USER MANUAL

SecureKey™ M100/M130
Encrypted Keypad with Optional Encrypted MSR

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Revision History

Revision	Description	Date	Author
50	First draft release for internal review	03/14/11	
A	Initial Release	05/14/11	
B	-Modified output format and added example data -Added instruction to change the initial key in the demo software -Modified commands to change XML output field settings	06/22/11	
C	-Added #6 configuration for firmware v1.04 and above -Added more explanation on the data output format	12/08/11	
D	-Added Admin menu command -Added new manual entry format for firmware v1.14 and above -Added Appendix A: Setting Configuration Parameters and Values	09/19/12	
E	-Added many sections -Major update to configuration settings	11/05/12	
F	Removed some parts related to security level 1 and 2 Change hash data to 20 bytes for manual entered data Many additions, corrections, and deletions to increase accuracy, make more complete, etc.	3/27/2013 4/03-12/2013	
G	Add handling shifted ABA track; mod-10 in configuration 8F add sending serial # in enumeration in AE; add ETrk3= Correct the field 9 description in section 9.3 Remove XML; PIN Pad encryption to PIN Key	5/15/2013- 7/31/2013 9/30/2013	
H	'0' and '1' bit set command; Security Code → Secure Code; Add enhanced encryption only for several settings; Corrected ADR and ZIP identifier digit pg. 28 Corrected Clear/Mask status definition pg. 29 Correct Appendix A commands for command ID 10, 13, 3E, 84. Remove command ID 60 Corrected 8F setting	2/7/2014 3/3/2014 4/24/2014 5/06/2014 6/6/2014 8/6/2014	
I	Add command to disable/enable admin key	8/8/2014	
J	Add custom settings 0x30 command definition; Clarified D2 and D3 use Add missing description for setting encryption 84, hash 5C and mask settings 86; Clarify and enhance 84 setting Add configuration 2F to control switching JIS II card type Document track selection feature 13 AF=10 encrypt loop reader; if SC=2 or 6 mark as ICC;	04/01/2015 06/02/2015 06/23/2015 06/26/2015 07/31/2015	Bruce K.
K	Added table of function codes for non-printable characters. Samsung acquired Loop so now Samsung Pay	09/30/2015	Bruce K.
L	Minor format improvements. Copy editing. Clarification of LRC calculation. Added Appendix E	11/25/2015	Kas T.

Table of Contents

1.0 Introduction

ID TECH SecureKey M series is an encrypted numeric keypad with an optional Magnetic Swipe Reader (MSR). The SecureKey keypad allows retailers to not only encrypt credit card data at the magnetic reader, but it also encrypts a manually entered credit card number. The SecureKey M series has 15 keys (10 Numeric, 5 functional) with a 2x20 backlit LCD.

SecureKey M series keypads encrypt the data using TDES or AES algorithm format with DUKPT key management. For encrypted card reader settings and operations, please refer to the P/N 80096504-001 *SecureMag User Manual*.

SecureKey M series is available with USB-Keyboard and USB-HID interface.

2.0 Product Configurations

SecureKey M series include 2 main models:

- SecureKey M100: Encrypted Keypad
- SecureKey M130: Encrypted Keypad with Magstripe Card Reader

Currently we offer the following configurations:

TDES encryption default

1. IDKE-504800B SecureKey M100 IDT Encryption Format, TDES
2. IDKE- 534833B SecureKey M130 IDT Original Encryption Format, TDES
3. IDKE-534833BE SecureKey M130 IDT Enhanced Encryption Format, TDES

AES encryption default

4. IDKE-504800AB SecureKey M100 IDT Encryption Format, AES
5. IDKE- 534833AB SecureKey M130 IDT Original Encryption Format, AES
6. IDKE-534833ABE SecureKey M130 IDT Enhanced Encryption Format, AES

3.0 Features

- Encrypted numeric keypad with 2x20 LCD and optional encrypted MSR
- 1,000,000 swipe, industry proven Magnetic Stripe Reader
- 20,000,000 key operations for each key
- Meets FCC Class B & CE regulatory requirements
- Plug-n-Play operation for USB-Keyboard and USB-HID interface
- Keypad is encrypted using DUKPT and TDES/AES encryption.
- Optional encrypted MSR with DUKPT and TDES/AES encryption
- Works with Windows 95/98, WINME 2000, XP, Vista, & Windows 7 thru 10

4.0 Terms and Abbreviations

AAMVA	American Association of Motor Vehicle Administration
ABA	American Banking Association
AES	Advanced Encryption Standard
ANSI	American National Standard Institute
ASIC	Application Specific Integrated Circuit
BPI	Bits per Inch
CE	European Safety and Emission approval authority
DES	Data Encryption Standard
DUKPT	Derived Unique Key Per Transaction
ESD	Electrostatic Discharge
GND	Signal Ground
HOST	A Personal Computer or Similar Computing Device
HID	Human Interface Device
IPS	Inches per Second
ISO	International Organization for Standardization
ITP	ID TECH Transport Protocol
JIS	Japanese Industrial Standard
KSN	Key Serial Number
LRC	Longitudinal Redundancy Check Character.
MAC	Message Authentication Code
MSR	Magnetic Stripe Reader
MTBF	Mean Time Between Failures
OTP	One Time Programmable
PAN	Primary account number
PCI	Payment Card Industry
PID	USB Product ID
POS	Point of Sale
P/N	Part Number
RoHS	Restrictions of Hazardous Substances
SHA-1	Enhance Cryptographic Hash Function
T1,T2,T3	Track 1 data, Track 2 data, Track 3 data
TDES	Triple Data Encryption Standard
USB	Universal Serial Bus
VID	USB Vendor ID

Note: many unusual words used in this document are defined in Appendix A Setting Configuration Parameters and Values table on page 50.

5.0 Applicable Documents

ISO 7810 – 1985	Identification Cards – Physical
ISO 7811 - 1 through 6	Identification Cards - Track 1 through 3
ISO 7812	Identification Cards – Identification for issuers Part 1 & 2
ISO 7813	Identification Cards – Financial Transaction Cards
ISO 4909	Magnetic stripe content for track 3

ANSI X.94 Retail Financial Services Symmetric Key Management
USB ORG USB Specification Rev. 2.0
Keyboard Key Code Specification Revision 1.3a, 3/16/2000, Microsoft Corporation
80096504-001 SecureMag User Manual

6.0 Function & Operation

On power-on, the device will go into its data capture mode. In data capture mode the device will prompt the user to enter data.

The device will display "Key is not injected!" if the device is not key-injected, with encryption enabled, after a key is pressed. The evaluation unit is injected with the ID TECH demo key by default and the data can be decrypted using the ID TECH SecureKey demo software.

6.1 Function Keys Operation:

Clear:

- Pressing the "Clear" key allows users to remove all entered data at the current level. The current transaction would not be cancelled.

BS:

- Pressing the "BS" (backspace) key allows users to remove the entered data one character at a time.

#Admin:

- Pressing the "#Admin" key when the screen displays "Swipe or Hand-Key Card Number" or "Enter Card Number then press Enter" allows user to enter the Admin Menu. Pressing the "#Admin" key in other screens puts the device in the Help Mode. This key can be disabled added in V1.27 (see 8F).

Cancel:

- Pressing the "Cancel" key once allows users to remove all the input in the current as well as the previous level. The device then goes back to the previous prompt of the current transaction. If the "Cancel" key is pressed twice, the current transaction would be cancelled and the device goes back to the initial mode.

6.2 Admin Menu

When the "Admin" key is pressed, the screen will display **"Select manual config 1-6"** to prompt the user to select one of six manual entry modes.

<u>Manually-Keyed Configuration Options (Firmware Version v1.14 or below)</u>
Configuration #1: Card Number, Expiration Date
Configuration #2: Card Number, Expiration Date, Zip Code
Configuration #3: Card Number, Expiration Date, Street Number of the Address, Zip Code
Configuration #4: Card Number, Expiration Date, Zip Code, Secure Code
Configuration #5: Card Number, Expiration Date, Address, Zip Code, Secure Code
Configuration #6: Card Number, Expiration Date, Address, Secure Code

<u>Manually-Keyed Configuration Options (Firmware Version v1.16 or above)</u>

Configuration #1: Card Number, Expiration Date
Configuration #2: Card Number, Expiration Date, Zip Code
Configuration #3: Card Number, Expiration Date, Street Number of the Address, Zip Code
Configuration #4: Card Number, Expiration Date, Secure Code, Zip Code
Configuration #5: Card Number, Expiration Date, Secure Code, Address, Zip Code
Configuration #6: Card Number, Expiration Date, Secure Code

When the user selects the key corresponding to a manual mode, and then selects enter, the mode will be configured and the unit will return to the data capture mode.
If the user selects more than one key, then the last key selected will be used to select the mode.
If a invalid key is selected the unit will display **"error"** then **"Select manual config 1-6"**

6.3 Help Mode

If the user selects the Admin key while in Admin mode, the unit enters the Help Mode. In the Help Mode, the unit displays short text messages of the various manual entry configurations with a 3 seconds pause between each message. Hitting any key in the Help Mode makes the unit return to the Admin Menu.

7.0 Configuration

The reader must be appropriately configured to your application. Configuration settings enable the reader to work with the host system. Once programmed, these configuration settings are stored in the reader's non-volatile memory (so they are not affected by the cycling of power).

7.1 Setup Command Structure

Commands sent to keypad/reader

a. Setting Command:
<STX><S>[<FuncID><Len><FuncData>…]<ETX><CheckSum>

b. Read Status Command:
<STX><R><FuncID><ETX><CheckSum>

c. Function Command:
<STX>[<FuncID><Len><FuncData>…]<ETX><CheckSum>

Response from SecureKey

a. Setting Command

Host		**SecureKey**
Setting Command	→	
	←	<ACK> if OK
	or	
	←	<NAK> if Error

b. Read Status Command

Host		**SecureKey**
Read Status Command	→	
	←	<ACK> and <Response> if OK
	or	
	←	<NAK> if Error

c. Other Commands

Host		**SecureKey**
Other Command	→	
	←	<ACK> and <Response> if OK
	or	
	←	<NAK> if Error

Where:

<STX>	02h
<S>	Indicates setting commands. 53h

<R>	Indicates read setting commands. 52h
<FuncID>	One byte Function ID identifies the particular function or settings affected.
<Len>	One byte length count for the following data block<FuncData>
<FuncData>	data block for the function
<ETX>	03h
<CheckSum>	Check Sum: The overall Modulo 2 (Exclusive OR) sum (from <STX> to <CheckSum>) should be zero.
<ACK>	06h
<NAK>	FD for USB KB interface 15 for all other interface

7.2 Communication Timing

The SecureKey takes time to process a command. During that processing time, it will not respond to a new command.

The typical delay for the reader to respond to a command is 20ms, the maximum delay for the reader to respond can be as much as 40ms. Caution must therefore be taken to maintain a minimum delay between two commands.

7.3 Default Settings

The SecureKey is shipped from the factory with the default settings already programmed. In the following sections, the default settings are shown in **boldface**.

For a table of default settings, see Appendix A.

7.4 General Selections

This group of configuration settings defines the basic operating parameters of SecureKey.

7.4.1 Change to Default Settings

<STX><S><18h><ETX><CheckSum>

This command does not have any <FuncData>. It returns most settings to their default values.

7.4.2 MSR Reading Settings

Enable or Disable the SecureKey swipe reader. If the swipe reader is disabled, no data will be sent out to the host.
<STX><S><1Ah><01h><MSR Reading Settings><ETX><CheckSum>
MSR Reading Settings:

"0" MSR Reading Disabled
"1" MSR Reading Enabled

7.4.3 Decoding Method Settings

The SecureKey can support four kinds of decoded directions.
<STX><S><1Dh><01h><Decoding Method
Settings><ETX><CheckSum>
Decoding Method Settings:
"0" Raw Data Decoding in Both Directions,
"1" Decoding in Both Directions.
"2" Moving stripe along head in direction of encoding.
"3" Moving stripe along head against direction of encoding.

With the bi-directional method, the user can swipe the card in either direction and still read the data encoded on the magnetic stripe. Otherwise, the card can only be swiped in one specified direction to read the card. Raw Decoding just sends the card's magnetic data in groups of 4 bits per character. The head reads from the first byte of each track, starting from the most significant bit. The data starts to being collected when the first 1 bit is detected. No checking is done except to verify track has or does not have magnetic data.

7.5 Review Settings

<STX><R><1Fh><ETX><CheckSum>

This command does not have any <FuncData>. It activates the review settings command. SecureKey sends back an <ACK> and <Response>.
<Response> format:
The current setting data block is a collection of many function-setting blocks <FuncSETBLOCK> as follows:

<STX><FuncSETBLOCK1>…<FuncSETBLOCKn><ETX><CheckSum>

Each function-setting block <FuncSETBLOCK> has the following format:
<FuncID><Len><FuncData>

Where:
<FuncID> is one byte identifying the setting(s) for the function.
<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.
<FuncSETBLOCK> are in the order of their Function ID<FuncID>

7.6 Review Serial Number

<STX><R><4Eh><ETX><CheckSum>

This command is to get device serial number.

