

HCR335

Hybrid Card Reader

Programmer's Manual

Document # : PM093-U

Revision A

Dec. 12, 2011

NOTICE

The issuer of this manual has made every effort to provide accurate information. The issuer will not be held liable for any technical and editorial omission or errors made herein; nor for incidental consequential damages resulting from the furnishing, performance or use of this material. This document contains proprietary information that is protected by copyright. All rights are reserved. No part of this document may be photocopied, reproduced, or translated without the prior written consent of the issuer. The information provided in this manual is subject to change without notice.

AGENCY APPROVED

- FCC class B
- CE class B
- Product Certificate by Taiwan BSMI



NOTE : This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures :

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/ TV technician for help.

You are cautioned that any change or modifications to the equipment not expressly approve by the party responsible for compliance could void your authority to operate such equipment.

WARRANTY

This product is served under one-year warranty to the original purchaser. Within the warranty period, merchandise found to be defective would be repaired or replaced. This warranty applies to the products only under the normal use of the original purchaser, and in no circumstances covers incidental or consequential damages through consumers' misuse or modification of the products.

PREFACE

This manual provides detailed information relating to the overall operational, electrical, mechanical, environmental and functional aspects of the HCR335. 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 HCR335, 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.

Table of Contents

1	Abbreviations, Notations and Terminology	1
2	General Description	2
2.1	Features.....	2
2.2	Application	2
2.3	Functions.....	2
2.4	Interface Part Number Description	3
3	Configurations.....	4
3.1	Dimensions of HCR335.....	4
3.2	Accessories of HCR335.....	4
3.3	Installation.....	5
4	Technical Specifications	7
4.1	Magnetic Card Specifications	7
4.2	IC Card Specifications	8
4.3	Mechanical Specifications.....	8
4.4	Electrical Specifications	9
4.5	Environmental Specifications	10
4.6	Pin Assignment.....	11
4.7	Communication.....	12
5	Reader's Behavior.....	13
5.1	Startup Sequence.....	13
5.2	Reader Mode Function	14
5.3	Card Position Handling	16
5.4	Smart Card Activation.....	17
5.5	Memory Card Operation	17
5.6	HCR335 Factory Default Setting	18
5.7	Trouble Shooting	19
6	Communication Protocol and Data Format.....	20
6.1	The Reader Command	20
6.2	Smart Card Command	20
6.3	Error Code	22
6.4	The Magnetic Stripe Card Data Output Format	22
6.5	Transaction Examples	23
7	Command Description	26

7.1	Reader Command	26
7.2	Configuration Command	30
7.3	Smart Card General Command	35
7.4	104-Type Card	40
7.5	S10 Card	45
8	LED Indication	48
8.1	After Power On.....	48
8.2	Generic Operation.....	48
8.3	Magnetic Card Reader Operation.....	48

1 Abbreviations, Notations and Terminology

The following abbreviations, notations and terminologies 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)

2 General Description

This section presents general information about the basic characters of the HCR335.

2.1 Features

The HCR335 provides the following features :

1	EMV 2000 Level 1 compliance
2	Read/write CPU and memory card.
3	Light weight : 110g (without cable and adapter)
4	Compact size : 107L*62W*26H mm
5	LED: indicating card status
6	The option of RS232 or USB interface model is available
6	Single, dual, or triple track versions: allowing for reading all types of magnetic cards, including credit cards and driver licenses.
7	Firmware upgradeable
8	Auto-ejection of card when power failure happens

2.2 Application

This Hybrid Reader is designed to read high and low coercivity magnetic cards, as well as performing read/write operations for CPU and memory cards.

For the magnetic stripe reader module, it can decode and verify up to 3 tracks of data simultaneously. This product communicates with a host computer or a terminal using a standard RS-232 or USB Virtual COM interface. The reader is widely accepted in the financial industry applications as its transmitting protocol is highly reliable and easy to use.

2.3 Functions

2.3.1 Read/Read_Write of Cards

The magnetic stripe reader module can read magnetic data from any available track encoded according to the ISO 7810, 7811, AAMVA, and CA old DMV standards. For smart card operations, it provides landing contact and card locking function to the card. It can perform read/write operations to the ISO7816-3 microprocessor smart cards (T=0, T=1) and some memory cards (S9, S10 and 104-type).

2.3.2 Operation Behavior

The reader acts as a bridge between the host and the smart card as it allows the host to access the smart card in all the read/write operations. The HCR335 is an EMV compliant device. Customers are able to build their own EMV applications running on the host terminal in a short time.

The HCR335 is a versatile hybrid reader. It is able to run on different operation modes through the "Mode Selection" command.. The reader is set to the "hybrid reader" mode as the manufacturer default mode setting. This mode allows the reader to read magnetic stripe card and IC card in turn. For the advance function descriptions, please refer to the "Reader's Behavior" in Section 5.

