HCR350-C
Programmer's Manual

Hybrid Card Reader - USB Interface

Document #: PM032-USB-U

Revision A

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- Specification for CE Class A
- Product Certificate by Taiwan BSMI (Bureau of Standards, Metrology and Inspection)

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PREFACE

This manual provides detailed information relating to the overall operational, electrical, mechanical, environmental and functional aspects of the HCR350-C. This document should be read and understood prior to initial operation of the product.

For ease of installation and programming use, we have addressed everything from its attractive features to its various configurations.

When designing the HCR350-C, we selected what we feel are the most useful features and functions. If in some cases you find that your specific needs differ from our existing products, we welcome your comments and suggestions. Custom-designed models are also available.

If further questions do arise, please call for technical support, our FAE will assist you in any way we can.

EMVCo Level 1 type approved

EMVCo approval of the interface module (IFM) contained in this Terminal shall mean only that the HCR350-C has been tested in accordance and for sufficient conformance with the EMV specifications, Version 3.1.1, as of 04-Apr-2005 to 15-Apr-2005 of testing. EMVCo approval is not in any way an endorsement or warranty regarding the completeness of the approval process or the functionality, quality or performance of any particular product or service. EMVCo does not warrant any product or services provided by third parties, including, but not limited to, the producer or provider of the IFM and EMVCo approval does not under any circumstances include or imply any product warranties from EMVCo, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by EMVCo. All rights and remedies regarding products and services which have received EMVCo approval shall be provided by the party providing such products or services, and not by EMVCo and EMVCo accepts no liability whatsoever in connection therewith.

Table of Contents

1 Abbreviations, Notations and Terminology

The following abbreviations, notations and terminology are used in this manual.

ACK	Acknowledgement (0x06)
CR	Carriage Return (0x0D)
DLE	Data Link Escape (0x10)
ES	End Sentinel
ESC	Escape (0x1B)
ETX	End of Text (0x03)
FF	Form Feed (0x0C)
LRC	Longitudinal Redundancy Check
NAK	Negative Acknowledgement (0x15)
NUL	Null (0x00)
PPS	Protocol and parameters selection
PSCR	Primary Smart Card Reader
SAM	Security Access Module, Secure Application Module
SI	Shift In (0x0F)
SOH	Start of Header (0x01)
SS	Start Sentinel
STX	Start of Text (0x02)
SYN	Synchronous (0x16)

2 General Description

This section presents general information about the basic characters of the HCR350-C.

2.1 Features

The HCR350-C provides the following features:

1	EMV 2000 Level 1 certificate.
2	Read/write CPU and memory card.
3	Light weight: 56g (without adapter)
4	Compact size: 108.7L*67W*10H mm (Without SAM board) Compact size: 108.7L*67W*20H mm (With SAM daughter board)
5	Single, dual, or triple track versions allow for reading all types of magnetic cards, including credit cards and drivers licenses.
6	Firmware upgradeable.

2.2 Application

This Hybrid Reader is designed to read high or low coercivity magnetic cards and read/write CPU and memory cards.

It decodes and verifies up to 3 tracks of data simultaneously. This product communicates with a host computer or other terminal using a virtual COM Port. Because of the transmitting protocol of HCR350-C is more precise, it is suitable for using in financial industry.

2.3 Function

2.3.1 Reading

The reader can read magnetic data from any available track encoded per ISO 7810, 7811, AAMVA, and CA old DMV. For smart card operation, it provides landing contact and card locking function while reading from and writing to ISO7816-3 microprocessor smart cards (T=0, T=1) and some memory cards.

2.3.2 Operation Behavior

The reader plays as the bridge between host and smart card that provides an effective way for host to access smart cards. For CPU card, the APDU (Application Protocol Data Unit) is included in the packet. For memory card, the transparent data will be instead. Moreover, it is EMV certificated that benefits customers to build their own host terminal in a short time for EMV application.

To work for various conditions and environment, HCR350-C has several operation modes that can be selected via the command set. The manufacturer default mode of HCR350-C is the EMV Hybrid mode. During normal operation, HCR350-C activates the smart card chip. The ATR (Answer to Reset) data are sent out automatically when reading is successful. Alternatively, it is convenient for host that initiates the transaction by issuing command. For detailed function description, please refer to "Reader's Behavior".

2.4 Part Number Description

The brief configuration of HCR350-C part number are shown as below:

HCR350-C33UH0XXX-XXX Triple track 1&2&3 and IC Card

HCR350-C33UH4XXX-XXX Triple track 1&2&3 and IC Card with 4 SAM

Note:

Optional configuration is available.

3 Configurations

This section shows the dimensions, accessories and setup for the HCR350-C.

