that is it uses substantially less operating current and somewhat less sleep current than the Sp3. An option for lower power consumption is available, but makes the reader more difficult to use.
- The Tm3 has additional configuration commands particularly to support encryption.
- The Tm3 only supports up to 4 SAM cards (the Sp3 supported up to 5). The SAM board is different between the readers.
- The Tm3 does not support memory cards in the SAM slots (the Sp3 did), but it is understood that almost all SAM cards are CPU cards. Pads C4 and C8 cannot be driven on SAM cards. Pads C4 and C8 are only used on memory cards.
- The Serial number can be 8 to 10 digits long, but if the unit is used for RS232 PnP the serial number must be 8 digits (or the serial number is truncated in the PnP string).
- The Tm3 can be configured to send a power-on string.
- The ICC access is somewhat slower because the icc clock was closer to the limit of ~4MHz vs. ~3.5MHz and icc commands must go through an SPI interface rather than writing directly to the processors SFRs.
- Buffered mode commands can now request optionally just tracks 1 and 2 or track 2 and 3.
- The reader supports a slow LED flash mode and the reader will flash slow green if in buffered mode but not armed to read. This indicates the reader is alive and well but not ready to read a MSR card.
- The Tm3 can support 1.8V cards on all connectors—but this has not been tested because we have not been able to locate a source of 1.8V cards.
- The Tm3HIR does not support hardware handshaking.
- Tm3HIR has Plug-and-Play off by default (reversed from Sp3) so PnP is not accidentally turned on.

ID TECH is committed to working with users to meet your special requirements.

2. DEFINITIONS, DOCUMENTS AND LINKS

2.1. Definitions

AAMVA	American Association of Motor Vehicle Administration
ABA	American Banking Association
ACK	Acknowledge
AES	Advanced Encryption Standard
ASIC	Application Specific Integrated Circuit
ASCII	American Standard Characters for Information Exchange
Asynchronous card	A microprocessor ICC, that follows ISO7816-3
ATR	Answer To Reset—the power on response from a ICC
BAUD	Roughly the RS232 communication in bits per second
BPI	Bits Per Inch
CADL	California Drivers License Format (obsolete)
C-APDU	Command-Application Protocol Data Unit
CBC	Cipher-block chaining
CCID	Chip (Smart) Card Interface Devices
CDC	USB to serial driver (Communication Device Class) allows a USB reader to appear as a COM device to a PC application.
CDL	California Drivers License format
CE	European Safety and Emission approval authority
Coercivity	The resistance of a magnetic field to change measured in Oersted.
COM	RS232 serial communication port
CTS	Clear-To-Send
DC	Direct Current
DES	Data Encryption Standard
DMV	Department of Motor Vehicle
DUKPT	Derived Unique Key per Transaction
EMV	Europay-MasterCard-Visa—Financial transaction certification
ESD	Electro-Static Discharge
ETX	End of Transmission
FC	Flexible Circuit
FCC	Federal Communications Commission
F/D Ratio	F=Frequency, D=Divisor. In ISO 7816-3, these terms specify the speed of the ICC interface.
Gate	A device preventing easy entry of anything except a card into the reader. This can limit dust and debris from getting inside.
GND	Signal Ground
Hex	Hexadecimal, base 16
HID	Human Interface Device
Host	The Personal Computer to which the reader is attached.
Hybrid	Combination of two technologies here Smart Card and MSR
IC, ICC	Integrated Circuit Card
IFD	Interface Device—this is how ISO 7816 refers to the reader.
IFS	Information Field Sizes, see ISO7816-3 section 9.5.2

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IPS	Inches per Second
ISO	International Organization for Standardization
JIS	Japanese Industrial Standard
JPOS	Java for Retail Point of Sale
KB	Keyboard
KSN	Key Serial Number
LED	Light Emitting Diode
LRC	Longitudinal Redundancy Check Character a form of error check character.
LSB	Least significant Bit
mA	Milliamperes
MAC	Message Authentication Code
Memory card	An ICC, commands supported vary by manufacturer, generally simpler and less expensive than microprocessor cards.
Microprocessor card	Either T=0 or T=1 asynchronous card
MSB	Most significant Bit
msec	Milliseconds
MSDN	Microsoft Developers Network
MSR	Magnetic Stripe Reader
mV	Millivolts
NACK	Non-acknowledge
OLE	Object Linking and Embedding
OPOS	OLE for Point Of Sale, driver decodes magnetic stripe data into logical fields
OTP	One Time Programmable
PAN	Primary account number
PC	Personal Computer
PCA	Printed Circuit Board (Assembled)
PCB	Printed Circuit Board bare.
PCI	Payment Card Industry
PC/SC or PCSC	Personal Computer/Smart Card interface, an industry standard
PC/SC2	Personal Computer/Smart Card interface version 2.0
PnP or PNP	Plug-and-Play
P/N	Part Number
POH	Powered On Hours
POS	Point of Sale
PPMSR	Serial Port Power Magstripe Reader
PPS	Protocol and Parameters Selection, see ISO7816-3 section 7.2
PS/2	IBM Personal System/2 Keyboard Interface
PSC	Programmable Security Code
R-APDU	Response-Application Protocol Data Unit
RoHS	Restriction of Hazardous Substances
RS232	Reference Standard serial communication
RTS	Request To Send
SAM	Secure Access Module also called Secure Application Module.
SHA-1	Enhance Cryptographic Hash Function
Smart Card	ICC, includes both memory and microprocessor cards

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Sp2	Abbreviation for Spectrum II
SPI	Serial Peripheral Interface
SPT3	Abbreviation for Spectrum III
SPT3c	SPT3 firmware supporting USB CDC
SPT3s	SPT3 firmware supporting RS232
SPT3u	SPT3 firmware supporting USB PC/SC
Synchronous card	see Memory card
T1, T2, T3	Track 1 data, Track 2 data, and Track 3 data
TDES	Triple Data Encryption Standard
Transport code	A password used between the ICC manufacturer and the card customer.
USB	Universal Serial Bus—a high speed connection to the host that also provides the reader with power
UV	Ultra Violet – spectrum of light rays
WHQL	Windows Hardware Quality Control Labs

Note: many unusual words in this document are defined in the Function ID table on page.

SPECTRUM III HYBRID MAGSTRIPE/SMART CARD READER

Related Documents

Published Documents

- EMV 2000 *Integrated Circuit Card Specifications for Payment Systems 4.0 (2000)*
ISO 7810 *Identification cards – Physical characteristics (1995)*
ISO 7811 *Identification cards –Recording technique (1995)*
ISO/IEC 7816 *Identification Cards - Integrated circuit(s) cards with contacts*
Part 2: *Dimension and location of the contacts (1989, DIS 1998)*
Part 3: *Electronic signals and transmission protocols (1997)*
Part 4: *Inter-industry commands for interchange (1995/Amd.1:1997)*
Amd1: Impact of secure messaging on the structures of APDU messages.
ISO 10202-4 *Financial transaction cards—Security architecture of financial transactions systems using integrated circuit cards—Part 4: Secure application modules*
AAMVA *Best Practices Guidelines for the Use of Magnetic Stripes PC/SC Workgroup Specifications Versions 1.0 and 2.0*
ISO 7810 *Identification Cards - Physical Characteristics (1995)*
ISO 7811 *Identification Cards -Recording Technique (1995)*
AAMVA *Best Practices Guidelines for the Use of Magnetic Stripes*
ISO 4909 *Magnetic stripe content for track 3*
ISO 7812 *Identification Cards – Identification for issuers Part 1 & 2*
ISO 7813 *Identification Cards – Financial Transaction Cards*
ANSI X9.24-2002 *Retail Financial Services Symmetric Key Management*
USB ORG *USB Specification Rev. 2.0*

ID TECH Documents

- 80064502-001 *SPT3 Memory Card Manual*
80064503-001 *SPT3 Down Load Manual*
80064506-001 *SPT3 Returned Statuses Manual*

2.2. Applicable Links

- AAMVA™ <http://www.aamva.org/>
EMV™ <http://www.emvco.com/>
ID TECH® <http://www.idtechproducts.com/>
MSDN™ <http://msdn.microsoft.com/library/>
PC/SC <http://www.pcscworkgroup.com/>
Windows Logo <http://www.microsoft.com/whdc/winlogo/default.mspx>
OPOS <http://monroecs.com/opus.htm>
ISO documents <http://www.iso.ch/>

Formatting to designate certain data types

- 'A' A single character in ASCII
41h A single character in hexadecimal

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41	A single character in a group of hexadecimal digits
“String”	ASCII character group if in communication group, not NULL terminated.
Default	A default value will be bolded
<ETX>	A communication member, one byte in size, except the message length.
6913	four-digit hex numbers are error status indications
[xxx ... xxx]	Square brackets designate optional or repeated data groupings
[52 4E]	Bold square brackets in headings are the key communication bytes for a particular command
B0	bit positions are all from position 0 to position 7 so if only B1 is set the value of a byte is 02h.

Note: All numeric characters are presented in hexadecimal, except numbers in single quotes are in ASCII.

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3. QUICK START

3.1. Quick Start Versions

The version of the quick start depends on the hardware and firmware of the reader being connected. Generally there are two types of readers those that appear to the application as a PC/SC reader and those that appear to the application as a COM device. The table below defines the type by part number SPT3 8xx or SPT3 5xx.

	part number	type	firm-ware	description
5	SPT3 85 or 55x	USB CDC	SPT3c*	USB reader using Microsoft's standard Communication Device Class driver for Windows 2000 and XP.
6	SPT3 86x or 56x	RS232 PC/SC	SPT3s	Serial reader with ID TECH'S PC/SC driver. This reader can operate as serial reader. OS Windows 2000 and XP.
8	SPT3 88x or 58x	RS232	SPT3s	Standard serial reader no driver required will work in any operating system supporting a serial port. Cannot do PC/SC.
9	SPT3 89x or 59x	USB PC/SC	SPT3u*	USB reader using ID TECH'S USB PC/SC driver for Windows 2000, XP and XP embedded.

*These readers have identical hardware the only difference being which firmware is loaded.

3.2. Required Equipment

1. For PC/SC a PC running Windows 2000 or later with an available USB port or DB9 serial communication port configured for plug and play, with CDROM or internet.
2. For Non-PC/SC a PC running Windows 98SE, ME, 2000 or later with an available USB port or RS232 port (DB-9) and any computer.
3. ID TECH SPT3 hybrid reader in default configuration.
4. Supplied USB cable or RS232 serial cable.
5. If RS232 the supplied 5 volt wall hugger power supply appropriate for your location.
6. Supplied sample T=0 microprocessor smart card.
7. Supplied CD-ROM containing drivers, demonstration programs, documentation, etc.

3.3. *Installing Drivers*

If a SPT3 reader was ever installed, it will install without prompting for the driver installation disk. The reader should be up and ready to work, go to the install demonstration software. If running a RS232 reader in non-PC/SC mode, no driver is required, go to 3.4 Demonstration on page 24. If installing a PC/SC reader go to 3.3.1 Install PC/SC Driver page 20. The final choice is installing USB-CDC driver go to 3.3.2 Install USB CDC Driver page 21.

3.3.1. **Install PC/SC Driver**

The ID TECH PC/SC drivers were designed for Windows 2000[®], Windows XP[®] (32 bit) and Windows XP embedded systems. Drivers connect a SPT3 USB or RS232 to the operating system. The following installation instructions assume the reader is being installed on Windows XP, the instructions for Windows 2000 will vary somewhat.

If USB PC/SC Reader

1. Connect USB cable between SPT3 and PC.
2. When the new hardware found balloon displays select it.
3. The found new hardware wizard will display.
4. Accept the default, "Install Software Automatically."
5. At the next prompt "If your hardware came with an installation CD or floppy insert it now." If not already done insert the provided CD.
6. At the last prompt, "Your device has been successfully installed," click finish.
7. Go to 3.4.1 PC/SC Demonstration on page 25.

If RS232 PC/SC Reader

1. Connect RS232 cable between SPT3 and PC. Plug wall hugger power supply to external power and connect power jack to back of the DB9 connector and boot or reboot PC. (Instead of rebooting the user can also scan for new hardware. Insert the CD that came with your hardware. To scan for new hardware select 'Start' [then 'Settings'] then 'Control Panel' [then 'Performance and Maintenance'] then ['Printers and other Hardware'] then 'Add Hardware' then 'Next' then 'Add/Troubleshoot a device' then click Next). Items in square brackets maybe required depending on your windows configuration settings.
2. When the new hardware found balloon displays select it. (If the PC boots without detecting new hardware, it is probably not configured for plug and play. If the LED remains amber after the PC has booted this is the case. See instructions 14.6 Configuring PC to Support Serial Plug and Play, page 120).
3. The found new hardware wizard will display. To the prompt can Windows connect to Windows update to search for this software, select "yes—this time only." Then click Next.
4. If prompted, "If your hardware came with an installation CD or floppy insert it now." Insert the provided CD. This is only necessary if your PC was unable to contact the Microsoft site and download the correct driver.
5. If prompted 'This wizard helps you to install software for: "ID TECH Spt3 Hybrid EMV Card Reader,'" Leave the default check box "Install the software

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- automatically (Recommended)” and click Next. Wait while the PC finds the proper driver to install and installs it.
6. At the last prompt, “The wizard has finished installing the software for: “ID TECH Spectrum II Magstripe and EMV Card Reader” click finish. The reason the wizard says that Spectrum II reader installed is because the RS232 PC/SC driver is identical between the Sp2 and SPT3.
 7. Select ‘Start’ [then ‘Settings’] then ‘Control Panel’ [then ‘Performance and Maintenance’] then ‘Administrative Tools’ then ‘Services’. Then scroll down to smart card. Verify that the Smart card service is started and that the start-up type is automatic. You can do this by double clicking on the word smart card, then select automatic and start the smart card service if the status says that it is stopped, and then click OK. Items in [] are optional depending on how your PC is configured.
 8. At this point the readers LED should be off. Proceed to install the demonstration program.
 9. Go to 3.4.1 PC/SC Demonstration on page 25.

3.3.2. Install USB CDC Driver

1. Connect USB cable between SPT3c and PC.
2. When the new hardware found balloon displays select it otherwise you should see “Welcome to the Found New Hardware Wizard”.
3. To the prompt can Windows connect to Windows Update to search for this software, select “no, not at this time” then click Next.
4. At the next prompt “If your hardware came with an installation CD or floppy insert it now.” Insert the CD into the CDROM driver and select “Install the software automatically (Recommended)” and then click Next.
5. At the prompt “the software you are installing is not signed,” click “Continue Anyway.” (The CDC driver is a standard Windows provided driver; ID TECH provides only the file to define the TM3HIR device).
6. At the last prompt, “The wizard has finished installing the software for ID TECH SPT3 USB RS232 Smart Card Reader” click Finish.
7. After installing the driver, the SPT3’s LED should be green. Select ‘start’ [then ‘Settings’] then ‘control panel’ [then ‘Performance and Maintenance’] then ‘system’ then ‘hardware’ then ‘device manager’ then ‘ports’ and note to which COM port the SPT3 is connected. Keep track of the port number, as this will be important when connecting the demonstration program to the reader. Continue to install the demonstration program.
8. If necessary because a required application can only access certain ports, one can change the COM port number. Follow these steps select ‘Start’ [then Settings’] then ‘Control panel’ [then ‘Performance and Maintenance’] then ‘System’ then ‘hardware’ then ‘Device Manager’. In the Device Manager under Ports double click on the SPT3c driver link (IDTECH SPT3 USB-RS232 Smart Card Reader (COM5). Select the “Port Settings” tab then select advanced. The currently selected port will display, selecting it will allow a different port to be chosen, ‘another’ port can be selected even if it says that the port is in use (some care should be exercised to avoid selecting a port

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actually in use). After selecting the new port, select OK then OK. Then scan for hardware changes and the new port should display.

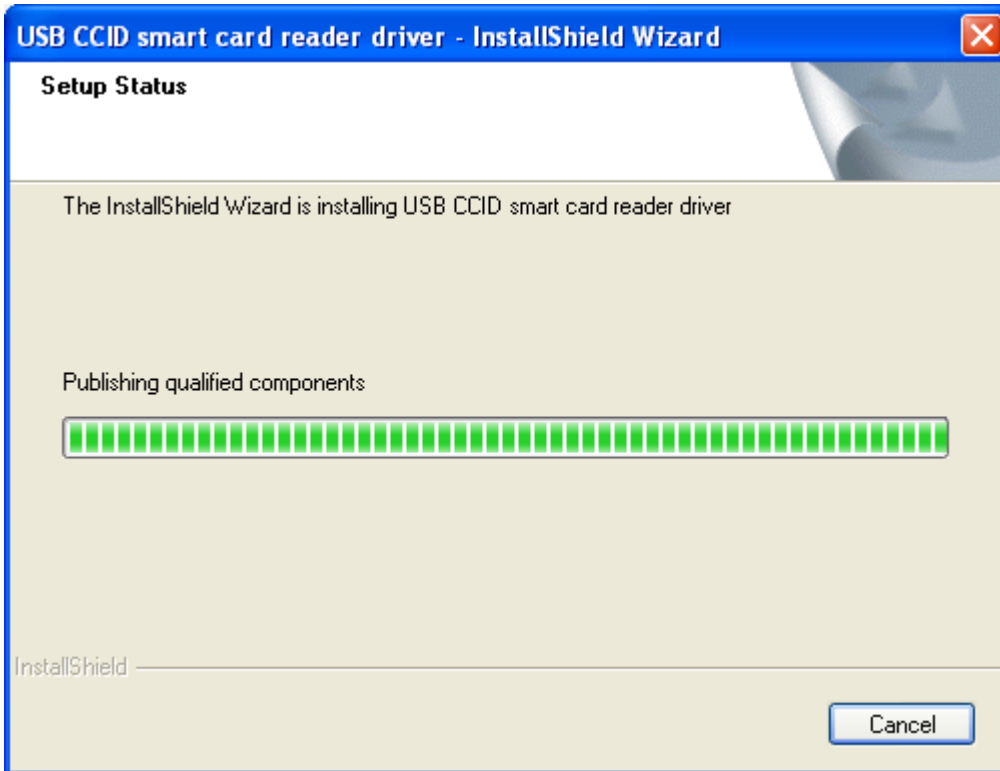
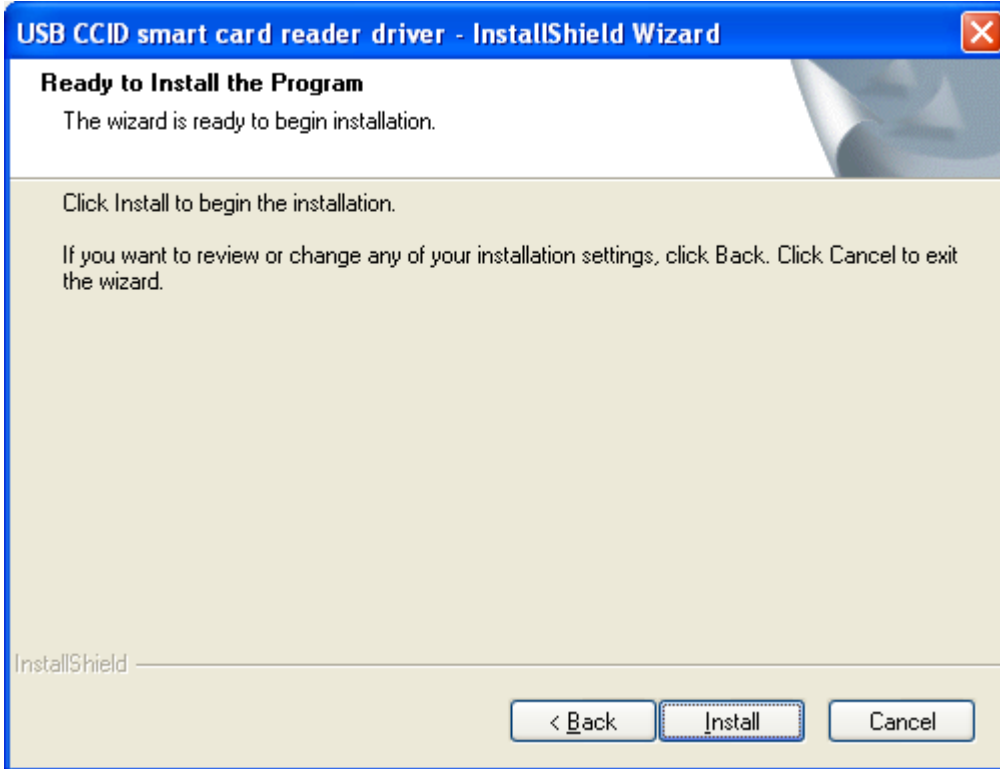
3.3.3. Install USB CCID Driver

USB CCID Driver part number: 80064813-002 USB CCID Driver Installation and Setting Package

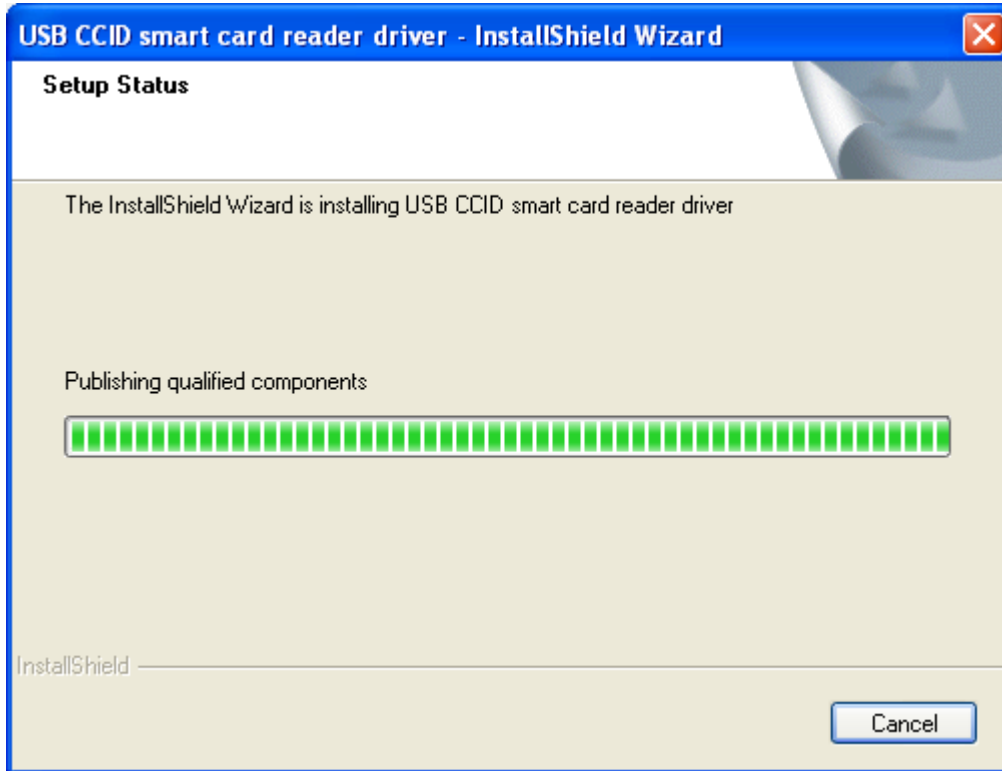
Please follow the prompts to install the USB CCID Driver



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Please un-plug then plug in the reader after CCID driver installation.

3.4. Demonstration Programs

If installing a COM device or non-PC/SC reader see 3.4.2 Non-PC/SC Demonstration page 25, the PC/SC reader demonstration application instructions immediately follow.

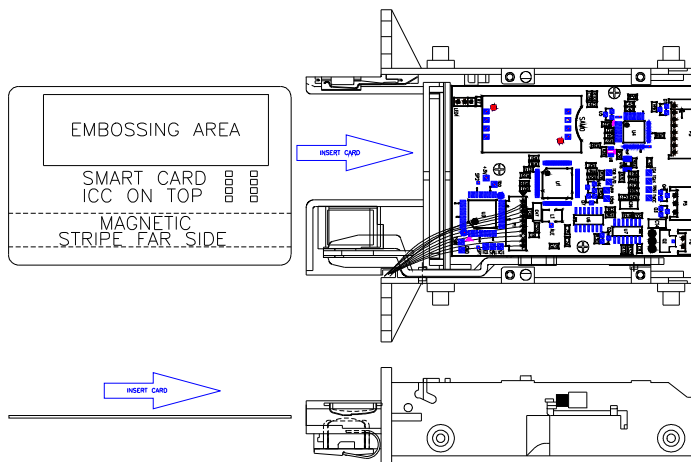


Figure 1 – Orientation for Inserting Card into Reader (Standard chassis shown)

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3.4.1. PC/SC Demonstration

Run the demo from the supplied CD by exploring to \demo\SPT3CppPcscDemo V2.0.1.0\release and double clicking on SPT3CppPcscDemo.exe the icon that looks like a smart card reader. Note a PC/SC reader must be connected or the program will report no smart card reader available. If there is a problem, install in the SPT3CppPcscDemo by double clicking on \Demo\SPT3CppPcscDemo V2.0.1.0\setup\Setup.exe and following the instructions. Once the demo is installed, select 'start' then 'all programs' then 'IDTECH' then 'SPT3CppPcscDemo' to run program. If everything is functioning properly the firmware, DLL and driver version information will display. To demonstrate that the smart card works, fully insert the provided sample microprocessor card (see card orientation figure above), and then select 'Connect Card'. To demonstrate that the card is functional, enter "00 A4 00 00 02 31 40" in the command box, and then select 'Send APDU' to card. This will select file 3140. One should get a "9000" status response from the card. Clear previous command. To read the first 4 bytes of that file enter "90 52 00 00 04" in the command box, and then select 'Send APDU'. You can check the response window to see the four bytes of response and two bytes of status 90 00. To demonstrate that the magnetic stripe reading works, select 'Disconnect', the message windows will say "context release successful". Then select 'Connect Rdr' and fully insert a magnetic stripe card. Select "Get Magstripe Data" button and then within 30 seconds pull the card in one clean motion from the reader. The contents of the cards tracks 1, 2 and 3 will display in the response area. To do a quick test of the readers functions select 'hardware test' and following the prompts using the sample microprocessor card when prompted to insert a valid test card. This verifies that the card seated switch and the latch are functioning properly. Withdraw the card as prompted to verify all three magstripe tracks are reading properly. This verifies that smart card reading and writing are functioning properly and that all three magnetic stripe tracks are reading properly.²

3.4.2. Non-PC/SC Demonstration

Install the HR_DLL Demo. To do this, in the provided CDROM, double click on the install program at \Demo\DLL-Demo-V4.1 041124\Setup.exe. Follow the on screen prompts to install it. There is a document describing this program on the CD-ROM at \Manuals\HrDLL_Dynamic_Link_Library_454.pdf.