2.4 Interface Part Number Description

Different Interface Models

The brief configuration of HCR335 part number are shown as below :

The HCR335 reader is available in three different interface models:

- 1) HCR335-RM-- RS232 interface model
- 2) HCR335-VM-- Use STM32F103 USB interface, which is compatible with USB specification Revision 2.0
- 3) HCR335-UM-- Use PL2303HX USB to Serial Bridge controller for USB interface

3 Configurations

This section provides information on the dimensions, accessories and how to setup for the HCR335.

3.1 Dimensions of HCR335

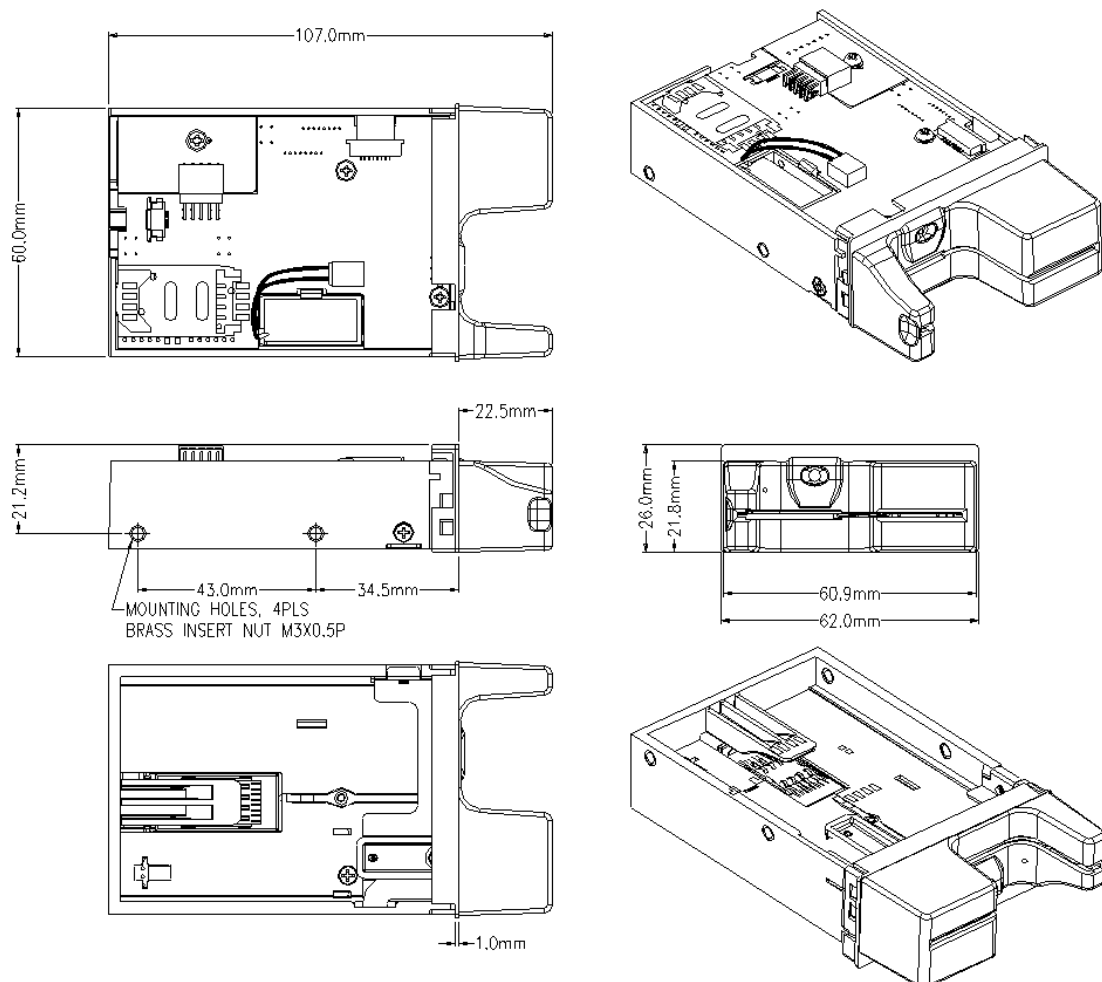


Figure 3-1 Dimensions of HCR335

3.2 Accessories of HCR335

The following accessories are enclosed in the reader package.

3.2.1 RS232 Interface Model (HCR335-RM):

1. Interface cable (DB9, 1.5M)
2. Power Adapter :
Input: AC 110V or 230V, Output: DC 5V regulated / 500mA
3. Shipping Disk

3.2.2 USB interface model (HCR335-VM or HCR335-UM)

1. USB interface cable
2. Shipping Disk

3.3 Installation

3.3.1 RS232 Interface Model (HCR335-RM) :

1. Turn OFF the computer.
2. Connect the DB9 connector of the HCR335 interface cable to a free serial port of the computer.
3. Connect the power jack into the DB9 connector of the interface cable.
4. Plug the power adapter into a proper AC outlet (see instructions on the adapter for the proper voltage).
5. Turn ON the computer.