7.7 Controlling Keyed-in Options

7.7.1 Configuration byte 8F controls Keyed in options

bit 0: if 0: output in original keyed output; 1: output in enhanced keyed-in output
bit 1: if 0: allow empty CVV entry; 1: require 3 or 4 CVV digits

bit 2: if 0: allow empty ZIP entry; 1: require 5 or more ZIP digits
bit 3: if 0: allow empty ADR entry; 1: require 1 or more ADR digits
bit 4: if 0: do mod-10 check on keyed-in PAN; 1: don't check PAN mod-10
bit 5: if 0: Admin key is enabled; 1: Admin key is disabled
bits 6-7: reserved all zero
Note: bits 1 through 3 are only applicable if the reader is configured for Manually-Keyed Configuration Options greater than 1 and only apply to firmware version 1.16 and above. The bit 5 option is available from firmware v1.27

Examples:
Disable Admin key:
Command: <STX><31><8F><01><20><ETX><Sum>
Enable Admin key:
Command: <STX><30><8F><01><20><ETX><Sum>

After the Admin key is disabled(locked), the operator cannot change the admin setting by press the "Admin" button until another command is sent to enable(unlock) the Admin key.

7.7.2 Configuration byte 8E Setting Admin Level Options

The reader can be configured to set the manually Keyed-in Configuration option in two ways first selecting the Admin key then a number from 1 to 6. For the meaning of these numbers see section 6.2 admin menu.

7.8 Message Formatting Selections

7.8.1 Preamble Setting

Characters can be added to the beginning of a string of data. These can be special characters for identifying a specific reading station, to format a message header expected by the receiving host, or any other character string. Up to fifteen ASCII characters can be defined. This is only sent in Key Board mode, not in HID mode.

<STX><S><D2h><Len><Preamble><ETX><CheckSum>

Where:
<Len>= the number of bytes of preamble string
<Preamble> = {string length}{string}
NOTE: String length is one byte, maximum fifteen <0Fh>.

7.8.2 Postamble Setting

The postamble serves the same purpose as the preamble, except it is added to the end of the data string, after any terminator characters. This is only sent in Key Board mode, not in HID mode.

<STX><S><D3h><Len><Postamble><ETX><CheckSum>

Where:
<Len> = the number of bytes of postamble string
<Postamble> = {string length}{string}
NOTE: String length is one byte, maximum fifteen <0Fh>.

7.9 Magnetic Track Selections

7.9.1 Track Selection

There are up to three tracks of encoded data on a magnetic stripe.

This option selects the tracks that will be read and decoded.

<STX><S><13h><01h><Track_Selection Settings><ETX><CheckSum>

Track_Selection Settings: (Options other that '0' available only in v1.27 and above)

"0" Any Track all three optional (default).
"1" Track 1 only and required
"2" Track 2 only and required
"3" Tracks 1 and 2 and both required
"4" Track 3 only and required
"5" Track 1 and 3 and both required
"6" Tracks 2 and 3 and both required
"7" Tracks 1, 2 and 3 and all required
"8" Tracks 1 and/or 2 and both optional
"9" Tracks 2 and/or 3 and both optional

Note: If any of the required multiple tracks fail to read for any reason, no data for any track will be sent.

7.10 Set MSR Data Terminator [53 21]

<STX><S><21h><01h><Terminator Setting><ETX><CheckSum>

The <Terminator Setting> byte is any one byte except 0x00:

The default is 0x0D, which is Carriage Return (CR), If 0x00 is set the reader will send no terminator.

Example to set to send Line Feed (LF=0x0A) after the last MSR data

<STX><S><21h><01h><0Ah><ETX><CheckSum>

The terminator value 30 is special it will send out two

characters CRLF or OD and OA

A Value of 0x00 means do not send any MSR data terminator.

7.11 Security Settings

7.11.1 Encryption Settings

Encryption type output.

<STX><S><4Ch><01h><Encryption Settings><ETX><CheckSum>

Encryption Settings:

"1" Enable TDES Encryption

"2" Enable AES Encryption

7.12 Review KSN (DUKPT Key management only)

<STX><R><51h><ETX><CheckSum>

This command is to get DUKPT key serial number and counter.

Response:
<ACK><STX><51h><0Ah><10 BYTE KSN><ETX><CheckSum>
Example:
06 02 51 0A 62 99 49 01 45 00 00 00 00 1B 03 B7
Note: the response was somewhat different before V1.25

7.13 Review Security Level

<STX><R><7Eh><ETX><CheckSum>

This command is to get the current security level.

Response:
<STX><7E><01><33h><ETX><CheckSum>

7.14 Control Credit Card Output when Card Swiped Lifted

<STX><S><AFh><01h><Control Settings><ETX><CheckSum>

Control Settings:

01h Disallow Credit Card swiped while lifted

00h Allow to send credit card data unencrypted when on shifted track

If a credit card is swiped, while the card is lifted, it is possible to get a good card read, where track 1 data is shifted into track 2 or track 3 and/or where track 2 data is shifted into track 3. Since the credit card data is always normally encrypted, this potentially allows the credit card data to be sent without encryption, exposing the card contents. By default this is allowed. This feature was added in V1.23.

7.15 Special Encrypted Output Control

<STX><R><30h><ETX><CheckSum>

This command is to get the custom settings options.

Response:
<STX><30><01><00h><ETX><CheckSum>
Examples:
To prevent sending unencryopted card data when swiped card is purposely lifted:
Command: <STX><31><30><01><01><ETX><Sum>
To enable sending unencryopted card data when swiped card is purposely lifted:
Command: <STX><30><30><01><01><ETX><Sum>

Bit0=1 allow non credit card track data to be sent without encryption (e.g. supervisor card).
Bit1=1 don't send empty encrypted package; A card may be poorly read such that there is no valid track data. If this bit is set the reader will not send an empty encrypted package under this situation.
Bit2=1 send reader serial number with encrypted data; If it is necessary to the send the readers serial number with the encrypted packages, setting this bit will cause that to occur.
Bit3=1 indicate busy while sending; If it is necessary to have the prompt to change while the reader is busy handling an encrypted transaction indicating that something is happening, setting this bit will cause this to happen.

7.16 Control Credit Card Output when Card Swiped Lifted

<STX><S><AFh><01h><Control Settings><ETX><CheckSum>

Control Settings:

01h Disallow Credit Card swiped while lifted

00h Allow to send credit card data unencrypted when on shifted track

If a credit card is swiped, while the card is lifted (that the bottom of the card is not at the bottom of the slot), it is possible to get a good card read, where track 1 data is shifted into track 2 or track 3 and/or where track 2 data is shifted into track 3. Since the credit card data is always normally encrypted, this potentially allows the credit card data to be sent without encryption exposing the card contents. By default this is allowed. This feature was added in V1.23.

7.17 Encrypted Output for Decoded Data

7.17.1 Encrypt Functions

When a card is swiped through the Reader, the track data will be TDEA (Triple Data Encryption Algorithm, aka, Triple DES) or AES (Advanced Encryption Standard) encrypted using DUKPT (Derived Unique Key Per Transaction) key management. DUKPT key management uses a base derivation key to encrypt a key serial number that produces an initial encryption key which is injected into the Reader prior to deployment. After each transaction, the encryption key is modified per the DUKPT algorithm so that each transaction uses a unique key. Thus, the data will be encrypted with a different encryption key for each transaction.

7.17.2 Security Related Function ID

Security Related Function IDs are listed below. Their functions are described in other sections.

Characters	Hex Value	Description
PrePANID	49	First N Digits in PAN which can be clear data
PostPANID	4A	Last M Digits in PAN which can be clear data
MaskCharID	4B	Character used to mask PAN
EncryptionID	4C	Security Algorithm
Device Serial Number ID	4E	Device Serial Number (Can be write once. After that, can only be read)
DisplayExpirationDateID	50	Display expiration data as mask data or clear data
KSN and Counter ID	51	Review the Key Serial Number and Encryption Counter format v1.22) 51 0A KSN
Session ID	54	Set current Session ID
Key Management Type ID	58	Select Key Management Type
HashOptID	5C	to include or not hash data
SecurityLevelID	7E	Security Level (Read Only)
EncryptOptID	84	which tracks to encrypt: note force
EncryptStrID	85	original or enhanced swipe encrypt structure
MaskOptID	86	which tracks to mask
EnFmtID	88	for XML
T3ExpDatePosID	89	offset to date on ISO4049 track 3
KeyedOptID	8F	original or enhanced keyed-in encrypt structure
MasterModeID	AB	master key loading mode
MKeyLoadedID	AC	'1'- master key loaded read only field
RkiTimeOutID	AD	RKI timeout in minutes
Equip2ID	AE	unusual special settings control
CustSet2ID	AF	check for cc tracks shifted due to swipe while card lifted; Support encrypting loop reader transaction

Feasible settings of these new functions are listed below.

Characters	Default Setting	Description
PrePANID	04h	00h ~ 06h

		Allowed clear text from start of PAN Command format: 02 53 49 01 04 03 LRC
PostPANID	04h	00h ~ 04h Allowed clear text from end of PAN Command format: 02 53 4A 01 04 03 LRC
MaskCharID	'*'	20h ~ 7Eh Command format: 02 53 4B 01 3A 03 LRC
DisplayExpirationDataID	'0'	'0' Display expiration data as mask data '1' Display expiration data as clear data
EncryptionID	'0'	'0' Clear Text '1' Triple DES '2' AES Command format: 02 53 4C 01 31 03 LRC
SecurityLevelID	'1'	'0' ~ '3' Command format: 02 52 7E 03 LRC
Device Serial Number ID	00, 00, 00, 00, 00, 00, 00, 00, 00, 00	10 bytes number: Command format: Set Serial Number: 02 53 01 4E 09 08 37 36 35 34 33 32 31 30 03 LRC Get Serial Number: 02 52 4E 03 LRC
KSN and Counter ID	00, 00, 00, 00, 00, 00, 00, 00, 00, 00	This field includes the Initial Key Serial Number in the leftmost 59 bits and a value for the Encryption Counter in the right most 21 bits. Get DUKPT KSN and Counter: 02 52 51 03 LRC
Session ID	00, 00, 00, 00, 00, 00, 00, 00	This Session ID is an eight bytes string which contains any hex data. This filed is used by the host to uniquely identify the present transaction. Its primary purpose is to prevent replays. It is only be used at Security Level 4. After a card is read, the Session ID will be encrypted, along with the card data, a supplied as part of the transaction message. The clear text version of this will never be transmitted.

		New Session ID stays in effect until one of the following occurs: 1. Another Set Session ID command is received. 2. The reader is powered down. 3. The reader is put into Suspend mode.
Key Management Type ID	'1'	Fixed key management by default. '1': DUKPT Key
HashOptID	'7'	hash all encrypted tracks
SecurityLevelID	'3'	Security Level (Read Only)
EncryptOptID	0	which tracks to encrypt
EncryptStrID	'1'	to use original or enhanced swipe encryption format
MaskOptID	7	which tracks may be sent masked
EnFmtID	023034	
T3ExpDatePosID	34	offset to track 3 expire date position
KeyedOptID	0 or 1	to use original or enhanced keyed in encryption format.
Equip2ID	00 (any)	if bit 4 is set high, the USB enumeration will include the reader's serial number.
CustSet2ID	**00H** (any)	bit0=0 send unencrypted as other type card; bit0=1 disallow a credit card /lifted/shifted 1 or 2 tracks ; bit4=1 support encrypting loop reader

7.17.3 Security Management

This reader is intended to be a secure reader. Security features include:

- Can include Device Serial Number
- Can encrypt track 1, track 2, and track 3 data for bank cards and other cards
- Provides clear text confirmation data including card holder's name and a portion of the PAN as part of the Masked Track Data for bank cards
- Optional display expiration date
- Security Level is settable
- By Setting (See AF) can prevent reading credit card where the card is lifted so track read is different from actural track. V1.23
- By default setting (See AF) will allow and encrypt Loop Reader transaction V.1.30.

The reader features configurable security settings. Before encryption 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.

7.17.4 MSR Data Masking

For ABA cards needing to be encrypted, encrypted data, hash data and clear text data maybe sent.

Masked Area

The data format of each masked track is ASCII.

The clear data includes start and end sentinels, separators, first N, last M digits of the PAN, card holder 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 '*'.

- 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
- DisplayExpirationDateID, parameter range '0'~'1', default value '0'

8.0 Descriptor

The USB version of the reader can be operated in two different modes:
- HID ID TECH mode (herein referred to as "***HID*** mode")
- HID with Keyboard Emulation (herein referred to as "***KB*** mode").

When the reader is operated in the HID mode, it behaves like a vendor defined HID device. A direct communication path can be established between the host application and the reader without interference from other HID devices.