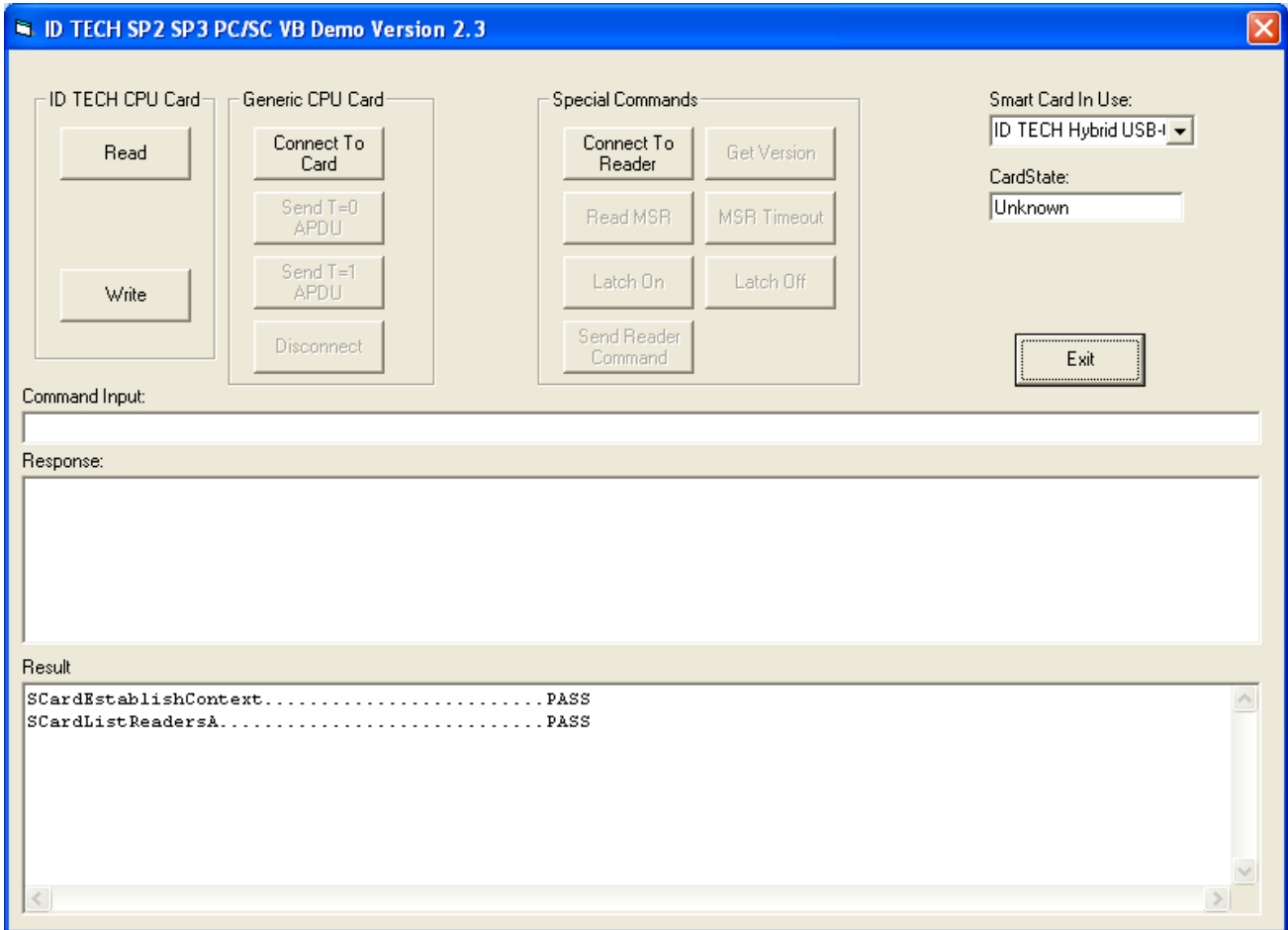
3.4.3. USB CCID Demonstration

IDT CCID VB Demo Software

The CCID VB Demo software may be used to demonstrate how to access CCID reader and the card in the reader through PC/SC API.

² The RS232-PC/SC driver disables the card present switch.

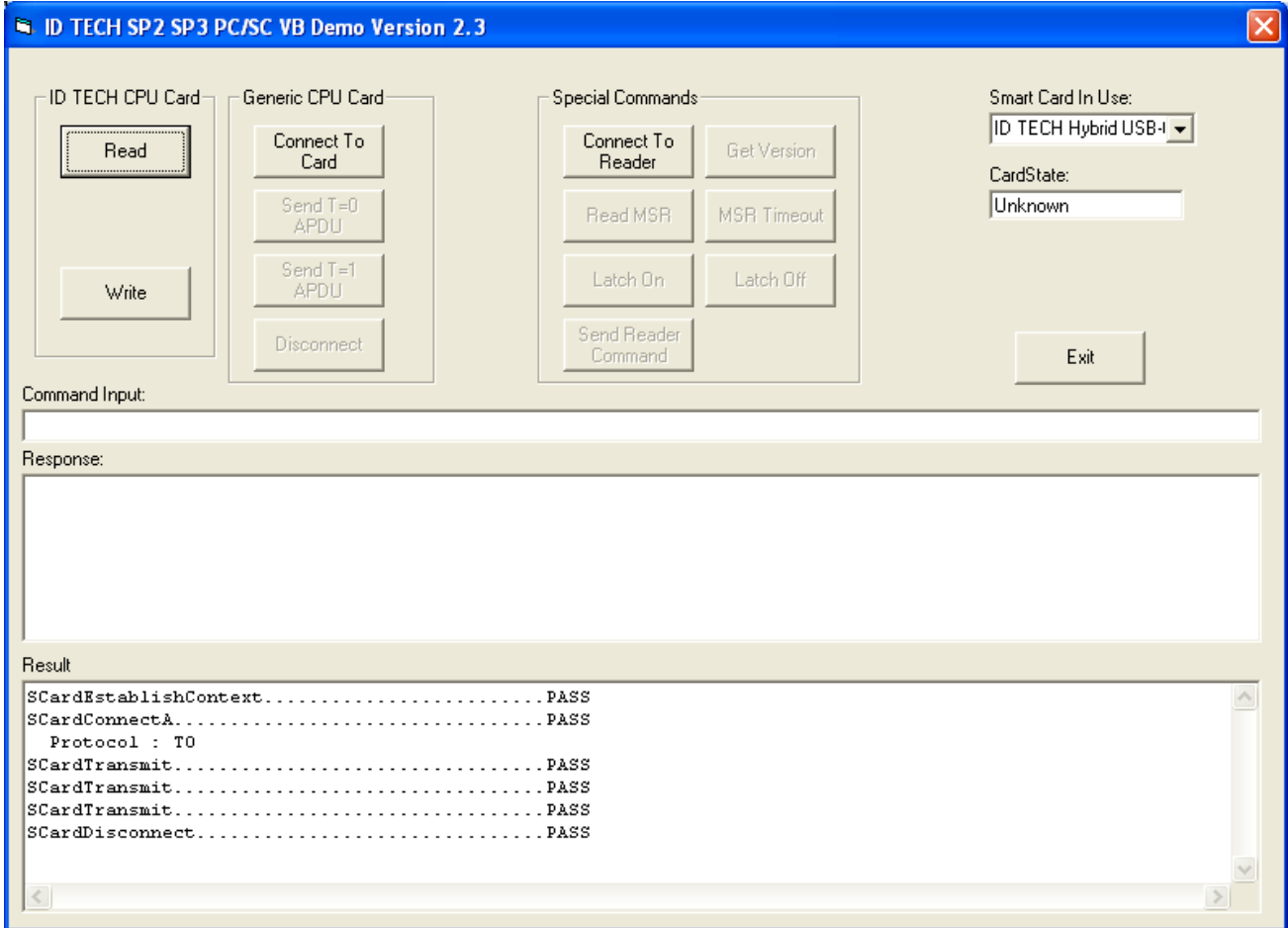
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Insert a standard ID TECH CPU card and click the “Read” button. This will execute a sequence of smart operations and data from the smart will be displayed in a small window:



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Click the Write button under “ID TECH CPU Card” group, this will do a complete a sequence of operations to write a string to the ID TECH CPU card in the reader.

You may also go step by step by using the buttons under “Generic CPU Card” group. For example, if you want to do an operation similar to the following test script for the ID TECH standard CPU card, (Different reference testing script will be needed if it is not an ID TECH standard CPU card)

(CLXSU004KC0.tst):
ID TECH Standard Micro processor Card Test Script

Power On

Response was compared with

```
\00\15;o\00\00\80%\A0\00\00\00hT\08\00\0B\00\82\90\00\90\00\99\03
  \6E
```

Select File 30 40

```
Response was compared with \00\02\90\00\F2\03
  \41\00\A4\00\00\02\30\40
```

Verify CHV

```
Response was compared with \00\02\90\00\F2\03
  \41\00\20\00\80\0Esamplepassword
```

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Read 8 bytes

Uncompared Response

\61\00\B0\00\00\08

Write 8 bytes 12345678

Response was compared with ``\00\02\90\00\F2\03

\41\00\D6\00\00\0812345678

Read 8 bytes

The output should be 12345678

Response was compared with ``\00\0A12345678\90\00\F2\03

\61\00\B0\00\00\08

Write 8 bytes ABCDEFGH

Response was compared with ``\00\02\90\00\F2\03

\41\00\D6\00\00\08ABCDEFGH

Read 8 bytes

The output should be ABCDEFGH

Response was compared with ``\00\0AABCDEFGH\90\00\F2\03

\61\00\B0\00\00\08

Power Off

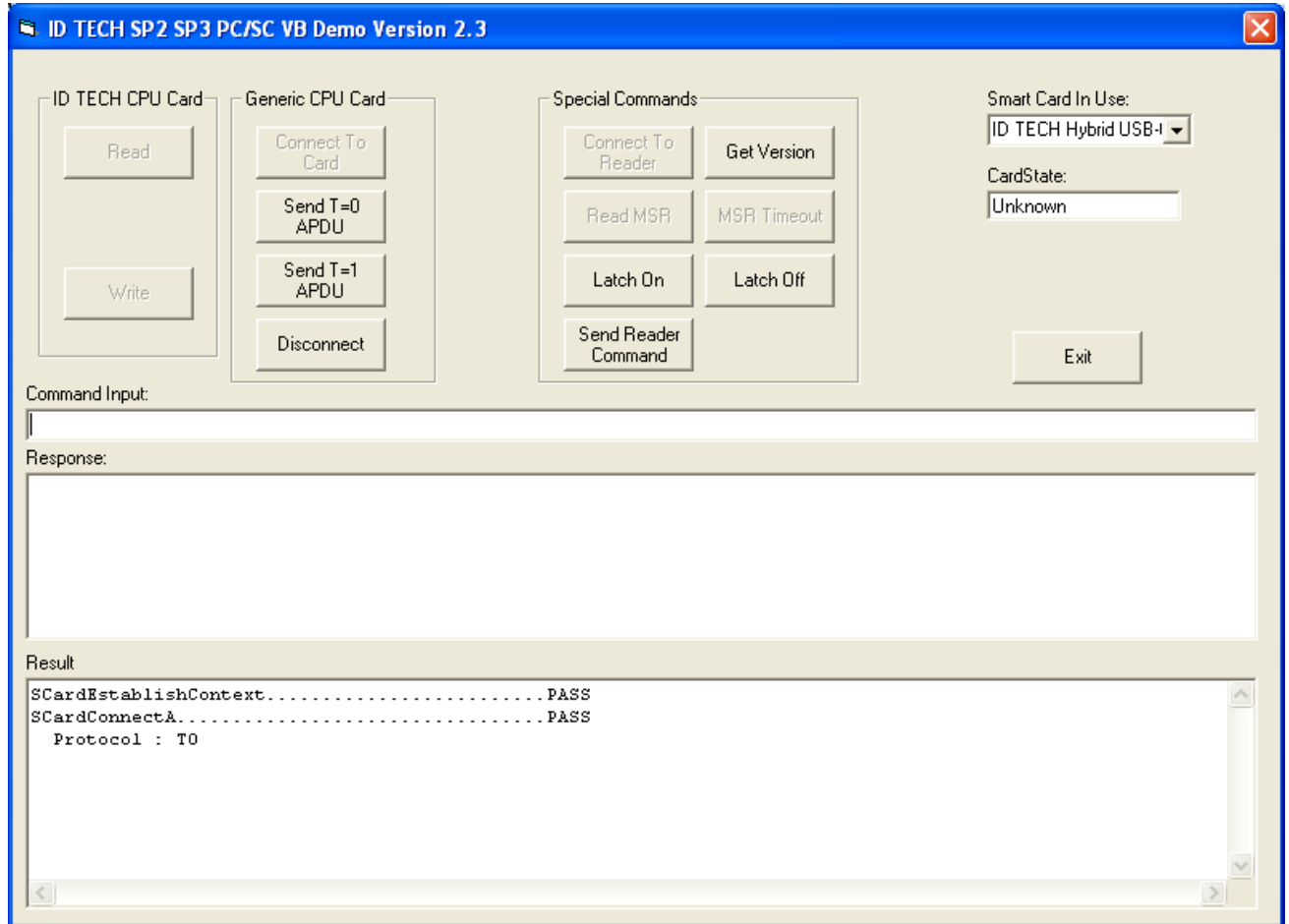
Response was compared with ``\00\02\90\00\F2\03

\4D

Following are some steps,

- Click "Connect to Card", (Will Connect to card and power up, like 6E command)

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- Copy and paste “\00\A4\00\00\02\30\40” to Command Input box then click “Send T=0 APDU” (Note: the first character 41 or 61 is not part of APDU and should not included)

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ID TECH SP2 SP3 PC/SC VB Demo Version 2.3

ID TECH CPU Card Read Write	Generic CPU Card Connect To Card Send T=0 APDU Send T=1 APDU Disconnect	Special Commands Connect To Reader Get Version Read MSR MSR Timeout Latch On Latch Off Send Reader Command	Smart Card In Use: ID TECH Hybrid USB-I CardState: Unknown Exit
--	--	--	---

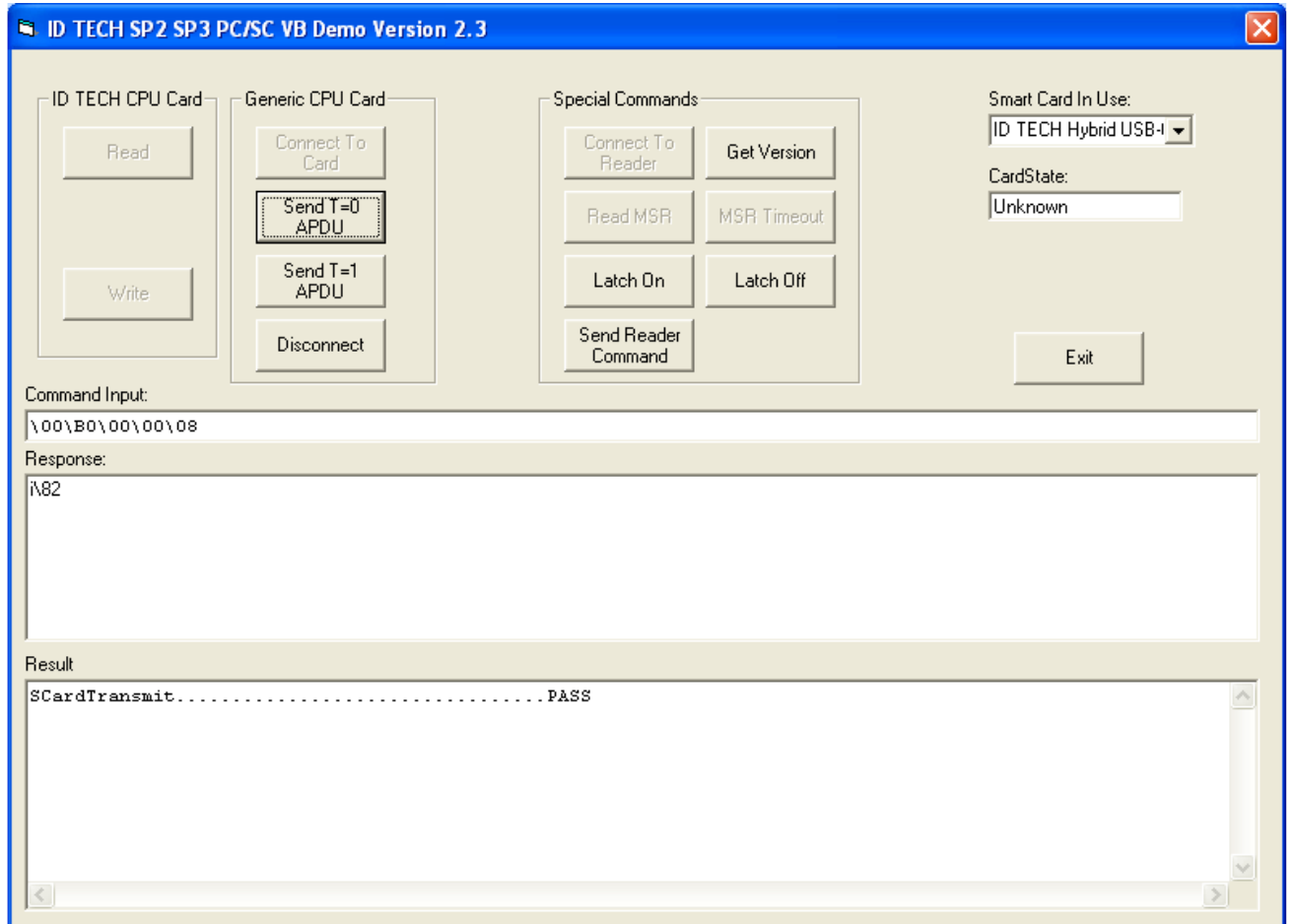
Command Input:
\00\A4\00\00\02\30\40

Response:
\90\00

Result
SCardTransmit.....PASS

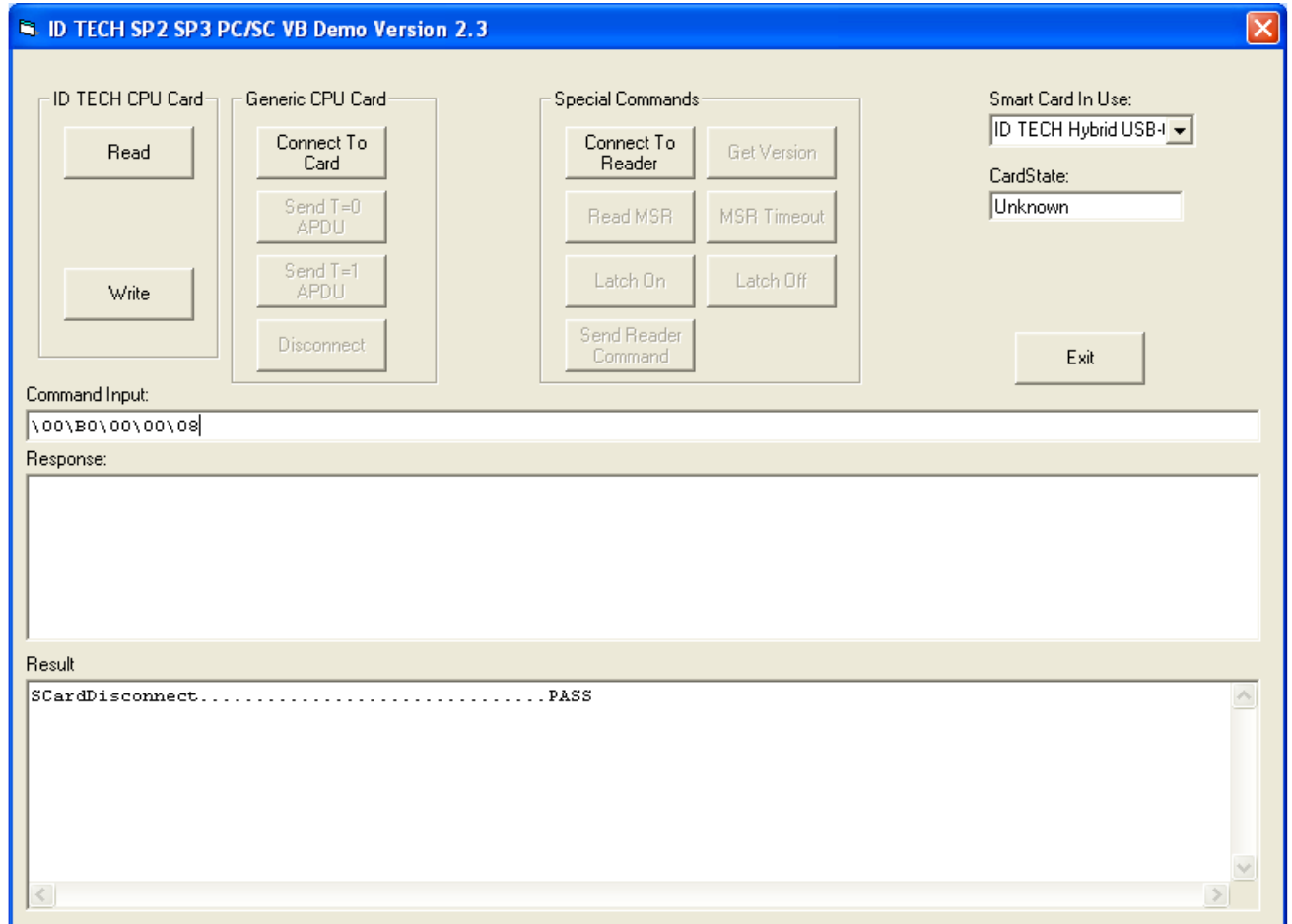
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- Copy – paste and send next APDU (Verify CHV)
\00\B0\00\00\08



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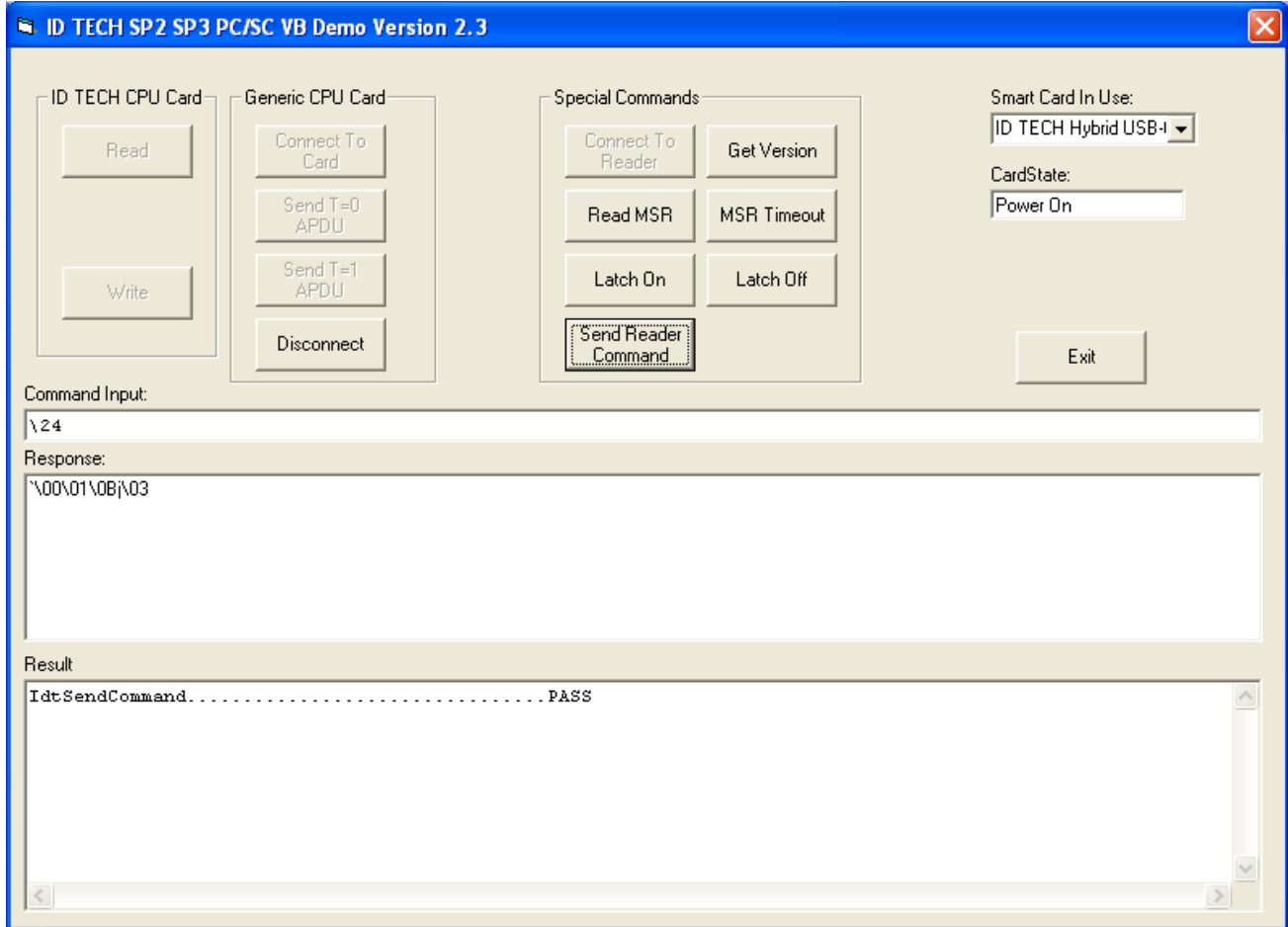
- Continue until last APDU, then click “Discontinue” button (similar to power down “4D” comm)



For a T=1 card, you may click the “Send T=1” button. Please be aware that the CCID driver will translate the T=1 APDU into T=1 RAW format. You cannot copy-paste and send T=1 RAW format data.

The “Special Commands” group allows you to send commands to reader via CCID Escape command. For example, you may click “Connect To Reader”, type “\24” and click Send Reader Command to get the reader status,

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Clicking other buttons will allow you to “Get Version”, “Read MSR”, “Reset MSR”, “Latch On” or “Latch Off”.

Note1: The CCID VB Demo does not support encrypted format data.

Note2: Send T=0 and Send T=1 use PC_to_RDR_XfrBlock command (ScardTransmit in PCSC API). “Send Reader Command” use PC_to_Rdr_Escape command (ScardControl in PCSC API).

Note3: You may also use Escape command (ScardControl) to directly access the smart card. In this approach, the command format is same as in regular RS232 test script. You need to send the 6E command to power up, 4D to power down, and keep 41, 61, 46 etc, in front of original commands. With VB Demo software, just click “Connect to Reader”, copy and paste each command from the script into the Command Input box and click “Send Reader Command.”