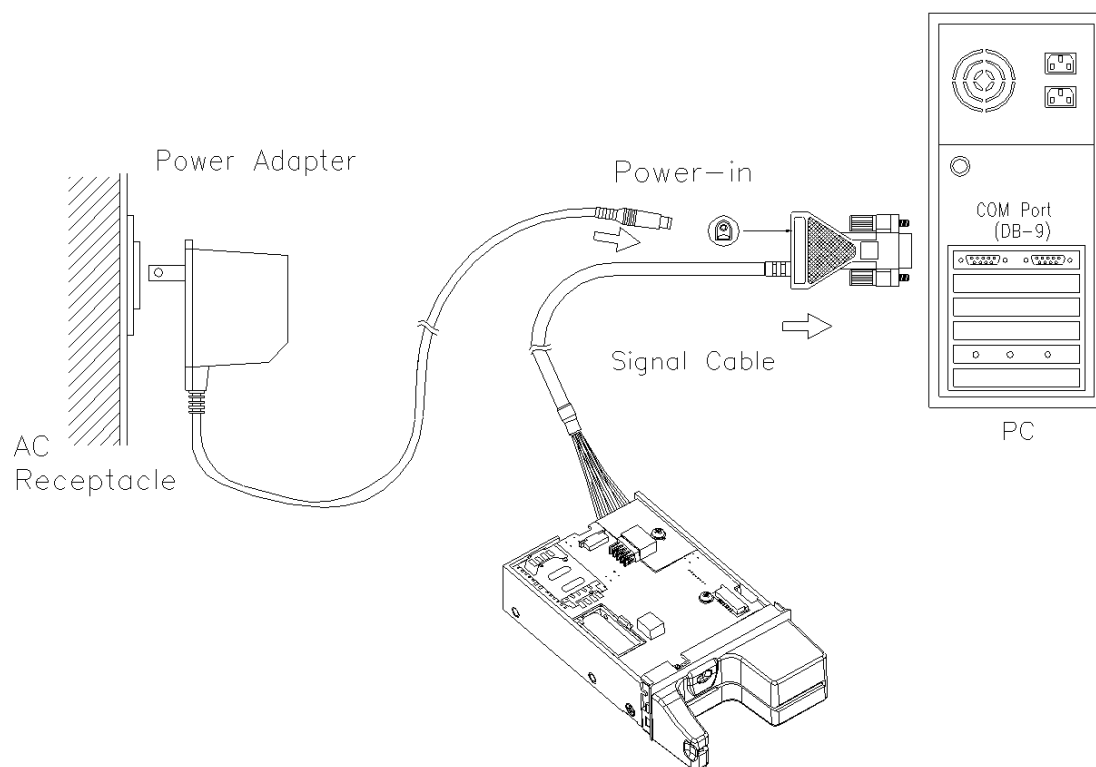


Figure 3-2 Installing HCR335 - RS232 Interface

3.3.2 USB Interface Model running the Virtual Communication Mode (HCR335-VM or HCR335-UM) :

1. With the USB cable connected to the HCR335 reader on one side, connect the USB type "A" connector to a free USB port of the computer.
2. Windows system will pop-up the "Driver request" message for the first time when the reader is plugged into the system
3. After the successful installation of the driver, the HCR335 can communicate with PC via a virtual COM port
4. For more detailed information, please refer to the "HCR335 USB driver installation guide"

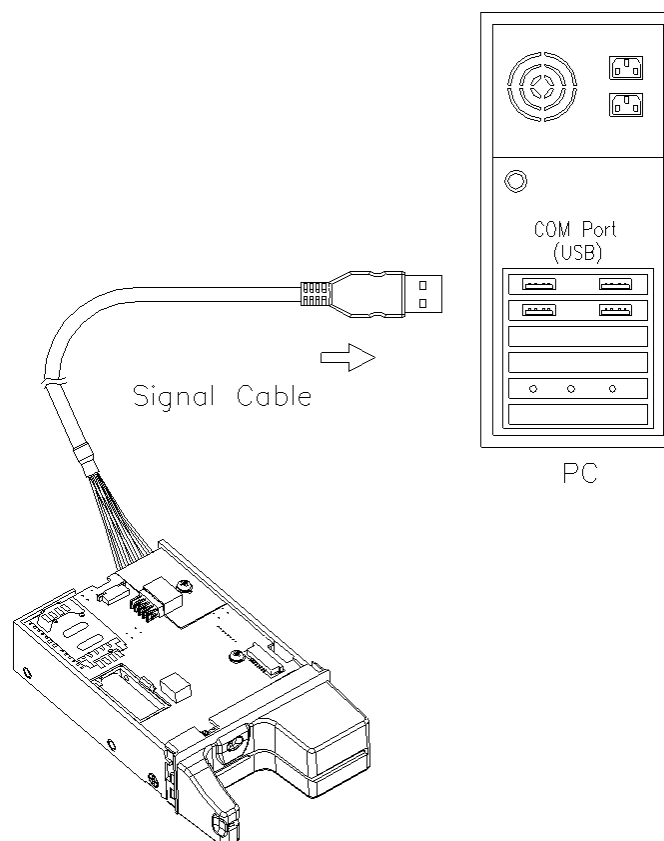


Figure 3-3 Installing HCR335 – USB Interface

4 Technical Specifications

4.1 Magnetic Card Specifications

4.1.1 Card Type

ISO standard card (ISO 7810 and 7811)

CA old DMV card

AAMVA card

High or low coercivity (300-4000oe) magnetic stripes card

4.1.2 Thickness

0.76mm $\pm$ 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 card	5-35
** Low Amplitude card	5-35

Note :

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

**Low amplitude card :

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

Built-in : One SAM (Security Access Module) socket.