8.1.1 Descriptor Tables

Device Descriptor:

Field	Value	Description
Length	12	
Des type	01	
bcd USB	00 02	USB 2.0
Device Class	00	Unused
Sub Class	00	Unused
Device Protocol	00	Unused
Max Packet Size	08	
VID	0A CD	
PID	26 10 26 20	HID ID TECH StructureHID Keyboard
BCD Device Release	00 01	
i-Manufacture	01	
i-Product	02	
i-Serial-Number	00	Changes to 3 if USB serial number enabled
# Configuration	01	

Configuration Descriptor:

Field	Value	Description
Length	09	
Des type	02	
Total Length	22 00	
No. Interface	01	
Configuration Value	01	
iConfiguration	00	
Attributes	80	Bus power, no remove wakeup
Power	32	100 mA

Interface Descriptor:

Field	Value	Description
Length	09	
Des type	04	
Interface No.	00	
Alternator Setting	00	
# EP	01	
Interface Class	03	HID
Sub Class	01	
Interface Protocol	01	
iInterface	00	

HID Descriptor:

Field	Value	Description
Length	09	
Des type	21	HID
bcdHID	11 01	
Control Code	00	
numDescriptors	01	Number of Class Descriptors to follow
DescriptorType	22	Report Descriptor
Descriptor Length	37 00 3D 00 52 00	HID ID TECH format HID Other format HID Keyboard format

End Pointer Descriptor:

Field	Value	Description
Length	07	
Des Type	05	End Point
EP Addr	83	EP3 – In
Attributes	03	Interrupt
MaxPacketSize	40 00	
bInterval	01	

Report Descriptor: (USB-HID Setting)

Value	Description
06 00 FF	Usage Page (MSR)
09 01	Usage(Decoding Reader Device)
A1 01	Collection (Application)
15 00	Logical Minimum
26 FF 00	Logical Maximum
75 08	Report Size
09 20	Usage (Tk1 Decode Status)
09 21	Usage (Tk2 Decode Status)
09 22	Usage (Tk3 Decode Status)
09 28	Usage (Tk1 Data Length)
09 29	Usage (Tk2 Data Length)
09 2A	Usage (Tk3 Data Length)
09 38	Usage (Card Encode Type)
95 07	Report Count
81 02	Input (Data, Var, Abs, Bit Field)
09 30	Usage (Total Sending Length)

95 02	Report Count (2)
82 02 01	Input (Data, Var, Abs, Bit Field)
09 31	Usage (Output Data)
96 9A 02	Report Count (666)
82 02 01	Input (Data, Var, Abs, Bit Field)
09 20	Usage (Command Message)
95 08	Report Count
B2 02 01	Feature (Data,Var, Abs, Buffered Bytes)
C0	End Collection

Report Descriptor: (USB KB Interface)

Value	**Description**
05 01	Usage Page (Generic Desktop)
09 06	Usage(Keyboard)
A1 01	Collection (Application)
05 07	Usage Page (Key Codes)
19 E0	Usage Minimum
29 E7	Usage Maximum
15 00	Logical Minimum
25 01	Logical Maximum
75 01	Report Size
95 08	Report Count
81 02	Input (Data, Variable, Absolute)
95 01	Report Count (1)
75 08	Report Size
81 01	Input Constant
95 05	Report Count
75 01	Report Size
05 08	Usage Page (LED)
19 01	Usage Minimum
29 05	Usage maximum
91 02	Output(Data Variable Absolute)
95 01	Report Count
75 03	Report Size
91 01	Output (Constant)
95 06	Report Count
75 08	Report Size
15 00	Logical Minimum
25 66	Logical Maximum (102)
05 07	Usage Page (key Code)
19 00	Usage Minimum

29 66	Usage Maximum (102)
81 00	Input(Data, Array)
06 2D FF	Usage Page (ID TECH)
95 01	Report Count
26 FF 00	Logical maximum (255)
15 01	Logical Minimum
75 08	Report Size (8)
09 20	Usage (Setup data byte)
95 08	Report Count (8)
B2 02 01	Feature (Data Var, Abs)
C0	End Collection

9.0 Data Output Format

For ID TECH standard data format, there are two different structures, the original and the enhanced output format. The default is the enhanced encryption output format.

<STX><DataLenL><DataLenH><Card Data><CheckLRC><CheckSum><ETX>

<STX> = 02h, <ETX> = 03h
<LenL><LenH> is a two byte length of <Card Data>.
<CheckLRC> is a one byte Exclusive-OR sum calculated for all <Card Data>.
<CheckSum> is a one byte Sum value calculated for all <Card Data>.

9.1 ID TECH Swipe Data Original Encryption Output Format

Field	Field Description
0	STX (02)
1	Data Length low byte
2	Data Length high byte
3	Card Encode Type (note 1 page 31 paragraph 9.4.1)
4	Track 1-3 Status (note 2 page 31 paragraph 9.4.2)
5	T1 data length
6	T2 data length
7	T3 data length
8	T1 clear/mask data - (Track 1 data)
9	T2 clear/mask data - (Track 2 data)
10	T3 clear data - (Track 3 data)
11	T1and T2 encrypted data
12	T1 hashed (20 bytes each) (if encrypted and hash tk1 allowed)
13	T2 hashed (20 bytes each) (if encrypted and hash tk2 allowed)
14	KSN (10 bytes)
15	CheckLRC
16	CheckSum
17	ETX (03)

9.2 ID TECH Swipe Data Enhanced Encryption Output Format

Field	Field Decryption
0	STX (02)
1	Data Length low byte
2	Data Length high byte
3	Card Encode Type (note 1 page 31 paragraph 9.4.1)
4	Track 1-3 Status (note 2 page 31 paragraph 9.4.2)
5	T1 data length
6	T2 data length
7	T3 data length
8	Clear/mask data sent status (note 3 page 31 paragraph 9.4.3)
9	Encrypted/Hash data sent status (note 4 page 31 paragraph 9.4.4)
10	T1 clear/mask data - (Track 1 data)
11	T2 clear/mask data - (Track 2 data)
12	T3 clear/mask data - (Track 3 data)
13	T1 encrypted data - (Track 1 encrypted data)
14	T2 encrypted data - (Track 2 encrypted data)
15	T3 encrypted data - (Track 3 encrypted data)
16	T1 hashed (20 bytes each) (if encrypted and hash tk1 allowed)
17	T2 hashed (20 bytes each) (if encrypted and hash tk2 allowed)
18	T3 hashed (20 bytes each) (if encrypted and hash tk3 allowed)
19	Reader Serial Number (10 bytes) (optional)
20	KSN (10 bytes)
21	CheckLRC
22	CheckSum
23	ETX (03)

9.3 ID TECH Manual Entry Original Data Output Format (Default)

Note: This is the default for historical reasons, for new development, the enhanced data output format should normally be used see page 29 Section 9.4 ID TECH Manual Entry Enhanced Data Output Format (New)

The default manual entry data output format does not include clear/masked data in the manual entry output.

Field	Field Decryption
0	STX (0x02)
1	Data Length low byte
2	Data Length high byte
3	card type always 85—keyed in (note 1 page 31 paragraph 9.4.1)
4	always 0
5	always 0
6	always 0
7	always 0
8	Status (1 byte) bit set if field is present in output (range 0-7)

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	0	0	0	SessionID	EXP	ADR	ZIP

9	Length of unencrypted key-in data
10	Encrypted card data (max: 180 bytes) PAN=EXP=CVV
11	Hash data (20bytes)
12	EXP one byte length+ASCII Expiration date (len: 1+4 bytes)
13	ADR one byte length+ASCII Street number (max: 1+20 bytes)
14	ZIP one byte length+ASCII Zip code (max: 1+10 bytes)
15	Reader Serial Number (10 bytes) (optional)
16	KSN (10 bytes)
17	CheckLrc
18	CheckSum
19	ETX (0x03)

Encrypted data sent status:

- Data Length low byte/high byte should be in length of characters.
- Data include encrypted card key-in PAN=EXP (YYMM) and 3-4 digit security code (CVV). The format should be:
  (Security level 3) PAN=YYMM=[CVV]

  Each field is separated by delimiter '=', this should always present even CVV is not keyed-in.
- Format of the fields: EXP, ADR and ZIP is:

1 byte field length in hex)	Data

The length byte ASCII not including length

9.4 ID TECH Manual Entry Enhanced Data Output Format (New)

The new manual entry output format is supported in firmware v1.14 and above
Command to enable the new manual entry format is 53 8F 01 01

Field	Usage Name
0	STX (0x02)
1	Data Length low byte
2	Data Length high byte
3	Card Encode Type always C0 ABA format (note 1 page 31 paragraph 9.4.1)
4	Field 4 see description (0x17 track2 only) or 37 track 2 and track 3 (page 31 paragraph 9.4.2)
5	T1 data length always 0
6	Length of unencrypted manual input data PAN; EXP [and CVV]
7	Length of unencrypted manual input additional data ZIP and/or ADR
8	Field 8 see description (page 31 paragraph 9.4.3)
9	Field 9 see description (page 31 paragraph 9.4.4)
10	Keyed-in data presented as track-2—;PAN=EXP[:CVV]?LRC
11	T3 clear additional keyed-in data in ASCII presented as track 3 [1ADR=][0ZIP=]
12	Encrypted Track-2 data
13	T2 hashed (20 bytes each)
14	Device serial number(10 bytes)(optional)
15	KSN (10 bytes)
16	LRC
17	Check Sum
18	ETX (0x03)

Note:

- Data Length low byte/high byte should be in length of characters.
- Field 11 includes encrypted PAN, EXP (YYMM) and 3-4 digit (CVV).
  The format should be:
  1) ;PAN=YYMM[:CVV]?LRC
     ';'—start sentinel
     '='—field separator between PAN and EXP
     ':'—field separator between EXP and CVV if there is a CVV
     '?'—end sentinel
- The format of the fields ADR and ZIP is:

1 byte field identifier '1'—ADR; '0'—ZIP	ASCII Data	field terminator '='

The track LRC calculation is defined in ISO/IEC 7811-2 section 11.2
The LRC character shall be encoded so that it immediately follows the end sentinel when the card is read in a direction giving the start sentinel first, followed by data and the end sentinel. The bit configuration of the LRC character shall be identical to the bit configuration of the data characters.
The LRC character shall be calculated using the following procedure:
The value of each bit in the LRC character, excluding the parity bit, is defined such that the total count of one bits encoded in the corresponding bit location of all characters of the data track, including the start sentinel, data, end sentinel, and LRC characters, shall be even. The LRC characters parity bit is

not a parity bit for the individual parity bits of the data track, but is only the parity bit for the LRC character encoded as described in 11.1.

Note: if the track buffer is in ASCII the ASCII offset must first be removed
Here is the LRC calculation for track 2 so the start sentinel (ss) value is 0x0B and the end sentinel (es) value is 0x0F, and the length of the track from ss to LRC is len. The position of the ss is 0.

```
BYTE track_lrc = 0;

For (BYTE i = 0; i < len; i++) {
     // accumulate XOR in lrc:
     track_lrc ^= track_buf[i];
}
track_buf[i] = track_lrc;
```

9.4.1 Note 1: Card Encode Type

Card Encode Type starts with 0: original encryption format
Card Encode Type starts with 8: enhanced encryption format

Value	Encode Type Description
00 / 80	ISO/ABA format
01 / 81	AAMVA format
03 / 83	Other
04 / 84	Raw; un-decoded format
85	manual entry mode (default)
C0	manual entry enhanced mode

9.4.2 Note 2: Track 1-3 status byte

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

9.4.3 Note 3: Clear/mask data sent status

Field 8 (Clear/mask data sent status) and field 9 (Encrypted/Hash data sent status) will only be sent out in enhanced encryption format.

Field 8: Clear/masked data sent status byte:
Bit 0: 1 —track 1 clear/mask data present
Bit 1: 1— track 2 clear/mask data present
Bit 2: 1— track 3 clear/mask data present or additional data present (in manual entry mode)
Bit 3: 1— reserved for future use (always 0)
Bit 4: 0 — TDES encryption; 1 — AES encryption
Bit 5: 1—service code '2' or '6'; use ICC when possible V1.30
Bit 6: 0— DATA Key; 1—PIN Key encryption
Bit 7: 1— reader serial number present

9.4.4 Note 4: Encrypted/Hash data sent status

Field 9: Encrypted data sent status
Bit 0: 1— track 1 encrypted data present
Bit 1: 1— track 2 encrypted data present
Bit 2: 1— track 3 encrypted data present
Bit 3: 1— track 1 hash data present
Bit 4: 1— track 2 hash data present

Bit 5: 1— track 3 hash data present
Bit 6: 1—session ID present
Bit 7: 1—KSN present

1. Encryption Option Setting: (for enhanced encryption format only except bits 6-7)

   Command: 53 84 01 <Encryption Option>

   Encryption Option: (**default 08h**)
   bit0: 1 – track 1 force encrypt
   bit1: 1 – track 2 force encrypt
   bit2: 1 – track 3 force encrypt
   bit3: 1 – track 3 force encrypt when card type is 0
   bit4: 1 – track 3 encrypted with card is type 0 and track 3 is ISO4904 send mask data
   if set allow credit card format tracks 1-3 to be masked even if force encrypt bit set.
   bit5: 0 – reserved for future use always zero
   bit6: 0 – reserved for future use always zero
   bit7: 1 – pad according to PKCS#5 (else pad with zeros)

   Note:
   1) When force encrypt is set, this track will always be encrypted, regardless of card type *(unless bit3 is 1),*. No clear/mask text will be sent.
   2) If and only if in enhanced encryption format, each track is encrypted separately. Encrypted data length will round up to 8bytes for DES or 16 bytes for AES.
   3) When force encrypt is not set, the data will be encrypted in original encryption format, that is, only track 1 and track 2 of type 0 cards (ABA bank cards) will be encrypted.