3.5. FAQ (Frequently Asked Questions)

1. **How do I install a TM3HIR reader?**
Follow the instructions at QUICK START on page 19
2. **When starting the SPT3CppPcscDemo, I get the error message: Function SCardListReaders returned 0x8010002E error code. No smart card reader available.**

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The operating system does not recognize an RS232 smart card reader attached to it if the PC has not been rebooted since attaching the reader, reboot the PC and see if the problem goes away. If the reader SPT3s in PC/SC mode, the PC may not be in plug and play mode, if the LED is amber this is the case. See instructions under 14.6 Configuring PC to Support Serial Plug and Play page 120 for help correcting this situation. If not verify in the control panel that there is a PC/SC reader attached. If an RS232 reader was detached and reattached see instructions 14.5 Reconnecting a Disconnected Reader page 120. If the reader is a USB reader it probably does not have PC/SC firmware loaded.

3. When starting the SPT3CppPcscDemo program I get the error message: Function SCardEstablishContext returned 0x8010001D error code.

The Smart card resource manager is not running. See instructions 14.4 configuring the Smart Card Service page 120.

4. When a command is sent to the reader the status code XXXX is returned, what does this mean?

For a condensed list of reader status codes see – Response Status Code Summary and Explanation Table page 72. There is a separate document included with this manual called SPT3_returned_Status.doc. This document gives a complete list of all the codes returned by the SPT3 with a description of what the error code means. The SPT3CppPcscDemo will automatically display these statuses with their meaning. Note the card or driver may return an error status as well for a list of PC/SC driver error statuses see – SCARD Error to Value page 95. ICC error statuses can generally be found in ISO-7816-4.

5. Does the SPT3 support my card?

The SPT3 supports all T=0 and T=1 microprocessor cards. There is one reader setting that affects microprocessor cards depending on whether the particular card supports or conflicts with the EMV specification. If your microprocessor card fails to work see page 57, the default setting restricts many cards incompatible with EMV, but that will work fine in a non-EMV situation. The SPT3 support a wide variety of memory cards, for a summary list of types of memory cards supported see Memory Card Commands page 68. There is also a separate memory card manual included with this manual that gives more information on the types of memory cards supported. In the SPT3CppPcscDemo Changing the default mode of the reader from EMV cards to ISO cards can be done by selecting the button Configure for ISO Card. To restore the reader to the original state select Configure for EMV Card.

6. The LED operation is different from the Sp2, why and how do I make it the same?

The LED operation is different because some considered the LED distracting or confusing. The LED can be made to operate like the Sp2 see Set Compatibility Mode page 59. For a description of how the LED now operates when controlled by the reader see LED Handling page 44.

4. PC/SC GENERAL DESCRIPTION

4.1. Purpose of PC/SC

The purpose of PC/SC is to simplify the integration smart cards and the operating system. It does this by creating a common application interface to smart cards. What that means is it makes the application independent of reader manufacturer. If one writes an application to access an ICC in one manufacturers reader then the same application should be able to access that card though any PC/SC smart card reader. PC/SC also makes the application somewhat independent of card manufacturer. PC/SC is not a full solution for a reader that includes features beyond smart cards. The insufficiencies of PC/SC v1.0 when using a hybrid reader include:

1. No built-in support for Magnetic stripe reading
2. No built-in support for card latching
3. No built-in support for memory cards
4. Requires a "seated" smart card for normal operation
5. Access to reader only through the Personal Computer/Smart Card interface
6. No support for SAM cards.

The supplied IDTLIB.DLL deals with all of these problems and makes interfacing to these functions seamless to the application.

This reader only supports PC/SC version 1.0. The specification for PC/SC version 2.0 is available and we are developing a driver but there is no driver available for customer use at this time.

4.2. EMV versus PC/SC

The EMV certification does not require PC/SC and PC/SC certification does not require EMV to some extent the certifications are incompatible. The purpose of EMV is to support reliable truly interoperable financial transactions, while PC/SC purpose is to support easy connection between a PC and smart cards. PC/SC certification requires support for a range of cards that are incompatible with EMV. To handle this, the reader has a configuration setting EMV/ISO. A reader configured for EMV (the default), supports only a subset of the cards supported by the SPT3 reader. A reader configured for ISO cards may not properly handle certain EMV transactions.

The banking industry generated the EMV specification to provide true interoperability between a wide variety of smart cards and readers. EMV certification is frequently required for certified banking applications. EMV is a detailed specification based on ISO 7816, but EMV is more restrictive and requires extensive certification testing. Europay, MasterCard, and Visa created this specification and it defines guidelines for debit and credit transactions. If the financial system, in which the ID TECH reader is incorporated, requires EMV certification, our reader is EMV level I certified. The system with the reader incorporated in will have to undergo EMV level II certification. The certification is to EMV 4.2.

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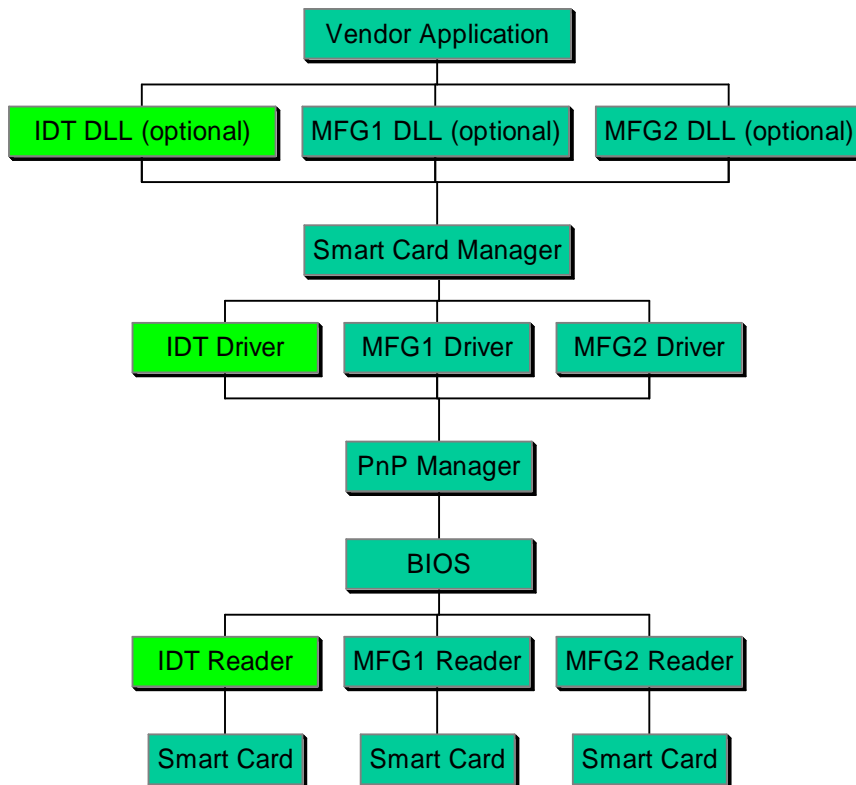
ISO 7816-3 is a limited specification to which all microprocessor cards are designed. ISO 7816-3 does not require certification. The purpose of this specification is to provide microprocessor card access.

4.3. *IdtLib.dll*

Purpose of the IdtLib.dll is to simplify access to reader/vendor specific functions like magnetic stripe reading and latch control in a PC/SC environment. This library is not required: all functions can be done by the application without this DLL. The purpose of the supplied DLL is to simplify use of the reader's features by an application program.³ It is compatible with the program of the same name provided with the Sp1 and Sp2.

4.4. *How the Various Parts of the PC/SC Fit Together.*

Figure 2 – Simplified PC/SC Component Organization



³ A newer DLL is required than one provided with the Sp1 or Sp2.

5. USB CCID GENERAL DESCRIPTION

5.1. General

The ID TECH TM3 CCID Hybrid reader is a USB PC/SC smart card and magnetic card hybrid reader. It works with Microsoft CCID driver and Windows PC/SC API.

5.2. USB Class and Drivers

- USB Version: USB V2.0
- USB Device: Not Specific
- USB Interface Class: USB Chip/Smart Card Interface Devices
- USB Vender ID: 0ACD
- USB Product ID: 1910
- Product String: ID TECH TM3-CCID Reader
- Maximum Power Claim: 100 mA
- Power Source: USB bus powered
- Remote Wakeup: No

- End Points Usage:

EP0: Control, 8 Bytes, USB Default Control Pipe

EP1: Bulk In, 32 Bytes, CCID Response Pipe

Ep1: Bulk Out, 32 Bytes, CCID Command Pipe

EP2: Interrupt In 32 Byte, CCID Event Notification Pipe

- USB Driver:
Windows build in CCID class driver will be used.
File: usbccid.sys
DriverVer: 8/1/2006,5.2.3790.2724
- No customer driver or INF file is needed for this Microsoft driver

5.3. USB descriptors

Following are the list of USB descriptors. The detailed information should be adjusted and tested during implementation. (Multiple byte data in byte transmit order)

Device Descriptor:

Field	Value	Description (ACR38)
Length	09	
Des type	01	
bcd USB	00 02	USB 2.0
Device Class	00	Not specific
Sub Class	00	Unused

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Device Protocol	00	Unused
Max Packet Size	08	
VID	CD 0A	
PID	10 19	
BCD Device Release	00 01	
i-Manufacture	01	
i-Product	02	
i-Serial-Number	00	
# Configuration	01	

Configuration Descriptor:

Field	Value	Description
Length	09	
Des type	02	
Total Length	43 00	
No. Interface	01	
Configuration Value	01	
iConfiguration	00	
Attributes	80	Bus power; (A0) if with remote wakeup
Power	32	100 mA

Interface Descriptor: (CCID)

Field	Value	Description
Length	09	
Des type	04	
Interface No.	00	
Alternator Setting	00	
# EP	03	
Interface Class	0B	Integrated Circuits Cards Interface Device
Sub Class	00	
Interface Protocol	00	
iInterface	00	

Smart Card Device Class Descriptor: (Call Management)

Field	Value	Description
Length	36	
bDescriptorType	21	Functional Descriptor type
bcdCCID	1001	CCID version in BCD (Binary Code Decimal)
bMaxSlotIndex	04	
bVoltageSupport	07	
dwProtocols	03 00 00 00	

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dwDefaultClock	0A 0F 00 00	
dwMaximumClock	0A 0F 00 00	
bNumClockSupported	00	
dwDataRate	00 2A 00 00	
dwMaxDataRate	20 A1 07 00	
bNumDataRatesSupported	00	
dwMaxIFSD	F0 00 00 00	
dwSynchProtocols	00 00 00 00	
dwMechanical	00 00 00 00	
dwFeatures	30 02 01 00	
dwMaxCCIDMessageLength	0F 01 00 00	
bClassGetResponse	00	
bClassEnvelope	00	
wLcdLayout	00 00	
bPINSupport	00	
bMaxCCIDBusySlots	01	

End Pointer Descriptor: (EP2)

Field	Value	Description
Length	07	
Des Type	05	End Point
EP Addr	82	EP2, Event Notification In
Attributes	03	Interrupt
wMaxPacketSize	20 00	32 Bytes
bInterval	18	

End Pointer Descriptor: (EP1)

Field	Value	Description
Length	07	
Des Type	05	End Point
EP Addr	01	EP1 Out, Command Down
Attributes	02	Bulk
Size	20 00	32 bytes
Interval	00	

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End Pointer Descriptor: (EP1)

Field	Value	Description
Length	07	
Des Type	05	End Point
EP Addr	81	EP1 In, Response Up
Attributes	02	Bulk
Size	20 00	32 Bytes
Interval	00	

5.4. CCID Messages

The TM3 CCID reader is based on USB CCID Specification Revision 1.1. (DWG_Smart-Card_CCID_Rev110.pdf). The specification described some class specific requests listed in following sections.

5.4.1. CCID Class-Specific Request

ABORT
GET_CLOCK_FREQUENCIES
GET_DATA_RATES

5.4.2. CCID Bulk Out Message and Response

PC_to_RDR_IccPowerOn
PC_to_RDR_IccPowerOff
PC_to_RDR_GetSlotStatus
PC_to_RDR_XfrBlock
PC_to_RDR_GetParameters
PC_to_RDR_ResetParameters
PC_to_RDR_SetParameters
PC_to_RDR_Escape
PC_to_RDR_IccClock
PC_to_RDR_T0APDU

PC_to_RDR_Mechanical
PC_to_RDR_Abort
PC_to_RDR_SetDataRateAndClockFrequency

5.4.3. CCID Bulk_IN Messages

CCID bulk in messages are used for Bulk Out Message response (See CCID Spec 4.2)

5.4.4. CCID Interrupt-In Messages

Two interrupt-in message is described by CCID Spec Section 4.3

RDR_to_PC_NotifySlotChange
RDR_to_PC_HardwareError

5. Reader Command Handling

Reader specific commands will be handled with CCID Escape command. The current Microsoft CCID driver does not support the Escape command by default. After doing a special registry setting, Escape commands can be used. Please see Appendix "How to Enable Escape Commands for USB CCID driver.doc" for instructions.

The Escape command (ScardControl() in PCSC API) will use the same command as RS232 version, with a 10 bytes CCID header, but without the ID TECH envelop.

RS232:

60 LenH LenL [Command] LRC 03

CCID:

[CCID header] [Command]

Ex: Get Reader Status Command:

RS232:

Host: 60 00 01 **24** 45 03

Rdr: 60 00 01 **0A** 6B 03

CCID:

Host: 6B 01 00 00 00 00 1D 00 00 00 **24**

Rdr: 83 01 00 00 00 00 1D 00 00 00 **0A**

Note: CCID header will be created and checked by CCID driver. Application does not need to handle it.

6. MSR function

Only buffered mode will be used for the MSR function.

7. Encryption

Like the RS232 version, the TM3 CCID reader does not support the encryption function for smart card data. Only MSR data can be encrypted. Smart card encryption is normally done by and on the smart card so that the unencrypted smart card data cannot be monitored.

8. Keyload for CCID

Keyload commands will go through the escape commands (ScardControl). The command format is exactly same as RS232 version, it does include the Keyload command envelop 02, 03 and lrc.

9. Supporting DLL (*)

A supporting dynamic link library ldtCcidDll.dll will have an interface similar to idtdll.dll. This will ease the transition for users who are using SP3 USB PC/SC reader.

10. TM3 CCID MSR support

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Due to the nature of Microsoft CCID driver and PC/SC API, the TM3 CCID reader can only use improved buffer mode to get MSR data. The major change to regular buffered mode is that the data can only be read once, and it will be cleared when sent. This was done to eliminate the possibility of sending data from a previous card read. Following is the suggested approach:

10.1 The host needs to send an Arm To Read command (50 01 30) to tell the reader to collect data from the next MSR card swipe. (In Security level 4, do an Authentication command, then Arm to Read), then prompt the user to withdraw the card properly.

10.2 The host needs to poll for MSR data availability by sending the “Read MSR Data” (51 01 30) command to get/try to get the data from the reader. The suggested polling rate is around 100-300ms.

10.3 The reader will respond

a. C0 00 Reader is still in armed mode. (data has not been collected yet); Host should continue polling;

b. xx xx Reading error; Two bytes error code. Reader will go to disarmed status. The host might prompt the user and rearm the reader

c. C0 XX + MSR data Reading success; MSR data will be sent in the packet as a response to the last poll command; then the reader will clear the MSR data buffer and return to disarmed mode; The host should process the data; Re-arm if needed;

10.4 After polling for a period of time (5 – 255 seconds) without data, the host should abort the MSR read by discontinuing polling and sending an “MSR Reset command” (50 01 32);

6. HYBRID READER—GENERAL AND ICC

6.1. Operation

The ID Tech Hybrid Reader is easy to operate. Make sure the reader is properly connected and receiving sufficient power. If non-PC/SC reader, the green LED indicates it is ready to read (if the LED is in reader control mode).

6.1.1. Smart Card Features

Supports 5, 3 and 1.8 Volt T=0 and T=1 microprocessor cards and many memory cards. The reader has automatic hardware protection for card removal, ESD, supply voltage drop, and short circuit. This unit reads from and writes information to IC cards compliant to ISO 7816 standards. The reader communicates depending on model using a RS232 or USB interface for both ICC and magnetic cards. Landing style contacts provide for long card life.

6.1.2. Magnetic Card Read Modes

The SPT3 supports two MSR modes.

“Auto Transmit mode” – Reader sends data as soon as the data is available. When using “Auto Transmit Mode”, the application program needs to be ready to receive data. Auto Transmit mode is not compatible with ID TECH’s PC/SC drivers.

“Buffered Mode” – The application program first sends an “Arm to Read” command to enable the magnetic stripe reading. Second, the user inserts and withdraws a

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Magstripe card, the decoded data is stored, third the readers notifies the host a Magstripe read occurred, and MSR is disarmed. The application program then sends a "Read MSR Data" command to retrieve the data from the buffer. When operating in PC/SC mode, the reader only supports buffered mode. Do not try to change this.

For "Auto Buffered Mode", the reader arms itself to capture MagStripe data, and if enabled, it will send a status informing of the presence of captured track data. The host requests the data with a "read MSR data" command. The reader sends the data, clears its buffer and immediately arms to capture the next card read.

To read a magnetic stripe card, just follow these simple steps, LED indication describes LED status change when it is under the control by reader:

6.1.3. Latch Operation

The Latch is an option feature and is not available on every reader. The latch is locked (latched) and unlocked by command. The latch can be locked only when a card is fully seated. A card can be forcibly removed without damage to the latch. If there is a power line voltage failure, the card is automatically unlatched using power reserves from the capacitors in the power supply output circuits. If the power supply is not capable of reserve power, an external capacitor must be connected to the reader PCA. This capacitor is part number 80059215-001. There is a connector on the PCA for this capacitor when ordered with the option.

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Insert the card, magnetic stripe down, into the reader until it hits a hard stop, (note if reader is configured for read on insert (the default is on withdrawal) it is important to insert the card in one continuous motion to insure proper reading of the data). If the reader is a non-PC/SC reader as soon as it detects data from magnetic stripe, the green LED indicator will go off.

When the card has been inserted all the way (hits the hard stop), the green LED will light again if operating in Sp2 LED compatibility mode.

Withdraw the card in one continuous motion. The green LED will go off again. (The reader is capable of reading a magnetic stripe on both insertion and withdrawal, but a more reliable read is normally experienced on withdrawal.)

If the reader controls the LED, the LED will turn red (to indicate a bad read) or green (to indicate a good read) meaning it is ready for another transaction.

Configuring the reader to support auto transmit mode, buffered mode, or auto buffered mode is done with MSR Transit Mode Setting [53 1A] page 77.

6.1.4. Smart Card Access

To read a smart card, just following these simple steps:

- Insert the smart card into reader as far as it will go. For orientation see figure on page 24.
- Use smart card commands to communicate with reader after the card has been inserted all the way.
- See Example T=0 Read and Write [41] Commands to Card page 64.

6.1.5. LED Handling

LED handling can be under the control of the reader or under the control of the host computer. The default operation is to have the LED under the control of the reader.

- On powering the reader the LED will flash red then green to indicate a successful start-up.
- For an RS232 reader in PC/SC mode, the LED will turn to amber after power up until the host plug and play "COM enumerator" detects the reader.
- The LED will flash amber on start-up if the configuration EEPROM has a problem.

LED handling in reader controlled mode

LED operation depends on whether the reader is in Auto-transmit or Buffer Mode. Auto-transmit is the default state unless the reader is in PC/SC mode then its default state is Buffered mode.

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LED handling in buffered mode

- The LED will turn green if the reader is armed to read a magstripe card.
- The LED will turn off if it is not armed to read a magstripe card or has just read a card.
- The LED will turn red to indicate that the recent magstripe card read was bad.
- The LED will slowly flash green if not armed to read

LED handling in auto-transmit mode

- The LED will turn green before smart card is powered on or after smart card has been powered off unless the reader is reading or just read a Magstripe card.
- The LED will turn off after powering 'on' the smart card.
- The Green LED indicates the smart processing is complete and the ICC powered off. The user can remove the smart card.

LED handling in host controlled mode

If the LED is under the command of the host the following settings are available.

- Turn the LED off
- Turn the LED on Green
- Turn the LED on Red
- Turn the LED on Amber
- Set the LED to Green Flashing
- Set the LED to Red Flashing
- Set the LED to Amber Flashing
- Set the LED to Flashing Red and Amber
- Set the LED to slow flashing Green, Amber or Red

Flashing rate is approximately .25 seconds on and .25 seconds off. Regardless of whether the LED is under the command of the host, the LED will still signal certain errors and start-up conditions. If configured for RS232 and Plug-and-Play, the LED will be amber until the reader has sent its plug-and-play string to the host. If there is a problem on first start-up with configuring the EEPROM the LED will hang flashing amber. Slow flashing the flash time is doubled and the duration of the LED being on is halved. Slow flashing rate is about .25 second on and off for 3 seconds.

6.1.6. Lighted bezel option (4 LEDs)

In readers with the lighted bezel option, the 4 LEDs function identically to the single LED operation as described above and are operated through the Green LED commands. For example, the command to light the LED green, all 4 LED will respond with green light simultaneously.

Configuring the reader to support host controlled LED commands is done with 6.4.6 Set Operation Mode [53 11] command, page 57. The host controls the LED with Host LED Control Command, page 50.

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To configure the reader to handle the LED like the SPT2, see 6.4.7 Set Compatibility Mode page 59.

6.1.7. Card Status Notification [B0 xx] or [2F 00]

There are six notifications the reader can issue. One is an error notification, the other five are optional card seated, card unseated notification, optional card present, card removed notification, and optional buffered magnetic stripe data available.

The reader issues an “error notification” (E0 00 02 2F 00 CD 03), if an IC card was removed while powered.

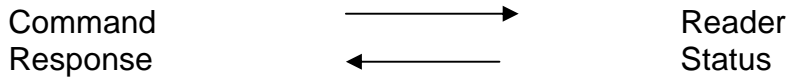
The reader can issue a “card notification” (60 00 02 B0 XX YY 03), if “card seated, card unseated, card present, card removed or buffered magnetic stripe data available notification” has been set to on and there has been a change to a card is fully inserted or present, or there is buffered magnetic stripe data available. The value of XX is the value of the status byte see 6.3.2 Get Reader Status [24] page 49. Each bit in this byte holds the current status of one piece of information: bit 0—card powered; bit 1—card seated; bit 2—card latched; bit 3—card present; and bit 4—magnetic stripe data available.

Configuring the reader to send or not send notifications is done with 6.4.6 Set Operation Mode [53 11] command, page 57. If the reader is operated in PC/SC mode do not change the card seated and buffered Magstripe data available notification settings, because the driver requires these notifications to function properly.

6.2. Communication Structure

This section defines the command format for communicating with the reader.

Turbo TLP-224 Protocol for Sending Commands and Receiving Responses



6.2.1. Host Command

All commands originate at the host and expect a response from the reader.

60 <Length> <Command ID> [<Command Data>...] LRC 03

Where:

<Length> = is a two-byte counter from <Command ID> to the end of <Command Data>.

<Command ID> = is a one byte value identifying a specific command ID, see command Table 1 – Reader Command ID Summary page 49 and Table 4 – Reader Command IDs Affecting Smart Card Summary page 60.

<Command Data> = is the data block associated with the command. See details under each individual command description.

6.2.2. Reader Response

All responses come from the reader in response to a command from the host.

60 <Length> [<Response Data>] <Status> LRC 03

Where:

<Length> = is a two-byte counter from <Response Data> to the end of <Status>.

<Response Data> = is the data block associated with the Response. See details under each individual command description.

<Status> is a two byte value indicating the success or failure of a command. See Table 5 – Response Status Code Summary and Explanation page 72.

The overall LRC (Modulus 2 = Exclusive OR) checksum (from 60 to LRC) should be zero. See 6.2.3 Example of LRC Calculation on page 48.

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6.2.3. Example of LRC Calculation

Note: SPT3c and SPT3u firmware do not set or check the communication LRC value, but a place holder character is required. The USB protocol assures the integrity of the message.

LRC = Longitudinal Redundancy Check. Calculated by taking 'Exclusive OR' (Modulus 2) of all characters preceding it, total with LRC is equal to zero.

Example: Calculation of the LRC character

The following memory card command means read 16 bytes of data from address 0000:

60 00 06 42 DA B0 00 00 10 5E 03

'5E' is the LRC character and it is derived as follows:

Characters	#1 (binary)	#2 (binary)	
60	0110	0000	
00	0000	0000	
06	0000	0110	
42	0100	0010	
DA	1101	1010	
B0	1011	0000	
00	0000	0000	
00	0000	0000	
10	0001	0000	
5E	0101	1110	Result of Exclusive 'OR'

6.2.4. Communication Timing

Maximum delay for the reader to respond to a read configuration command is 5ms. typical delay is 2ms.

Maximum delay for the reader to respond to a write configuration command is 20ms. Typical delay is 5ms.

During the command processing time, the reader will not respond to a new command. The reader will accept a new command as soon as it has responded to the previous command.

Smart card reads and writes timing can vary substantially between cards. By the specifications a smart card may take as long as a minute to complete a command, so the host application should be prepared to wait 60 seconds before retrying a slow smart card access command if worst case timings need to be considered.

Note: Maximum delay between two characters in a command is 100ms.

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6.3. General Reader Commands Description

Table 1 – Reader Command ID Summary

ASCII	Page	HEX	Name	Use
'\$'	49	24	Reader Status Report	Request reader status byte
'8'	51	38	Copyright Report	Requests reader's copyright notice
'9'	47	39	Version Report	Requests version string
'I'	51	49	Reader Reset	Reset the reader (Not available is USB readers).
'L'	63	4C	Latching Functions	Latching and Unlatching Card
'P'	75	50	Arm/Disarm	Arm to Capture Buffer Mode MSR
'Q'	76	51	Read Buffered Data	Read Stored MSR Data
'R'		52	Read Options	Read various reader optional settings
'S'		53	Set Options	Set various reader optional functions
'I'	50	6C	Led Functions	Turning on/off/flash the bicolor-LED
'z'	51	7A	Enter downloader	Upgrading Firmware
'4'		34	Data report	

6.3.1. Get Firmware Version Description [39]

60 00 01 39 58 03

Note: An approximately '55-byte' version description will be returned. The description and length varies somewhat by hardware.

Response is as follows:

60 <Length> <Version Description> LRC 03

Response Example (mixed hex and ASCII):

60 00 31 "ID TECH TM3 Secure Hybrid USB Serial Reader V2.18" 0B 03

6.3.2. Get Reader Status [24]

60 00 01 24 45 03

The Status byte returned is defined as follows.

Bit Position	'0'	'1'
0	ICC Power not ready	ICC Powered
1	Card not seated	Card seated
2	Latch released	Latch closed*
3	Card not present	Card present*
4	No magnetic data	Magnetic data present
5-7	Unused all 0	

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*Note: flag is always 0 unless reader has the specific option.
Magnetic data present flag is always 0 if a reader is set in "Auto Mode".