Optional : Four SAM daughter board

4.3 Mechanical Specifications

4.3.1 Body Material

PC+20%GF+6%PTFE

4.3.2 Dimension

Length : 107mm

Width : 62mm

Height : 26mm

4.3.3 Weight

110g (without cable and adapter)

4.3.4 Magnetic Head Life

500K insertion cycles Min., 1M insertion cycles optional

4.3.5 IC Card Contact Life

1M Min.

4.3.6 IC Card Contact Resistance

100mΩ Max.

4.4 Electrical Specifications

4.4.1 Power Required

DC 5V $\pm$ 5%

4.4.2 Power Consumption

RS232 Interface Model :

Idle w/o SAM and Smart Card : 75mA (Typical), 90mA (Maximum)

Magnetic Stripe Card, IC Card, fully loaded : 160mA (Maximum)

Solenoid Firing : 380mA (Maximum)

USB Interface Model :

Idle w/o SAM and Smart Card : 90mA (Typical), 110mA (Maximum)

Magnetic Stripe Card, IC Card, fully loaded : 180mA (Maximum)

Solenoid Firing : 400mA (Maximum)

4.4.3 Communication

RS232 interface :

HCR335-RM model : Standard RS232 signal levels (RS-232 format, TTL level optional)

USB interface :

A. HCR335-VM model : Use STM32F103 USB interface, which is Compatible with USB specification Revision 2.0..

B. HCR335-UM model : Use PL2303HX USB to Serial Bridge controller for USB interface.

4.4.4 Auto-eject function

HCR335 will eject the card automatically in the case of power failure happened.

4.4.5 Ripple

250mVp-p Max.

4.4.6 Dielectric Strength

250VDC for 1 minute

4.4.7 Insulation Resistance

10M Ω min. at 250VDC

4.5 Environmental Specifications

4.5.1 Temperature

Operating : -10-55°C

Storage : -30-70°C

4.5.2 Humidity

Operating : 10-90% (non-condensing)

Storage : 10-90% (non-condensing)

4.6 Pin Assignment

4.6.1 RS232 Interface (HCR335-RM)

DB9	SIGNAL	DIRECTION	PCB-J1	SIGNAL
1				
2	RXD	← Serial data to host	3	TXD
3	TXD	→ Serial data from host	5	RxD
4				
5	GND		2	GND
6	DSR	Connect to the DC Jack (V+) of the cable		
7	RTS	→ Clear to Send Data	6	CTS
8	CTS	← Request to Send Data	4	RTS
9				

Note : PCB-J1-1 : VCC IN (5V)

4.6.2 USB Interface (HCR335-VM & HCR335-UM)

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

4.7 Communication

4.7.1 Synchronization

The reader interface receives and transmits serial asynchronous data at voltage levels compatible with the RS232 specification (HCR335-RM) or USB specification (HCR335-VM & HCR335-UM).

4.7.2 RS232 Signal

Logic 1 = -3 volts to -15 volts

Logic 0 = +3 volts to +15 volts

4.7.3 Baud Rate

Default : 9600

Optional : 1200, 2400, 9600, 19200, 38400

4.7.4 Word Length

Default : 8 data bits

Optional : 7, 8

4.7.5 Parity

Default : None

Optional : None, Even, Odd

4.7.6 Stop Bit

Default : 1

5 Reader's Behavior

5.1 Startup Sequence

After power on, the HCR335 will send an initial character, ' : ' (0x3A), to notify the host.

If there is a card in the slot before power on, the reader will inform the host with an error code **0x0E**. The LED will be turned on in RED.

If the card is locked, it will be ejected automatically for several times.

After the card is withdrawn, the reader will set the LED to green and get into the main task.

5.2 Reader Mode Function

There are four operation modes in the HCR335 reader.

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 the ISO 7816 reader mode. The fourth is the ISO7816 hybrid mode. Please refer to the "Mode Selection" command in Section 7.1.5 for details. In general, the factory default mode is set to mode 1 (EMV hybrid mode). The following table illustrates the differences between all four modes.

Mode	Supported Function	The Solenoid's Behavior for Card Insertion
1	EMV smart card Magnetic stripe card	Fire to release the lock mechanism.
2	Magnetic stripe card	No action.
3	ISO7816 smart card Memory Card : S9, S10 104-type	Fire to release the lock mechanism.
4	ISO7816 smart card Memory Card : S9, S10, and 104-type Magnetic stripe card	Fire to release the lock mechanism.