3.1 Dimensions of HCR350-C

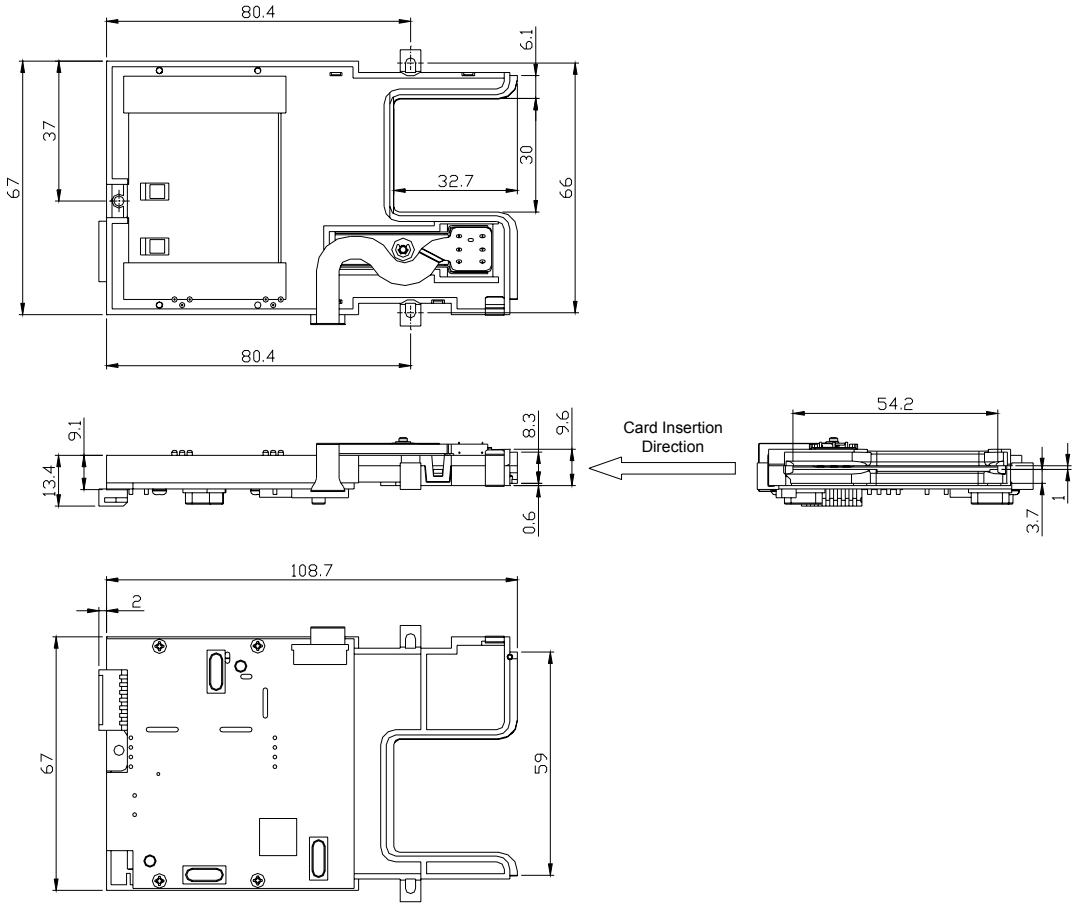

Figure 3-1 Dimensions of HCR350-C

3.2 Accessories of HCR350-C

The following accessories should be enclosed in your package:

Interface cable (USB, 1.5M)

User's manual or Simple manual

3.3 Installation

1. Connect USB type A connector of signal cable to a free USB port. Connect the connector to HCR350-C.
2. Normally, windows system prompts "driver request" message for the first time install.
3. After successful installed the driver, HCR350-C can communicate with PC via a virtual COM port.

For more detailed information, please refer to "HCR350-C USB driver installation guide."

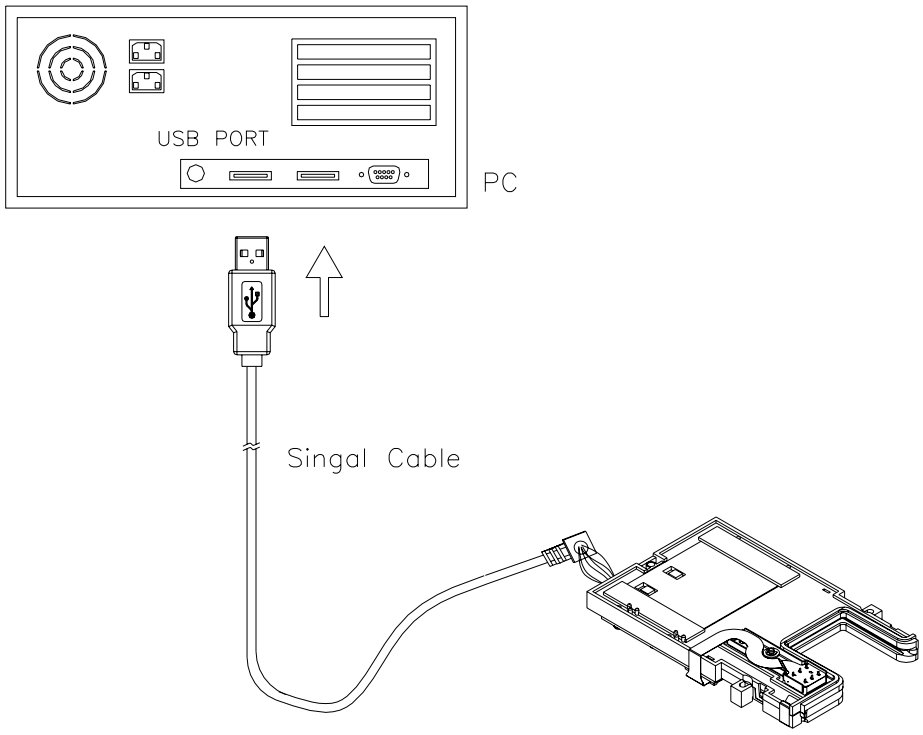

Figure 3-2 Installing HCR350-C

4 Technical Specifications

4.1 Magnetic Card Specifications

(For magnetic stripe reader only)

4.1.1 Card Type

ISO standard card (ISO 7810 and 7811)

CA old DMV

AAMVA

Read high or low coercivity magnetic stripes (300-4000oe)

4.1.2 Thickness

0.76mm ± 0.08mm

4.1.3 Card Format

Track 1 & 3: 210 bpi

Track 2: 75 bpi

4.1.4 Card Operation Speed

Test Card	Speed (IPS)
ISO standard card	4-40
* Jitter	5-35
** Low Amplitude	5-35

Note:

*Jitter card: Reliable reading of magnetic stripes encoded with bit cell length variations within ±15% of normal as defined by ISO 7811.