2. Hash Option Setting:

   Command: 53 5C 01 <Hash Option>

   Hash Option: ('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

3. Mask Option Setting: (for enhanced encryption format only)

   Command: 53 86 01 <Mask Option>

   Mask Option: (**Default: 0x07**)
   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

   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.

9.4.5 Description:

Track 1, Track 2 and Track 3 Unencrypted Length

This one-byte value is the length of the original Track data. It indicates the number of bytes in the Track masked data field. It should be used to separate Track 1, Track 2 and Track 3 data after decrypting Track encrypted data field.

Track 1 and Track 2 Masked

Track data masked with the MaskCharID (default is '*'). The first PrePANID (up to 6 for BIN, default is 4) and last PostPANID (up to 4, default is 4) characters can be in the clear (unencrypted).

Track 1, Track 2 and Track 3 Encrypted

This field is the encrypted Track data, using either TDES-CBC or AES-CBC with initial vector of 0. If the original data is not a multiple of 8 bytes for TDES or a multiple of 16 bytes for AES, the reader right pads the data with 0.

The key management scheme is DUKPT. For DUKPT, the key used for encrypting data is called the Data Key. Data Key is generated by first taking the DUKPT Derived Key exclusive or'ed with 0000000000FF00000000000000FF0000 to get the resulting intermediate variant key. The left side of the intermediate variant key is then TDES encrypted with the entire 16-byte variant as the key. After the same steps are preformed for the right side of the key, combine the two key parts to create the Data Key.

Encrypted Data Length

Original Structure
Track 1 and Track 2 data are encrypted as a single block. In order to get the number of bytes for encrypted data field, we need to get Track 1 and Track 2 unencrypted length first. The field length is always a multiple of 8 bytes for TDES or multiple of 16 bytes for AES. This value will be zero if there was no data on both tracks or if there was an error encoding both tracks. Once the encrypted data is decrypted, all padding bytes need to be removed. The number of bytes of decoded track 1 data is indicated by track 1 unencrypted length field. The remaining bytes are track 2 data, the length of which is indicated by track 2 unencrypted length field.
Enhanced Structure
Track 1, 2 and 3 data are encrypted separatedly. In order to get the number of bytes for each track encrypted data field, the field length is always a multiple of 8 bytes for TDES or multiple of 16 bytes for AES. This value will be zero if there was no data on a track. Once the encrypted data is decrypted, all padding bytes need to be removed. The number of bytes of decoded track n data is indicated by track n unencrypted length field.

Track 1, Track 2 and Track 3 Hashed

SecureKey reader uses SHA-1 to generate hashed data for track 1 to track 3 unencrypted data. It is 20 bytes long for each track. This is provided with two purposes in mind: One is for the host to ensure data integrity by comparing this field with a SHA-1 hash of the decrypted Track data, prevent unexpected noise in data transmission. The other purpose is to enable the host to store a token of card data for future use without keeping the sensitive card holder data. This token may be used for comparison with the stored hash data to determine if they are from the same card.

Original Encryption Format Swipe Output

028801001F372300%*5150********7903^PAYPASS/MASTERCARD^***************?*;5150*
*******7903=***************?*8871B640F379F3BD8D057A13F8145439B28D80BE8A43F3440
D85928F576065EEE1BA54CAADFF67D552C2B0CBF1A9F34B63402B967998FC7C80487C8A6D
BFD46975985D3D7E865FEEF6A48930751DC971FDFCBC1989294B7EF6F0D0007AA731C31F57
4608EB85E57751DA48970F96B0E8BECDB94D672D746C2CC75176FA6E0C9E6FEFE0B154A095
9B629949012500000000197F6903

Key Value: F5 BF 6B E8 55 AB 92 3A DE 7E 77 40 D8 46 F9 DE
KSN: 62 99 49 01 25 00 00 00 00 1A

Decrypted Data:

Data in ASCII Format
%B5150710200107903^PAYPASS/MASTERCARD^090910140000631??;5150710200107903=0909
1014000631?0

Data in HEX Format
25423531353037313032303031303739303 35E50415950415353 2F4D41535445524341524 45E30393
039313031343030303033633 13F3F3B353135303731303230303130373930333D3039303931303134
303030303633313F30000000000000

Enhanced Encryption Format Swipe Output

028C01801F372300039B%*5150********7903^PAYPASS/MASTERCARD^***************?*;5
150********7903=***************?*C5E75008986207CBFC9B1DA19F6EFFB392E26C04C3BC
76121C480A3B6FC122EDCE85B813682DAC3628002507B424831A0D6196BDF563F182147055D
DF7F5CB7EA2226764915B3A1B41190105132DB237068A9F56407F7FB69F39A429B97EB1911F5
74608EB85E57751DA48970F96B0E8BECDB94D672D746C2CC75176FA6E0C9E6FEFE0B154A09
59B6299490125000000001B777703

Key Value: 32 68 28 A3 E4 F5 84 48 09 D2 8A B5 EB B8 AA 74
KSN: 62 99 49 01 25 00 00 00 00 1C

Decrypted Data:

Data in ASCII Format

%B5150710200107903^PAYPASS/MASTERCARD^090910140000631??
;5150710200107903=0909101400000631?0

Data in HEX Format
2542353135303731303230303130373930335E50415950415353 2F4D4153544552434152445E30393
039313031343030303033313F3F00
3B353135303731303230303130373930333D303930393130313430303030303633313F300000000000

Manual Entry Format (default)
029C0085000000000718A1F6300C7241C9933DE31A01AB0C6021563FFC7B4810D94DA8863CE5
EC84B37EA79A87D96572047CFCF1068F043039303905313037323105393036333062994901250000
000001D095B03

Key Value: B8 C7 3E 0A 17 58 09 5A 7A 86 44 6F 9B B5 76 FF
KSN: 62 99 49 01 25 00 00 00 00 1D

Decrypted Data:

Data in ASCII Format
515710200107903=0909=356

Data in HEX Format
353135373130323030313037393033 3D303930393D333536

Manual Entry Format (new)

029200C0170018000292;515071******7903=0909?*FBCE9EFFF7500011FA447DC93C11F3816B
C7A37EED3CBD0464AB280F610A7035448E0888CDF683D6C5C32DBE629949003700006000161
DB103

Masked manually entered data: ;515071******7903=0909?*

Key Value: D1 3F 0B D8 47 AA 1D 27 C1 1C F8 4C D8 66 6A 2E
KSN: 62 99 49 00 37 00 00 60 00 16

Decrypted Data:
Data in ASCII Format
;5150710200107903=0909?0

Data in HEX Format
3B353135303731303230303130373930333D303930393F30

Note: To use this format set configuration byte 85 to 31 and 8F to 1.

10.0 MSR Settings

10.1 Setting Command

The setting data command is a collection of one or more function setting blocks and its format is as the following:

Command: <STX><S><FuncSETBLOCK1>…<FuncBLOCKn><ETX><LRC>
Response: <ACK> or <NAK> for wrong command (invalid funcID, length or value)

Each function-setting block <FuncSETBLOCK> has following format:

<FuncID><Len><FuncData>
The setting command will function with any one, any group or all the setting in one command.

Where:
<FuncID> is one byte identifying the setting(s) for the function.
<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.

10.2 Bit Setting and Clearing Commands

This is a special type of setting command. For an 'S' (53) command that is setting only one configuration byte, the first byte of the command (the 'S' or 53) can be replaced with a '0' (31) to clear individual bits or a '1' (31) to set individual bits without changing the other bits in that configuration byte. These commands allows one to set or clear one or more bits of a configuration setting.
A command to clear one bit of a configuration setting is ‘0’.

Example:
30 30 01 80 will clear the highest bit in configuration byte 30
31 30 01 80 will set the highest bit in configuration byte 30
31 30 01 81 will set the lowest and highest bits of configuration byte 30

This simplifies the setting commands for those not familiar with hexadecimal values; there is no need to read the setting before writing the setting; and it reduces the chance of changing another setting when setting a bit value.

Limitations

It can only be used on a one byte configuration setting.
This cannot be used on special fields like the security level, that is no 30 7E 01 02
This cannot be used to simultaneously turn some bits on and some bits off, so no changing 31 to 32 which is necessary to change TDES to AES.

10.3 Get Setting

This command will send current setting to application.
Command: <STX> <R> <ReviewID> <ETX> <LRC 1>

Response: <ACK> <STX> <FuncID> <Len> <FuncData> <ETX> <LRC 2>

<FuncID>, <Len> and <FuncData> definition are same as described above.
Note: ReviewID (value 0x1F) will return all funcID-s.

10.4 Security Management

The MSR reader is intended to be a secure reader. Security features include:

- Can include Device Serial Number
- Can encrypt track 1, track 2 and track 3 data for all bank cards (ETrk1 and ETrk2 will be empty if non bank card is swiped).
- Provides clear text confirmation data including card holder's name and a portion of the PAN as part of the Masked Track Data (for bank cards)
- Optional display expiration date (for bank cards)
- Configurable Security Level

The reader supports five Security Levels. This allows customer to select the security profile needed for the application. The Security Level can be raised by command, but can never be lowered:

- Level 0
  Security Level 0 is a special case. It signifies that all DUKPT keys have been used. In this case the unit is at the end of its useful life. This level is set automatically by the reader when it runs out of DUKPT keys. The life time of DUKPT keys is one millions. Once reach the end of keys' life time, user should inject DUKPT keys again.

- Level 1—not applicable because encryption required
  Reader properties are as configured from factory having the lowest level of default settings. There is no encryption process, no key serial number transmitted with decoded data. The reader has read operation and decoded track data is sent in default format.
  Encrypt type TDES and AES cannot be selected under Level 1.

- Level 2—not applicable because encryption required
  Key Serial Number and/or Initially Loaded Device Key have been injected. The encryption process is not activated and decoded track data is sent in default format.
  Key Serial Number and Initially Loaded Device Key can be set only once after manufacture.

- Level 3
  Both Key Serial Number and Initially Loaded Device Keys are injected and encryption is on. The encryption process is activated. The output of level 3 will be different from level 1 and level 2. Clear data output cannot be selected under Level 3. The output format in this level is more rigidly fixed so many track formatting output options are not supported, see function ID table for limitations.

- 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 swipe.

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. The output format in this level is more rigidly fixed so many track formatting output options are not supported, see function ID table for limitations.

10.5 Encryption Management

The Encrypted swipe 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.

10.6 Check Card Format

- ISO/ABA (American Banking Association) Card
  - Encoding method
    - Track1 is 7-bit encoding.
    - Track1 is 7-bit encoding. Track2 is 5 bits encoding. Track3 is 5-bit encoding.
    - Track1 is 7-bit encoding. Track2 is 5 bits encoding.
    - Track2 is 5-bit encoding.
    - If only track3 and it is 5 bit encoding, ISO4909 and has PAN
  - Additional checks
    - Track1 2nd byte is 'B'.
    - There is at least one '=' in track 2 and the position of '=' is between 12th ~ 20th character.
    - Total length of track 2 is above 19 characters.
    - Total of 4 digits after the separator character for expiration date or a second separator to indicate no expiration date
    - Card number range in PAN will be used to identify bank card.

- 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)

10.7 MSR Data Masking

For ABA Card Data (Card type 0)

For cards that need to be encrypted, 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, card holder name (for Track1). Optional expiration date may be revealed. The rest of the characters should be masked using mask character.