5.2.1 Mode 1 : EMV Hybrid Mode

Normal scenario :

When the HCR335 detects a card inserted into the slot, it fires the solenoid to release the lock mechanism. This allows the user to push the card to the end position and then be locked. Now the smart card activation sequence starts running and the LED is turned into amber color. If the smart card activation sequence is successful, the HCR335 will send out the ATR to the host. After that, the host can send the APDU commands to talk with the smart card. After transaction is completed, the host has to send the "Eject Card" command in order to release the card. After the card is withdrawn, the reader will send out the decoded card data if it is the MSR card and is read from the magnetic header.

Abnormal scenario :

Once the card is entered into the entrance it has to reach to the end within a maximum allowable time of 5 seconds. If the traveling time is longer than 5 seconds, the HCR335 will turn off the power of the solenoid, ejecting the card and sends out the error code 0x0E. The LED will turn into red to notify the user. If the card is still locked inside, the

HCR335 will automatically eject it several times until it leaves the end position. The user has to remove the card and re-insert again.

5.2.2 Mode 2 : Magnetic Stripe Card Reader Mode

There is no action for the solenoid after the HCR335 detects the MSR card to be inserted. The LED is turned off to indicate that the HCR335 is in magnetic card reading state. When the user withdraws the card from the HCR335, the card data of the MSR card will be sent out to the host. The HCR335 will set the LED to green, amber, or red for 0.5 second to indicate the results of all three tracks ok, one/two tracks error, or all three tracks with error respectively.

Once the card is inserted into or withdrawn from the reader, the latter will read for the magnetic card data until it obtains the whole tracks' data. The reader will store the data in its buffer and will send it out once the card is withdrawn from the reader.

If the reader cannot obtain the complete track data, it will send out the last swiped data.

Note : if all tracks have errors, there is no data output from the HCR335.

5.2.3 Mode 3 : ISO 7816 Reader Mode

The behavior of mode 3 is almost the same as mode 4 except that there is no magnetic card support. For the memory card data information, please refer to their memory cards technical specifications.

5.2.4 Mode 4 : ISO 7816 Hybrid Reader Mode

Mode 4 is for supporting ISO 7816 smart cards, memory cards and magnetic cards. The working scenario is same as mode 1.

5.3 Card Position Handling

5.3.1 Normal Operation

[In mode 1, 3, and 4]

Card inserted

- Card is in the correct position (card end sensor blocked)
- IC card reading loop activated (start IC card reading)
- Host sends the eject card command to the HCR335 right after transaction is completed.
- HCR335 ejects the card by firing the solenoid and then monitoring the card end sensor,
- If the card end sensor changes state, the HCR335 will send a code to the host notifying the card is leaving. After the card is withdrawn, the HCR335 goes back to the standby state (waiting for next card reading cycle)

[In mode 2]

Card data is processed along with the card insertion to the end position,

- HCR335 decodes the card data and if it is good it will send it out to the host after the card is withdrawn.
- If the data is no good, HCR335 will process the data again when the card is pulling out. If the data is good, HCR335 will send the decoded data to the host.
- If the data is not good, HCR335 will send nothing and wait for the next card insertion.

5.3.2 Abnormal Operation

[In mode 1, 3, and 4]

Case 1 : During the card reading process and before receiving the card eject command, if the card end sensor changes state (blocked, HCR335 failed itself or manipulated), the HCR335 will send the code to the host notifying the card is leaving

- HCR335 monitors the card end sensor, if blocked again before the card is withdrawn (card left the card-in switch), the HCR335 will fire the solenoid to eject the card. This will be a continuous process until the card is totally withdrawn.

Case 2 : After receiving the card eject command, the HCR335 fires the solenoid to eject the card

- HCR335 monitors the card end sensor. If the card state is not changed (unblocked, card is manipulated), the HCR335 will fire the solenoid again to eject the card. This will be a continuous process until the card is totally withdrawn.

Case 3 : Card is inserted but the HCR335 cannot detect the card by the card end sensor within a time out period of 5 seconds. the HCR335 will send an error code to notify the host. If the card reaches the end position after time out, the HCR335 will fire the solenoid to eject the card.

[In mode 2]

No matter is on purpose or not, if an non-MSR card is pushed to the IC card position and blocks the card end sensor, the HCR335 will fire the solenoid to eject the card and with no data to be sent out. The HCR335 will monitor the card end sensor and if the card end sensor is still blocked, the HCR335 will fire the solenoid to eject the card. (this could be a closed loop till the failure is solved).

5.4 Smart Card Activation

The HCR335 contains one primary smart card reader for ID-1 card and four SAM card sockets (optional) for ID-000 card. Basically, after the user inserts the card into the primary card reader, the HCR335 needs to send the "Cold Reset" command from the 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, HCR335 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.

5.5 Memory Card Operation

The HCR335 supports the S9, S10 and 104-type memory cards as basic features. Since the HCR335 is firmware upgradeable, it is possible to extend the support to other memory cards per customer's request. Please contact UIC for this support.