Response is as follows:

60 00 01 <Reader Status> LRC 03

Response Examples:

60 00 01 00 61 03 no card present

60 00 01 08 69 03 card present

60 00 01 0A 6B 03 card present and seated

60 00 01 0B 6A 03 card present, seated, and powered

60 00 01 0E 6F 03 card present, seated and latched

6.3.3. Latch Close Command [4C 01]

60 00 02 4C 01 2F 03

Use this command to close the latch and entrap the card.

Note: Reader must have the "latch" option on the reader to use this command.

Note: A card must be seated in the reader to close the latch.

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

2A00 latch failed to close

2C07 no card seated to latch

6900 latch function subtype must be 0 or 1

6901 reader is not configured with latch hardware

6.3.4. Latch Open Command [4C 00]

60 00 02 4C 00 2E 03

Use this command to release the latch and allow the card to be removed.

Note: Reader must have the "latch" option to support this command.

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

2A08 latch failed to open

6900 latch function subtype must be 0 or 1

6902 reader is not configured with a latch

Note: The latch will open automatically when the reader is first powered.

Note: The latch will open automatically when the reader loses power, some systems do not have enough latent power to allow the read to complete this operation and the reader must then be equipped with an optional power fail unlatch capacitor.

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Host LED Control Command [6C]

60 00 02 6C <LED Command> LRC 03

This command is used to change the color setting on the LED.

Note: Reader must have the “LED” option under host control for this command function properly.

Where <LED Command> are:

ASCII	Hex	Action
'0'	30	LED will be turned off.
'1'	31	LED will be turned on green.
'2'	32	LED will be turned on red.
'3'	33	LED will be turned on amber.
'4'	34	LED will be flashing red/amber.
'5'	35	LED will be flashing green.
'6'	36	LED will be flashing red.
'7'	37	LED will be flashing amber.
'A'	41	LED will be slow flashing green.
'B'	42	LED will be slow flashing red.
'C'	43	LED will be slow flashing amber.

Example: To flash the LED green:

60 00 02 6C 35 3B 03

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

6913 2nd byte of LED command must be 30-37

691F host LED control not enabled. To configuring the reader to support host controlled LED commands see 6.4.6 Set Operation Mode [53 11] command, page 57.

6.3.5. Reader Reset Command [49]

60 00 01 49 28 03

The reader supports a reset reader command. This allows the host to return the reader to its default state, i.e. card not powered, not armed to read, latch open, no magnetic or ICC data stored, etc. The reader remains on-line. This won't reset any of the readers' configuration settings. This function is limited on USB readers because it can cause the driver on the PC to hang to only opening the latch.

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

6.3.6. Get Copyright Information [38]

60 00 01 38 59 03

Response is as follows:

60 00 3F <Copyright String> LRC 03

Response Example mixed hex and ASCII:

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60 00 3F Copyright (c) 2005, International Technologies & Systems Corp. LRC 03

6.4. Reader Configuration Commands Description

6.4.1. Restore Configuration Settings to Default [53 18]

60 00 02 53 18 29 03

This command restores most settings to their default value. See Table 2 – Default MSR Configuration Settings page 52, for default values. Note: Executing this command does not affect the operations mode (page 57), or the serial number.

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

Default Configuration Settings

Table 2 – Default MSR Configuration Settings	
SETTING	DEFAULT
MSR Reading	Enabled Auto Mode*
Magnetic Decoding Method	Report on Withdraw
Send Option	Send Start/end Sentinel
Terminator Settings	CR (Hex OD)
Prefix Setting	None
Suffix Setting	None
Track Selected Settings	Any Track
Track Separator Settings	CR (Hex OD)
Baud Rate Setting	38400 bps
X-On Character Setting	DC1 (Hex 11) unused
X-Off Character Setting	DC3 (Hex 13) unused
Track 1 ID	None
Track 2 ID	None
Track 3 ID	None
Operations Mode	MSR Enveloped, MSR data present notification off*, Standard Decoder
IC Card Type	5V Microprocessor Card
Memory IC Card Type	Type 0 3-byte I ² C Card

*PC/SC driver changes this to Buffered Mode & magstripe data notification on.

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6.4.2. Read All Configuration Settings [52 1F]

60 00 02 52 1F 2F 03

This command does not have any <FuncData>. It retrieves all current settings. The Spectrum 3 reader sends back an <ACK> and <Response>.

<Response> format:

The current configuration data block is a collection of many Function-Setting blocks <FuncSETBLOCK> as follows:

60 <Length> <FuncSETBLOCK1>...<FuncSETBLOCKn> LRC 03

Each Function-Setting block <FuncSETBLOCK> has the following format:
<FuncID> <Len> <FuncData>

Where:

<Length> is a two bytes counter, which indicates bytes of all <FuncSETBLOCK>. The most significant byte comes first.

<FuncID> is a one byte Function ID identifies the setting(s) for the function. For a complete list of FuncID see Table 3 – Configuration Function ID Summary and Explanation page 54.

<Len> is a one-byte length count for the following function-setting block <FuncData>.

<FuncData> is the current setting for this function. It has the same format as in the Sending Command for this function. See SENDING COMMAND LIST for details.

<FuncSETBLOCK> are in the order of their function ID <FuncID>.

Example:

```
60 00 51 10 01 00 11 01 0E 12 01 00 13 01 30 17 01 0D 19
01 31 1A 01 31 1D 01 33 1B 01 B8 21 01 31 41 01 37 47 01
11 48 01 13 31 01 00 32 01 00 33 01 00 61 02 C0 00 62 02
80 00 63 02 00 00 64 02 00 00 65 02 00 00 D2 01 00 D3 01
00 1C 02 BF 01 1E 01 00 5D 03
```

Example Interpreted:

60 00 51	ACK, length data: 0051 hex or 81 decimal.
10 01 00	10=card option—page 52, length 1, value 00
11 01 0E	11=operation mode—page 57, length 1, value 0E
12 01 00	12=memory card type—page 68, length 1, value 00

61 02 00 00 6n = Set SAM card option, See page 71, length 2, value 00 00

5D 03 LRC, ETX.

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6.4.3. Read Specific Configuration Setting [52 nn]

60 00 02 52 <Configuration> LRC 03

The <Configuration> byte corresponds to the byte from a specific configuration value.

All MSR reader Read Configuration Commands are listed in the following format:

60 00 02 52 <FuncID> LRC 03

For example to read the “Card Option” configuration send

60 00 02 52 10 20 03

Table 3 – Configuration Function ID Summary and Explanation

Function Description	Function ID	Function Value	Page
IC Card Option	10	Any Value	52
Set Operation Mode	11	Any Value	57
Memory IC Card Type	12	00 – 07H	68
Track Selected Settings	13	'0' – '9'	80
Track Separator Settings	17	Any ASCII Code	80
Send Option	19	'0' – 0x3F	78
MSR Reading	1A	'0' – '3'	77
Custom Equip Selling	1C	Any Value	
Magnetic Decoding Method	1D	'1' – '4'	77
Terminator Settings	21	None, any '0' - CRLF	78
Track 1 ID	31	Any ASCII Code	78
Track 2 ID	32	Any ASCII Code	79
Track 3 ID	33	Any ASCII Code	79
Baud Rate Setting	41	'5' – '9'	54
Connector 0 setting	60	Any Value	71
SAM 1 setting	61	Any Value	71
SAM 2 setting	62	Any Value	71
SAM 3 setting	63	Any Value	71
SAM 4 setting	64	Any Value	71
Prefix Setting	D2	String	78
Suffix Setting	D3	String	79
Compatibility mode	1E	00 – 07H	59
Reader serial number	4E	8 to 10 Digits	52
Memory card page size	15	8, 16, 32, 64 or 128	69

6.4.4. Set BAUD Rate [53 41] (RS232 only)

The RS232 interface has several programmable features so the SPT3s can

SPECTRUM III HYBRID MAGSTRIPE/SMART CARD READER

be optimized for the user's application. These settings can be made through a basic set up defined in the following sections.

Note: A SPT3s operated in PC/SC mode must leave BAUD rate at the default because the driver only supports the default BAUD rate.

Note: Default settings are in bold and underlined

Baud-Rate	9.6K, 19.2K, 38.4K , 57.6K and 115.2K
Data-Bits	8
Parity	None
Stop Bits	1
Hand-Shaking	None (can be configured to hardware handshaking)

The hybrid reader will set itself to operate at the last configured BAUD rate; the default is 38.4K bits/sec after power up. After connecting the application can choose from 9.6K, 19.2K, 38.4K, 57.6K and 115.2K bits/sec. Reader will turn to the set BAUD rate after sending the response to this set command. Application should turn to the new BAUD rate after receiving the response to ensure the communication between application and hybrid reader.

Set host to reader BAUD Rate Command
60 00 04 53 41 01 <BAUD Rate Setting> LRC 03

The <BAUD Rate Setting> byte is defined below:

ASCII	Hex	BAUD Rate
'5'	35	9600 bits/sec
'6'	36	19.2K bits/sec
'7'	37	38.4K bits/sec
'8'	38	56.7K bits/sec
'9'	39	115.2K bits/sec

All other values are reserved.

Example to set baud rate to 115.2K BAUD
60 00 04 53 41 01 39 4E 03

Command completed successfully response 9000 is as follows:
60 00 02 90 00 F2 03

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6.4.5. Set Smart Card Options [53 10]

60 00 04 53 10 01 <Card Option> LRC 03

The <Card Option> byte is defined as follows.

Bit Position	'0'	'1'
0	Reserved	
1	<u>Reader handles PPS command</u>	Host handles PPS command
2	<u>Act on T=0 61 and 6C cmds</u>	Send T=0 61 & 6C to host
3	<u>1.8V Off</u>	1.8V On
4	<u>EMV Card</u>	ISO Card
5	<u>3V Off</u>	3V On
6	<u>5V On</u>	5V Off
7	<u>Microprocessor Card</u>	Memory Card

EMV card is subject to all the checks described on EMV 4.0 specification, and the card communication follows the specification.

For a microprocessor card if more than one voltage is 'on', the reader will try lowest voltage first then next higher and finally the highest when attempting to retrieve the ATR. Subsequent communication between the SPT3 and the ICC will continue to use the voltage at which the ATR was retrieved.

Memory card handling is different if both 3V and 5V options are 'on' the reader will only attempt to communicate at the lowest voltage i.e. 3V.

Note: The EMV vs. ISO setting may have to be properly set depending on the type of card accessed. If it is an EMV card involved in EMV transactions then it must be set to EMV. However, EMV is more restrictive than ISO and if the reader is configured to EMV mode then many cards will not function because the EMV forces the reader to be more restrictive than the ISO 7816 specification allows.

Example to set configuration access an ICC card at 5V, ISO, microprocessor card
60 00 04 53 10 01 10 36 03

Command completed successfully response 9000 is as follows:
60 00 02 90 00 F2 03

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6.4.6. Set Operation Mode [53 11]

60 00 04 53 11 01 <Operation Mode> LRC 03

The <Operation Mode> byte is defined as follows.

Bit Position	'0'	'1'
0	PC/SC mode Off	PC/SC Mode On
1	Card Seated Change Off	Card Seated Change On
2	Card Present Change Off	Card Present Change On
3	MSR Data Envelop Off	MSR Data Envelop On
4	LED Controlled by reader	LED Controlled by Host
5	Magnetic data present off	Magnetic data present on (default if PC/SC)
6	Standard decoder	Raw magnetic data decoder
7	No Mag status sent when MSR data not enveloped	Force to send C0XX status When no enveloped

For the SPT3s, PC/SC Mode On set the reader to “Plug and Play.” All USB readers ignore this setting, as they are always plug-and-play, but in a USB reader plug-and-play does not force to PC/SC mode. For details see Plug and Play Support (RS232 only) page 58.

For any reader operating in PC/SC mode do not change bits 1, 3 and 5 as the driver depends on these bits being on to function properly, the PC/SC driver checks and sets these bit as required when the reader first connects to the driver.

If “Raw data decoder” has been set, the reader treats all magstripe data as a bit string and sends it out in hex format. The reader suppresses leading and trailing zeros. All track data is sent with no regard to track designation or separation. No error checking is performed.

Note: The reader only reports magnetic data present notification when set to buffered mode.

A “Status change notification” (60 00 02 B0 <Card Status> LRC 03) is issued by the reader, if “Card Seated Change” or “Card Present Change” has been set on and card switch changed.

If the LED control bit is changed to host control, the LED is turned off.

After a good read, Magstripe data will be sent out enveloped (60 <Len_H> <Len_L> <Card data indication 1> <Card indication 2> <Magstripe data> LRC 03), if “MSR Data Envelop” is on, Otherwise magstripe will be sent out without an envelope <Card data indication 1> <Card indication 2> <Magstripe Data>). In PC/SC mode the Magstripe data is always enveloped.

<Card data indication 1> (<C0>) identifies a response as magnetic data.

<Card data indication 2> is flags about current read.

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Bit Position	'0'	'1'
0	Track 1 decode fail	Track 1 decode success
1	Track 2 decode fail	Track 2 decode success
2	Track 3 decode fail	Track 3 decode success
3	No Track 1 data	Track 1 data exists
4	No Track 2 data	Track 2 data exists
5	No Track 3 data	Track 3 data exists
6–7	Unused	

Note: Track 1, 2, or 3 decode flag is 0 if the track does not exist.

Note: The Operation Mode configuration byte is unchanged when the reader's configuration is reset to its default setting. The default setting as shipped from the factory is AEH for RS232 reader and 8 for CCID reader.

Command completed successfully response 9000 is as follows:

```
60 00 02 90 00 F2 03
```

Plug and Play Support (RS232 only)

Reader will notify the operating system of its arrival by sending "Device ID String" at 1200 baud (1200, 7, 1, Mark), after the reader is powered up or reconnected to the PC. The reader will only send this string if the operating system requests it. The operating system will only request the PnP string on boot and on scanning for hardware changes. To set an RS232 reader to PC/SC mode configure it for plug-and-play.

Plug-and-Play Device ID String:

```
(<01 22>ITS0020[Serial Number]\\ID TECH 0030 Hybrid Mag&EMV Card Reader  
[Check Sum byte 1][Check Sum byte 2])
```

[Serial Number] is an 8-byte string, represents serial number of a device.

[Check Sum byte 1] and [Checks Sum byte 2] are single byte check characters.

To change the reader from the default setting to PnP or to restore the PnP setting, see Section 6.4.6 Set Operation Mode [53 11] page 57.

6.4.7. Set Compatibility Mode [53 1E]

60 00 04 53 1E 01 <Compatibility Mode> LRC 03

The <Compatibility Mode> byte is defined as follows.

Bit Position	'0'	'1'
0	Report errors as SPT3	Report errors as Sp2
1	Display LED as SPT3	Display LED as Sp2
2-7	Unused, all should be 0	

The SPT3 reports each error status with a unique number. The Sp2 reports errors from multiple sources with the same error code. The high byte of the error code should be identical in each of these cases. The low byte of the error code as reported by the Sp2 is usually 0. The low byte of the error code from the SPT3 uniquely identifies the source of the particular error. The document (SPT3_Returned_Status) lists all the statuses and a description of their meaning.

The Sp2 displays an Amber LED when the reader is communicating with the card or with the host computer. The SPT3 does not use the LED to indicate communication with the card or with the host.

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

6.4.8. Read Reader Serial Number [52 4E]

60 00 02 52 4E 7E 03

Note: An '8 to 10-byte' string of serial number will be returned.

Response is as follows:

60 00 0B 4E 09 08 <Serial Number (8-10 bytes)> LRC 03

6.5. *Microprocessor Commands Descriptions*

All ICC reader commands follow the Turbo TLP-224 protocol and use the ISO 7816-4 Application Protocol Data Unit (APDU) or 7816-3 Transport Protocol Data Unit (TPDU) structure to communicate with the IC card. Note: <length> is two bytes first byte is the most significant second is the least significant.

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6.5.1. Smart Card Commands Summary

Table 4 – Reader Command IDs Affecting Smart Card Summary

ASCII	Hex	Page	Name	Use
'A'	41	60	Input from or output to a T=0 or T=1 microprocessor card	Write command (may include data) to a microprocessor (T=0 or T=1) card
'B'	42	68	Communicate with memory card	Command for accessing, reading and writing memory cards
'C'	43	70	Select ICC connector	Switches between User and SAM ICC connectors
'F'	46	65	Raw T=1 I/O with microprocessor card	Sends command to T=1 card & awaits response, host handles T=1 protocol.
'M'	4D	62	ICC Power OFF	Power off ICC card
'n'	6E	60	ICC Power ON	Power on microprocessor card, return ATR

6.5.2. Transmission Protocol for ICC Cards

Following are the command/response protocols for communication between the hybrid reader (ICC media) and host. The protocol used by this reader is turbo TLP-224. All commands and characters are presented in 'Hex'. Note: Maximum buffer size for read or write is 262 bytes.

Successful Command Response Sequence

Host to Hybrid Reader Command

```
60 LH LL nnnnnnnnnnnnnnnnnnn ZZ 03
ACK length data(C-APDU) LRC 03
```

Hybrid Reader to Host Response

```
60 LH LL nnnnnnnnnnnnnnnnnnn SS ZZ 03
ACK length data(R-APDU) Status LRC 03
```

Note: length is two bytes, first byte is the most significant, second is the least significant.

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Unsuccessful Command Response Sequence

Host to Hybrid Reader Command

```
60 LH LL nnnnnnnnnnnnnnnnnnnn ZZ 03
ACK length data(C-APDU) LRC 03
```

Hybrid Reader to Host Response

```
E0 LH LL nnnnnnnnnnnnnnnnnnnn SS ZZ 03
NACK length data(R-APDU) Status LRC 03
```

Or

```
E0 LH LL SS ZZ 03
NACK length Status LRC 03
```

The status either defines a successful transaction or gives an error code (see Table 5 – Response Status Code Summary and Explanation page 72).

6.5.3. Power On (Get ATR) Command [6E]

```
60 00 <Length> 6E [<Option>] [<PPS>] LRC 03
```

This command is used to power up the currently selected microprocessor card. It follows the ISO7816-3 power up sequence and returns the ATR as its response. Memory cards do not have an explicit power up command, i.e. any I/O operation sent to the card causes a power up.

<Option> and <PPS> are optional, but <Option> must be present if <PPS> is used.

Note: The <Option> byte is defined as follows.

Bit Position	‘0’	‘1’
0	No IFS	Send S(IFS) request if T=1 protocol
1	No Explicit PPS	Explicit PPS
2-5	Unused (all 0)	
6	Auto PPS	No auto PPS for negotiable mode
7	IFS response check	No check on response of S(IFS) request

<PPS> is to set the Protocol and Parameters Selection between card and reader, only Di <= 4 are supported. PPS must follow the structure specified in ISO 7816-3 as PPS0, [PPS1], [PPS2], and [PPS3]. Typically the <PPS> is two bytes long. For more information see ISO 7816-3 section 7.2.

Example:

```
60 00 04 6E 02 10 11 09 03
Where 02 is the <Option> 10 is PPS0 and 11 is PPS1
```

Response is as follows:

```
60 00 <ATR Length> <ATR string> LRC 03
```

Example:

```
60 00 15 3B 6F 00 00 80 25 A0 00 00 00 68 54 08 00 0B 00
82 90 00 90 00 99 03
```

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Other possible response statuses:

- 2C06 no card seated to request ATR
- 2D01 Card Not Supported,
- 2D03 Card Not Supported, wants CRC
- 690D command not supported on reader without ICC support
- 8100 ICC error time out on power-up
- 8200 invalid TS character received
- 8500 PPS confirmation error
- 8600 Unsupported F, D, or combination of F and D
- 8700 protocol not supported EMV TD1 out of range
- 8800 power not at proper level
- 8900 ATR length too long
- 8B01 EMV invalid TA1 byte value*
- 8B02 EMV TB1 required*
- 8B03 EMV Unsupported TB1 only 00 allowed*
- 8B04 EMV Card Error, invalid BWI or CWI*
- 8B06 EMV TB2 not allowed in ATR*
- 8B07 EMV TC2 out of range*
- 8B08 EMV TC2 out of range*
- 8B09 per EMV96 TA3 must be > 0xF*
- 8B10 ICC error on power-up
- 8B11 if EMV96 T=1 then TB3 required*
- 8B12 Card Error, invalid BWI or CWI
- 8B13 Card Error, invalid BWI or CWI
- 8B17 EMV TC1/TB3 conflict*
- 8B20 EMV TD2 out of range must be T=1*
- 8C00 TCK error
- A304 connector has no voltage setting
- A305 ICC error on power-up invalid (SBLK(IFSD) exchange
- E301 ICC error after session start

*Connector is configured for EMV, but ICC is not a valid EMV ICC. To support this card in this connector change the configuration from EMV to ISO see 6.4.5 Set Card option [53 10] page 56. If connector is a SAM connector also see 6.7.4 Set SAM Card Option [53 6n 02] on page 71.

Please refer to Appendix C for the complete list of response codes.

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6.5.4. Power Off Command [4D]

60 00 01 4D 2C 03

This command is used to power down the current selected card. It works for both microprocessor and memory cards.

Note: If powering off an ICC in a SAM connector be aware all SAM connectors will be powered off.

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

6907 command not supported on reader without ICC support

6.5.5. ICC Reader Microprocessor Card Output Command Structure [41]

60 <length> 41 <APDU> LRC 03

This 41 command is used to pass any T=0 or T=1 APDU to a microprocessor card.

Note if the host does the PPS exchange, the host must also do the IFS exchange

See Example T=0 and T=1 Read and Write Commands to Card [41] page 63

Possible response statuses:

2C02 no microprocessor ICC seated

6903 reader configured without ICC support

9000 Success

Example T=0 and T=1 Read and Write Commands to Card [41]

IBM PC/SC T=1 test card example (Card available from PC/SC workgroup).

Start the IDTECH PC/SC Sample demo program insert the IBM PC/SC T=1 card in the reader.

In the command window type the following commands in hex:

Command to set Card type as 5V, EMV, microprocessor card

60 00 04 53 10 01 00 26 03

Response completed successfully 9000 is as follows:

60 00 02 90 00 F2 03

Command to request ATR

60 00 02 6E 01 0D 03

ATR response should be

60 00 1A 3B EF 00 FF 81 31 86 45 49 42 4D 20 4D 46 43 34

30 30 30 30 38 33 31 43 90 00 D1 03

Command to Select File 0007

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60 00 08 41 A4 A4 00 00 02 00 07 2C 03

Response should be

60 00 10 63 0C 03 E8 00 07 00 00 00 FF FF 11 01 00 90
00 73 03

Write File 5 bytes from 0000

60 00 0B 41 A4 D6 00 00 40 00 01 02 03 04 1C 03

Response completed successfully 9000 is as follows:

60 00 02 90 00 F2 03

Read File 05 bytes from 0000

60 00 06 41 A4 B0 00 00 05 36 03

Response from the reader should be

60 00 07 00 01 02 03 04 90 00 F3 03

Command to power off the ICC

60 00 01 4D 2C 03

Response completed successfully 9000 is as follows:

60 00 02 90 00 F2 03

If and only if the reader is configured to allow the host to do PPS commands see 6.4.5 page 56, then immediately after the power on command and response when required, the host can send a PPS command:

Do a PPS Exchange

60 00 05 41 FF 11 18 F6 LRC 03

PPS Exchange response

60 00 04 FF 11 18 F6 64 03

6.5.6. ICC Reader Microprocessor Card Input Command Structure [41]

60 <length> 41 <APDU> LRC 03

This 41 command is used to pass any T=0 read or T=1 APDU to a microprocessor card where both data and an ISO status are expected from card.

See Example T=0 and T=1 Read and Write Commands to Card [41] page 63

Possible response statuses:

2C02 no microprocessor ICC seated
6903 reader configured without ICC support
9000 Success

Example T=0 Read and Write [41] Commands to Card

If you use the ID TECH provided sample card labeled Microprocessor – 1K Byte P/N: 80005206-001. (If the reader has not been installed follow the installation procedure in section 3 QUICK START page 19).

Start the ID TECH PC/SC Sample demo program insert the T=0 sample card in the

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reader.

In the command window type the following commands in hex: In each of the examples the underlined portion of the command is the part that is entered. The rest of the command is the envelope, which is added automatically by the demo program.

Select File 3040

41 00 A4 00 00 02 30 40

Response completed successfully 9000 is as follows:

60 00 02 90 00 F2 03

Verify CHV (samplepassword)

60 00 14 41 00 20 00 80 0E 73 61 6D 70 6C 65 70 61 73

73 77 6F 72 64 LRC 03

Response completed successfully 9000 is as follows:

60 00 02 90 00 F2 03

Write 8 bytes 12345678 to file 3040 address 0000

60 00 0E 41 00 D6 00 00 08 31 32 33 34 35 36 37 38 F9 03

Response completed successfully 9000 is as follows:

60 00 02 90 00 F2 03

Read 8 bytes from address 0000

60 00 06 41 00 B0 00 00 08 LRC 03

Response should be

60 00 0A 31 32 33 34 35 36 37 38 90 00 F2 03

Write 8 bytes ABCDEFGH to address 0000

60 00 0E 41 00 D6 00 00 08 41 42 43 44 45 46 47 48 LRC 03

Response completed successfully 9000 is as follows:

60 00 02 90 00 F2 03

Read 8 bytes from address 0000

60 00 06 41 00 B0 00 00 08 LRC 03

Response should be ABCDEFGH

60 00 0A 41 42 43 44 45 46 47 48 90 00 F2 03

6.5.7. ICC Reader Microprocessor Card Raw T=1 Command Structure [46]

60 <length> 46 <NAD> <PCB> <LEN> <INF> <EDC> LRC 03

This command is used to pass a T=1 data block to a microprocessor card.

See Example T=1 Raw Read and Write Commands to Card page 66.

Response completed successfully 9000 is as follows:

60 00 02 90 00 F2 03

Possible response statuses:

2C04 no T=1 raw card seated

6906 reader configured without ICC support

9000 Success

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Example T=1 Raw Read and Write Commands to Card

This sample uses the IBM PC/SC T=1 Test Card (Card available from PC/SC workgroup).

Negotiate IFS (Propose maximum block size of 254 bytes).