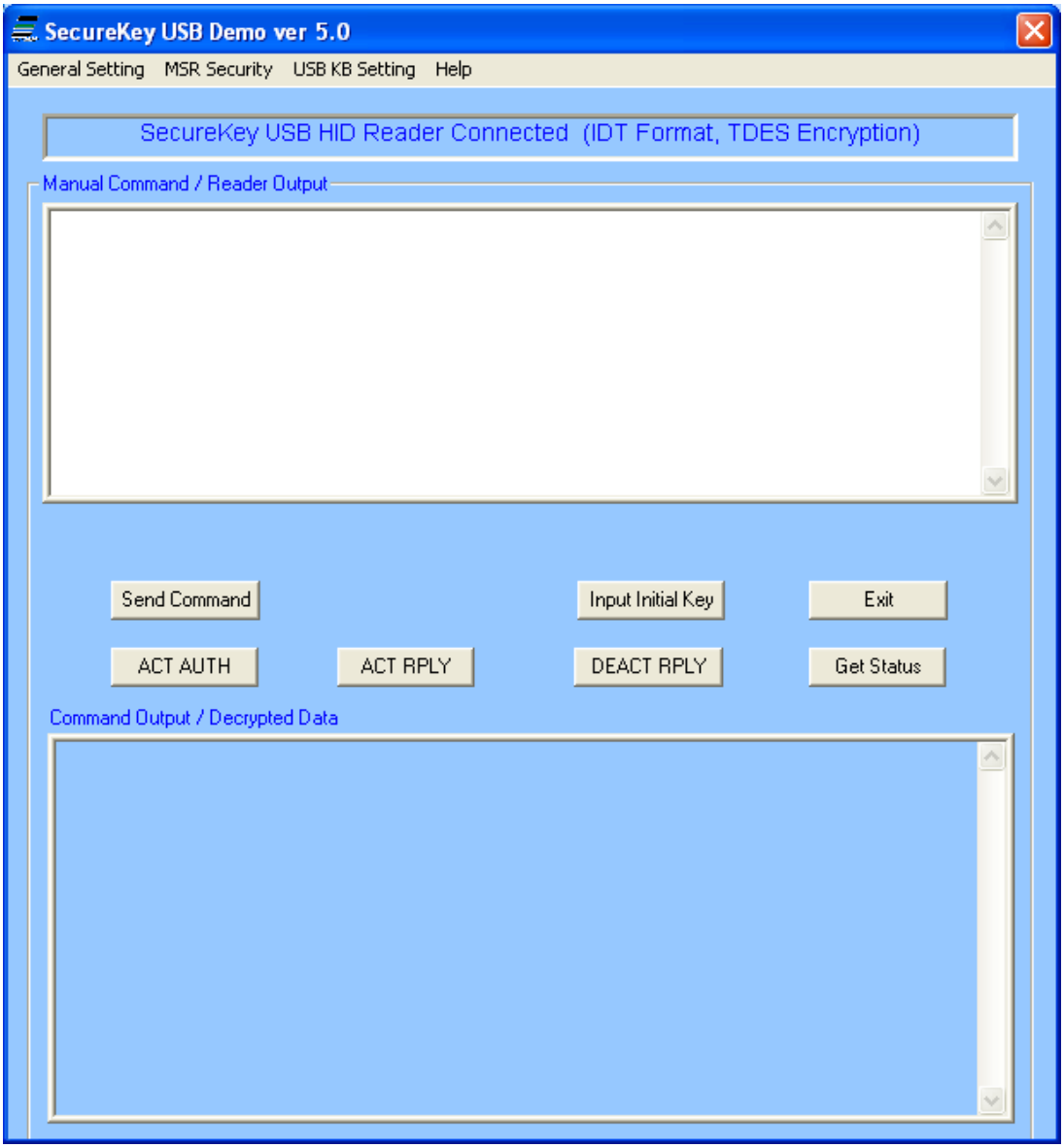
Mask character default value is '*'.

11.0 SecureKey Decryption Demo Software

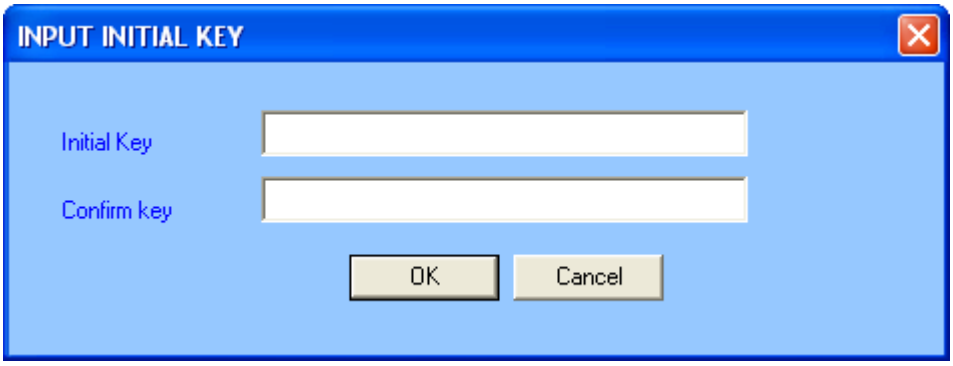
SecureKey demo software is available to demonstrate the MSR data decryption. Please see the below screenshots:

This demo software can be used for USB-HID or USB KB interface. For USB KB interface, please make sure the cursor is placed in the “manual command” window before swiping a card.

The following demo software screenshots are shown for reference and might not reflect the latest demo software version.

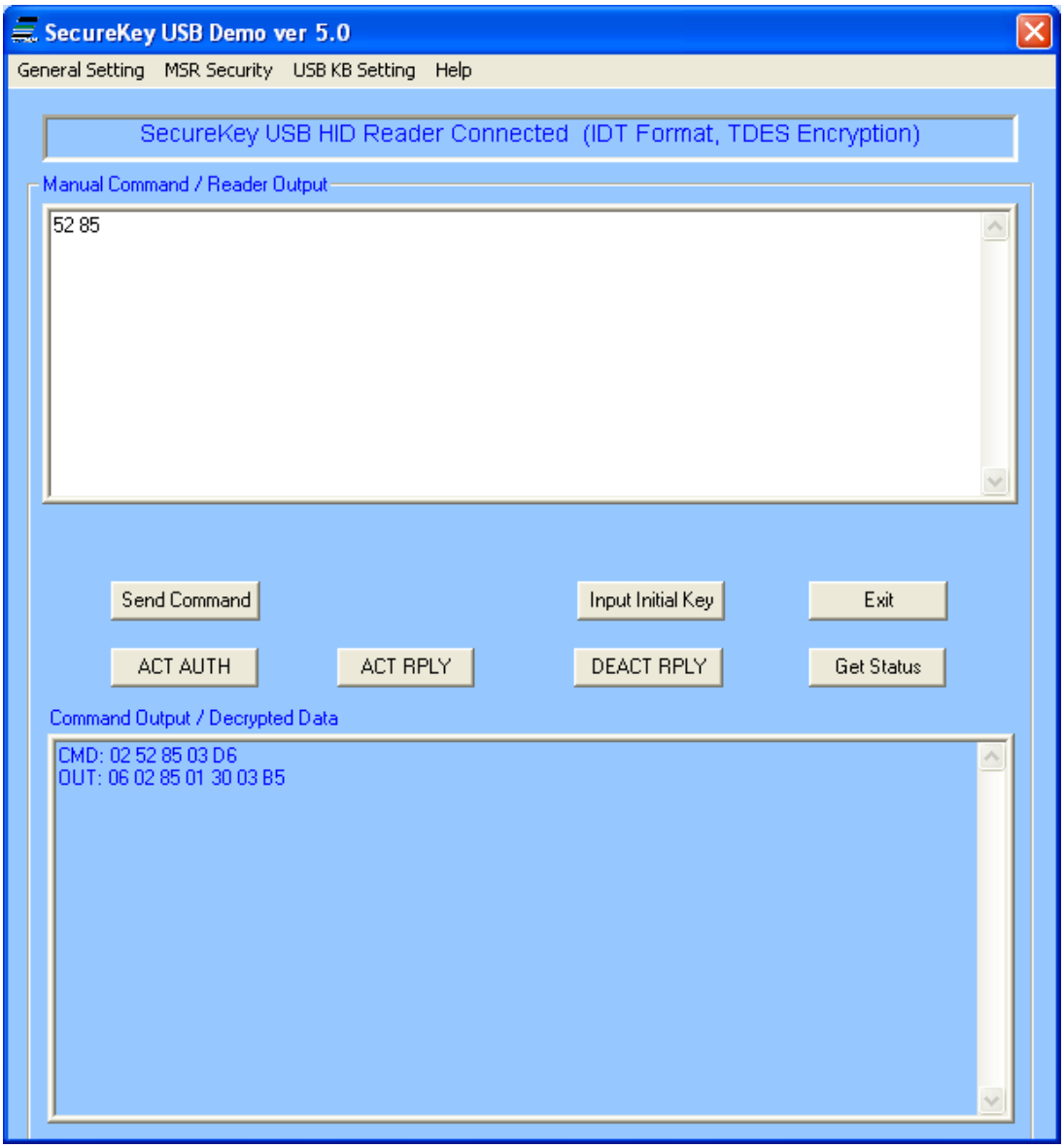


The demo software uses the IDTECH demo key
0123456789ABCDEFFEDCBA9876543210
to decrypt the swiped or entered data by default. To change the decryption key, click on “input initial key”



11.1 Card Swipe Data, IDTECH Original Encryption Format

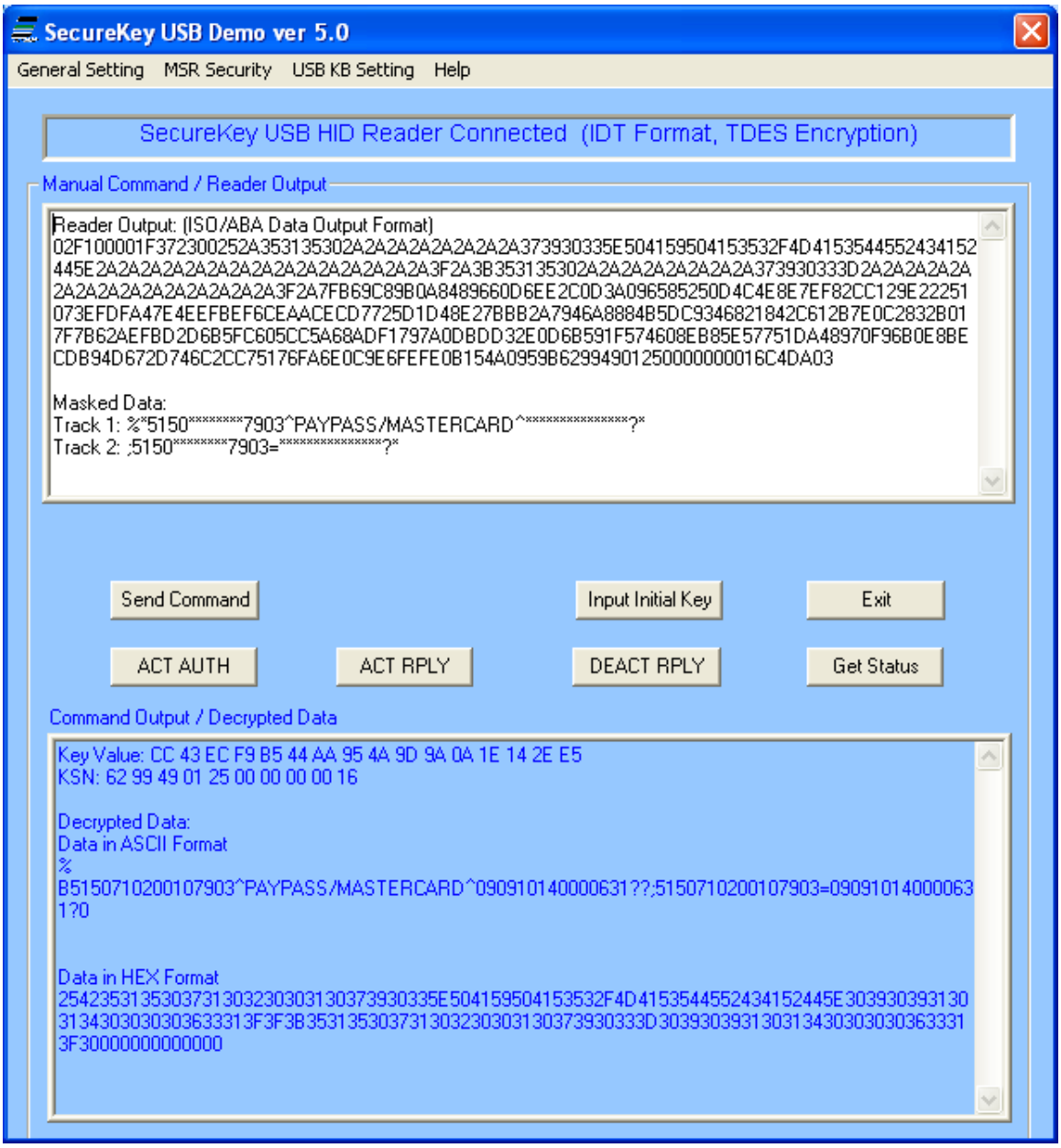
Type 52 85 on the manual command screen to see the current SecureKey setting and press “Send Command”



Check the 5th byte of the response, if it's "30", the SecureKey is in IDTECH original encryption format, for example 06 02 85 01 30 03 85
If the 5th byte is "31", the SecureKey is in IDTECH enhanced encryption format.