The HCR335 will accept the transparent data sent directly from the host to the memory card. Please refer to the memory card command in the S9/S10 data sheet. For the S9 memory card, the HCR335 will set its data length reading for each reading command to 16 bytes. For the S10 memory card, this length would be 256 bytes. The HCR335 reader does not support the protection bit (bit 9) operation for the SLE 4428 card.

5.6 HCR335 Factory Default Setting

Communication protocol : 9600bps, 8 data bits, none parity, 1 stop bit

Operation mode : mode 1 (EMV hybrid mode)

Track setting : 3 tracks enable, SS/ES sending enable, and LRC sending enable

MSR Prefix : Disable

5.7 Trouble Shooting

5.7.1 Card Jammed

If the card is unexpectedly locked in the reader at any time, the user can use a needle or something sharp push into the hole near the LED indicator to eject the card out. This can be done no matter the power of reader is on or off.

Using a needle or something shaped like one to insert the hole for ejecting card.

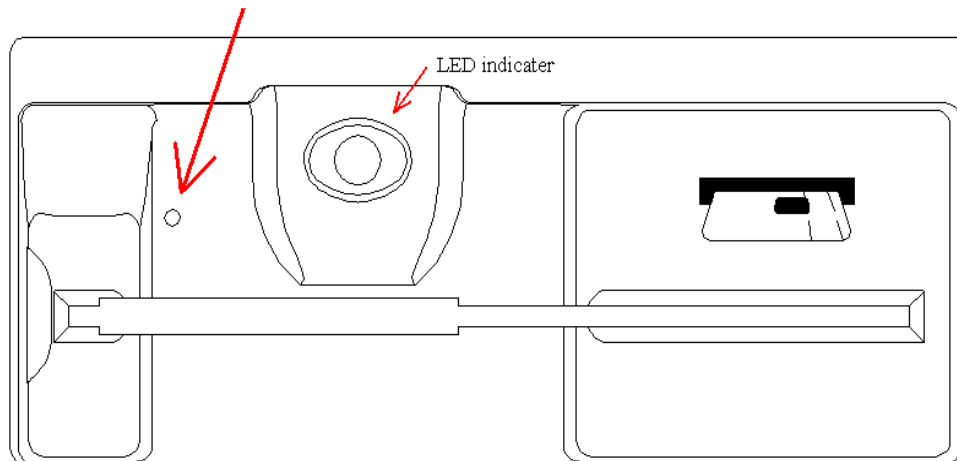


Figure 5-1 Trouble shooting for HCR335

6 Communication Protocol and Data Format

The reader is implemented with a simple and straightforward protocol to exchange data..

6.1 The Reader Command

Host to Reader

Command
<ESC>[Command Bytes]

Reader to Host

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

6.2 Smart Card Command

The reader can perform read/write operations on the memory cards (S9, S10 and 104-type) and CPU cards (meet ISO 7816-3 or EMV specification). Their data formats are quite different. For the details please refer to their specifications.

6.2.1 Protocol 1 :

Host to Reader

Command
<ESC>\${Command Bytes}

Reader to Host

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

6.2.3 ²Protocol 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 ²Protocol 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 and without data output.
<NAK>	Fail.
<ACK>[Data]<CR>	Success and with data output.

¹ The number of bytes = [(Length-H) * 256 + (Length-L)] * 2² These protocols are not supported in the 104-type card

6.3 Error Code

If any error occurs during the data communication, the reader will send out one or two error codes to inform the host.

Error Code	Description
<0x08>	APDU data length is not enough.
<0x09>	Timeout/Error occurs during the APDU processing.
<0x0A>	The alphanumeric in the APDU data are out of range.
<0x0B>	Current smart card is deactivated.
<0x0C>	ATR error or NO smart card in the SAM slot.
<0x0E>	Card insertion error.
<0x0F>	Card is ejected from slot.

6.4 The Magnetic Stripe Card Data Output Format

If the HCR335 reader is working in the Hybrid reader or MSR mode, upon a MSR reading operation, the reader will send out the magnetic card data as in the below format :

Single track	<STX><SS><TRACK1 or 2 or 3 DATA><ES><LRC><ETX>		
Dual track	<STX><SS><TRACK1or 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 the user's card contains both the smart card chip and the magnetic stripe. The SAM card is available in this example and the parameter setting of the reader is the manufactory's default value. Please be aware that this is just an example where the APDU data for the smart card are captured from a specific test card. It may not work the same way for other cards.