**Low amplitude:

Reliable reading of magnetic stripes encoded at 60% or more of the encoding amplitude as defined by ISO 7811.

4.2 IC Card Specifications

4.2.1 Card Type

ISO 7816-1, 2, 3, 4

Memory card: Synchronous type

S9 card (SLE4418/4428)

S10 card (SLE4432/4442)

104-type (Euro Chip, SLE4406/4436/5536)

CPU card: Asynchronous type, T=0 or T=1

4.2.2 SAM Module

Optional: four SAM daughter board

4.3 Mechanical Specifications

4.3.1 Body Material

PC+20%GF+6%(W) TEFLON; 94V0

4.3.2 Dimension

Length: 109mm

Width: 67mm

Height:

10mm (without SAM daughter board)

20mm (with SAM daughter board)

4.3.3 Weight

56g (without adapter)

4.3.4 Magnetic Head Life

(For magnetic stripe reader only)

500K Min., 1M optional

4.3.5 IC Card Contact Life

500K Min.

4.3.6 IC Card Contact Resistance

100MΩ Max.

4.4 Electrical Specifications

4.4.1 Power Required

DC 5V ± 10%

4.4.2 Power Consumption

5.0 VDC ± 10%, Ripple 250 mV p-p

10mA maximum, Magnetic Stripe Only Model

90mA maximum, Magnetic Stripe and IC Card Model, Loaded

300mA maximum, Magnetic Stripe, IC Card and Four SAM board, Fully Loaded

4.4.3 Communication

Standard USB signal levels (comply with USB specification v1.1)

4.4.4 Dielectric Strength

250VDC for 1 minute

4.4.5 Insulation Resistance

10MΩ min. at 250VDC

4.5 Environmental Specifications

4.5.1 Temperature

Operating: -10-50°C

Storage: -30-70°C

4.5.2 Humidity

Operating: 15-90% (non condensing)

Storage: 10-90% (non condensing)

4.6 USB Connector Termination Assignment

Contact Number	Signal Name	Typical Wiring Assignment	J3
1	Vbus	Red	1
2	D-	White	5
3	D+	Green	3
4	GND	Black	2
Shell	Shield	Drain Wire	7

4.7 Communication

4.7.1 Synchronization

The interface receives and transmits serial asynchronous data at voltage levels compatible with USB 1.1 specification.

4.7.2 Baud Rate

Default: 38400

Optional: 1200, 2400, 9600, 19200, 38400

4.7.3 Word Length

Default: 8 data bits

Optional: 7, 8

4.7.4 Parity

Default: None

Optional: Even, Odd, None

4.7.5 Stop Bit

Default: 1

Optional: 0, 1

5 Reader's Behavior

5.1 Reader Mode Function

There are four operation modes in HCR350-C.

The first mode is the EMV hybrid mode that can read/write EMV smart cards and read magnetic stripe cards. The second mode is the magnetic stripe card reader mode. The third is ISO 7816 reader mode. The fourth mode is the ISO7816 hybrid mode. Please refer to "Mode Selection" command. In general, the factory default mode is mode 1, EMV hybrid mode. Below table illustrates the differences between each mode.

Mode	Supported Function
1	EMV smart card Magnetic stripe card
2	Magnetic stripe card
3	ISO7816 smart card Memory Card: S9, S10 104-type
4	ISO7816 smart card Memory Card: S9, S10, and 104-type Magnetic stripe card

5.1.1 Mode 1: EMV Hybrid Mode

When HCR350-C detects a card to be inserted to the end position, reader sends <SYN>. The smart card activation sequence is starting by command. If the smart card activation sequence is successful, HCR350-C returns the ATR to host. Therefore, host can send the APDU command to deal with smart card. When user withdraws the card, reader sends <SI>, and reading magnetic data. If reading is successful, the decoded data will be sent out.

5.1.2 Mode 2: Magnetic Stripe Card Reader Mode

The reader is always reading magnetic data while the card is withdrawing, and sent out immediately when reading is successful.

Note: if all tracks error, there is no data output from HCR350-C.

5.1.3 Mode 3: ISO 7816 Reader Mode

The behavior of mode 3 is almost same as mode 4 except no magnetic card support. Regarding the memory card data, please refer to these memory cards' technical specification.

5.1.4 Mode 4: ISO 7816 Hybrid Reader Mode

Mode 4 is to support ISO 7816 smart card, memory card and magnetic card. The working scenario is same as mode 1.

5.2 Smart Card Activation

HCR350-C contains one primary smart card reader for ID-1 card and four SAM card sockets (optional) for ID-000 card. Basically, when customer inserts the card into the primary card reader, HCR350-C needs the "Cold Reset" command from host to activate the smart card and then the ATR is sent back if the activation sequence is successful. For SAM card, host has to switch to SAM slot by "Select SAM" command and sends "Cold Reset" command to startup SAM card. Besides, no two SAM cards can work simultaneously in the multi-SAM board. In other words, whenever you select to another SAM card socket, HCR350-C will shut down current SAM card and then switch to the SAM card socket you selected. In addition, host needs to issue a smart card activation command for the SAM card again.

5.3 Memory Card Operation

HCR350-C supports S9, S10 and 104-type memory cards as default. Since HCR350-C is firmware upgradeable, it is possible to add the customized memory cards per customer's requirement. Please contact us.