60 00 06 46 00 C1 01 FE 3E LRC 03

Response

60 00 05 00 E1 01 FE 1E LRC 03

Select file 0007

60 00 0C 46 00 00 07 A4 A4 00 00 02 00 07 02 LRC 03

Response

60 00 14 00 00 10 63 0C 03 E8 00 07 00 00 00 FF FF 11 01
00 90 00 13 LRC 03

Write 1 byte to file at address 0000

60 00 0B 46 00 40 06 A4 D6 00 00 01 00 35 LRC 03

Response

60 00 06 00 40 02 90 00 D2 LRC 03

Read 1 byte from file starting at address 0000

60 00 0A 46 00 00 05 A4 B0 00 00 01 10 LRC 03

Response

60 00 07 00 00 03 00 90 00 93 LRC 03

Write 25 bytes to address 0000

60 00 23 46 00 40 1E A4 D6 00 00 19 00 01 02 03 04 05 06
07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 14 15 16 17 18 2D
LRC 03

Response

60 00 06 00 40 02 90 00 D2 LRC 03

Read 19H (25 decimal) bytes starting at address 0000

60 00 0A 46 00 00 05 A4 B0 00 00 19 08 LRC 03

Response

60 00 1F 00 00 1B **00 01 02 03 04 05 06 07 08 09 0A 0B 0C**
0D 0E 0F 10 11 12 13 14 15 16 17 18 90 00 93 LRC 03

6.5.8. ISO 7816 Command Structure

CLA INS P1 P2 [Lc] [Data] [Le]

ISO 7816-3 Command Structure:

CLA INS P1 P2 P3 (Lc or Le) Data (if P3 is Lc)

Definition of Commands:

<CLA> ISO Class byte

<INS> ISO instruction code

<P1> ISO Parameter 1, usage varies with commands

<P2> ISO Parameter 2, usage varies with commands

<Lc> The number of bytes present in the data field of the command APDU

<Le> The maximum number of bytes expected in the data field of the response APDU.

<P3> ISO Parameter 3, length of data Lc or maximum length of expected reply Le

<Data> Data to send, varies with commands

<NAD> ISO Node Address always 0 for T=1 protocol

<PCB> ISO Protocol Control Byte for T=1 protocol

<LEN> Length byte for T=1 protocol

<INF> Information field for T=1 protocol

<EDC> Error detection code of the block, only LRC is supported.

Response Structure:

<Data>(Optional)<SW1> <SW2>

<Data> Response data usually Le bytes if operation was successful

<SW1> Status byte 1

<SW2> Status byte 2

6.6. Memory Card Commands

6.6.1. General

The primary documentation detailing memory cards is the Spectrum III Memory Card Manual. Memory card commands consist of the memory command identifier (42H) and an ISO APDU. The reader interprets the command based on current selected memory card type and performs the requested operation. The reader returns ISO7816 status (SW1, SW2) after finishing the operation.

6.6.2. ICC Reader Memory Card Command Structure [42]

60 <length> 42 <Command> LRC 03

This command is used to perform an operation on a memory card.

For More information on accessing memory cards see SPT3 Memory Card Manual (80064502-001)

Response completed successfully 9000 is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

- 2A06 no ICC voltage defined on connector
- 2C03 no memory card seated
- 2D00 memory card type not supported
- 6904 reader configured without ICC support
- 6E00 memory card class must be 'DA'

6.6.3. Set Memory Card Type [53 12]

60 00 04 53 12 01 <Setting> LRC 03

<Setting> is a byte defined as follows.

Hex	Memory Card Description
00	3-byte I²C memory card
01	4-byte I ² C memory card
02	SLE4428 and SLE4418 cards
03	SLE4442 and SLE4432 cards
04	GPM 276 (support is omitted)
05	GPM 271 (support is omitted)
06	SLE4404 and AT88SC101 cards
07	SLE4406 cards

60 00 04 53 12 01 01 25 03

Response is as follows:

60 00 02 <Return Status (2 bytes)> LRC 03

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

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6.6.4. Set Memory Card Page Write Size [53 15]

60 00 0C 53 15 01 <Page Size in Bytes> LRC 03

Page Size is a one byte value indicating the page size for the memory card. Only memory cards types zero and one I²C use this feature. The default value of 8 will work for all supported cards. If performance of the write to card becomes a problem when writing larger blocks of data, setting this value correctly will increase performance.

Chip Type	Memory Card Type	Page Size	Card Size in Bytes
AT24C01A	0	8	128
AT24C02	0	8	256
AT24C04	0	16 (10H)	512
AT24C08	0	16 (10H)	1024
AT24C16	0	16 (10H)	2048
AT24C64	1	32 (20H)	8192
AT24C128	1	64 (40H)	16384
AT24C256	1	64 (40H)	32768
AT24C512	1	128 (80H)	65536

Command to set the page size to 32 bytes for the type 1 AT24C64 card.

60 00 04 53 15 01 20 03 03

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

Note: if speed is not an issue this can be safely ignored.

6.7. SAM—Secure Access Module Support

6.7.1. SAM Purpose

SAM is a smart card in a smaller form factor, that provides authentication and or encryption support for a particular card type. They fit into either one SIM connector on the PCA or into up to four SIM connectors on an expansion board that attaches to the reader. If a reader is set up to support only one type of card then the reader will probably only need one SAM card. If a reader is configured to accept a variety of cards e.g. Visa, MasterCard and Discover (electronic purse/cash cards) it may need a SAM card for each card type that it supports.

6.7.2. Typical SAM Operation

Note: Because PC/SC v1.0 only can handle one card at a time, SAM access should be done without the PC/SC interface. This is necessary because when Windows Smart Card Manager talks to an ICC it controls the sequence numbering, chaining, etc. so it will become confused if attempting to talk to a second ICC before the session with the first ICC is closed.

In typical operation the host will ask the users card for a random number, which is then given to the SAM card. The SAM card will then generate an encoded message

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containing a secret key, which is presented to the user card. The user card will generate a response, which is given to the SAM card, which will then inform the host of the user's card validity.

Many types of smart card applications require additional security/fraud protection. One such method for insuring secure transactions is the use of a "Secure Application Module" (SAM). The SAM is a miniature smart card (it is slightly larger than the contact pads on a standard smart card) that contains security algorithms, and provides a secure place to store keys. ID TECH insert readers can optionally provide for up to five (5) independent SAM connectors, one is located on the main printed circuit board (PCA), or up to five are located on a separate PCA that is secured to the main PCA. The quantity required depends upon the customer's application(s).

ID TECH's family of EMV smart card and hybrid insert reader/writers can support up to 6 smart card connectors (4 SAM & 1 smart card connector). When addressing the connectors, the main (smart card) connector is assigned the number '0', and each of the SAM modules is assigned a number from 1 to 5. If the SAM daughter board is used do not use the SAM connector on the main PCA because it is inaccessible and it has the same address as a connector on the SAM board so there would be a conflict.

6.7.3. ICC Connector Selection [43 0n]

60 00 02 43 <Card Connector> LRC 03

<Card Connector> is a byte defined as follows.

Hex	Connector Description
00	User Card Connector (main module)
01	SAM Connector 1 (on main board or on SAM daughter board)
02	SAM Connector 2
03	SAM Connector 3
04	SAM Connector 4

The ICC Connector selection command allows the application to select a card (connector) to read from or to write to, the application can only communicate with one card at a time, either main user ICC or a SAM ICC. The user connector (0) is selected when the reader is powered or reset.

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

6905 reader not configured with SAM support or SAM connector > 4

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6.7.4. Set SAM Card Option [53 6n]

60 00 05 53 <SAM Setting> 0n <Card Option> [<Memory Card Type>] LRC 03

<SAM Setting> is a byte defined as follows.

Hex	
60	User Card Connector (Module 0)
61	SAM Connector 1
62	SAM Connector 2
63	SAM Connector 3
64	SAM Connector 4

<Card Option> and <Memory Card Type> are single bytes with the same definition as main card.

Example to set SAM connector 1 to an ISO, 5V, microprocessor card

60 00 05 53 61 01 10 LRC 03

Example to set SAM connector 1 to a 5V type 1 memory card (4 byte i2c).

60 00 05 53 60 02 80 01 LRC 03

Note: Only the User connector (SAM 0) supports memory cards or memory card commands that is a 53 6X command with a length longer than 01.

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

6.7.5. SAM Card Operation Scenario

- Set "Card Option" and "Memory Card Type" for cards going to read/write on both main Module and SAM module (if necessary)
- Select main card (optional)
- Power on main card (optional)
- Select SAM card
- Power on SAM card
- Select card connector (main or SAM)
- Smart card (main or SAM) read/write operation
- Repeat f and g until card access complete
- Select SAM card (optional)
- Power off SAM card (optional)
- Select main card
- Power off main card

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6.7.6. Notes for SAM Card Operation

“Get Reader Status” command reports the status of the user card only.

Power off the SAM card connectors before installing or removing any SAM cards. The easiest way to be sure of this condition is to disconnect power from the reader. The reader does not have a card seated signal for each SAM card and therefore is not able to power on or off these cards properly unless they start in a known state.

6.8. *Return Status Summary and Explanation*

Table 5 – Response Status Code Summary and Explanation	
Code	Definition
C0xx	Magnetic Card Data with envelop
B00x	Card insert Notification
9000	Operation completed successfully (All Operations)
8C00	TCK error
8Bxx	Unsupported TAx, TBx, TCx, TDx
8900	ATR too long
880x	Power not ready for T=0 microprocessor card
8700	Protocol not supported by the reader
8600	Unsupported Fi or Di in PPS
8500	PPS confirmation error
8400	Parity error in reception
830x	Parity Error in transmission
8200	Unknown TS
810x	Time out
6E00	CLA not supported
6D0x	INS not supported
69xx	Command not supported
670x	Warning, Value read is different from value written
6688	Invalid PSC presented
6687	No more retries
6686	No more counter to decrease
2F00	ICC pulled from user slot while powered
2D0x	Memory card not supported
2C0x	Card not present
2B00	Address not supported
2A0x	Command received correctly, but could not complete
0080	Driver reported user supplied buffer too small
0079	Driver reported time out error

Note: See Appendix C for a full list of responses.

7. HYBRID READER—MAGNETIC STRIPE SUPPORT

7.1. Features

ID TECH's magnetic stripe reader can be configured to read 1, 2, or 3 tracks of data from a card conforming to ISO 7811 standards. Its default setting reads and transmits data after a card withdrawal operation. This intelligent reader allows the user to control the magnetic stripe data as well as modify the interface parameters. This reader does not support data editing.

Interfaces	RS232 or USB 2.0 full speed
Max Tracks	Three each at 210 bpi
Formats Decoded	ISO-7811 and AAMVA format

7.1.1. Message Format

Table 6 – Magnetic Stripe Message Formatting	
Terminator	CR , None, CR/LF or any
Prefix	None Up to 9 characters
Track 1 ID	None One character
Track 2 ID	None One character
Track 3 ID	None One character
Suffix	None Up to 9 characters (after terminator)

7.1.2. Magnetic Stripe Data

MSR Reading	Enable and Disable
Decoding Method	Two Ways, Insertion, Withdrawal
Send Option	Start/End sentinel, Account Number only for 2 nd Track
Track Selection	Any Track , T1, T2, T3, T1T2, T1T3, T2T3 and T1T2T3
Track Separator	Any ASCII Character
Track 1 ID	Any ASCII Character
Track 2 ID	Any ASCII Character
Track 3 ID	Any ASCII Character

7.2. Features Description

MSR Mode Setting

This feature allows the application program to enable or disable MSR reading and set MSR mode to auto transmit mode or buffered mode.

MSR Configuration Setting

This feature allows the application program to disable or enable the transmitting of the start/end sentinel, disable or enable Account Number only

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for second track.

Terminator/Prefix/Suffix

Reader supports simple message formatting by using the Terminator, the Prefix and the Suffix.

Track Selection

This feature allows the application program to specify which track(s) to read.

Track Separator

Track Separator can be any ASCII character, 00H is reserved for no separator.

Magnetic Standard Decode and Raw Data Decode

There are two MSR decode methods.

1. "Standard Decode" – follows ISO specification. This is the default method.
2. "Raw Data Decode" – With this feature, raw magnetic stripe data can be sent to the host for further processing. Two ASCII characters represent each raw data byte: the first ASCII character is for the high nibble of the hex code, and the second ASCII character is for the low nibble of the hex code. For example, the two characters "4" and "B" represent raw data 4Bh (01001011).

Configuring the reader to work in standard decode (default setting) or raw magnetic data decode is done with the 6.4.6 Set Operation Mode [53 11] command, page 57.

7.3. Default Card Data Output

```
SS1 T1_DATA ES CR  
SS2 T2_DATA ES CR  
SS3 T3_DATA ES CR
```

Where: SS1 (start sentinel track1) = '%'

SS2 (start sentinel track 2) = ','

SS3 (start sentinel track 3) = ';' for ISO, '%' for AAMVA

ES (end sentinel all tracks) = '?'

7.4. Buffered Mode Operation Commands

7.4.1. Arm to Read Command [50 01 30]

60 00 03 50 01 30 02 03

This command enables the MSR to be ready for a card insert and withdrawal in buffered mode.

Any previously read data will be erased and reader will wait for the next insert and withdrawal.

As the user inserts and withdraws a card, the data will be saved, but will not be sent to the host. The reader holds the data until receiving the next "Arm to Read" or "MSR Reset" command.

A notification will be sent to inform host of magnetic data presence after a card is inserted and after it is withdrawn if the corresponding bit in "Operation Mode" has been set. See page 57.

Successful response is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

6912 'P' command length must be 1

6916 'P' command data must be 0x30 or 0x32

6920 Reader not configured for buffered mode

6922 Reader not configured for magstripe read

7.4.2. MSR Reset Command [50 01 32]

60 00 03 50 01 32 00 03

This command will disable MSR read and clear any magnetic data in buffered mode. The reader enters to a disarmed state and will ignore MSR data.

Successful response is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

6912 'P' command length must be 1

6916 'P' command must be 0x30 or 0x32

6920 Reader not configured for buffered mode

6922 Reader not configured for magstripe read

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7.4.3. Read MSR Data Command [51 01]

60 00 03 51 01 <Track Selection Option> LRC 03

The <Track Select Option> byte is defined as follows:

ASCII	Hex	Track Selected
'0'	30	Any Track
'1'	31	Track 1
'2'	32	Track 2
'3'	33	Track 1 and Track 2
'4'	34	Track 3
'5'	35	Track 1 and Track 3
'6'	36	Track 2 and Track 3
'7'	37	Track 1, Track 2 and Track 3
'8'	38	Track 1 and or Track 2
'9'	39	Track 2 and or Track 3

This command requests card data information for the buffered mode.

The selected MSR data is sent to the host with or without envelope format, according to the operation mode setting.

This command does not erase the data in buffered mode but does erase the data after if it is sent in auto buffered mode.

Successful response is as follows:

60 <Len_H> <Len_L> <C0> <xx> <MSR Data> LRC 03

Other possible response statuses:

6911 'Q' command length must be 1

6921 reader not configured for buffered mode

C000 no magstripe data available

7.5. *MSR Configuration Commands Description*

All MSR reader Configuration Commands are listed in the following format:

60 <Length> 53 <FuncID> <Len> <FuncData> LRC 03

Length is a two bytes counter, which indicates length of data from 53 to end of <Func Data>. The most significant byte comes first.

Note: Default settings are in BOLD print

7.5.1. MSR Transmit Mode Setting [53 1A]

60 00 04 53 1A 01 <MSR Transmit Mode> LRC 03

The <MSR Transmit Mode> byte is defined as follows:

ASCII	Hex	Definition
'0'	30	MSR Reading Disable
'1'	31	MSR Reading Auto Transmit Mode
'2'	32	MSR Reading in Buffered Mode (Default if PC/SC mode)*
'3'	33	Auto Buffered Mode

Example to enable MSR reading auto transmit mode

60 00 04 53 1A 01 31 1D 03

*Buffered mode is set automatically by the drivers on PC/SC readers and should not be changed.

7.5.2. MSR Read Direction Setting [53 1D]

60 00 04 53 1D 01 <Read Direction> LRC 03

The <Read Direction> byte is defined as follows:

ASCII	Hex	Definition
'1'	31	Read on both insertion and withdrawal
'2'	32	Read on insertion only
'3'	33	Report on withdrawal only
'4'	34	Read on withdrawal only

Example: 60 00 04 53 1D 01 33 18 03 read on withdrawal only

Report on withdrawal reads the card on both the way in and the way out, but it only sends the card data after the card has been withdrawn. It has the advantages of read more reliable read and not sending so much data.

Note: Unless the users are trained or the reader is a partial insert reader about 20% of the population will not insert a card smoothly enough to be read during insertion. Nearly everyone extracts a card smoothly.

Note: It is not recommended that a reader configured to send the track data encrypted be set to read on insert and withdrawal. If a secure insertion reader is set to read on insert and withdrawal then it uses up the DUKPT keys in half a million inserts where as the lifetime of the reader is one million inserts. This is because one DUKPT key is used on insert and one on withdrawal. This means either the effective lifetime of the reader is reduced by half or the reader must be returned to have a new DUKPT loaded after half a million card reads.

If a secure insertion reader is set to read on insert and withdrawal ('1') when the card is inserted, there is a finite amount of time necessary for the reader to decode the MSR data and encrypt the tracks and send the message to the host before the reader can arm to read on withdrawal. For a triple track card at the default TDES encryption the card must be left inserted for about 0.4 seconds. This delay is longer that a person who is inserting and removing the

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card would leave the card seated. The time to transmit and the time to decode depend on the number and length of the tracks and whether the tracks are encrypted and who the data is sent to the host (a slower rate occurs RS232 units at slower baud rates. This is especially true with an encrypted reader because it has about three times as much data to end to the host.

If the goal of setting the reader on insert and withdrawal read is to increase the chance that an inserted card will be read then setting the reader to report-on-withdrawal (the default) will accomplish this goal because the reader will read and decode the MSR on insert, but it will not encrypt and send the data until the card is removed, but it will combine the insertion and extraction track data so that there is one report of the best available track data. Even with report-on-withdrawal there is a minimum time the card must remain seated of about 100ms to be able to arm to read before the card is withdrawn, but this time is normally less than the time the card remains seated unless the patron is doing an aggressive insertion and withdrawal. Report-on-withdrawal only uses on DUKPT key per insertion. In PC/SC mode the report on withdrawal setting is treated as read on withdrawal.

7.5.3. MSR Send Option Setting [53 19]

60 00 04 53 19 01 <Send Option> LRC 03

The <Send Option> byte is defined as follows.

Bit Position	'0'	'1'
0	No Start/End Sentinel	<u>Send Start/End Sentinel</u>
1	<u>All Data on track 2</u>	Account Number on track 2
2	Don't report track errors	Report tracks in error
3-7	Unused	

7.5.4. MSR Data Terminator Setting [53 21]

60 00 04 53 21 01 <Terminator Setting> LRC 03

The <Terminator Setting> byte is defined as follows:

ASCII Hex	Definition
'0' 30	CR/LF
0 00	None

Any other character will send the char

Example to set to send CRLF after the last MSR data

60 00 04 53 21 01 30 27 03

Example to set CR

60 00 04 53 21 01 0D LRC 03

7.5.5. MSR Data Prefix String Setting [53 D2]

60 <length> 53 D2 <Len> <Prefix String> LRC 03

Where:

<Prefix String> = {string length}{string}

{String length} is one byte, maximum value 9

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<Len> is the number of bytes of Prefix string including string length
<length> is a two bytes counter, which indicates the number of bytes in command from 53 to the end of <Prefix String>. The most significant byte comes first.

Example to set the prefix to "TRK"
60 00 07 53 D2 04 03 54 52 4B AC 03

7.5.6. MSR Data Suffix String Setting [53 D3]

60 <length> 53 D3 <Len> <Suffix String> LRC 03

Where:

Suffix String = {string length}{string}

String length is one byte, maximum 9

Len is the number of bytes of Suffix string including string length

Length is a two bytes counter, which indicates the number of bytes in command from 53 to the end of the <Suffix String>. The most significant byte comes first.

Example to put a ']' at the end of the MSR data
60 00 05 53 D3 02 01 5D BB 03

7.5.7. Track ID Setting [53 3n]

Track 1 ID Setting [53 31]

60 00 04 53 31 01 <Track 1 ID> LRC 03

<Track 1 ID>: ASCII code set as Track 1 ID, NULL for None.

Example: 60 00 04 53 31 01 00 07 03 Send no Track 1 ID

Track 2 ID Setting [53 32]

60 00 04 53 32 01 <Track 2 ID> LRC 03

<Track 2 ID>: ASCII code set as Track 2 ID, NULL for None.

Example: 60 00 04 53 32 01 32 36 03 Send Track 2 ID of ASCII '2'

Track 3 ID Setting [53 33]

60 00 04 53 33 01 <Track 3 ID> LRC 03

<Track 3 ID>: ASCII code set as Track 3 ID, NULL for None.

Example: 60 00 04 53 33 01 03 06 03 Send Track 3 ID of Hex 03

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7.5.8. Track Selection Setting [53 13]

60 00 04 53 13 01 <Track_Selection> LRC 03

<Track_Selection>:

ASCII Hex Definition

'0'	30	Any Track
'1'	31	Track 1 Only
'2'	32	Track 2 Only
'3'	33	Track 1 & Track 2
'4'	34	Track 3 Only
'5'	35	Track 1 & Track 3
'6'	36	Track 2 & Track 3
'7'	37	All Three Tracks
'8'	38	Any of Track 1 and/or Track 2
'9'	39	Any of Track 2 and/or Track 3

Example to select all 3 tracks and all must have valid data:

60 00 04 53 13 01 37 LRC 03

Note: If a track selected above (as opposed to any track), that track 'must' be present and good or the reader does not transmit any track information.

7.5.9. Track Separator Setting [53 17]

60 00 04 53 17 01 <Track_Separator> LRC 03

<Track_Separator> is one ASCII byte:

The default value is **CR** (Hex 0D).

Example to set the track separator to CR (carriage return)

60 00 04 53 17 01 0D 2C 03

7.6. Key Loading Command

Note: This command is normally only used by a key loading facility. This protocol is completely different from the normal reader protocol.

The Encrypted read supports TDES and AES encryption standards for data encryption. Encryption can be turned on via a command. TDES is the default.

If the reader is in security level 3, for the encrypted fields, the original data is encrypted using the TDES/AES CBC mode with an Initialization Vector starting at all binary zeroes and the Encryption Key associated with the current DUKPT KSN.

KSN and Device Key loading commands and responses protocol:

When DUKPT key management is used, it is necessary to load Key Serial Number (KSN) and Initially Loaded Device Key before transaction.

The encryption key is TDES with 128-bit keys or AES encryption with double length keys (128-bit keys including parity).

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KSN and Device Key loading commands and responses protocol:

Command:

<STX><'F'><'F'><Command Data (BASE64)><0x0D><0x0A><ETX><LRC>

Response:

<ACK/NAK><STX><'F'><'F'>< Respond Data(BASE64)><0x0D><0x0A><ETX> <LRC>

STX: 0x02

ETX: 0x03

ACK: 0x06

NAK: 0x15

BASE64: Data encoded with base64 algorithm

LRC: Xor'd all the data before LRC except STX.

A successful key loading process includes the following steps:

- Get Key status

Command Data: <FF><13><01><02><LRC>

Response Data: <FF><00><01><04><LRC>

For Example:

Command: \02\46\46\2F\78\4D\42\41\75\38\3D\0D\0A\03\LRC

Response: \06\02\46\46\.....\0D\0A\03\LRC

- Load KSN

Command Data: <FF><0A><11><KSN#><KSN bytes><LRC>

Response Data: <FF><00><06><RESPONSE CODE><LRC>

<KSN#>: TDES: 0x32 DES: 0x0A

<KSN bytes>: 16 bytes ASCII for KSN

<RESPONSE CODE>: 6 bytes data in ASCII format, which is converted from the first 3 cipher hex data. These cipher data are generated by encrypting KSN bytes and "00 00 00 00 00 00 00 00".

For Example:

Command:

\02\46\46\2F\77\6F\52\4D\6B\5A\47\52\6B\59\35\4F\44\63\32\4E\54\51\7A\4D\6A\45\77\52\54\43\69\0D\0A\03\5D

Response: \06\02\46\46\.....\0D\0A\03\LRC

- Load Encryption Key

Command Data: <FF><0A><LENGTH><KEY#><KEY bytes><LRC>

Response Data: <FF><00><06><RESPONSE CODE><LRC>

<LENGTH>: TDES: 0x21 DES: 0x11

<KEY#>: TDES: 0x33 DES: 0x0B

<KEY bytes>: TDES: 0x20 DES: 0x10

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<RESPONSE CODE>: 6 bytes data in ASCII format, which is converted from the first 3 cipher hex data. These cipher data are generated by encrypting KEY bytes and "00 00 00 00 00 00 00 00".

For Example:

Command:

```
\02\46\46\2F\77\6F\68\4D\7A\5A\42\51\7A\49\35\4D\6B\5A\42\51\54\45\7A\4D\54\56\43\4E  
\45\51\34\4E\54\68\42\51\6A\4E\42\4D\30\51\33\52\44\55\35\4D\7A\4E\42\6C\51\3D\3D\0D  
\0A\03\2D
```

Response: \06\02\46\46\.....\0D\0A\03\LRC

8. SECURITY FEATURES

HIR Reader features configurable security settings. Before encryption feature can be enabled, Key Serial Number (KSN) and Base Derivation Key (BDK) must be loaded before encrypted transactions can take place. The keys are to be injected by certified key injection facility.

There are five security levels available on the reader as specified in the followings:

- **Security Level 0**
Security Level 0 is a special case where all DUKPT keys have been used and is set automatically when it runs out of DUKPT keys. The lifetime of DUKPT keys is 1 million. Once the key's end of life time is reached, user should inject DUKPT keys again.
- **Security Level 1**
By default, the readers from factory are configured to have this security level. There is no encryption process, no key serial number transmitted with decoded data. The reader would function as a non-encrypting reader and have decoded track data same as level 1.
- **Security Level 2**
Key Serial Number and Base Derivation Key have been injected but the encryption process is not yet activated. The reader would send out decoded track data in default format.
- **Security Level 3**
Both Key Serial Number and Base Derivation Keys are injected and encryption mode is turned on. For payment cards, both encrypted data and masked clear text data are sent out. Users can select the data masking area; however, the encrypted data format cannot be modified.
- **Security Level 4**
When the reader is at Security Level 4, a correctly executed Authentication Sequence is required before the reader sends out data for a card. Commands that require security must be sent with a four byte Message Authentication Code (MAC) at the end. Note that data supplied to MAC algorithm should NOT be converted to ASCII-Hex, rather it should be supplied in its raw binary form. Calculating MAC requires knowledge of current DUKPT KSN, this could be retrieved using Get DUKPT KSN and Counter command.

Default reader properties are configured to have security level 1 (no encryption). In order to output encrypted data, the reader has to be key injected with encryption feature enabled. Once the reader has been configured to security level 2, 3 or 4, it cannot be reverted to a lower security level.

8.1. Encryption Management

The Encrypted read supports TDES and AES encryption standards for data encryption. Encryption can be turned on via a command. TDES is the default.

If the reader is in security level 3, for the encrypted fields, the original data is encrypted using the TDES/AES CBC mode with an Initialization Vector starting at all binary zeroes and the Encryption Key associated with the current DUKPT KSN.

8.2. Check Card Format

- ISO/ABA (American Banking Association) Card (card type 0)

Encoding method

Track1 is 7 bits encoding and there is no track 2 or 3.