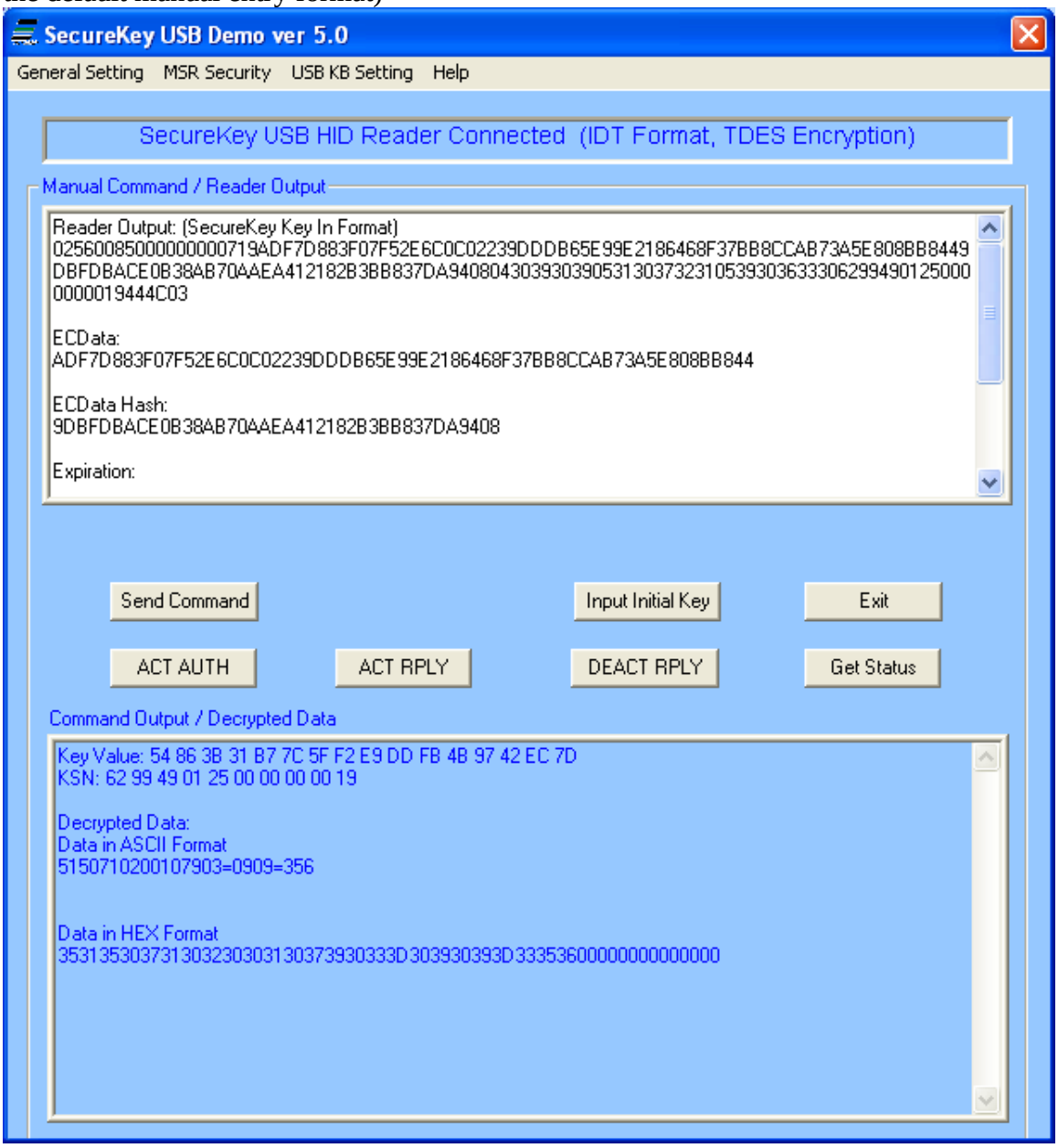
To change the encryption format, go to "MSR Security" and select the original or enhanced encryption format

Swipe a card, the output and decrypted data will be shown on screen.


SecureKey USB Demo ver 5.0
General Setting
MSR Security
USB KB Setting
Help
SecureKey USB HID Reader Connected (IDT Format, TDES Encryption)
Manual Command / Reader Output
Reader Output: (ISO/ABA Data Output Format)
02F100001F372300252A353135302A2A2A2A2A2A2A373930335E50415950415353 2F4D4153544552434152
445E2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A3F2A3B353135302A2A2A2A2A2A2A373930333D2A2A2A2A2A
2A2A2A2A2A2A2A2A2A2A2A3F2A7FB69C89B0A8489660D6EE2C0D3A096585250D4C4E8E7EF82CC129E22251
073EFDFA47E4EEFBEF6CEAACECD7725D1D48E27BBB2A7946A8884B5DC9346821842C612B7E0C2832B01
7F7B62AEFBD2D6B5FC605CC5A68ADF1797A0DBDD32E0D6B591F574608EB85E57751DA48970F96B0E8BE
CDB94D672D746C2CC75176FA6E0C9E6FEFE0B154A0959B629949012500000000016C4DA03
Masked Data:
Track 1: %*5150********7903^PAYPASS/MASTERCARD^**********?*
Track 2: ;5150********7903=**********?*
Send Command
Input Initial Key
Exit
ACT AUTH
ACT RPLY
DEACT RPLY
Get Status
Command Output / Decrypted Data
Key Value: CC 43 EC F9 B5 44 AA 95 4A 9D 9A 0A 1E 14 2E E5
KSN: 62 99 49 01 25 00 00 00 00 16
Decrypted Data:
Data in ASCII Format
%
B5150710200107903^PAYPASS/MASTERCARD^09091014000063 1??;5150710200107903=09091014000063
1?0
Data in HEX Format
25423531353037313032303031303373930335E50415950415353 2F4D4153544552434152445E303930393130
313430303030363331 3F3F3B3531353037313032303031303739303 3D303930393130313430303030363331
3F30000000000000

11.2 Key in data, IDTECH Format

Manually key in the card data on the device, the data will show on the demo as the following (shown is the default manual entry format)



12. Specifications

Mechanical

ITEM	SPECIFICATION
Key switch Information	
Total/ Pre-Travel	2.5 + 0.5 mm/ 1.5 + 0.4 mm
Operating Type	Tactile Type
Operating Force	55 + 7g
Tactile Feel Force	30 + 14g
Letter of Keycap	Traditional North American
Material of Key switch	Silicone Rubber (Rubber Key Pad)
Keyboard Information	
Enclosure	Top & Bottom Case
Material	High Impact ABS
Color	Black
Cable Information	
Jacket Material	Polyester 0.075 mm
Conductors	Polyester 0.10 mm
Color	Upper circuit: 3M467+PET125S
Length	Lower circuit: 3M467+PET 100S
PC Connector	Acheson ED-725A 5~10 um
Keyboard Membrane Material	The auxiliary ports are only on the USB keyboard &
Spacer	located horizontal to each other on the rear. USB port
Back-up Plate	plastic color is white.
Upper Circuit	
Lower Circuit	
Silver	
Interface	USB-KB and USB-HID

Electrical

ITEM	SPECIFICATION
Max Rating	+5.0 VDC ±10%, 60ma Max (excludes ICC)
Type of Circuit	1 Circuit 1 Contact
Insulation Resistance	DC 100V 50 M Ω Min
Bounce	10 ms Max
Operating Life	20,000,000 keystrokes
Industry Requirements	FCC class B and CE

Quality & Reliability

ITEM	SPECIFICATION

MI Requirement	The keyboard meets the FCC class B limits
ESD Immunity	The keyboard passes 0KV to 8 kV minimum without any data loss; passes 8KV to 15 kV minimum that may cause malfunctions. No internal components are destroyed and after reset, the keyboard functions normally.
MTBF	The main operating time between failures will be more than 60,000 hours
Drop	610 mm (24”) height Drop: 4 corner, 4-sidelines, 2-sides front/back
Vibration	Vibration frequency 60 Hz/sec. 3 mm amplitude of an oscillation. X,Y,Z each axis at 2 hours
Operating Temperature	0°C ~ 40°C
Storage Temperature	-20°C ~ + 40°C

MagStripe Reader

Number of tracks	Tracks 1 & 2 or Tracks 2 & 3 or Tracks 1, 2 & 3
Encryption	TDES or AES with DUKPT key management
Compatibility	ISO 7810 and 7811-1 through -6
Output data formatting	Standard output format
Operating Life	1,000,000 card swipes
Card speed range	3 to 60 IPS (Inches Per Second)

7.6.6.7 **XML Data Output Format**

The XML data output format is as below. Messages (swiped and keyed credit, debit, other, gift, drivers licenses, etc.) need to include at least the <Addr></Addr> tag. The XML tags needs to be in the following order:

```
<DvcMsg Ver="1.1">
   <Dvc attribute list ...></Dvc>
   <Card attribute list ...></Card>
   <Addr attribute list ...></Addr>
   <Tran attribute list ...></Tran>
</DvcMsg>
```

Field Name	Attribute	Required	Max Length	Type	Description
Ver	DvcMsg	Required	10	String	Device Message Version (use 1.1)
App	Dvc	Required	50	String	Application Name
AppVer	Dvc	Required	10	String	Application Version
DvcType	Dvc	Required	40	String	Device Type (MODEL-MANUFACTURER)
DvcSN	Dvc	Required	40	String	Device Serial Number
Entry	Dvc	Required	20	String	Card Entry Method (SWIPE, MANUAL, CONTACTLESS)
CEncode	Card	Optional	2	Integer	Card Encoding Type: 0 = ISO/ABA 1 = AAMVA 2 = Keyed (Manual Keyed) 3 = Other
Trk1	Card	Optional	240	String	Track 1 (currently only used for non-financial cards)
Trk2	Card	Optional	180	String	Track 2 (currently only used for non-financial cards)
Trk3	Card	Optional	180	String	Track 3 (currently only used for non-financial cards)
ETrk1	Card	Optional	240	String	Encrypted Track 1
ETrk2	Card	Optional	180	String	Encrypted Track 2
ECData	Card	Optional	180	String	Encrypted Card Data (Card Number=ExpDate(YYMM)=Security Code)
CDataKSN	Card	Optional	40	String	Card Data Key Serial Number
MskPAN	Card	Optional	30	String	Masked PAN. Format: 4003********6781
Exp	Card	Optional	8	String	Expiration Date. Format: YYMM
CHolder	Card	Optional	80	String	Cardholder Name
AVSAddr	Addr	Optional	50	String	AVS Address
AVSZip	Addr	Optional	20	String	AVS Zip Code
TranType	Tran	Required	40	String	Transaction Type (CREDIT, DEBIT)

Field Name	Attribute	Required	Max Length	Type	Description
EFormat	Card	Optional	2	Integer	Encryption Format: 0 = Default 1 = Format1 2 = Format2 3 = Format3 4 = Format4 5 = Reserved for future use 6 = Reserved for future use

12.0 Appendix A Setting Configuration 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
TrackSelectID	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	1 (1 ~ 255)	USB HID Polling Interval
TrackSepID	17	Track Separator	0x0D=CR/Enter	CR for RS232, Enter for KB any character supported except 00 which means none.
SendOptionID	19	Send Option	'1' ('0'~'F') '5' for Port Powered IV	Sentinel and Account number control
DecodingMethodID	1D	Decoding Direction	'1' ('0'~'3')	Reading Direction 0x30 – Raw Data Decoding in Both Directions. **0x31 – Decode in Both directions.** 0x32 – Moving Stripe Along Head in Direction of Encoding. 0x33 – Moving Stripe Along Head Against Direction of Encoding.
ReviewID	1F	Review All Settings	None	
TerminatorID	21	Terminator	0x0D (any)	CR for RS232, Enter for KB; '0' for CRLF
FmVerID	22	Firmware Version	None	
USBHIDFmtID	23*	USB HID Fmt (HID rdr only)	'0' ('0', '8')	'0' ID TECH Format; '8' HIDKB format
ForeignKBID	24	Foreign KB	'0' ('0' ~0x3E)	Foreign Keyboard US 0x30 SWISS 0x31 SWEDISH 0x32 SPANISH_MEX 0x33 NORWAY 0x34 ITALIAN 0x35 GERMAN 0x36 FRENCH 0x37