HCR350-C accepts the transparent data from host and sends to memory card directly. Please refer to S9/S10 data sheet for memory card command. For data length reading from S9 memory card, HCR350-C set to 16 bytes for each reading command. For S10 memory card, the length of reading data would be 256 bytes. Beside, HCR350-C doesn't support protection bit (bit 9) operation for SLE 4428.

5.4 HCR350-C Factory Default Setting

Communication protocol: 38400bps, 8 data bits, none parity, 1 stop bit
Operation mode: mode 1
Track setting: 3 tracks enable
MSR Prefix: disable

6 Communication Protocol and Data Format

The readers implement a simple and straightforward protocol to exchange data that eliminates redundancy word and protocol to reduce customer's effort and not to make thing complicated.

6.1 The Reader Command

Host to Reader

Command
<ESC>[Command Bytes]

Reader to Host

Response	Description
<ACK>	Success without data output.
<NAK>	Fail.
<ACK>[Data]<CR>	Success with data output.

6.2 Smart Card Command

The readers can read/write memory card (S9, S10 and 104-type) and CPU card (meet ISO 7816-3 or EMV specification). The data formats are quite different. Please refer to their specification.

6.2.1 Protocol 1:

Host to Reader

Command
<ESC>$[Command Bytes]

Reader to Host

Response	Description
<ACK>	Success without data output.
<NAK>	Fail.
<ACK>[Data]<CR>	Success with data output.

6.2.2 Protocol 2:

Host to Reader

Command Header				Information Field
<ESC>%	Length-H	Length-L	Command Byte	Parameter
2 bytes	2 bytes	2 bytes	2 bytes	[1]Variable

Reader to Host

Response	Description
<ACK>	Success without data output.
<NAK>	Fail.
<ACK>[Data]<CR>	Success with data output.

6.2.3 [2]Protocol 3:

Host to Reader

Command Header		Information Field	Trailer
<NUL>	<SOH>	C-APDU or Transparent Data	<CR>
1 byte	1 byte	Variable	1 byte

Reader to Host

Response	Description
[Data]<CR>	R-APDU or Transparent Data

6.2.4 [2]Protocol 4:

Host to Reader

Command Header		Information Field	Trailer
<NUL>	<STX>	C-APDU or Transparent Data	<CR>
1 byte	1 byte	Variable	1 byte

Reader to Host

Response	Description
<ACK>	Success without data output.
<NAK>	Fail.
<ACK>[Data]<CR>	Success with data output.

[1] The number of bytes = [(Length-H) * 256 + (Length-L)] * 2

[2] Not support these protocols for 104-type card.

6.3 Error Code

For any error occurs during data transaction, the reader replies one or two error codes to inform host.

Response Code	Description
<0x08>	APDU data length is not enough.
<0x09>	Timeout occurs during APDU processing and smart card is deactivated.
<0x0A>	The alphanumeric in APDU data are out of range.
<0x0B>	Current smart card is deactivated.
<0x0C>	ATR error or NO smart card.
<0x0F>	Card is ejected from slot.
<0x16>	Card is inserted into slot.

6.4 The Magnetic Stripe Card Data Output Format

For Hybrid reader or MSR mode, HCR350-C sends back the magnetic card data with below format:

Single track	<STX><SS><TRACK1 or 2 or 3 DATA><ES><LRC><ETX>
Dual track	<STX><SS><TRACK1 or 2 DATA><ES><LRC><DLE> <STX><SS><TRACK2 or 3 DATA><ES><LRC><ETX>
Triple track	<STX><SS><TRACK1 DATA><ES><LRC><DLE> <STX><SS><TRACK2 DATA><ES><LRC><DLE> <STX><SS><TRACK3 DATA><ES><LRC><ETX>
SS, ES, and LRC are optional.	

	Track 1	Track 2	Track 3
SS	% (ISO, DMV, AAMVA)	; (ISO, DMV, AAMVA)	; (ISO) ! (DMV) % (AAMVA)
ES	? (ISO, DMV, AAMVA)		

6.5 Transaction Examples

6.5.1 CPU card:

We assume that user's card contains both smart card chip and magnetic stripe. The SAM card is available in this example and the parameter setting of reader is manufactory's default value. Beside, please aware of the APDU data for smart card are captured from a specific test card that is just for example. Thus, it may not be suitable for other cards.

Host		HCR350-C
Power on the reader		We assume the mode of HCR350-C is mode 1, EMV hybrid Mode.
User inserts customer card, and reader sends <SYN>.		
	←	<SYN>
Host queries the ATR of customer card by sending "COLD RESET" command.		
<ESC>$C	→	
	←	<ACK>
	←	3B600000<CR> The reader returns ATR sequences. Important: for IC card reading error, a <FF> code is sent instead of ATR.
<0x00><0x01>00A40000022F00<0x0D>	→	
	←	9000<CR> User's card replies successful code
<ESC>$S1	→	
	←	<ACK> The reader switches to first SAM slot.
<ESC>$A	→	Host request HCR350-C to activate SAM card that is located in first SAM slot.
	←	<ACK>
	←	3B301100<CR> The reader returns ATR from SAM card.
<ESC>$P	→	
	←	<ACK> The reader switches to PSCR.
<0x00><0x01>00A40000022F00<0x0D>	→	