Track2 is 5 bits encoding and there is no track 1 or 3.

Track1 is 7 bits encoding. Track2 is 5 bits encoding and there is no track 3.

Track1 is 7 bits encoding. Track2 is 5 bits encoding. Track3 is 5 bits encoding.

There is no Track1. Track2 is 5 bits encoding. Track3 is 5 bits encoding.

Track1 is 7 bits encoding. There is no Track2. Track3 is 5 bits encoding.

Additional check

Track1 2nd byte is 'B'.

There is only one '=' in track 2 and the position of '=' is between 12th – 20th character.

Total length of track 2 should above 21 characters.

- AAMVA (American Association of Motor Vehicle Administration) Card

Encoding method

Track1 is 7 bits encoding. Track2 is 5 bits encoding. Track3 is 7 bits encoding.

- Others (Customer card)

8.3. MSR Data Masking

For encrypted ABA cards, both encrypted data and clear text data are sent.

Masked Area

The data format of each masked track is ASCII.

The clear data include start and end sentinels, separators, first N, last M digits of the PAN, cardholder name (for Track1).

The rest of the characters should be masked using mask character.

Set PrePANClrData (N), PostPANClrData (M), MaskChar (Mask Character)

N and M are configurable and default to 4 first and 4 last digits. They follow the current PCI constraints requirements (N 6, M 4 maximum).

Mask character default value is '*'.

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- Set PrePANClrDataID (N), parameter range 00h–06h, default value 04h
- Set PostPANClrDataID (M), parameter range 00h–04h, default value 04h
- MaskCharID (Mask Character), parameter range 20h–7Eh, default value 2Ah
- DisplayExpirationDataID, parameter range '0'–'1', default value '0'

8.4. Output Format

Generally, the output format is the same between the RS232 and USB HID. The output that follows is the RS232 reader because it is a subset of the other two reader interface types. The USB HID reader output is padded with zeros at the end of the secure MSR output until the length is 512 bytes.

The secure output is in either one of two protocols the MOIR (the default protocol) or the NGA protocol. These will be described below.

8.4.1. Data Format

Enhanced Encrypt Format for HIR

(Note there is no Original encrypt format structure support in the HIR)

<u>Offset</u>	<u>Usage Name</u>
0	60
1	Data Length high byte
2	Data Length low byte
3	Card Encode Type
4	Track 1-3 Status
5	T1 data length
6	T2 data length
7	T3 data length
8	Field Byte 8 (see Notes and example)
9	Field Byte 9 (see Notes and example)
10	T1 data (masked if card type 0) (omitted if card type 4)
	T2 data (masked if card type 0) (omitted if card type 4)
	T3 data unencrypted (omitted if card type 4)
	Encrypted section
	T1-T2 data encrypted (if card type 0 or 4, else omitted)
	T3 data encrypted (only if card type 4)
	Session ID (8 bytes) (Only if security level 4 & card type 0 or 4)
	End encrypted section
	T1-T3 hashed (if card type 0 or 4) (20 bytes each)
	Serial Number (10 bytes) (optional)
	KSN (10 bytes) only if card type 0 or 4)
	LRC
	ETX

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1. Encrypt Option Setting: // always effect
53 84 01 encrypOpt // default 0x08
encryptOpt:
bit0: 1 – tk1 force encrypt *
bit1: 1 – tk2 force encrypt *
bit2: 1 – tk3 force encrypt *
bit3: 1 – tk3 force encrypt when card type is 0

Note:

- 1) *When force encrypt is set, this track will always be encrypted, regardless of card type. No clear/mask text will be sent.*
 - 2) *If and only if in enhanced encrypt structure, each track encryption is separated, encrypted data length will round up to 8 or 16 bytes.*
 - 3) *When force encrypt is not set, it encrypts ABA card track data just like the original structure, that is, only T1 and T2 in card type zero will be encrypted.*
1. hash Option Setting:
53 5C 01 hashOpt // default 0x37
hashOpt: ('0' – '7')
Bit0: 1 – track1 hash will be sent if data is encrypted
Bit1: 1 – track2 hash will be sent if data is encrypted
Bit2: 1 – track3 hash will be sent if data is encrypted

2. Mask Option Setting: // only effected in enhanced structure
53 86 01 maskOpt // Default: 0x07
maskOpt:
bit0: 1 – tk1 mask data allow to send when encrypted
bit1: 1 – tk2 mask data allow to send when encrypted
bit2: 1 – tk3 mask data allow to send when encrypted

Note: *When mask option bit is set – if data is encrypted (but not forced encrypted), the mask data will be sent; If mask option is not set, the mask data will not be sent under the same condition.*

Note:

- 1) Field 4:
Bit 0: 1— track 1 sampling data present
Bit 1: 1— track 2 sampling data present
Bit 2: 1— track 3 sampling data present
Bit 3: 1— track 1 decoded data present
Bit 4: 1— track 2 decoded data present
Bit 5: 1— track 3 decoded data present
Bit 6, 7 — Reserved for future use

- 2) Field 8:

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- bit 0: 1—if TK1 clear/mask data present
- bit 1: 1—if TK2 clear/mask data present
- bit 2: 1—if TK3 clear/mask data present
- bit 3: 0—0 reserved future use
- bit 4: 0—TDES; 1 AES encryption
- bit 5: 0—0 reserved future use
- bit 6: 1—if Pin key; otherwise data key
- bit 7: 1—if serial number included (always 10 bytes)

3) Field 9:

- bit 0: 1—if TK1 encrypted data present
- bit 1: 1—if TK2 encrypted data present
- bit 2: 1—if TK3 encrypted data present
- bit 3: 1—if TK1 hash data present
- bit 4: 1—if TK2 hash data present
- bit 5: 1—if TK3 hash data present
- bit 6: 1—if session ID present
- bit 7: 1—if KSN present

Card Type:

<u>Value</u>	<u>Encode Type</u>	<u>Description</u>
80		ISO/ABA format
81		AAMVA format
83		Other
84		Raw; un-decoded format.

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0198 Total message length in hexadecimal
3F Track 1-3 found and properly decoded
48 Length of track 1 data is 48h (72 decimal) bytes
23 Length of track 2 data is 23h (35 decimal) bytes
6B Length of track 3 data is 6Bh (107 decimal) bytes
03 indicates tracks 1 and 2 as masked
BF Tracks 1-3 are encrypted
Tracks 1-3 are hashed
the KSN is included

Track one masked track data displayed in hexadecimal

252A343236362A2A2A2A2A2A2A2A2A393939395E42555348204A522F47454F5247452057
2E4D525E2A
2A2A3F2A

Track two masked track data displayed in hexadecimal

3B343236362A2A2A2A2A2A2A2A2A393939393D2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A3
F2A

Track one encrypted track data displayed in hexadecimal

26B03F2BD327CA087C159DEA3E77974A36B6E89CB5BC85EF92D08FB011520890
99FE2A348DF2BA8D7AFEF16A1F5F2CEA46946A92CDC2AB3B750D1AEF8127995E
E6A944E12F9DF40E

Track two encrypted track data displayed in hexadecimal

46607F06C68E057DA05CC3BBB2BD68ECE1D7D89A4671423C4F649082106A785A
62D9382968BCF4CF

Track three encrypted track data displayed in hexadecimal

D0ECE3CF33449F265542CB4AE6240F99CDACD08E92744FFC04C683834EB4D04C
9CB9D2A4B4A4FFE15F7C70169C89288097C4B8BB42C67D33073CFEE68B95D0F8
8C6CF82F86BF8E7FE5909D153710399940C9DAD8BD26E929EE98BEBFA9D3C19A
AC047B61E8ED56BE52D4A7F8B5FFFA01

First 20-bytes of track one data hashed (optional)

3418AC88F65E1DB7ED4D10973F99DFC8463FF6DF

First 20-bytes of track two data hashed (optional)

113B6226C4898A9D355057ECAF11A5598F02CA31

First 20-bytes of track three data hashed (optional)

688861C157C1CE2E0F72CE0F3BB598A614EAABB1

Serial Number (10 bytes)

30303132333435363738

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Example Security Level 4 decryption

Example of decryption of a three-track ABA card with the enhanced encryption format with AES. This example does not include the card status reports.

```
6001B8803F48236B83FF252A343236362A2A2A2A2A2A2A393939395E42555348204A
522F47454F52474520572E4D525E2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A
2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A
A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2
A445843030809C0E253E6900EEA0FFD078D51B9A7840AA5F98CC2DEADB2497DF29D
6C848645E8241D4ED80AA92ACA5D09E0F1F3669CE77D4BE332BDCE2E1295C13ADF
4BE7793FA7FA24128171796A45E39404F4A4DE137B4BA165F67719BC633087F11330F
4DB2323618CEAAA40DB37773676888FF493D82F8F9757E8148F9C05EC1BB2D2D54F
B8F320C793C1F3C7D8916C693F97970DFAED98F1ECAC6AF24BBA783BE7EDA1EB89
7D0CF737C6B95AF16BD15C6AE99C2C7B99EB079F2E19877DF3482A0CE5ABD8A8DD
FED106C07A3244F0C932BF691B07023D671656B2AAB5A5B65170A895BE90610DA284
394723418AC88F65E1DB7ED4D10973F99DFC8463FF6DF113B6226C4898A9D355057E
CAF11A5598F02CA31688861C157C1CE2E0F72CE0F3BB598A614EAABB1629949011A
0003A000130003
```

Actual start of the encrypted transaction

60, length(MSB, LSB), card type, track status, length track 1-length track 2-length track 3,
mask clear status, crypt hash status

60 01B8 80 3F 48-23-6B 03FF

01B8 Total message length in hexadecimal

80 Enhanced encryption structure (default) with ABA card

3F Track 1-3 found and properly decoded

48 Length of track 1 data is 48h (72 decimal) bytes

23 Length of track 2 data is 23h (35 decimal) bytes

6B Length of track 3 data is 6Bh (107 decimal) bytes

03 indicates tracks 1 and 2 as masked

FF Tracks 1-3 are encrypted

Tracks 1-3 are hashed

The KSN is included

The Session ID is included

Track one encrypted track data displayed in hexadecimal (length rounded upto next length
evenly divisible by 16 (the AES block size)

```
DBD7EFAF49EE84708053F744F288916E851789A445843030809C0E253E6900EE
A0FFD078D51B9A7840AA5F98CC2DEADB2497DF29D6C848645E8241D4ED80AA92
ACA5D09E0F1F3669CE77D4BE332BDCE2
```

Track two encrypted track data displayed in hexadecimal (length rounded upto next length
evenly divisible by 16 (the AES block size)

```
E1295C13ADF4BE7793FA7FA24128171796A45E39404F4A4DE137B4BA165F6771
9BC633087F11330F4DB2323618CEAAA4
```

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Track three encrypted track data displayed in hexadecimal (length rounded upto next length evenly divisible by 16 (the AES block size)

0DB37773676888FF493D82F8F9757E8148F9C05EC1BB2D2D54FB8F320C793C1F
3C7D8916C693F97970DFAED98F1ECAC6AF24BBA783BE7EDA1EB897D0CF737C6B
95AF16BD15C6AE99C2C7B99EB079F2E19877DF3482A0CE5ABD8A8DDFED106C07
A3244F0C932BF691B07023D671656B2A

Session ID encrypted data displayed in hexadecimal

AB5A5B65170A895BE90610DA28439472

First 20-bytes of track one data hashed (20 bytes)

3418AC88F65E1DB7ED4D10973F99DFC8463FF6DF

First 20-bytes of track two data hashed (20 bytes)

113B6226C4898A9D355057ECAF11A5598F02CA31

First 20-bytes of track three data hashed (20 bytes)

688861C157C1CE2E0F72CE0F3BB598A614EAABB1

Serial Number (10 bytes) (optional)

30303132333435363738

KSN (10 bytes)

629949011A0003A00013

LRC and ETX

00 03

Clear/Masked Data in ASCII:

Track 1: %*4266*****9999^BUSH JR/GEORGE W.MR^*****?*

Track 2: ;4266*****9999=*****?*

Key Value: 8A DA 61 2E C2 8F B1 81 96 DA 34 3F CB 32 95 7E

KSN: 62 99 49 01 1A 00 03 A0 00 13

Session ID: AA AA AA AA AA AA AA AA

Decrypted Data in ASCII all three tracks:

%B4266841088889999^BUSH JR/GEORGE

W.MR^0809101100001100000000046000000?!

;4266841088889999=080910110000046?0

;333333333376767607070776767633333333337676760707077676763333333333767676
07070776767633333333337676760707?2

Track 1 decrypted data in hex including padding zeros

2542343236363834313038383838393939395E42555348204A522F47454F52474520572E
4D525E30383039313031313030303031313030303030303030303034363030303030303F21
0000000000000000

10. PC/SC APPLICATION PROGRAMMING IN C++

10.1. PC/SC Programming Overview

This manual does not attempt to document all possible smart card calls. Below are listed PC/SC functions to perform a simple transaction to a smart card in the order they are needed. The following link would be a typical link to get the full context of these smart card functions from the MSDN library.

<http://msdn.microsoft.com/library/default.asp?url=/library/en-us/security/security/scardestablishcontext.asp>

Also included are typical function calls that can be used to perform the various PC/SC functions. For programming functions that are vendor specific like magnetic stripe reading and latch see APPENDIX B: ID TECH PC/SC IDTLIB.DLL GUIDE page 121. For a sample program demonstrating the use of these functions, see Sample PC/SC VC++ Demonstration Program.

10.2. SCardEstablishContext

The **SCardEstablishContext** function opens a communication context with the resource manager context (the scope) within which database operations are performed.

```
SCardEstablishContext (SCARD_SCOPE_USER, NULL, NULL, &ContextHandle);
```

10.3. SCardConnect

The **SCardConnect** function establishes a connection (using a specific resource manager context) between the calling application and a smart card contained by a specific reader. If no card exists in the specified reader, an error is returned.

```
SCardConnect (ContextHandle, ReaderName [ReaderCount],  
             SCARD_SHARE_SHARED, SCARD_PROTOCOL_T0 |  
             SCARD_PROTOCOL_T1, &CardHandle, &ActiveProtocol);
```

10.4. SCardTransmit

The **SCardTransmit** function sends a service request to the smart card, and expects to receive data back from the card.

```
SCardTransmit (CardHandle, &IO_Request, scardSendBuff, sendLength, NULL,  
              scardRecvBuff, &recvLength);
```

SPECTRUM III HYBRID MAGSTRIPE/SMART CARD READER

10.5. *SCardDisconnect*

The **SCardDisconnect** function terminates a connection previously opened between the calling application and a smart card in the reader.

SCardDisconnect (CardHandle, SCARD_EJECT_CARD);

10.6. *SCardReleaseContext*

The **SCardReleaseContext** function closes an established resource manager context, freeing any resources allocated under that context, including SCARDHANDLE objects and memory allocated using the SCARD_AUTOALLOCATE length designator.

SCardReleaseContext (ContextHandle);

SCardReleaseContext (ContextHandle);

Table 7 – SCARD Error to Value

Error Code	Hexadecimal Value
SCARD_F_INTERNAL_ERROR	80100001
SCARD_E_CANCELLED	80100002
SCARD_E_INVALID_HANDLE	80100003
SCARD_E_INVALID_PARAMETER	80100004
SCARD_E_INVALID_TARGET	80100005
SCARD_E_NO_MEMORY	80100006
SCARD_F_WAITED_TOO_LONG	80100007
SCARD_E_INSUFFICIENT_BUFFER	80100008
SCARD_E_UNKNOWN_READER	80100009
SCARD_E_TIMEOUT	8010000A
SCARD_E_SHARING_VIOLATION	8010000B
SCARD_E_NO_SMARTCARD	8010000C
SCARD_E_UNKNOWN_CARD	8010000D
SCARD_E_CANT_DISPOSE	8010000E
SCARD_E_PROTO_MISMATCH	8010000F
SCARD_E_NOT_READY	80100010
SCARD_E_INVALID_VALUE	80100011
SCARD_E_SYSTEM_CANCELLED	80100012
SCARD_F_COMM_ERROR	80100013
SCARD_F_UNKNOWN_ERROR	80100014
SCARD_E_INVALID_ATR	80100015
SCARD_E_NOT_TRANSACTED	80100016
SCARD_E_READER_UNAVAILABLE	80100017

SPECTRUM III HYBRID MAGSTRIPE/SMART CARD READER

Table 7 – SCARD Error to Value

Error Code	Hexadecimal Value
SCARD_P_SHUTDOWN	80100018
SCARD_E_PCI_TOO_SMALL	80100019
SCARD_E_READER_UNSUPPORTED	8010001A
SCARD_E_DUPLICATE_READER	8010001B
SCARD_E_CARD_UNSUPPORTED	8010001C
SCARD_E_NO_SERVICE	8010001D
SCARD_E_SERVICE_STOPPED	8010001E
SCARD_E_UNEXPECTED	8010001F
SCARD_E_ICC_INSTALLATION	80100020
SCARD_E_ICC_CREATEORDER	80100021
SCARD_E_UNSUPPORTED_FEATURE	80100022
SCARD_E_DIR_NOT_FOUND	80100023
SCARD_E_FILE_NOT_FOUND	80100024
SCARD_E_NO_DIR	80100025
SCARD_E_NO_FILE	80100026
SCARD_E_NO_ACCESS	80100027
SCARD_E_WRITE_TOO_MANY	80100028
SCARD_E_BAD_SEEK	80100029
SCARD_E_INVALID_CHV	8010002A
SCARD_E_UNKNOWN_RES_MNG	8010002B
SCARD_E_NO_SUCH_CERTIFICATE	8010002C
SCARD_E_CERTIFICATE_UNAVAILABLE	8010002D
SCARD_E_NO_READERS_AVAILABLE	8010002E
SCARD_E_COMM_DATA_LOST	8010002F
SCARD_W_UNSUPPORTED_CARD	80100065
SCARD_W_UNRESPONSIVE_CARD	80100066
SCARD_W_UNPOWERED_CARD	80100067
SCARD_W_RESET_CARD	80100068
SCARD_W_REMOVED_CARD	80100069
SCARD_W_SECURITY_VIOLATION	8010006A
SCARD_W_WRONG_CHV	8010006B
SCARD_W_CHV_BLOCKED	8010006C
SCARD_W_EOF	8010006D
SCARD_W_CANCELLED_BY_USER	8010006E

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Table 8 – SCARD Error Text Description

	Text Description
SCARD_E_BAD_SEEK	An error occurred in setting the smart card file object pointer.
SCARD_E_CANCELLED	A SCardCancel request canceled the action.
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 didn't 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 invalid.
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 invalid.
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.

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Table 8 – SCARD Error Text Description

	Text Description
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 non-existent 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 timeout 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, reader maybe disconnected.
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.

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Table 8 – SCARD Error Text Description

	Text Description
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 cancelled 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 invalid.
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 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 wrong PIN was presented preventing card access.

11. HYBRID READER DEMONSTRATION SOFTWARE

There are three demonstration programs for the SPT3. Use the HRDLL Demo for a reader not operated in PC/SC mode. The other two programs demonstrate PC/SC reader access in C++ and VB. The PC/SC Visual C++ Demonstration Program and the PC/SC Visual Basic Demo Program SP2-SPT3 PCSC VB DEMO. These programs demonstrate how the reader functions and provide sample code to develop an application to integrate the Spectrum 3 into a system.

11.1. *HRDLL Demo Program Non-PC/SC*

HRDLL is a software program that allows the user to perform simple read operations with both smart and magnetic cards, and write to the smart card. This program is described in detail in the document included in the CD \manuals\HrDLL_Dynamic_Link_Library_454.pdf.

11.2. *PC/SC Visual C++ Demonstration Program*

This PC/SC demonstration and sample program was written in Microsoft Visual C++ 6.0. The demonstration program is only meant to run when there is a PC/SC smart card reader attached to the system. The program responds differently if the ID TECH Hybrid Reader is connected and selected than if another manufacturer's PC/SC reader is selected. The purpose of this program is to demonstrate how to find, connect to and use ID TECH PC/SC hybrid reader in a Windows environment.

This demonstration program on start up reacts differently if there is more than one PC/SC reader found attached to the system than if there is only one reader attached to the system. Buttons are grayed out when a function is not available. The demo program is configured to support a maximum of four connected PC/SC smart card readers; any beyond this limit are not displayed.

For any function that accesses the reader (except test hardware) the first operation that must be done is to connect either to the reader or to the card. Do this by selecting the "Connect to Rdr" or "Connect to Card" button. If a microprocessor card is seated in the reader and will remain in the reader until the smart card access portion of the connection is done then the user should select connect to card. If smart card accesses are going to be made then the user should connect to the card. For all other function connect to the reader. If it is desired to connect to the card when connected to the reader or vice versa, select the "Disconnect" button and then the appropriate button.

If the reader is not an ID TECH reader then the demo program does not give the option of connecting to the reader, because the reader's PC/SC driver does not support this vendor specific function.

11.2.1. Requirement

To test this program, you must connect the ID TECH PC/SC reader to a Windows 2000 or a Windows XP PC that has installed an ID TECH PC/SC driver. You also need the ID TECH Standard microprocessor Smart Card to perform the operation.

This demo program requires the use of idtlib.dll ID TECH's PC/SC hybrid reader support DLL. An application can be written to do all reader function without this DLL, but the use of the DLL simplifies the use of the reader functions. The software supports readers in PC/SC mode.

11.2.2. Installation

To test this program, you must connect the ID TECH PC/SC reader to a Windows 2000 or a Windows XP PC and install the PC/SC driver. If not already done, see 3.3.1 Install PC/SC Driver page 20 for instructions. You also need the ID TECH standard microprocessor Smart Card to perform the operation. The software supports up to four PC/SC readers.

Install this program by double clicking on setup.exe in the installation CD in the \Demo\SPT3CppPcscDemo v2.0.1.0 directory and follow the directions. The program can be run without installation by opening the release directory and running SPT3CppPcscDemo.exe from that directory. The program is composed of two parts, IDT PCSC Demo.exe and IDTLIB.DLL.

11.2.3. Operation

Timeout

The "Set Magstripe Timeout" and "Get Magstripe Timeout" buttons are the buttons to set the timeout functions for how long the reader/driver should wait for an expected event before aborting. The default timeout is 30 seconds. To change the default timeout type a decimal number between 0 and 255 seconds into the command field then select the "Set Magstripe Timeout" button. To check the current value of the timeout, select the "Get Magstripe Timeout" button.

Version

The get version command button in upper right hand corner returns the "Reader Version", "DLL Version" and "Driver Version" will be returned in the message window. The Demo version can be displayed by right clicking on the title bar and then selecting about SPT3Demo.

Latch

Use the "Latch On" and "Latch Off" commands to latch a card in the reader to keep it from being extracted while the ICC is being accessed. Pulling the card during this period is called tear. The latch can only close when there is a card seated in the reader. It is possible, but more difficult to pull a card out of the reader while it is held by the latch.

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Send Command

The “Send Command” button is to send user commands through the PC/SC driver to the reader. Use this command to issue commands to the reader or card as if it was not in PC/SC mode. For instance to get the readers version enter ‘39’ in the message field and select the send command button. Another example to get the readers status, enter a ‘24’ in the message field and select the command button.

Send APDU

The “Send APDU” button sends a particular APDU to a microprocessor (asynchronous) card. APDUs are always at least 4 bytes and usually at least 5 bytes. An example of an APDU for the Sample T=0 smart card provided by ID TECH is to type 00 A4 00 00 02 31 40 in the message field then select the send APDU button. This is the command to select file 3140, this file can be accessed without a password. To read the first 4 bytes of the content of that file enter 90 52 00 00 04 in the message field then select the send APDU button. The response should look like 00 06 90 48 F5 00 90 00. The 90 00 at the end of a smart card response is the normal response code for success.

Magnetic Stripe

The “Get Magstripe Data” button powers the card off and if a magnetic stripe card is withdrawn before the time out period it will display the magnetic stripe data in the response window. If the reader remains at its default configuration then the tracks of data will be displayed on separate lines with track 1 first and track 3 last. If one desires to get a specific track or tracks the numbers 0-7 can be entered in the command box and the reader will return the requested tracks. It is better to select 0 get any track if that is acceptable rather than 7, which is, get all three tracks, because the reader will not send the track data unless all three tracks are error free.

Test Hardware

The “Test Hardware” button function is designed to use a Sample ID TECH T=0 test card and verify that the reader card communication, seated switch, latch, smart card access, and magnetic stripe access are functional. If the reader passes this test it is functioning properly.

Set LED

The “Set LED” button function is designed to change the LED setting on the reader. Note: the reader must be changed from the default “reader controlled LED” to host controlled LED”. To do this enter 53 11 01 3F in the command box and then select the send Command button. Note: this command assumes that the reader is at the default setting. Once the reader is configured to accept LED commands, enter the number of the LED command 30 through 37 then select the set LED button. The LED should now display with the desired appearance.

Configuration

The “Read Configuration”, “Configure for EMV Card”, and “Configure for ISO7816” buttons are a group. EMV is somewhat tighter specification than ISO7816. PC/SC configures the reader to support this specification. All cards should be able to connect with the reader set to ISO7816 as this is a more general specification, but not all communication will function properly if the reader is to be used in an EMV environment.

Card Off

The “Card Off” button powers down the current card in the reader.

Get Status Direct

The get status direct function is occasionally necessary if one needs to determine the full actual status of the reader on functions for which notifications are not being sent for instance is the card in the reader currently latched? This function should not normally be used to get the readers status because the performance of the PC would be slowed by the extra commands being sent to the reader when the driver already knows the readers status.

Exit

The “Exit” button closes the demo program and release the reader to allow it to be attached by another application.

There are four card states UNKNOWN, UNSEATED, SEATED and POWERED and there are four connection states UNKNOWN, DISCONNECT, TOCARD and TOREADER.

11.2.4. Program Source Code:

This Demonstration program is provided with Source code (compiled with MS Visual C++ 6.0) to aid the developer in quickly making an application that properly performs the intended functions through the PC/SC interface and utilizing the supplied DLL.

11.3. PC/SC Visual Basic Demonstration Program

ID TECH has developed a PC/SC VB Demo Program named “ID TECH PC/SC VB Demo”.

11.3.1. Requirement

To test this program, you must connect the ID TECH PC/SC reader to a Windows 2000 or a Windows XP PC that has installed the ID TECH PC/SC driver. You also need the ID TECH standard microprocessor smart card to perform the operation. The software supports multiple readers, but all readers must be in PC/SC mode.

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11.3.2. Installation

Installation can be accomplished by clicking on the setup.exe program on the installation CD and following the directions prompted by the windows. The program can be run without installation by selecting the support directory then running IdtPcscVbDemo.exe.