				JAPAN 0x38 UK 0x39 UNIVERSAL 0x3A SPANISH_SPA 0x3B BRAZIL 0x3C ARABIA 0x3D CANADIAN_FRENCH 0x3E
RdrOpt2	2F	ReaderOption2	0 (20)	Bit5=1 JIS II card type switches from 0x87 to 0x85
CustSetID	30	Custom setting Options	0 (0-0xF)	Bit0=1 allow non credit card track data to be sent without encryption; Bit1=1 don't send empty encrypted package; Bit2=1 send reader serial number with encrypted data; Bit3=1 indicate busy while sending;
Track1PrefixID	34	Track 1 Prefix	0 (any string)	No prefix for track 1, 6 char max
Track2PrefixID	35	Track 2 Prefix	0 (any string)	No prefix for track 2, 6 char max
Track3PrefixID	36	Track 3 Prefix	0 (any string)	No prefix for track 3, 6 char max
Track1SuffixID	37	Track 1 Suffix	0 (any string)	No suffix for track 1, 6 char max
Track2SuffixID	38	Track 2 Suffix	0 (any string)	No suffix for track 2, 6 char max
Track3SuffixID	39	Track 3 Suffix	0 (any string)	No suffix for track 3, 6 char max
KeyTypeID	3E*	data or pin key	0	0-data key; 5A-pin key
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
SerialNumberID	4E*	device serial #	any 8-10 bytes	8-10 digit serial number; Can be set only once
DispExpDateID,	50	mask or display expiration date	'0"0'-'1'	‘0’ mask expiration date; ‘1’ display expiration date
SessionID	54	8 byte hex not stored in EEPROM	None	always init to all ‘FF’
Mod10ID	55	include mod10	'0' ('0'-'2')	‘0’ don’t include mod10, ‘1’

		check digit		display mod10, ‘2’ display wrong mod10
KeyManageTypeID	58*	DUKPT	‘1’	‘1’ DUKPT
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.
HexCaseID,	5D		'1' (‘0’-‘1’)	‘0’ send in lower case; ‘1’ send in upper case
T17BStartID	61	Track 1 7 Bit Start Char	‘%’ (any)	‘%’ as Track 1 7 Bit Start Sentinel
T16BStartID	62	T16B Start	‘%’ (any)	‘%’ as Track 1 6 Bit Start Sentinel
T15BStartID	63	T15B Start	‘;’ (any)	‘;’ as Track 1 5 Bit Start Sentinel
T27BStartID	64	Track 2 7 Bit Start Char	‘%’ (any)	‘%’ as Track 2 7 Bit Start Sentinel
T25BStartID	65	T25BStart	‘;’ (any)	‘;’ as Track 2 5 Bit Start Sentinel
T37BStartID	66	Track 3 7 Bit Start Char	‘%’ (any)	‘%’ as Track 3 7 Bit Start Sentinel
T36BStartID	67	T36BStart	‘!’ (any)	‘!’ as Track 3 6 Bit Start Sentinel
T35BStartID	68	T35BStart	‘;’ (any)	‘;’ as Track 3 5 Bit Start Sentinel
T1EndID	69	Track 1 End Sentinel	‘?’ (any)	‘?’ as End Sentinel
T2EndID	6A	Track 2 End Sentinel	'?' (any)	‘?’ as End Sentinel
T3EndID	6B	Track 3 End Sentinel	'?' (any)	‘?’ as End Sentinel
T1ERRSTARTID	6C	Track 1 error code	‘%’ (any)	start sentinel if track 1 error report
T2ERRSTARTID	6D	Track 2 error code	‘;’ (any)	start sentinel if track 2 error report
T3ERRSTARTID	6E	Track 3 error code	‘+’ (any)	start sentinel if track 3 error report
SecureLrcID	6F	Secured output format track LRC option *enhanced only*	‘1’ (‘0’-‘1’)	‘1’ to send track LRC in secured output data; ‘0’ don’t send track LRC
EquipFwID	77*	feature option setting	any	Factory Reader firmware configuration setting
SyncCheckID	7B	check for track sync bits-can allow poorly encoded cards	‘2’ (‘0’-2’)	check leading & trailing sync bits ‘0’ 13 bits; ‘1’ 13 bits, but allow if valid through track LRC; '2' 9 bits

		to be read		ABA; 13 bits IATA; 16 bits JIS
SecurityLevelID	7E*	Reader's encryption level	'1' or '3' ('0'-'4')	'1' no encryption; '2' key loaded; '3 encrypted reader; '0' DUKPT exhausted; '4' authentication required
EncryptOptID	84	encryption options, *enhanced only*	08 encrypt track 3 if card type 0; (0-FF)	**bit 0** encrypt trk1; **bit 1** encrypt trk2; **bit 2** forces encryption on track 3 and there would be no mask data; **bit 3** encrypt trk3; **bit 4** encrypt trk3 if card type 0 only and allow trk1, trk 2, trk3 masked data to be sent as well. **bit 7** pad according to PKCS#5
EncryptStrID	85*	encrypt structure	'0'	'0' original; '1' enhanced
MaskOptID	86	clear / mask data options	7 (0-F)	bit 0 send clear/mask trk1 bit 1 send clear/mask trk2 bit 2 send clear/mask trk3 bit 3 don't mask trk1 'B'
EnFmtID	88		\02\30\34	encryption format defined in xml specification
T3ExpDatePosID	89	expire date position'2'	0x34 ((0x34, 0x36)	track 3 expiration date position offset
AdminLvlID	8E	Admin Level	B, 15, 1F, 29, 33, 3D	B-Admin 1; 15-Admin 2; 1F-Admin 3; 29-Admin 4' 33-Admin 5; 3D-Admin 6
KeyedOptID	8F*	Keyed Options	0-(any)	0-original format; 1-enhanced format see 7.7.1 Configuration byte 8F controls Keyed in options page 13
MasterModeID	AB		'1' master key loading mode	Special for key loading
MKeyLoadedID	AC		0 (any)	Special for key loading (read only)
RkiTimeOutID	AD	RKI timeout	2(2-255)	Remote Key Injection Timeout in minutes
Equip2ID	AE	special settings	00 (any)	if bit4 high send serial number during enumeration
CustSet2ID	AF	sending credit card shifted by lifting card.	**10H** (any)	bit 0=0 allow track shifted CC card; bit0=1 don't send track shifted Credit Card; bit4=1 support encrypting loop reader transaction

PrefixID	D2	Preamble	0 (any 15)	No Preamble, 15 char max; Only sent in KB mode
PostfixID	D3	Postamble	0 (any 15)	No Postamble, 15 char max; only sent in KB mode

* These settings do not change with a default all command.

1 PrefixID and PostFixID are ignored on encrypted transaction unless the reader is a keyboard reader, then they are supported so that the host can recognize the reader's output.

13.0 Appendix B Guide to Encrypting and Decrypting Data

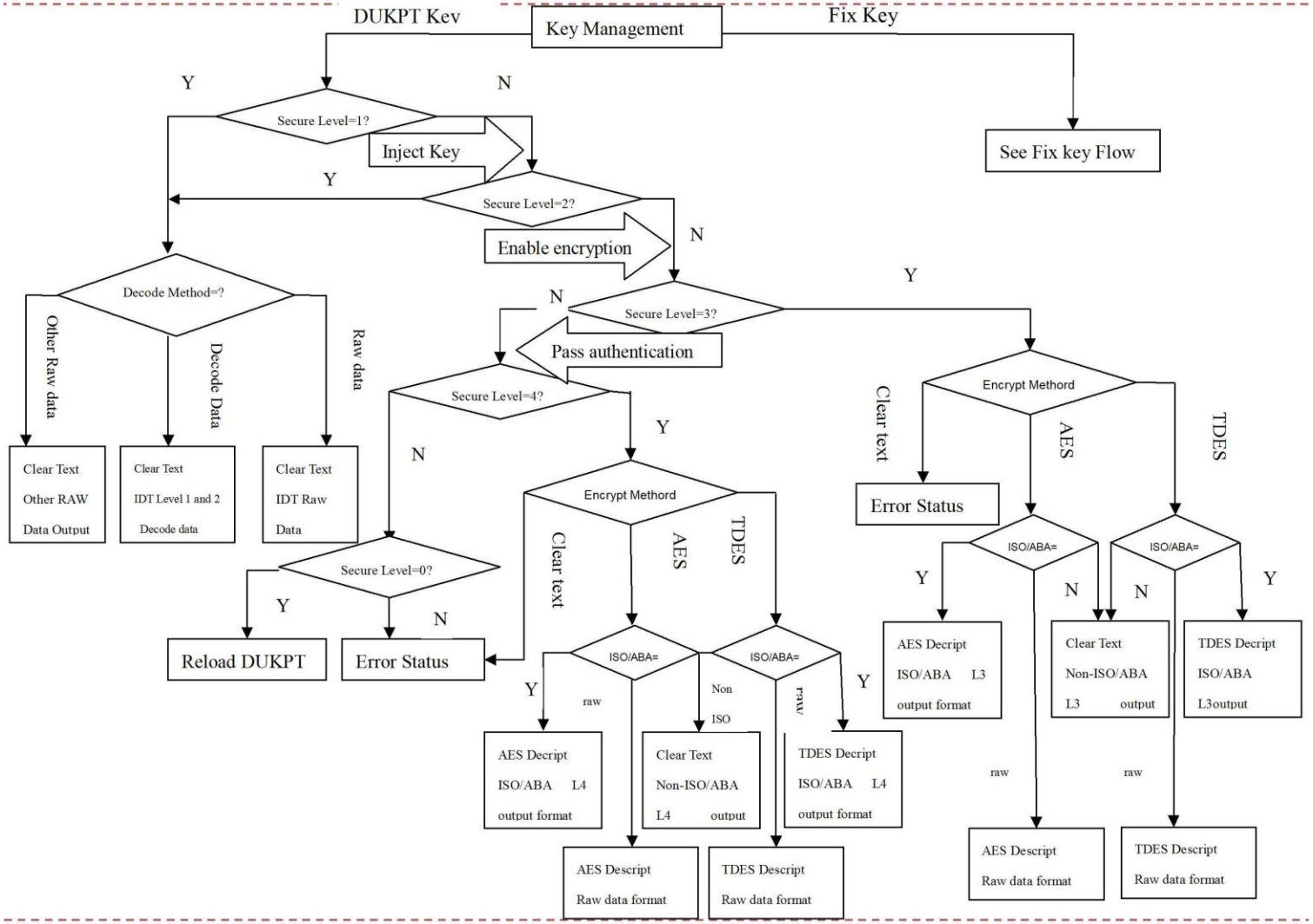
The encryption method used by SecureKey is called Cipher-block Chaining (CBC). With this method, each block of data is XOR'ed with the previous data block before being encrypted. The encryption of each block depends on all the previous blocks. As a result, each encrypted data block would need to be decrypted sequentially.

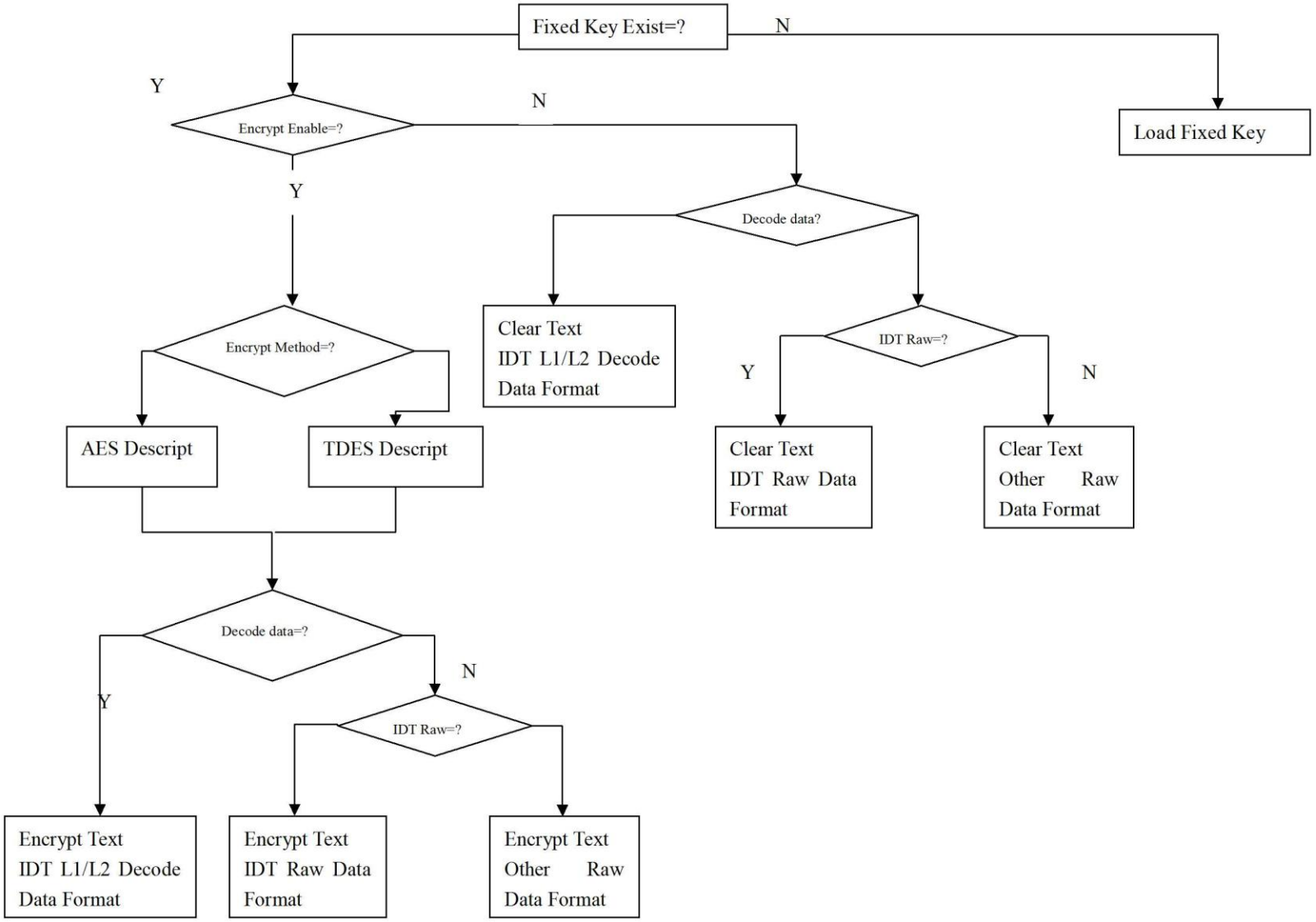
To encrypt the data, first generate an 8-byte random initialization vector which is XOR'ed with the first data block before it is encrypted. Then the data is encrypted with the device key using TDES algorithm. The result is again XOR'ed with the next 8-byte data block before it is encrypted. The process repeats until all the data blocks have been encrypted.