	←	9000<CR>
<ESC>$S1	→	
	←	<ACK> The reader switches to first SAM slot.
<0x00><0x01>00A40000022F00<0x0D> The reader continues talking to SAM card.	→	
	←	9000<CR> SAM card replies successful code
<ESC>$D	→	
	←	<ACK> The reader deactivated the first SAM card
<ESC>$P	→	
	←	<ACK> The reader switches to PSCR.
User removes the card, and reader sends <SI>.		
	←	<SI> It indicates that HCR350-C is to start reading magnetic stripe data. Important: for all requested MSR tracks data reading error, there is not data to be sent out. (For magnetic stripe reader only.)
	←	<STX>%11111?{LRC}<DLE> <STX>;22222?{LRC}<DLE> <STX>;33333?{LRC}<ETX> (For magnetic stripe reader only.)
		Transaction completed

6.5.2 Memory card:

Host		HCR350-C
Power on the reader		We assume the mode of HCR350-C is mode 1.
<ESC>M4	→	
	←	<ACK> The reader switches to mode 4.
User inserts SLE 4428 card, and reader sends <SYN>.		
	←	<SYN>
Host queries the ATR of customer card by sending "COLD RESET" command.		
<ESC>$C	→	
	←	<ACK>
	←	92231091<CR> The reader returns ATR sequences. Important: The data in memory card we present here are just for reference.
<0x00><0x01>0E0000<0x0D>	→	
	←	92231091FFFFFFFFFFFFFFFFFFFFFFFF<CR> User's card replies 16 bytes data
User removes the card, and reader sends <SI>.		
	←	<SI> It indicates that HCR350-C is to start reading magnetic stripe data. Important: for all requested MSR tracks data reading error, there is not data to be sent out. (For magnetic stripe reader only.)
	←	<STX>%11111?{LRC}<DLE> <STX>;22222?{LRC}<DLE> <STX>;33333?{LRC}<ETX> (For magnetic stripe reader only.)
		Transaction completed

7 Command Description

This section describes the commands and responses available for the HCR350-C series. Each item includes the ASCII, hexadecimal codes and comments paragraph. The comments paragraph provides an explanation of the command. The letter 'x' indicates a variable and the letter 'h' is an abbreviation of 'hexadecimal'.

7.1 Reader Command

7.1.1 <ESC>Mx – Mode Selection

x = 1, 2, 3, 4

x = 1, EMV Hybrid mode (memory card is not available in this mode)

x = 2, MSR mode

x = 3, ISO 7816 mode (supports memory card)

x = 4, ISO 7816 Hybrid mode (supports memory card)

Note: Mode 2 is for magnetic stripe reader only.

Caution:

This command is only valid in idle mode (i.e. no card in PSCR). It may cause unknown side effect when HCR350-C receives such command during the PSCR processing session.

For example:

Host		HCR350-C
<ESC>M1	→	
	←	<ACK> EMV Hybrid mode is selected.

7.1.2 <ESC>R – Software Reset

After receiving this command, the reader performs software reset.

For example:

Host		HCR350-C
<ESC>R	→	
		The readers will not response anything.

7.1.3 <ESC>U – Report Software Version Number

The readers report software version information.

For example:

Host		HCR350-C
<ESC>U	→	
	←	<ACK>
	←	35C04511 01-Jan-2004 The readers report software version as 35C04511, and the coding date as 01-Jan-2004.

7.1.4 <ESC>S – Card Position

Host may send this command to query whether card is present or not in PSCR. If the card is inserted to the very end of the reader, replies '1' (0x31). Otherwise, '0' (0x30) sends back to host.

For example:

Host		HCR350-C
<ESC>S	→	
	←	<ACK>
	←	1<CR> The card is inserted to the very end of the reader.

7.2 Configuration Command

7.2.1 <ESC>O – Enter Configuration Mode

After enter into On-Line configuration mode, only below commands could be accepted.

For example:

Host		HCR350-C
<ESC>O	→	
	←	<ACK> The reader enters into On-Line configuration mode.

7.2.2 <ESC>c – ROM Checksum

The readers report 4 digits current checksum bytes in ASCII code format.

For example:

Host		HCR350-C
<ESC>c	→	
	←	<ACK>
	←	1234<CR> The checksum of firmware is 1234.

7.2.3 <ESC>i – Report Current Interface Status

The reader uses 7 bytes code to show current interface status. The first byte is current accessed interface, the next four indicate the cards in PSCR and SAM card reader is active or not, and the last two are the current accessed slot of SAM card reader.

Data format: <A>P<B>S<C><D><E>

Byte <A>

Current accessed interface.

1: PSCR

0: SAM card reader

Byte <B>

The card in PSCR is active or not.

1: Active

0: Inactive

Byte <C>

The card in current accessed slot of SAM card reader is active or not.

1: Active

0: Inactive

Byte <D><E>

Current accessed slot of SAM card reader.

01: 1st Slot

02: 2nd Slot

03: 3rd Slot

04: 4th Slot

For example:

Host		HCR350-C
<ESC>i	→	
	←	<ACK>
	←	0P1S002<CR> Current accessed interface: SAM The card in PSCR is active. The card in current accessed slot of SAM card reader is inactive. Current accessed slot of SAM card reader: 2nd Slot

7.2.4 <ESC>m – Reader Mode Query

The readers report current mode after receiving this command.

For example:

Host		HCR350-C
<ESC>m	→	
	←	<ACK>
	←	1<CR> Current mode is 1 (EMV Hybrid mode).

7.2.5 <ESC>px – MSR Track Data Prefix Option

(For magnetic stripe reader only.)

x = 0, 1

x = 0, turn off prefix string (default)

x = 1, turn on prefix string

If "prefix string" option is ON, the string "TK1", "TK2", and "TK3" will be added into the card data. The MSR data may be like this:

<STX>TK1[track 1 data]<DLE><STX>TK2[track 2 data]<DLE><STX>TK3[track 3 data]<ETX>

For example:

Host		HCR350-C
<ESC>p1	→	
	←	<ACK> Set prefix option on

7.2.6 <ESC>q – Exit Configuration Mode

Except power cycling, this is only command to exit On-Line configuration mode.