11.3.3. Launching

Before launching the program, make sure that the ID TECH PC/SC Reader is connected to the PC and the ID TECH standard microprocessor card is seated in the reader. Select “Start – Programs – IDT PCSC VB Demo” to launch the program. If the program reports Smart card resource manager not running then see 14.4 on page 120.

The program should automatically detect the connected ID TECH PC/SC Reader. If there is more than one smart card reader connected to the PC then select “ITS 0030 0” reader from the list of smart card readers in use.

11.3.4. Operation

In the program GUI, there are three groups of command buttons. Each group performs different function test.

In “ID TECH CPU Card” group, if you press the “Read” button, the program reads 15 characters from the smart card. Pressing the “Write” button allows you to write a string to the card.

In “General CPU Card” group, first press “Connect to Card” to establish the connection to the card. Then type in an APDU command in the APDU test box and press “Send T=0 APDU” button. The data should be in ASCII format and nonprintable characters should be represented by \XX. For example, “\00\D6\00\00\07ID TECH” is a correct APDU. (A sample APDU shows up when you put the cursor in the “APDU String” box but do not click the mouse). You may repeat this step to perform all the operation that you want and press “Disconnect” to finish the operation.

You may need to write down all the APDU commands in paper, check it very carefully then type in these commands. Improper commands might permanently damage the test card!

The “Special Commands” group allows you to perform Latch and MSR function and to get the reader, driver and DLL version. You need to connect to the card or reader by clicking the “Connect to Reader” button or “Connect to Card” button before you can do the rest of the operation. After finishing all operations, you need to press “Disconnect” button in “General CPU Card” group to disconnect.

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Pressing the “Latch On” button locks the latch in the reader. You should hear the “click” sound and the card should be locked in the reader. Pressing the “Latch Off” button unlocks the latch in the reader. You should hear another “click” sound and the card should be able to be pulled out. Only the standard chassis supports the latch and its function.

Pressing the “Read Version” button displays the PC/SC driver version number, the IdtDll.dll (please see “Program Source Code” section for description) version number and the PC/SC reader version number.

To read a magnetic stripe card, click connect to reader, then insert the magnetic stripe card in the reader, then click the “Read MSR” button and properly withdraw the card within a “MSR Timeout” period. If success, the magnetic stripe data should be displayed in the “Response” text box. Each time after you boot up your PC, the “MSR Timeout” is set to the default value of 30 seconds. Use the “MSR Timeout” button to change the PC/SC driver MSR timeout delay.

11.3.5. Program Source Code

The “ID TECH PC/SC VB Demo” program is provided with source code to help the user developing their application program. The code is written in Microsoft Visual Basic 6. Following is a list of files

IdtPcscDemo.frm – The main project form

PcscInterface.bas – A utility module to declare the Windows Smart Card API. The variable names, such as those in typedef's and function parameters, have been retained from the C++ API definition.

PcscError.bas – A utility module to define error codes in Windows Smart Card API

IdtLib.dll – A utility dynamic linked library to provide support for ID TECH PC/SC reader special function, such as Latch Function, MSR function...

IdtLib.bas – A utility module to declare functions in the IdtLib.dll

IdtPcscVbDemo.vbp – The project file

User may develop their application program by modifying the main project form. All the utility modules and DLL can be included in their project without or with very little modification.

12. SPECIFICATIONS

Table 9 – Electrical Specifications

RS232 or USB:	+5 VDC, 100 mV ripple max
RS232 12V DC Version:	+12 VDC, 100 mV ripple max
Operating Current:	120mA maximum for three tracks of magnetic data.
Chassis Ground:	Connected to GND and magnetic head case.

*Without latch or smart card option(s).

Table 10 – Environmental Specifications

Operating Temperature:⁴	32°F to 131°F (0°C to 55°C).
Storage Temperature:	-40°F to 158°F (-40°C to 70°C).
Humidity:	Maximum 95% non-condensing.

Table 11 – Reliability Specifications

Magnetic Head Life:	1,000,000 passes minimum.*
IC Card Connector:	1,000,000 cycles minimum.* Contacts are gold plated and exceed EMV life requirements for minimum resistance over the life of the reader.
Chassis and Bezel:	1,000,000 card cycles minimum.*

*All wear reliability numbers are based on operation in a benign environment.

⁴ Extended temperature available

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Table 12 – Mechanical Specifications

Magnetic Stripe Formats:	ISO 7811, F2F. Media with magnetic coercivity of 300 through 4,000 Oersted can be read.
Smart Card Contacts	ISO 7816-2 Smart Cards, Reader meets EMV contact force and resistance specifications. Contacts are Landing Contacts.
Reading Speed:	5 to 60 inches per second.
Media Thickness:	.025 to .035 inches. Maximum card thickness .035 inches.
Dimensions:	See the outline drawings in the following section for dimensions on the standard and compact chassis. The bezel type, size, and panel cutouts are also given in drawing format.
Options: Standard Chassis	Latch, Gate, Security Access Module (SAM) , LED Indicator, “Card Seated” Signal (optional for magnetic stripe, standard for ICC), “Card Present” Signal, Metal Bezel (other bezels are mounted to the reader chassis; the metal bezel not mounted and is supplied separate.
Options: Compact Chassis	Security Access Module (SAM) , LED Indicator, “Card Seated” Signal (optional for magnetic stripe, standard for ICC), “Card Present” Signal

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13.4. Mounting

The standard chassis is mounted using the front flange or the side mounting studs. The compact chassis is mounted using the side threaded inserts; the rear, bottom threaded insert can also be used.

The reader should be mounted with the debris slot facing down.

13.5. Hybrid Reader Connectors

The connection to the insert reader is provided through a 7 or 8-pin header at the rear of the chassis. On RS232 units power is 5 Volts DC and supplied through pin four (4) on the header, on the insert reader's PCA. ID TECH has optional cables for mating the 7 or 8-pin connector on one end, and a standard USB or DB9 female connector with receptacle for a Power Jack on the opposite end. The DB9 connector has standard RS232 pin outs (see below) and connects to host's RS232 Port.

There is a connector for the optional power failure latch release capacitor. This capacitor (P/N 80059215-001) is needed only if the main power supply does not have reserve output capacity in the event of a power line failure.

The following sub-sections define reader connector signals and pin-out.

Pin Designation for the 7 Pin Header on the USB Insert Reader

Molex Connector	
Position	Signal Name
PIN 1:	CH_GND
PIN 2:	---
PIN 3:	D+
PIN 4:	---
PIN 5:	V_IN
PIN 6:	D-
PIN 7:	GND

Header Description: Molex P/N: 51004-0700

DB9 Female Host Connector Pin Designation

RS232 DB9 Connector	
Position	Signal Name
PIN 2:	TXD
PIN 3:	RXD
PIN 4:	DSR
PIN 5:	GND
PIN 6:	DTR
PIN 7:	CTS
PIN 8:	RTS

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Pin Designation for the 8 Pin Header on the RS232 Insert Reader

Molex Connector	
Position	Signal Name
PIN 1:	CASE GND
PIN 2:	TXD
PIN 3:	RXD
PIN 4:	VCC/DTR
PIN 5:	RTS
PIN 6:	CTS
PIN 7:	GND
PIN 8:	DSR

Header Description: Molex P/N: 51004-0800

Pin Designation for the 7 Pin Header on the RS232 Insert Reader

Molex Connector	
Position	Signal Name
PIN 1:	CASE GND
PIN 2:	TXD
PIN 3:	RXD
PIN 4:	VCC/DTR
PIN 5:	RTS
PIN 6:	CTS
PIN 7:	GND

Header Description: Molex P/N: 51004-0700

Power Adapter (RS232 Units only)

5V, 500mA

Polarity: Center Positive (+)

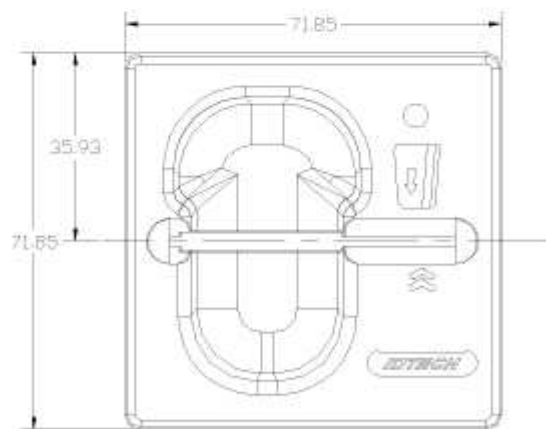
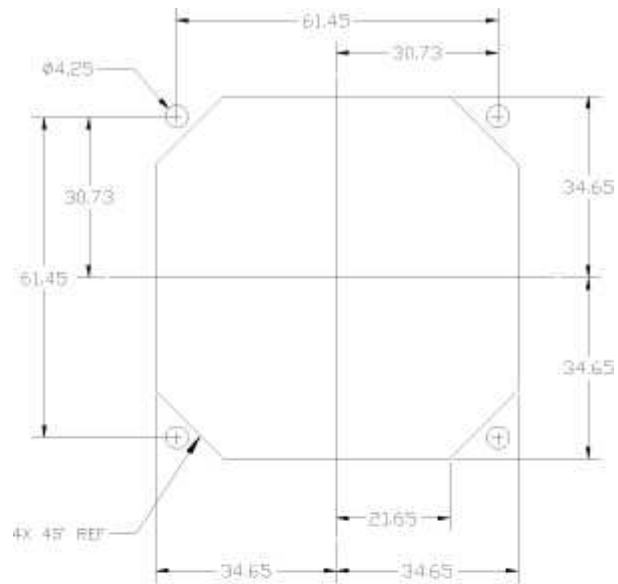
Warning: Any power supply (VCC) higher than 5.5 V may damage the unit

Note: There is a 12V option PCA for the reader; it can not be used with the SAM daughter board because they both mount in the same location.

13.6. Hybrid Reader Bezel information

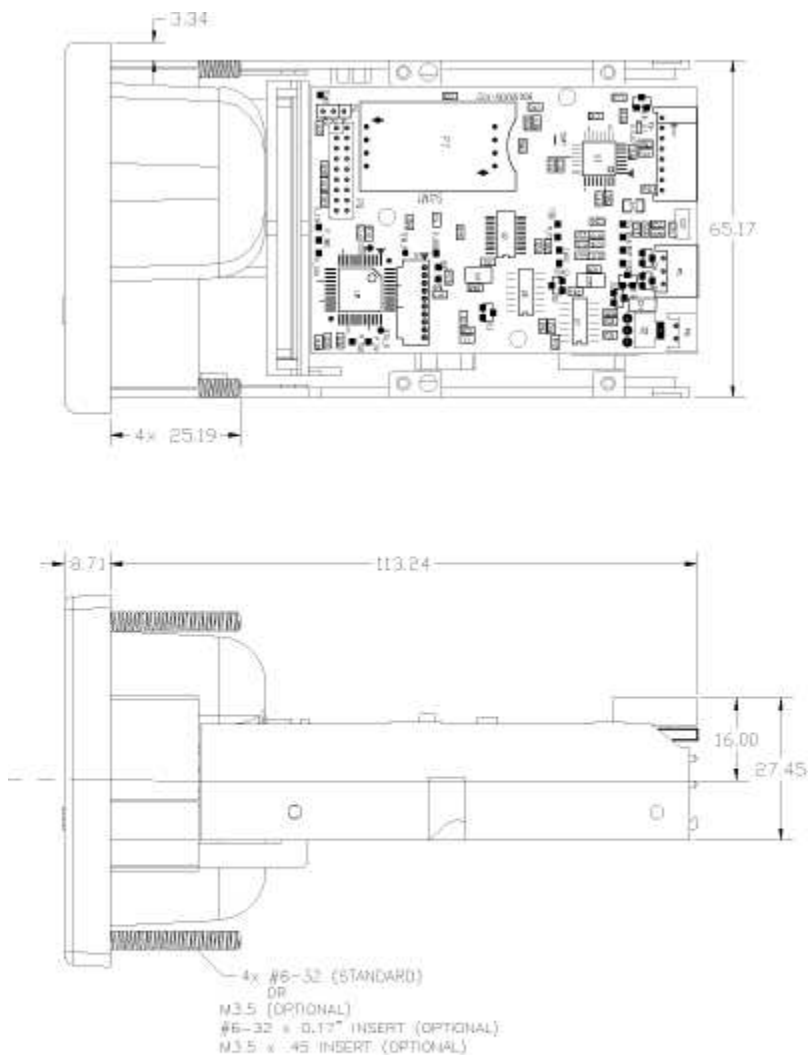
There are three available bezels shown in the drawings below. Select the desired bezel type for cutout and mounting. Other bezel option may be available; contact the nearest Sales Representative for information.

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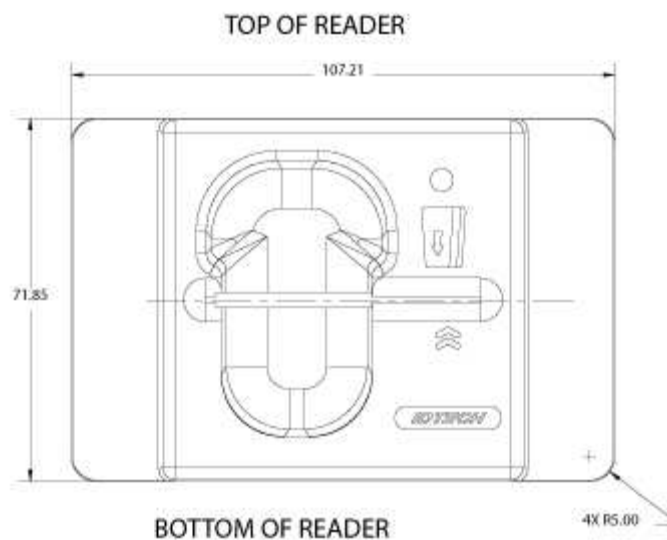
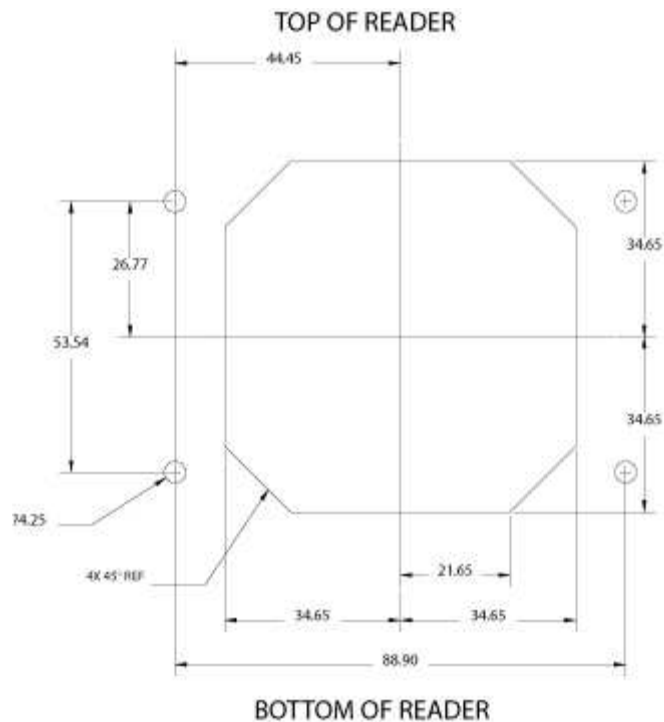
FLUSH BEZEL
CUTOUT & FRONT VIEW

SPECTRUM III HYBRID MAGSTRIPE/SMART CARD READER



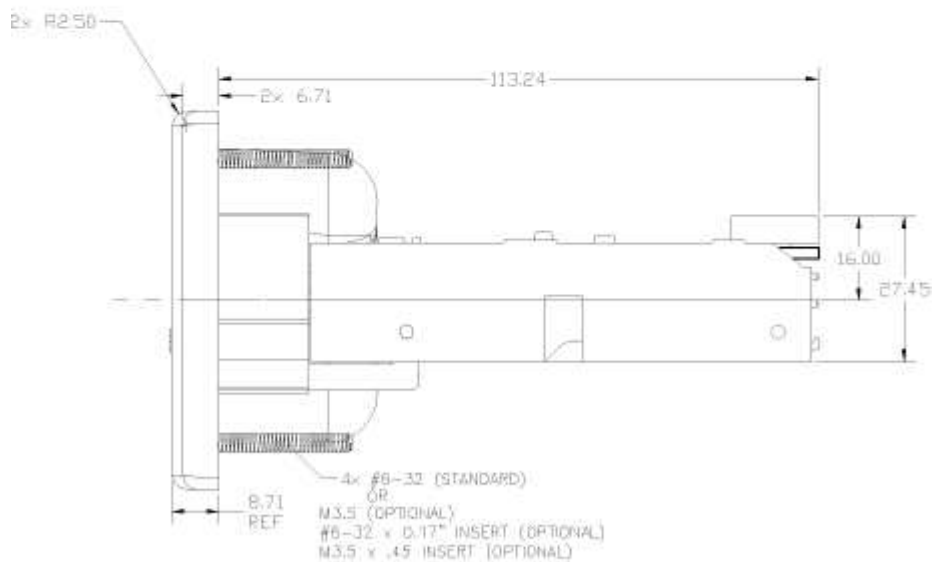
FLUSH BEZEL
MOUNTED, TOP & SIDE VIEW

SPECTRUM III HYBRID MAGSTRIPE/SMART CARD READER



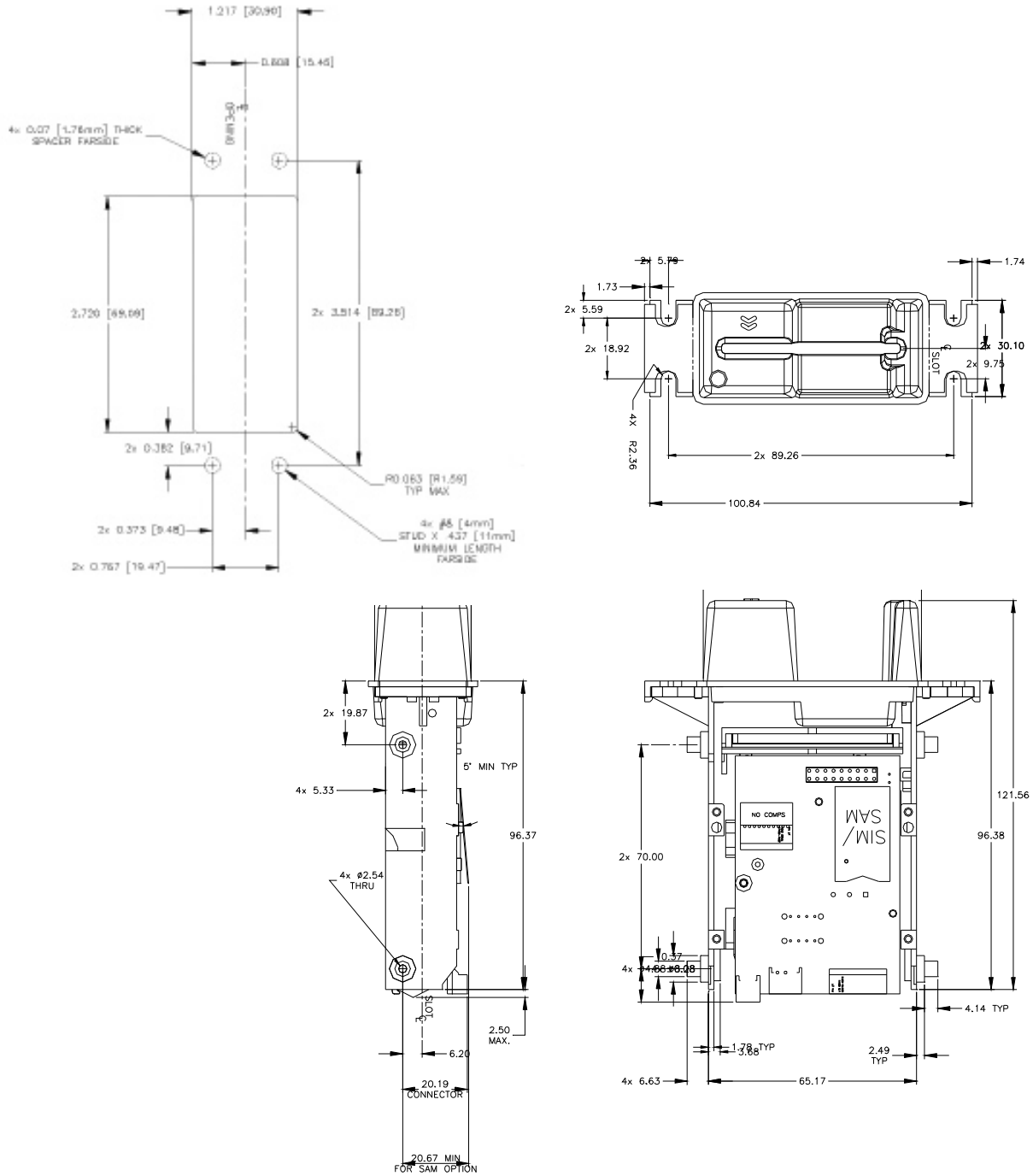
LARGE FLUSH BEZEL CUTOUT & FRONT VIEW

SPECTRUM III HYBRID MAGSTRIPE/SMART CARD READER



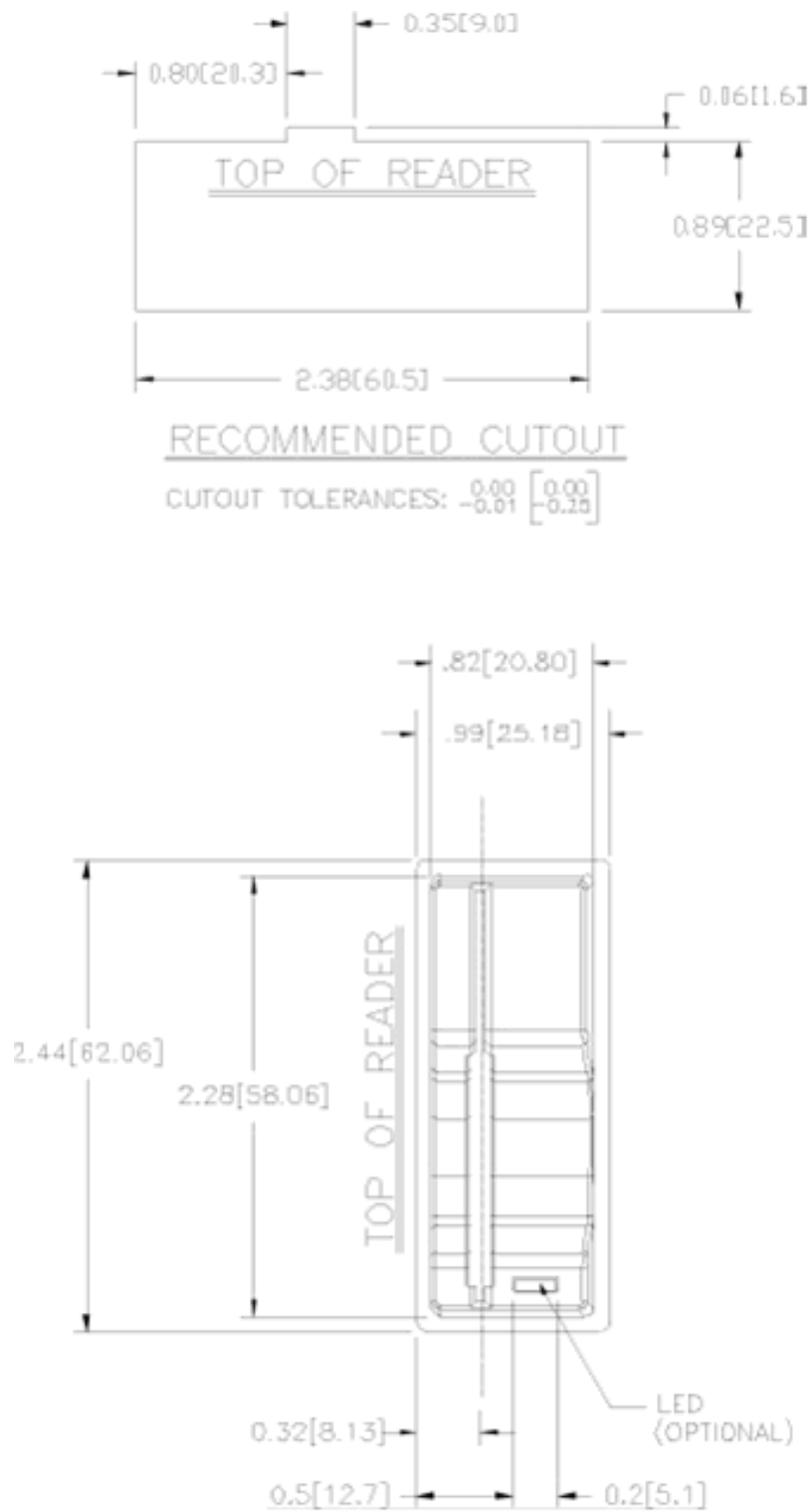
LARGE FLUSH BEZEL
MOUNTED, TOP & SIDE VIEW

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Compact TM3HIR with Bezel Drawing:



14. APPENDIX A: SPECIAL INSTALLATION INSTRUCTIONS

For standard installation instructions refer to QUICK START on page 19.

14.1. *Installing Unsigned Driver Over Signed Drivers*

This procedure should only be done if requested to do so by ID TECH personal. One has to be careful when installing a driver that has not been signed over a driver that has been signed, the Windows operating system prefers the signed driver and if you are not paying attention Windows will say I found a better driver than the one you specified and go ahead and install that. Try these instructions.

Unzip the driver below in an appropriate place and remember where that directory is. Then go to settings/control panel/system/hardware/device manager

- Select smart card readers then
- Right click on the name of the driver installation file (.inf) ...
- Select properties/driver/update driver/next
- Select display list of known drivers .../next
- Select have disk/browse/browse select the location when the driver was unzipped
- Select OK/next/next and yes to the prompt that digital signature not found
- Then finish/close.

14.2. *Configuring to Allow Installation of Unsigned Drivers*

The default configuration of XP can be changed to disallow the installation of an unsigned driver. If your PC has been so configured it will be necessary to control panel/system/hardware/driver signing and confirm the setting is not “block”, “warn” is the default setting.

14.3. *Configuring to Display System Files*

Note because drivers are system files (*.sys) they are not be visible by default with windows explorer To display system files in a Windows 2000 system go to explorer/tools/folder options/view and uncheck boxes hide file extensions of known types and uncheck hide protected operating system files.

14.4. *Configuring the Smart Card Service*

If the PC/CS demo application cannot connect to SPT3u (or SPT3s in PC/SC mode) because it gets the error "Smart card resource manager not running," then go to 'Start' [then 'Settings'] then 'Control Panel' [then 'Performance and Maintenance] then 'Administrative Tools' then 'Services' then scroll down to 'Smart Card' service and check to see if the status on the Smart Card service is started and the startup type set to automatic. This service should be set to 'Automatic' and 'Started'. If not then to change these settings right click on the line that says Smart Card then under the general tab go down to start-up type and change the setting to automatic. Then under service status select Start. Verify that the demo application can connect to the reader.