Host		HCR335
Power on the reader		We assume the mode of HCR335 is mode 1, EMV hybrid Mode.
	←	: The reader replies a colon to indicate it is ready.
User inserts the card to PSCR.		
		HCR335 starts the IC card process.
	←	3BF71100008171FE420000639501019000CC<CR> The reader returns the ATR sequences. Important : If IC card reading error occurs, a <FF> code is sent instead of the ATR.
<0x00><0x01>00A40200020011<0x0D>	→	
	←	9000<CR> User's card replies the successful code
<ESC>\$S1	→	
	←	<ACK> The reader switches to the first SAM slot.
<ESC>\$A	→	The host requests the HCR335 to activate the SAM card that is located in the first SAM slot.
	←	<ACK>3BF71100008171FE420000639501019000CC<CR> The reader returns the ATR from the SAM card.
<ESC>\$P	→	
	←	<ACK> The reader switches to PSCR.
<0x00><0x01>00A40200020011<0x0D>	→	

	←	9000<CR>
<ESC>\$S1	→	
	←	<ACK> The reader switches to the first SAM slot.
<0x00><0x01>00A40200020011 <0x0D> The reader continues talking to SAM card.	→	
	←	9000<CR> The SAM card replies the successful code
<ESC>\$D	→	
	←	<ACK> The reader deactivates the first SAM card
<ESC>\$P	→	
	←	<ACK> The reader switches to PSCR.
<ESC>E	→	
	←	<ACK><SI> The reader ejects the card. It indicates that the HCR335 starts to read magnetic stripe data.
		Important : For all requested MSR tracks data reading errors, there is no 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		HCR335
Power on the reader		We assume the mode of HCR335 is mode 1.
	←	: The reader replies a colon to indicate it is ready.
<ESC>M4	→	
	←	<ACK> The reader switches to mode 4.
User inserts the SLE 4428 card to PSCR.		
		HCR335 starts the IC card process.
	←	92231091<CR> The reader returns the ATR sequences. Important : The data in the memory card we present in here are just for reference.
<0x00><0x01>0E0000<0x0D>	→	
	←	92231091FFFF8113FFFFFFFFFFFFFFFFFFFF<CR> User's card replies 16 bytes of data
<ESC>E	→	
	←	<ACK><SI> The reader ejects the card. It indicates that the HCR335 starts reading magnetic stripe data.
	←	Important : For all requested MSR tracks data reading errors, there is no 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 HCR335 series. Each item includes the ASCII and hexadecimal codes, plus the comments section. 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>A – Enable Reader

This command will enable the reader from the disable state. After power on, the HCR335 will be in enable state (i.e. normal operation). However, the HCR335 can be changed into the disable state after receiving a DISABLE command.

Caution : If there is a card in the PSCR, it will cause an abnormal action to the reader. It is better to use the 'Card Position' command, <ESC>S, before sending this command.

Condition 1 : The reader is in the disable state.

Host		HCR335
<ESC>A	→	
	←	<ACK> Enable the reader and set to the default setting.

Condition 2 : The reader is in the enable state.

Host		HCR335
<ESC>A	→	
	←	<ACK> There is nothing changed for the reader.

7.1.2 <ESC>D – Disable Reader

This command sets the reader to the disable mode. Whenever the reader gets into the disable mode, all <ESC> sequence commands will be rejected except the Enable Reader command <ESC>A and the Card Position command <ESC>S.

For example :

Host		HCR335
<ESC>D	→	
	←	<ACK> Turn the LED off. Eject the card right away no matter the card is present in the PSCR or not.

7.1.3 <ESC>E – Eject Card

After receiving this command, the HCR335 will eject the card immediately no matter the transaction is completed or not.

For example :

Host		HCR335
<ESC>E	→	
	←	<ACK>

7.1.4 <ESC>Lx – Set the LED Status in the Idle Mode

x = 'n' → green

x = 'b' → green blinking

x = 'o' → LED off

This command is to set the LED status in the idle mode.

Host		HCR335
<ESC>Ln	→	
	←	<ACK> LED is set to green.

Note :

There are some ways to reset the reader to the default setting.

Please refer to the list as follows :

Power cycling

<ESC>R: the soft reset command

The reader's status is changed from disable to enable.

7.1.5 <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 the idle mode (i.e. no card in PSCR). It may cause an unknown side effect when the HCR335 receives such command during the PSCR processing session.

In mode 1 and 4, when the HCR335 detects an inserted card, it will fire the solenoid to release the lock mechanism, allowing the user to insert the card all the way to the back up to a maximum duration of 5 seconds. If the card is not at the end position before the time is out, the HCR335 will turn the LED to red indicating a failure. The user has to remove the card and reinsert it.

In mode 3, the behavior of the HCR335 is the same as the above two modes except for no MSR card reading.

In mode 2, the MSR only mode, the lock mechanism is not involved in the operation. The HCR335 will turn the LED off, indicating that MSR data will be processed. After the card is withdrawn, the HCR335 will turn the LED to GREEN, AMBER, or RED to indicate the results of all three tracks ok, one/two tracks error, or all three tracks with error respectively. Regarding the track enable/disable function, please refer to the <ESC>O, <ESC>w commands for details.

For example :

Host		HCR335
<ESC>M1	→	
	←	<ACK> EMV and MSR mode is selected.

7.1.6 <ESC>R – Software Reset

After receiving this command, the reader will perform the software reset.

For example :

Host		HCR335
<ESC>R	→	
		The readers will not respond anything.