For example:

Host		HCR350-C
<ESC>q	→	
	←	<ACK> The readers quit On-Line configuration mode.

7.2.7 <ESC>r – Report RS232 and Track Setting

The readers use 4 bytes code to set its parameters.

Data format: <A><B><C><D>

Each byte is in ASCII code to present 4 bits setting such as '0', '1'…'9', 'A'…'F' to 0000,0001…1001,1010…1111, respectively.

Byte <A>

Bit 3 (MSB)	0 - LRC sending enable, 1 - LRC sending disable
Bit 2	1 - odd, 0 - even, only available in 7 data bits
Bit 1	1- 7 data bits; 0- 8 data bits
Bit 0 (LSB)	0 - SS/ES sending disable, 1 - SS/ES sending enable

Byte <B>

Bit 3, 2, 1	Baud rate 001-38400, 110-19200, 100-9600, 010-2400, 000-1200
Bit 0 (LSB)	0 - no flow control, 1 - RTS-CTS flow control

Byte <C>

Reserved (default = 0)

Byte <D>

	Track	Bit value= 0	Bit value= 1
Bit 2	3	Disable	Enable
Bit 1	2	Disable	Enable
Bit 0	1	Disable	Enable
Bit 3 (MSB): Reserved (default = 0)			

For example:

Host		HCR350-C
<ESC>r	→	
	←	<ACK>
	←	1807<CR> RS232: 9600, 8, n, 1, no flow control, SS/ES sending enable, LRC sending enable, triple track

7.2.8 <ESC>s – Set Serial Number

The readers can save up to 7 bytes data as serial number.

The factory default setting is 7-digit zeros as ASCII characters 0000000.

For example:

Host		HCR350-C
<ESC>s1234567	→	
	←	<ACK> The s/n is set to 1234567.

Note: The command <ESC>s will reset serial number to default, 0000000.

7.2.9 <ESC>u – Report Serial Number

Get serial number from the reader.

For example:

Host		HCR350-C
<ESC>u	→	
	←	<ACK>
	←	1234567<CR> The readers report s/n as 1234567.

7.2.10 <ESC>w – Set RS232 and Track Parameter

Set reader RS232 and track parameters.

Command format: <ESC>w<A><B><C><D>

For detailed information about bit pattern <A>, <B>, <C>, and <D>, please refer to command <ESC>r above.

HCR350-C will write these parameters into EEPROM after command being executed successfully. The new setting will be effective after power cycling.

For example:

Host		HCR350-C
<ESC>w1807	→	
	←	<ACK> The readers set as RS232: 9600, 8, n, 1, no flow control, SS/ES sending enable, LRC sending enable, triple track

7.3 Smart Card General Command

7.3.1 <ESC>$A – Activate Smart Card

Command format: <ESC>$A [Voltage] [Protocol] [F] [D]

Parameter description:

1. It's only effective in ISO mode.
2. These are optional, but all lower bytes must be included.
3. Use default values, if reader activates the card automatically or the byte(s) is/are not specified.
4. If the reader doesn't support this ATR, it will send PPS request to card. If PPS is successful, the original ATR will be send out, otherwise error code <FF> instead.

[Voltage] The voltage applied to smart card

'3' (0x33) 3 Volt

'5' (0x35) 5 Volt (Default)

[Protocol] The protocol type requested by PPS

'0' (0x30) Protocol T=0

'1' (0x31) Protocol T=1

Default: The first protocol indicated in ATR.

[F][D] The transmission factors requested by PPS

F/D	01	02	03	11	12	13	Others
Transmission Rate	9600	19200	38400	9600	19200	38400	Not Support

Default: '13' (0x31 0x33)

Activate current available smart card interface. Since the reader supports one primary smart card reader and four SAM card readers, it activates (or talk) current available interface (primary reader or SAM). In other words, it is up to users to send selection command to determine which card needs to be dealt. About select command please refer to commands <ESC>$P and <ESC>$S.

Example 1: The test card has ATR, 3B 60 00 00.

Host		HCR350-C
<ESC>$A	→	
	←	<ACK>
	←	3B600000<CR>

Example 2: EMV mode. The test card has ATR, 3B F0 18 00 FF 81 31 FE 45 27.

Host		HCR350-C
		Insert Card
	←	<SYN>
<ESC>$A	→	
	←	<ACK><FF> Reader doesn't support F/D=18.
<ESC>$A5111	→	
	←	<ACK><FF> Reader doesn't support F/D=18.

Example 3: ISO mode. The test card has ATR, 3B F0 18 00 FF 81 31 FE 45 27.

Host		HCR350-C
		Insert Card
	←	<SYN>
<ESC>$A300	→	
	←	3BF01800FF8131FE4527<CR> Send PPS successfully to propose using voltage=3V, F/D=03, and T=0.
<ESC>$A5111	→	
	←	3BF01800FF8131FE4527<CR> Send PPS successfully to propose using voltage=5V, F/D=11, and T=1.

7.3.2 <ESC>$C – Cold Start Smart Card

Command format: <ESC>$C [Voltage] [Protocol] [F] [D]

The same as command <ESC>$A.

7.3.3 <ESC>$D – Deactivate Smart Card

To deactivate current active smart card interface (primary smart card or SAM).

For more information about the operation of working interface, please refer to commands <ESC>U, <ESC>$A, <ESC>$P, and <ESC>$Sx.