14.5. *Reconnecting a Disconnected Reader*

If an RS232 PC/SC reader is disconnected or powered down while operating, the demo application will no longer be able to connect to the reader. To correct this situation, reboot the P/C or in the control panel disable the reader and re-enable the reader. The demo application should now be able to connect to the reader.

If any PC/SC reader is disconnected and reconnected the file handle the application communicated with the driver becomes invalid, it is necessary to disconnect the application from and reconnect to the driver. This usually means closing and restarting the application. The SPT3CppPcscDemo show how to do this automatically.

If the SPT3c reader is disconnected and reconnected close and reopen the application to continue to communicate with the reader.

14.6. *Configuring PC to Support Serial Plug and Play*

If the PC boots With a SPT3s configured for Plug and Play without displaying a message that new hardware has been installed and you are installing a RS232 reader, your PC is probably not configured for Plug and Play on the serial connections. If the supplied reader has an LED, the LED control is in the default setting (under reader control), and that LED remains amber throughout the boot process this is the case. Refer to the PC manufacturers instructions on configuring the BIOS for PnP (Plug and Play). To enter the BIOS early during the boot process enter the proper key. The PC will normally display the proper key to press to enter the BIOS). This process varies depending on the BIOS installed in the PC so full instructions would require different instructions for each type of PC.

15. APPENDIX B: ID TECH PC/SC IDTLIB.DLL GUIDE

Purpose of this library is to simplify access to reader when using vendor specific functions like magnetic stripe reading and latch control. This library is not required: all functions can be done by the application without requiring this DLL. This DLL is provided to make the programming of an application to utilize the reader's functions simpler.

The error return codes are either SCARD_S_SUCCESS for success, "-1", if the function failed entirely or the standard smart card error codes see – SCARD Routine Return Values page 127.

Function prototypes for the callable functions in the IDTLIB.DLL for handling vendor specific IOCTL calls to the ID TECH hybrid reader in a Windows PC/SC environment.

Note: hCard is the card handle returned by Windows from SCardConnect().

IDTLIB_API LONG IdtGetVersion (

OUT BYTE *versionBuffer, // pointer to buffer to hold the version string.
// buffer must be at least 7 bytes long.
IN OUT DWORD *versionBufferLength);

DWORD versionBufferLength is an unsigned long integer (32 bits) that holds the length of the buffer in bytes to hold the version string when called and on return to hold the actual size in bytes of the version string. This function returns version of IDTDLL.DLL.

IDTLIB_API LONG IdtReadMagstripe (

IN ULONG hCard, // unsigned long integer (32 bits) card handle
OUT BYTE *outputBuffer,
IN OUT DWORD *outputBufferLength,
IN BOOLEAN TurnCardOff);

IDTLIB_API LONG IdtSendCommand (

IN ULONG hCard, // unsigned long integer (32 bits) card handle
IN BYTE *commandBuffer, // pointer to buffer with command to send to reader.
IN DWORD commandLength,
OUT BYTE *responseBuffer,
IN OUT DWORD *responseBufferLength);
DWORD commandLength is an unsigned long integer (32 bits) that holds the length of the command in the commandBuffer
BYTE *responseBuffer is a pointer to a byte buffer into which the response from the reader will be placed.
DWORD responseLength is an unsigned long integer (32 bits) that holds the length of the response in bytes in the responseBuffer

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IDTLIB_API LONG IdtLatch (
IN ULONG hCard); // unsigned long integer (32 bits) card handle

IDTLIB_API LONG IdtUnlatch (
IN ULONG hCard); // unsigned long integer (32 bits) card handle

IDTLIB_API LONG IdtCardOff (
IN ULONG hCard); // unsigned long integer (32 bits) card handle

IDTLIB_API LONG IdtSetMagstripeTimeout (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
IN UCHAR timeout);
UCHAR timeout is an unsigned character holding the new timeout value in seconds.
UCHAR timeout is an unsigned character (8 bits) value of the timeout value in seconds.

IDTLIB_API LONG IdtGetMagstripeTimeout (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
OUT UCHAR *timeout); // returns timeout value in seconds.

IDTLIB_API LONG IdtGetDriverVersion (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
OUT UCHAR *drvVersion);

IDTLIB_API LONG IdtGetFirmwareVersion (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
OUT UCHAR *fwVersion); // pointer to buffer to receive firmware version.

LONG IDTLIB_API IdtGetReaderState (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
OUT UCHAR *readerState);
// Get the current (cached) state of the reader
// readerState is defined as follows:
// bit 0: power, 0 => not ready, 1 => ready
// bit 1: card, 0 => card not seated, 1 => card seated
// bit 2: latch, 0 => released, 1 => closed
// bit 3: card, 0 => card not present, 1 => card present

This version only returns the cached version of reader state in the driver. It avoids sending a smart card command to the reader and should be used when the user is only interested in the info relating to whether the card is seated, present, or removed. Since reader state is updated when card notification is received, it may not reflect the TRUE current reader state as far as other state information such as latch state is concern. To obtain the TRUE reader state of the reader, use IdtGetReaderStateDirect.

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LONG IDTLIB_API IdtGetReaderStateDirect (

```
IN ULONG hCard,          // unsigned long integer (32 bits) card handle
OUT UCHAR *readerState);
// Get the current state of the reader
// readerState is defined as follows:
// bit 0: power, 0 => not ready, 1 => ready
// bit 1: card, 0 => card not seated, 1 => card seated
// bit 2: latch, 0 => released, 1 => closed
// bit 3: card, 0 => card not present, 1 => card present
```

Note this version of API will send a smart card command to the reader. If you are only interested in the current card state, i.e. whether the card is seated, present, or removed, use `IdtGetReaderState`, which returns the cached state without sending a smart card command to the reader.

LONG IDTLIB_API IdtSetLEDColor (

```
IN ULONG hCard,          // unsigned long integer (32 bits) card handle
IN BYTE  LEDColor);     // a color reader will set to.
```

This API is used to set the LED color, provided the reader is set into the host controlled mode.

The LED colors are defined as (note that they are in ASCII):

```
#define LED_OFF          '0'
#define LED_GREEN       '1'
#define LED_RED         '2'
#define LED_AMBER       '3'
#define REDAMB_FLASH    '4'
#define GREEN_FLASH     '5'
#define RED_FLASH       '6'
#define AMBER_FLASH     '7'
```

LONG IDTLIB_API IdtSetMSRReadMode (

```
IN ULONG hCard,          // unsigned long integer (32 bits) card handle
IN BYTE  readMode);     // is the MSR mode reader will set to.
```

This API is used to set the MSR read mode and read modes are defined as (note that they are in ASCII):

```
#define MSR_MODE_DISABLE '0'
#define MSR_MODE_AUTO_TX '1' // auto-transmit mode
#define MSR_MODE_BUFFER  '2' // buffered mode (forced for PC/SC)
```

LONG IDTLIB_API IdtResetMSRBuffer (

```
IN ULONG hCard);       // unsigned long integer (32 bits) card handle
```

This API is used to reset the MSR buffer (clear the buffer) and put the reader into disarmed state.

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LONG IDTLIB_API IdtStartMagstripe (

IN ULONG hCard, // unsigned long integer (32 bits) card handle
IN DWORD outputBufferLength,
IN BOOLEAN TurnCardOff);

This API is used to initiate the reading of MSR data. The user is expected to follow up this call by polling the reader for MSR data using IdtPollMagstripe (). This is only for use in non-buffered mode.

LONG IDTLIB_API IdtPollMagstripe (

IN ULONG hCard, // unsigned long integer (32 bits) card handle
IN BYTE TrackSelect, // byte to select tracks of magnetic stripe
OUT BYTE *outputBuffer, // pointer to a buffer containing the magnetic data
OUT DWORD *outputBufferLength);
DWORD outputBufferLength is a pointer to an unsigned long integer that holds the length of magnetic data.

This API is used to poll the reader after the user has issued the IdtStartMagstripe () call. If the MSR data is available, it will be returned according the tracks selected. This is only for use in non-buffered mode.

Return code:

- SCARD_S_SUCCESS: MSR data available.
- SCARD_E_NOT_READY: MSR data not available yet.
- SCARD_E_TIMEOUT: Attempt to read has timed out.

Track selections are defined as follows (note that they are in ASCII):

```
#define MSR_RD_ANY_TRK '0'  
#define MSR_RD_TRK_1 '1'  
#define MSR_RD_TRK_2 '2'  
#define MSR_RD_TRK_12 '3'  
#define MSR_RD_TRK_3 '4'  
#define MSR_RD_TRK_13 '5'  
#define MSR_RD_TRK_23 '6'  
#define MSR_RD_ALL_TRK '7'
```

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Write Your Own Functions

If you wish to write your own functions and eliminate the use of the DLL all these commands use the ScardControl () to communicate with the driver.

<http://msdn.microsoft.com/library/default.asp?url=/library/en-us/security/Security/scardcontrol.asp>

```
LONG ScardControl (  
    SCARDHANDLE hCard,  
    DWORD dwControlCode,  
    LPCVOID lpInBuffer,  
    DWORD nInBufferSize,  
    LPVOID lpOutBuffer,  
    DWORD nOutBufferSize,  
    LPDWORD lpBytesReturned);
```

Parameters

<i>hCard</i>	[in] Reference value returned from SCardConnect.
<i>dwControlCode</i>	[in] Control code for the operation. This value identifies the specific operation to be performed.
<i>lpInBuffer</i>	[in] Pointer to a buffer that contains the data required to perform the operation. This parameter can be NULL if the <i>dwControlCode</i> parameter specifies an operation that does not require input data.
<i>nInBufferSize</i>	[in] Size, in bytes, of the buffer pointed to by <i>lpInBuffer</i> .
<i>lpOutBuffer</i>	[out] Pointer to a buffer that receives the operation's output data. This parameter can be NULL if the <i>dwControlCode</i> parameter specifies an operation that does not produce output data.
<i>nOutBufferSize</i>	[in] Size, in bytes, of the buffer pointed to by <i>lpOutBuffer</i> .
<i>lpBytesReturned</i>	[out] Pointer to a DWORD that receives the size, in bytes, of the data stored into the buffer pointed to by <i>lpOutBuffer</i> .

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Return Values

This function returns different values depending on whether it succeeds or fails.
Success SCARD_S_SUCCESS. Failure An error code, see Table 13 – SCARD Routine Return Values page 127.

Example:

SMARTCARD_MACRO	SCARD_CTL_CODE
SMARTCARD_VS_GENERIC_COMMAND	2100
SMARTCARD_VS_LOCK_LATCH	2101
SMARTCARD_VS_UNLOCK_LATCH	2102
SMARTCARD_VS_GET_MAGSTRIPE	2103
SMARTCARD_VS_SET_MAGSTRIPE_TIMEOUT_COMMAND	2104
SMARTCARD_VS_GET_MAGSTRIPE_TIMEOUT_COMMAND	2105
SMARTCARD_VS_GET_DRIVER_VERSION_COMMAND	2106
SMARTCARD_VS_GET_FIRMWARE_VERSION_COMMAND	2107
SMARTCARD_VS_GET_READER_STATE_COMMAND	2108
SMARTCARD_VS_START_MAGSTRIPE	2109
SMARTCARD_VS_POLL_MAGSTRIPE	2110
SMARTCARD_VS_SET_MSR_READ_MODE	2111
SMARTCARD_VS_GET_MSR_READ_MODE	2112
SMARTCARD_VS_MSR_RESET	2113
SMARTCARD_VS_MSR_ARM_TO_READ	2114
SMARTCARD_VS_MSR_READ_DATA	2115
SMARTCARD_VS_HOST_LED_CTRL	2116
SMARTCARD_VS_READER_RESET	2117

```
#define SMARTCARD_VS_GET_MAGSTRIPE    SCARD_CTL_CODE (2103)
```

```
// wait for the card to be removed and read the magnetic stripe
```

LONG IDTLIB_API IdtReadMagstripe(

```
IN ULONG hCard,  
OUT BYTE *outputBuffer,  
IN OUT DWORD *outputBufferLength,  
IN BOOLEAN TurnCardOff) {  
    DWORD bytesBack;  
    LONG ret;  
  
    If (TurnCardOff)  
        IdtCardOff (hCard);  
    ret = SCardControl (hCard, SMARTCARD_VS_GET_MAGSTRIPE, NULL, 0,  
        outputBuffer, *outputBufferLength, &bytesBack);  
    *outputBufferLength = bytesBack;  
    return ret;  
}
```

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Table 13 – SCARD Routine Return Values

Value	Description
ERROR_BROKEN_PIPE	The client attempted a smart card operation in a remote session, such as a client session running on a terminal server, and the operating system in use does not support smart card redirection.
SCARD_E_BAD_SEEK	An error occurred in setting the smart card file object pointer.
SCARD_E_CANCELLED	The action was canceled by a 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 invalid.
SCARD_E_INVALID_PARAMETER	One or more of the supplied parameters could not be properly interpreted.

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SCARD_E_INVALID_TARGET	Registry startup information is missing or invalid.
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	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.

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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	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	Smart card has been removed, so further communication is not possible.
SCARD_W_RESET_CARD	Smart card has been reset, so any shared state information is invalid.
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	Smart card is not responding to a reset.
SCARD_W_UNSUPPORTED_CARD	Reader cannot communicate with the card, due to ATR string configuration conflicts.
SCARD_W_WRONG_CHV	Card cannot be accessed because the wrong PIN was presented.

16. APPENDIX C: Complete List of Response Codes

[2A01] configuration update failed
[2A02] configuration update failed
[2A03] unable to write byte to EEPROM configuration
[2A04] configuration update failed
[2A05] configuration update failed
[2A06] no icc voltage not defined on connector
[2A07] length != 1 or 2 on SAM options setting
[2A09] command aborted by the icc
[2A0A] sle4406 parameters error
[2A0B] sle4406 parameters error
[2B00] sle4404 invalid address must be even 16 bit boundary
[2C02] no microprocessor icc seated
[2C03] no memory card seated
[2C04] no T=1 raw card seated
[2C06] no card seated to request ATR
[2C08] T=1 card unseated
[2C09] T=0 card unseated
[2D00] memory card type not supported
[2D01] Card Not Supported,
[2D03] Card Not Supported, wants CRC
[2F01] Fault Alarm, ICC powered off
[6686] 4404 no more counter to decrease
[6686] gpm271 no more counter to decrease
[6686] gpm276 no more counter to decrease
[6686] not enough tokens
[6687] sle4428 report no retries remain
[6687] sle4442 report no retries remain
[6688] 4406 invalid secret key presented
[6688] 4428 invalid PSC presented
[6688] sle4442 invalid PSC presented
[6701] failed to properly reset configuration
[6704] gpm271 read value different from expected
[6705] gpm276 byte(s) not successfully erased
[6706] 4406 invalid length
[6707] sle4404 value written doesn't match
[6708] sle4404 value written to fuse doesn't match expected
[6709] sle4406 value written doesn't match
[6900] latch function subtype must be 0 or 1
[6903] reader configured without icc support
[6904] reader configured without icc support
[6905] rdr not configured with SAM support or SAM conn > 5
[6906] reader configured without icc support
[6907] reader configured without icc support
[6908] 'R' cmd subtype invalid

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[6909] invalid baud rate value
[690A] Set C4 cmd legal values only 0-1
[690B] Set C8 cmd legal values only 0-1
[690C] set cmd subtype invalid
[690D] cmd not supported on rdr without icc support
[690E] invalid cmd response
[690F] invalid baud rate value
[6910] invalid serial number length
[6911] 'Q' cmd length must be 1
[6912] 'P' cmd length must be 1
[6913] 2nd byte of LED cmd must be 30-37
[6914] invalid value of the memory card type
[6916] 'P' cmd must be 0x30 or 0x32
[6918] gpm276 cannot erase 0 bytes
[6919] gpm271 count of bytes to erase is zero
[691B] sle4404 cannot erase 0 bytes or odd # of bytes
[691C] sle4404 password must be even # of bytes > 0
[691D] download code missing or corrupted
[691E] MSR read method must be 1, 2, 3 or 4
[691F] host LED control not enabled
[6920] Reader not configured for buffered mode
[6921] reader not configured for buffered mode
[6922] Reader not configured for magstripe read
[6D01] INS not supported on i2c cards
[6D02] INS not supported on sle4428 cards
[6D03] INS not supported on sle4442 cards
[6D04] INS not supported on gpm271 cards
[6D05] INS not supported on gpm276 cards
[6D06] INS not supported on sle4404 cards
[6D07] INS not supported on sle4406 cards
[6E00] memory card class must be 'DA'
[8001] sle4428 count bytes to verify must be 2
[8002] i2c no Data or write cnt != byte recvd
[8003] sle4428 count bytes to read required
[8004] sle4428 no Data or write cnt != bytes recvd
[8005] i2c count bytes to read required
[8006] sle4442 count bytes to verify must be 3
[8007] sle4428 no Data or write cnt != bytes recvd
[8008] sle4442 count bytes to read required
[8009] sle4442 count of protection bytes to read must be 4
[800A] sle4442 no Data or write cnt != byte recvd
[800B] sle4442 no Data or write cnt != byte recvd
[800D] gpm271 count bytes to read required
[800E] sle4428 count bytes to read required
[800F] gpm276 count bytes to read required
[8013] sle4406 count bytes to read required

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[8014] sle4404 count bytes to read required
[8015] sle4404 no Data or write cnt != byte recvd
[8016] gpm276 no Data or write cnt != byte recvd
[8017] gpm271 no Data or write cnt != byte recvd
[8018] sle4406 no Data or write cnt != byte recvd
[8019] setting mag prefix D2 cmd invalid length
[801A] setting mag postfix D3 cmd invalid length
[801B] setting baud rate invalid length
[801C] Case 2 incorrect Data length or should be write cmd
[801D] Case 4 incorrect Data length
[8100] icc err time out on power-up req. by Sp2 Driver
[8100] icc error timeout on power-up
[8100] timeout rcving proc byte from T=0 card
[8101] icc timeout error
[8200] invalid TS character received
[8300] T=0 parity on header transmission
[8301] T=0 parity on transmission
[8400] parity err rcving proc byte from T=0 card
[8500] PPS confirmation error
[8501] PPS confirmation error unexpected input
[8600] Unsupported F, D, or combination of F and D
[8700] protocol not supported EMV TD1 out of range
[8800] power not at proper level
[8801] unable to power memory card
[8802] T=1 power not at proper level
[8803] error on power up
[8803] power not at proper level
[8803] power not at proper level
[8804] power not at proper level
[8804] power not at proper level
[8805] power not at proper level
[8805] power not at proper level
[8900] ATR length too long
[8B01] EMV invalid TA1 byte value
[8B02] if EMV TB1 required
[8B03] EMV Unsupported TB1 only 00 allowed
[8B04] EMV Card Error, invalid BWI or CWI
[8B06] EMV TB2 not allowed in ATR
[8B07] EMV TC2 out of range
[8B08] EMV TC2 out of range
[8B09] per EMV96 TA3 must be > 0xF
[8B10] icc error on power-up
[8B11] if EMV96 T=1 then TB3 required
[8B12] Card Error, invalid BWI or CWI
[8B13] Card Error, invalid BWI or CWI
[8B17] EMV TC1/TB3 conflict

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[8B20] EMV TD2 out of range must be T=1
[8C00] TCK error
[9000] assume ISO status is OK
[9000] initialize resp status
[9000] Success
[A301] icc error on power-up current overflow
[A304] connector has no voltage setting
[A305] icc error on power-up invalid (sblk(IFSD) xchg
[A306] icc error on request ATR from CPU icc
[A307] icc error on power-up at current limit
[B0xx] card status reporting
[E300] i2c card ack failure
[E300] io line low--card error after session start
[E301] icc error after session start
[E302] io line low--card error after session start
[E302] T=1 icc error (data too long)
[E303] i2c card ack failure
[E304] T=1 too many retries to get resp
[E305] 3 byte i2c cmd & MS addr ack failure
[E306] 3 byte i2c LS addr ack failure
[E307] 4 byte i2c cmd ack failure
[E308] 4 byte i2c MS addr ack failure
[E309] 4 byte i2c LS addr ack failure
[E30A] i2c failure to reset card
[E310] report timeout error
[E311] icc error unexpected input
[E401] error sending command to T=0 card
[E402] error rcving proc byte from T=0 card
[E403] T=0 error getting 2nd status byte
[E404] T=0 inconsistent proc byte rcvd
[E405] T=0 error processing blk after proc byte
[E406] prob rcving proper # bytes from icc
[FFFE] internal error code
[FFFF] if we haven't had a bad status

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17. APPENDIX A Setting Parameters and Values

Following is a table of default setting and available settings (value within parentheses) for each function ID.

Function ID	Hex	Description	Default Setting	Description	
HTypeID*	10	Terminal Type	'0' (‘0’-‘2’, ‘4’-‘6’)	PC/AT, Scan Code Set 2, 1, 3, PC/AT with external Keyboard and PC/AT without External Keyboard	u k
ReaderOptID	11	Reader Option	A Eh (RS232) /08h (CCID)	Any	
Memory Card Type	12	Memory Card type	'0'	Default to I ² C cards	k
TrackSelect ID	13	Track Selection	'0' ('0'-'9')	Any Track 0-any; 1-7—bit 1 tk1, bit 2 tk2; bit 3 tk3. '8'—tk1-2; '9' tk2-3	
PollingIntervalID	14	Polling Interval (for USB CDC)	1 (1 – 255)	USB HID Polling Interval	u
Page Size	15	Memory Land Page	'8'	8, 16, 32, 64	-
FmtOptionID	16	UIC, Mag-Tek	H'59'	Refer to MiniMag RS232 User's Manual	-
TrackSepID	17	Track Separator	CR/0D	CR for RS232, Enter for KB any character supported except 00, which means none.	
DefaultAllID	18	Default All			
SendOptionID	19	Send Option	'1' ('0'-0x3F)	Sentinel and Account number control	
MSRReadingID	1A	MSR Reading	'1' ('0'-'3')	Enable MSR Reading '0' MSR disable; '2' Buffer Mode; '3' Auto Buffer Mode	
DecodingMethodID	1D	MSR Read Direction	'3' ('1'-'4')	'1'-both '2'-insert '3'-report on withdrawal '4'-withdrawal	
CompatibleID	1E	Compatible ID	'0'		
ReviewID	1F	Review All Settings	None		
TerminatorID	21	MSR Terminator	CR/0D	CR for RS232	
FmVerID	22	Firmware Version			
CustSetID	30	custom Settings	0	if bit 2 = 1 then send serial # with encrypted transaction before KSN	-
Track1ID	31	Track 1 ID	NULL	Any ASCII Code	

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Track2ID	32	Track 2 ID	NULL	Any ASCII Code	
Track3ID	33	Track 3 ID	NULL	Any ASCII Code	
Key type	3E	Key type	'0' data key, 'Z' PIN key		-
EpVerID*	40		None		
BaudID	41	Baud Rate	'7' ('5'-'9')	38,400 bps, '5' is 9600 bps; '9' is 115.2 kbps	s
HandID	44	Hand Shake	'0' ('0'-'1')	'0': none; '1': hardware hand shake	s
PrePANID	49	PAN to not mask	4 (0-6)	# leading PAN digits to display	
PostPANID	4A	PAN to not mask	4 (0-4)	# of trailing PAN digits to display	
MaskCharID	4B	mask the PAN with this character	'*' 20-7E	any printable character	
CrypTypeID	4C	encryption type	'1' ('1'-'2')	'1' 3DES '2' AES	r
SerialNumberID	4E	device serial #	any 8-10 bytes	8-10 character serial number	r
DispExpDateID,	50	mask or display expiration date	'0' '0'-'1'	'1' don't mask expiration date	
SessionID	54	8 byte hex not stored in EEPROM	None	always init to all 'FF'	
Mod10ID	55	include mod10 check digit	'0' '0'-'2'	don't include mod10, '1' display mod10, '2' display wrong mod10	
DesKeyID	56	DES Key Value	0	internal use only	r n
AesKeyID	57	AES Key Value	0	internal use only	r n
KeyManagementTypeID	58	DUKPT	'1' ('0'-'1')	'0' fixed key; '1' DUKPT key	
HashOptID,	5C		'7' ('0'-'7')	Send tk1-2 hash bit 0:1 send tk1 hash; bit 1:1 send tk2 hash; bit2:1 send tk3 hash.	
T1ERRSTARTID	6C	Track 1 error code	'%'	start sentinel if track 1 error report	
T2ERRSTARTID	6D	Track 2 error code	'.'	start sentinel if track 2 error report	
T3ERRSTARTID	6E	Track 3 error code	'+'	start sentinel if track 3 error report	

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Secure LRC ID	6F		'1' ('0' - '1')		-
SyncCheckID	7B	check for track sync bits	'2' ('0'-2')	check leading & trailing sync bits on track data (if poorly encoded card)	
SecurityLevelID	7E			'0' key exhausted; '1' non-encrypted; '2' key loaded non encrypted '3' encrypted; '4'	n r
EncryptOptionID	84	encryption options	8 encrypt trk 3 if card type 0; (0-F)	bit 0 encrypt trk1; bit 1 encrypt trk2; bit 3 encrypt trk3; bit 4 encrypt trk3 if card type 0	
MaskOptionID	86	clear / mask data options	7	bit 0 send clear/mask trk1 bit 1 send clear/mask trk2 bit 2 send clear/mask trk3	
PrefixID	D2	Preamble	0	No Preamble, 15 char max	
PostfixID	D3	Postamble	0	No Postamble, 15 char max	

*Unused entries in this table were left for completeness even though unused in the MIR reader to avoid conflicting definitions between products.

Note not all function ID are present in different hardware version of the MIR, the last column above has some codes:

- '-' feature not currently supported; exists for compatibility
- 's' feature available on in the RS232 serial version of the reader
- 'u' feature available only in the USB version;
- 'r' reset all does not affect this value
- 'n' not directly settable

Most function ID settings that relate to the content of formatting of the track output do not work in secure mode.

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19. LIMITATIONS

Limitations on the use of PC/SC and SAM

All SAM cards must tolerate the voltage setting of any card accessed in the reader.

Limitations on the use of PC/SC and memory cards

The best way to use memory cards in a PC/SC reader is to leave the card type selected as microprocessor card. The only limitation this places on the host application is that memory card ATR commands are not allowed. Memory card ATR commands are not required because all memory cards are powered on with any command sent to them. Second, most memory cards do not support ATR commands so the reader simulates these commands by reading the first four bytes on the card. The problem is that if the memory card type is selected the reader cannot connect to a microprocessor card. PC/SC driver does not know that the memory type is incorrect and will never allow the PC/SC application to attach to the memory card.