The host can decrypt the cipher text from the beginning of the block when the data is received. However, it must keep track of both the encrypted and clear text data. Or alternatively, the data can be decrypted backward form that last data block to the first, so that the decrypted data can replace the original data as the decryption is in process.

To decrypt the data using reverse method, first decrypt the last 8-byte of data using TDES decryption. Then perform an XOR operation with result and the preceding data block to get the last data block in clear text. Continue to decrypt the next previous block with the same method till it reaches the first block. For the first data block, the XOR operation can be skipped, since it is XOR'ing with 00h bytes.

14.0 Appendix C Key Management Flow Chart




Fixed Key Exist=?
N
Load Fixed Key
Y
Encrypt Enable=?
N
Y
Decode data?
Clear Text
IDT L1/L2 Decode
Data Format
IDT Raw=?
Y
N
Clear Text
IDT Raw Data
Format
Clear Text
Other Raw
Data Format
Encrypt Method=?
AES Descript
TDES Descript
Decode data=?
Y
N
IDT Raw=?
Encrypt Text
IDT L1/L2 Decode
Data Format
Encrypt Text
IDT Raw Data
Format
Encrypt Text
Other Raw
Data Format

15.0 Appendix D Example of IDTECH Raw Data Decryption

Original Raw Data Forward Direction:
01D67C81020408102D4481020408102042890A350854A2FB3EE4BA3D4065B67A9C391F58
2A42B99A858A90AF60852B14AA628A0D
028FC210842C18421084030092040B51581F24B56074404811160D

Original Raw Data Backward Direction:
01A28CAA51A9420DEA12A342B33A84A835F13872BCDB4C0578BA4EF9BE8A542158A1
228408102040810245681020408102 7CD60D
02D11024045C0D5A49F03515A04092018042108430684210 87E20D

Note:

a. There is track number before each track. Track 1 is 01, Track 2 is 02, Track 3 is 03.
b. There is track separator after each track: 0D

Example of decryption of a two track ABA card with the original encryption format. For both Fix & DUKPT key management.
SecureKey **Reader with default settings**

Key for all examples is
0123456789ABCDEFFEDCBA9876543210

Original Encryption Format
Original encryption format (this can be recognized because the high bit of the fourth byte underlined (00) is 0.
028700041B331A0027D2E435CEE303F007E977B598B7E3C57C76F4445E309F6916C0321A
0F915B6E490813498839049FE5204762327C3C758C5BF82542DEEDD8D6AF88019149A702
FF2D43BD4AD60031FA450720B00D7808E15F3D5B29AE712C64A1212E9AF6F483BD4079
8A9FF2DDE77D046620B55BCE94A4D5534CF57E7E07629949011A0000000001871D03

STX, Length (LSB, MSB), card type, track status, length track 1, length track 2, length track 3
02 8700 04 1B 33 1A 00

Track 1 & 2 encrypted length 0x33+0x1A rounded up to 8 bytes =0x4D -> 0x50 (80 decimal)

27D2E435CEE303F007E977B598B7E3C57C76F4445E309F6916C0321A0F915B6E49081349
8839049FE5204762327C3C758C5BF82542DEEDD8D6AF88019149A702FF2D43BD4AD600
31FA450720B00D7808

Track 1 hashed
E15F3D5B29AE712C64A1212E9AF6F483BD40798A

Track 2 hashed
9FF2DDE77D046620B55BCE94A4D5534CF57E7E07

KSN
629949011A0000000001

LRC, checksum and ETX
87 1D 03

Key Value: 8A 60 A3 EB 80 87 63 52 B8 F5 05 CD A8 3C 33 70
KSN: 62 99 49 01 1A 00 00 00 00 01

Decrypted Raw Data:
01D67C81020408102D44810204081020428 90A350854A2FB3EE4BA3D4065B67A9C391F58
2A42B99A858A90AF60852B14AA628A
028FC210842C18421084030092040B51581F24B5607440481116

-=-=-=--=-=-=--=-=-=--=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=--=-=-=-=--=-=-=-=--=-=-=-=-=-=--=-=-=-=--=-=-
=--=-

Security Level 4 Original Encryption Format
028F00041B331A0070756B86C0B670DAAA78EEA454F5A7BAFB5CDA91BA9A5B62BB49
F67CD21484D3138DB3468C80F3468688AE61E3FB25FEEB630B81717CC405F8A73430FC
AFEF98C4CEDE76AB7AAC0D9090E2B25F7E77F7888306B57CB67A9BE15F3D5B29AE71
2C64A1212E9AF6F483BD40798A9FF2DDE77D046620B55BCE94A4D5534CF57E7E076299
49011A0000000002DD5D03

Key Value: 06 A9 B3 23 2A 69 B4 57 61 76 5E C3 CB A3 33 37
KSN: 62 99 49 01 1A 00 00 00 00 02
Session ID: AA AA AA AA AA AA AA AA

Decrypted Data:
01D67C81020408102D448102040810204289 0A350854A2FB3EE4BA3D4065B67A9C391F58
2A42B99A858A90AF60852B14AA628A
028FC210842C18421084030092040B51581F24B5607440481116

16.0 Appendix E Function Code for Non-printable ASCII Character and Keystroke

For non-printable ASCII character, keystroke used in setting command are defined as follows:

For most of character "Shift On" and "Without Shift" will be reverse if Caps Lock is on. Firmware need check current Caps Lock status before sending out data.

For Function code B1 to BA, if "Num Lock" is not set, then set it and clear it after finishing sending out code.

For Function code BB to C2, C9 to CC, if "Num Lock" is set then clear it and set it after finishing sending out code.

Key Code Table in USB HID Keyboard Interface

Keystroke	Hex Value	Functional Code	USB HID KB Code
Ctrl+2	00		1F Ctrl On
Ctrl+A	01		04 Ctrl On
Ctrl+B	02		05 Ctrl On
Ctrl+C	03		06 Ctrl On
Ctrl+D	04		07 Ctrl On
Ctrl+E	05		08 Ctrl On
Ctrl+F	06		09 Ctrl On
Ctrl+G	07		0A Ctrl On
BS	08	\bs	2A
Tab	09	\tab	2B
Ctrl+J	0A		0D Ctrl On
Ctrl+K	0B		0E Ctrl On
Ctrl+L	0C		0F Ctrl On
Enter	0D	\enter	28
Ctrl+N	0E		11 Ctrl On
Ctrl+O	0F		12 Ctrl On
Ctrl+P	10		13 Ctrl On
Ctrl+Q	11		14 Ctrl On
Ctrl+R	12		15 Ctrl On
Ctrl+S	13		16 Ctrl On
Ctrl+T	14		17 Ctrl On
Ctrl+U	15		18 Ctrl On
Ctrl+V	16		19 Ctrl On
Ctrl+W	17		1A Ctrl On
Ctrl+X	18		1B Ctrl On
Ctrl+Y	19		1C Ctrl On
Ctrl+Z	1A		1D Ctrl On

ESC	1B	\esc	29
Ctrl+\	1C		31 Ctrl On
Ctrl+]	1D		30 Ctrl On
Ctrl+6	1E		23 Ctrl On
Ctrl+-	1F		2D Ctrl On
SPACE	20		2C
!	21		1E Shift On
"	22		34 Shift On
#	23		20 Shift On
$	24		21 Shift On
%	25		22 Shift On
&	26		24 Shift On
'	27		34
(	28		26 Shift On
)	29		27 Shift On
*	2A		25 Shift On
+	2B		2E Shift On
,	2C		36
-	2D		2D
.	2E		37
/	2F		38
0	30		27 Shift On
1	31		1E Shift On
2	32		1F Shift On
3	33		20 Shift On
4	34		21 Shift On
5	35		22 Shift On
6	36		23 Shift On
7	37		24 Shift On
8	38		25 Shift On
9	39		26 Shift On
:	3A		33 Shift On
;	3B		33
<	3C		36 Shift On
=	3D		2E
>	3E		37 Shift On
?	3F		38 Shift On
@	40		1F
A	41		04 Shift On
B	42		05 Shift On
C	43		06 Shift On
D	44		07 Shift On
E	45		08 Shift On

F	46		09 Shift On
G	47		0A Shift On
H	48		0B Shift On
I	49		0C Shift On
J	4A		0D Shift On
K	4B		0E Shift On
L	4C		0F Shift On
M	4D		10 Shift On
N	4E		11 Shift On
O	4F		12 Shift On
P	50		13 Shift On
Q	51		14 Shift On
R	52		15 Shift On
S	53		16 Shift On
T	54		17 Shift On
U	55		18 Shift On
V	56		19 Shift On
W	57		1A Shift On
X	58		1B Shift On
Y	59		1C Shift On
Z	5A		1D Shift On
[	5B		2F
\	5C		31
]	5D		30
^	5E		23 Shift On
_	5F		2D Shift On
`	60		35
a	61		04
b	62		05
c	63		06
d	64		07
e	65		08
f	66		09
g	67		0A
h	68		0B
i	69		0C
j	6A		0D
k	6B		0E
l	6C		0F
m	6D		10
n	6E		11
o	6F		12
p	70		13

q	71		14
r	72		15
s	73		16
t	74		17
u	75		18
v	76		19
w	77		1A
x	78		1B
y	79		1C
z	7A		1D
{	7B		2F Shift On
|	7C		31 Shift On
}	7D		30 Shift On
~	7E		35 Shift On
DEL	7F		2A
F1	81	\f1	3A
F2	82	\f2	3B
F3	83	\f3	3C
F4	84	\f4	3D
F5	85	\f5	3E
F6	86	\f6	3F
F7	87	\f7	40
F8	88	\f8	41
F9	89	\f9	42
F10	8A	\fa	43
F11	8B	\fb	44
F12	8C	\fc	45
Home	8D	\home	4A
End	8E	\end	4D
→	8F	\right	4F
←	90	\left	50
↑	91	\up	52
↓	92	\down	51
PgUp	93	\pgup	4B
PgDn	94	\pgdn	4E
Tab	95	\tab	2B
bTab	96	\btab	2B Shift On
Esc	97	\esc	29
Enter	98	\enter	28
Num_Enter	99	\num_enter	58
Delete	9A	\del	4C
Insert	9B	\ins	49

Backspace	9C	\bs	2A
SPACE	9D	\sp	2C
Pause	9C	\ps	48
Ctrl+[	9F	\ctr1	2F Ctrl On
Ctrl+]	A0	\ctr2	30 Ctrl On
Ctrl+\	A1	\ctr3	31 Ctrl On
Left_Ctrl_Break	A2	\l_ctrl_bk	Clear Ctrl Flag
Left_Ctrl_Make	A3	\l_ctrl_mk	Set Ctrl Flag for following char(s)
Left_Shift_Break	A4	\l_shift_bk	Clear Shift Flag
Left_Shift_Make	A5	\l_shift_mk	Set Shift Flag for following char(s)
Left_Windows	A6	\l_windows	E3 (left GUI)
Left_Alt_Break	A7	\l_alt_bk	Clear Alt Flag
Left_Alt_Make	A8	\l_alt_mk	Set Alt Flag for following char(s)
Right_Ctrl_Break	A9	\r_ctrl_bk	Clear Ctrl Flag
Right_Ctrl_Make	AA	\r_ctrl_mk	Set Ctrl Flag for following char(s)
Right_Shift_Break	AB	\r_shift_bk	Clear Shift Flag
Right_Shift_Make	AC	\r_shift_mk	Set Shift Flag for following char(s)
Right_Windows	AD	\r_windows	E7 (right GUI)
Right_Alt_Break	AE	\r_alt_bk	Clear Alt Flag
Right_Alt_Make	AF	\r_alt_mk	Set Alt Flag for following char(s)
Num_Lock	B0	\num_lock	53
Num_0	B1	\num0	62 Num Lock On
Num_1	B2	\num1	59 Num Lock On
Num_2	B3	\num2	5A Num Lock On
Num_3	B4	\num3	5B Num Lock On
Num_4	B5	\num4	5C Num Lock On
Num_5	B6	\num5	5D Num Lock On
Num_6	B7	\num6	5E Num Lock On
Num_7	B8	\num7	5F Num Lock On
Num_8	B9	\num8	60 Num Lock On
Num_9	BA	\num9	61 Num Lock On
Num_Home	BB	\num_home	5F
Num_PageUp	BC	\num_pgup	61
Num_PageDown	BD	\num_pgdn	5B
Num_End	BE	\num_end	59
Num_↑	BF	\num_up	60
Num_→	C0	\num_right	5E
Num_↓	C1	\num_down	5A
Num_←	C2	\num_left	5C
Print_Scrn	C3	\prt_sc	46
System_Request	C4	\sysrq	9A

Scroll_Lock	C5	\scroll	47
Pause	C6	\menu	76
Break	C7	\break	
Caps_Lock	C8	\caps_lock	39
Num_/	C9	\num_/	54
Num_*	CA	\num_*	55
Num_-	CB	\num_-	56
Num_+	CC	\num_+	57
Num_.	CD		
Num_DEL	CE		
Num_INS	CF		
Delay_100ms	D0	\delay	Delay 100 ms