For example:

Host		HCR350-C
<ESC>$D	→	
	←	<ACK> Deactivate current smart card interface.

7.3.4 <ESC>$P – Select Primary Smart Card Interface

Set active smart card interface to primary smart card reader. There are total five smart card slots in the reader. The first one is primary smart card reader. It is intended to accept customer's card. The rest four readers are used for SAM (Security Access Modular) card.

SAM card can be implemented for electronic-purse or electronic-cash application that contains the authentication mechanism or other verification method to verify customer card. One of smart card payment systems, Mondex, uses SAM card as merchant card to receive the payment from customer card. Some known smart card payment systems fit SAM card in to prevent fraud card.

In normal operation, the reader auto detects a customer card to be inserted into primary smart card reader. After customer card removed, the readers switch back to SAM card reader. User does not take any action to access customer's card. However, if customer would like to access SAM card, it is necessary to issue SAM card selection command to the reader; and then if customer would like to switch back reading customer's card, user has to send Select Primary Smart Card Interface command.

Note: This is only effective while smart card is inserted, otherwise <NAK> sends back to host.

For example:

Host		HCR350-C
<ESC>$P	→	
	←	<ACK> Switch to PSCR.
<ESC>$A	→	
	←	<ACK>
	←	3B600000<CR> The reader reports ATR sequence bytes as 3B600000 from primary smart card.

7.3.5 <ESC>$Sx – Select SAM Card Interface

x = 1, 2, 3, 4

Set active smart card interface to SAM card reader.

Since the readers support one primary smart card reader and four SAM card readers, it activates (or talk) current available interface (primary reader or SAM). In other words, it is up to users to send selection command to determine which card needs to be dealt.

However, if primary card reader is in idle (no card), the readers set available interface to SAM. When the readers detect a card inserted in primary card reader, it will change the interface to primary smart card reader automatically without resending interface selection command.

SAM card can be implemented for electronic-purse or electronic-cash application that contains the authentication mechanism or other verification method to verify customer card. One of smart card payment systems, Mondex, uses SAM card as merchant card to receive the payment from customer card. Some known smart card payment systems fit SAM card in to prevent fraud card.

Note:1. This is only effective while SAM daughter board is laid.

2. No x suffixed (i.e. <ESC>$S) will set to the previous activated SAM card interface.

For example:

Host		HCR350-C
<ESC>$S1	→	
	←	<ACK> Switch to SAM card reader, slot 1.
<ESC>$A	→	
	←	<ACK>
	←	3B600000<CR> The readers report ATR sequence bytes as 3B600000 from SAM card.

7.3.6 <ESC>$W – Warm Start Smart Card

Command format: <ESC>$W [Protocol] [F] [D]

Parameter description: Please refer to command <ESC>$A.

The reader will perform a warm start on current interface after receiving this command. Since it supports one primary smart card and four SAM card readers, it performs a warm start on current available interface (primary reader or SAM).

Smart card must be activated before sending this command, otherwise, a <NAK> will return to host.

Note:1. This is only available in CPU card.

2. Continue using the same voltage as the Cold Start.

7.4 104-Type Card

7.4.1 Power Up

The card is powered under 5V and answers 8 bytes as Answer To Reset.

Host to HCR350-C: <ESC>% 00 00 D1

HCR350-C to host: <ACK> X_1 X_2 X_3 X_4 <CR>

X_1 X_2 X_3 X_4: The data sent by the card in its ATR.

After power up, the card is ready to operate.

For example:

Host		HCR350-C
<ESC>%0000D1	→	
	←	<ACK>
	←	17043132<CR>

7.4.2 Get Authentic Parameter

This command set 12 bytes of authentic request parameters

Host to HCR350-C: <ESC>% 00 06 D2 AD_H AD_L CLK_H CLK_L Cal_H Cal_L

HCR350-C to host: <ACK>

AD_H AD_L: Start bit address of authentic control

Key1 = 110 (0x006E), Key2 = 111 (0x006F).

CLK_H CLK_L: Clock periods for loading data.

The value should be 177 (0x00B1).

Cal_H Cal_L: Clock counter for response bit calculation.

The recommended value is 160 (0x00A0).

For example:

Host		HCR350-C
<ESC>%0006D2006E00B100A0	→	
	←	<ACK>

7.4.3 Request Authentication

This command performs a basic authentic for SLE4436/5536 and gets a response code from the card.

Host to HCR350-C: <ESC>% 00 06 D3 C_1 C_2 C_3 C_4 C_5 C_6

HCR350-C to host: <ACK> X_1 X_2 <CR>

C_1 C_2 ... C_6: Challenge data.

X_1 X_2: The calculation of response codes.

For example:

Host		HCR350-C
<ESC>%0006D3313233343536	→	
	←	<ACK>
	←	9D3A<CR>

7.4.4 Request Extended Authentication

This command performs an extended authentic for SLE5536 only and gets a response code from the card.

Host to HCR350-C: <ESC>% 00 06 D0 C_1 C_2 C_3 C_4 C_5 C_6

HCR350-C to host: <ACK> X_{1H} X_{1L} X_{2H} X_{2L} <CR>

C_1 C_2 ... C_6: Challenge data.

X_1 X_2: The calculation of response codes.

7.4.5 Write Bit

This command allows writing a bit from the specified address. The next counter stage of the specified bit address will be erased if the Val equals 1.

Host to HCR350-C: <ESC>% 00 03 D4 AD_H AD_L Val
HCR350-C to host: <ACK>

AD_H AD_L: Indicate the bit address where to write.
Val: The value of bit 0 equals 0 then a write operation will be performed else the bit of specified address will be written and the next counter stage will be erased.

For example:

Host		HCR350-C
<ESC>%0003D4006100	→	
	←	<ACK>

7.4.6 Write Bit with Backup

This command allows writing a counter bit and erasing next counter stage with backup. The command can be used for reloading cycle, counter recovering cycle and backup bit reset cycle.

Host to HCR350-C: <ESC>% 00 02 DC AD_H AD_L
HCR350-C to host: <ACK>

AD_H AD_L: Indicate the bit address where to write.
AD_H should be 00.

For example:

Host		HCR350-C
<ESC>%0002DC005E	→	
	←	<ACK>

7.4.7 Write Byte

This command allows writing bytes to the specified bit address of the card.

Host to HCR350-C: <ESC>% 00 NB DD AD_H AD_L X_1 X_2... X_n

HCR350-C to host: <ACK>

AD_H AD_L: Indicate the bit address where to be wrote.

X_1 X_2…X_n: These are the data to write in the card.

(NB –2): This is the number of bytes to write.

For example:

Host		HCR350-C
<ESC>%0005DD0080123456	→	
	←	<ACK>

7.4.8 Read Data

This command allows reading data bytes from the specified bit address.

Host to HCR350-C: <ESC>% 00 03 D5 AD_H AD_L NB

HCR350-C to host: <ACK> X_1 X_2 … X_n <CR>

AD_H AD_L: Indicate the bit address where to read.

NB: This is the number of bytes to read.

X_1 X_2…X_n: These are the data to read from the card.

For example:

Host		HCR350-C
<ESC>%0003D5001006	→	
	←	<ACK>
	←	313233343536<CR>

7.4.9 Transport Code

This command allows submitting the transport code to the card in order to enable the card personalization mode.

Host to HCR350-C: <ESC>% 00 05 DB AD_H AD_L T_1 T_2 T_3

HCR350-C to host: <ACK>

AD_H AD_L: Indicate the address of the free Error Counter bit in the card.

AD_H should be 00.

T_1 T_2 T_3: These are the specified transport codes.

For example:

Host		HCR350-C
<ESC>%0005DB0048F3FFFF	→	
	←	<ACK>

7.5 S10 Card

7.5.1 Read/Write

This command allows either to read or to write bytes from or into the specified address of 4432/4442 cards.

Each command of 4432/4442 consists of three bytes:
Control Byte, Address Byte, and Data Byte.

If we want to write 6 bytes in consecutive addresses, we need to send command 6 times for writing the whole 6 bytes. For speeding up the access time, we combine these 6 command packages into one package; use the first *Control Byte*, the first *Address Byte* and all *Data Bytes*, to reduce the communication time. HCR350-C will then split the combined command into 6 individual commands and send them to the card consecutively.

Update 6 bytes of main memory of 4432/4442 cards with 6 separated commands:

38 20 39 → Update Main Memory on address 0x20 with value 0x39
38 21 38 → Update Main Memory on address 0x21 with value 0x38
38 22 37 → Update Main Memory on address 0x22 with value 0x37
38 23 36 → Update Main Memory on address 0x23 with value 0x36
38 24 35 → Update Main Memory on address 0x24 with value 0x35
38 25 34 → Update Main Memory on address 0x25 with value 0x34

Update 6 bytes of main memory of 4432/4442 cards with one command:

38 20 39 38 37 36 35 34

In case of a read command:

Host to HCR350-C: <ESC>% 00 04 C2 CF CB AD NF

HCR350-C to host: <ACK> X_1 X_2 … X_n <CR>

CF: Indicate the clock frequency

CB: Indicate the control byte

AD: Indicate the start address byte

NF: No effect byte. Any value is valid.

X_1 X_2 … X_n: These are the data to read from the card

For example:

Host		HCR350-C
<ESC>%0004C20030FA00	→	
	←	<ACK>
	←	313233343536<CR>
IC card return the data from address 0xFA to 0xFF. (Clock Freq.: 20kHz)		

In case of a write command:

Host to HCR350-C: <ESC>% NB_H NB_L C2 CF CB AD X_1 X_2... X_n

HCR350-C to host: <ACK>

CF: Indicate the clock frequency

NB_H NB_L: This is the total message length

CB: Indicate the control byte

AD: Indicate the start address byte

X_1 X_2... X_n: These are the data to be written to the card (n≧1)

For example:

Host		HCR350-C
<ESC>%0009C2003820393837363534	→	
	←	<ACK>
Update main memory from address 0x20 to 0x25 with value 0x39 0x38 0x37 0x36 0x35 0x34. (Clock Freq.: 20kHz)		

Note 1:

Clock Frequency (CF):

0x30 0x31	50 kHz (20 us)
0x30 0x32	33.3 kHz (30 us)
0x30 0x33	25 kHz (40 us)
0x30 0x30, 0x30 0x34, or others	20 kHz (50 us) **Default**

(The clock frequency on SLE 4432/4442 is 7 – 50 kHz.)

Note 2:

If the start address is out of range, reader will return a <NAK>, and won't execute it.

The range of every memory:

4432/4442 card	
Main Memory	0x00 – 0xFF
Protection Memory	0x00 – 0x1F
4442 card only	
Security Memory	0x00 – 0x03

Note 3:

On writing process, if the start address is in the range, but the data is too much, then reader will only write the valid addresses.

For example:

Host		HCR350-C
<ESC>%0009C20038FE393837363534	→	
	←	<ACK>
Only update main memory from address 0xFE to 0xFF with value 0x39 0x38. (Clock Freq.: 20kHz)		