7.1.7 <ESC>S – Card Position

The host can send this command to query the reader whether card is present or not in the PSCR. If the card is inserted to the very end of the reader, the reader will reply a '2' (0x32). If the card is in the half way of the reader, it will reply a '1' (0x31). Otherwise, the '0' (0x30) will be sent back to the host. This command is useful after the HCR335 sends out the one-time report of the "card inserted error code" as the host can find out whether the card is being removed or not.

For example :

Host		HCR335
<ESC>S	→	
	←	<ACK>1<CR>
		The card is in the half way of the reader.

7.1.8 <ESC>U – Report Software Version Number

The reader will report the software version information.

For example :

Host		HCR335
<ESC>U	→	
	←	<ACK>3350151K<SP>07-Oct-2011
		The reader reports the software version as 3350151K, and the coding date as 07-Oct-2011.

7.2 Configuration Command

7.2.1 <ESC>O – Enter Configuration Mode

With the reader entering into this On-Line configuration mode, it will only accept the commands listed from 7.2.2 to 7.2.10.

For example :

Host		HCR335
<ESC>O	→	
	←	<ACK> The reader enters into On-Line configuration mode.

7.2.2 <ESC>c – ROM Checksum

The reader reports the 4 digits current checksum bytes in ASCII code format.

For example :

Host		HCR335
<ESC>c	→	
	←	<ACK>
	←	1234<CR> The checksum of firmware is 1234.

7.2.3 <ESC>i – Report Current Interface Status

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

Data format : <A>PS<C><D><E>

Byte <A>

Current accessed interface.

1 : PSCR

0 : SAM card reader

Byte

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		HCR335
<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 : 2 nd Slot

7.2.4 <ESC>m – Reader Mode Query

The reader reports the current reader mode after receiving this command.

For example :

Host		HCR335
<ESC>m	→	
	←	<ACK>1<CR>
		Current mode is 1 (EMV and MSR mode).

7.2.5 <ESC>px – MSR Track Data Prefix Option

x = 0, 1

x = 0, turn off the prefix string (default)

x = 1, turn on the prefix string

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

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

For example :

Host		HCR335
<ESC>p1	→	
	←	<ACK> Set the prefix option on

7.2.6 <ESC>q – Exit Configuration Mode

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

For example :

Host		HCR335
<ESC>q	→	
	←	<ACK> The reader quits the On-Line configuration mode.

7.2.7 <ESC>r – Report RS232 and Track Setting

The reader uses a 4-byte code to set different parameters.

Data format : <A><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

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

For example :

Host		HCR335
<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 reader can save up to 7 bytes of data as serial number.

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

For example :

Host		HCR335
<ESC>s1234567	→	
	←	<ACK> The s/n is set to 1234567.

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

7.2.9 <ESC>u – Report Serial Number

Get the serial number from the reader.

For example :

Host		HCR335
<ESC>u	→	
	←	<ACK>1234567<CR> The reader reports the s/n as 1234567.

7.2.10 <ESC>w – Set the RS232 and Track Parameters

Set the RS232 and track parameters for the reader.

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

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

The HCR335 will write these parameters into the EEPROM after the command is executed successfully. The new settings will take effect after power cycling of the reader.

For example :

Host		HCR335
<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 the Smart Card

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

Parameters description :

1. It's only effective in the ISO mode.
2. These are optional, but all lower bytes must be included.
3. Default values for the 4 parameters will be used if the 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 the PPS request to the card. If PPS is successful, the original ATR will be sent out, otherwise it will send the error code <FF>.

[Voltage] The voltage applied to smart card

'3' (0x33) 3 Volt

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

[Protocol] The protocol type requested by the PPS

'0' (0x30) Protocol T=0

'1' (0x31) Protocol T=1

Default : The first protocol indicated in the 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 the current available smart card interface

Since the reader supports one primary smart card reader and four SAM card readers, it has to activate (or talk to) an interface as the current available interface (primary reader or SAM). In other words, it is up to users to send the selection command to determine which card to be dealt with.

However, if the primary card reader is in idle (no card), the reader will set the available interface to the SAM. When the reader detects a card inserted in the primary card reader, it will change the interface to the primary smart card reader automatically. It is unnecessary to resend the interface selection command. For more information about the select commands please refer to commands <ESC>\$P and <ESC>\$S.

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

Host		HCR335
<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		HCR335
		Insert Card
	←	<FF> Reader doesn't support F/D=18.
<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		HCR335
		Insert Card
	←	3BF01800FF8131FE4527<CR> Send PPS successfully to set the reader using voltage=5V, F/D=13, and T=1.
<ESC>\$A3003	→	
	←	<ACK>3BF01800FF8131FE4527<CR> Send PPS successfully to set the reader using voltage=3V, F/D=03, and T=0.
<ESC>\$A5111	→	
	←	<ACK>3BF01800FF8131FE4527<CR> Send PPS successfully to set the reader using voltage=5V, F/D=11, and T=0.

7.3.2 <ESC>\$C – Cold Start Smart Card

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

The parameters details are the same as the command <ESC>\$A.

7.3.3 <ESC>\$D – Deactivate Smart Card

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

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

For example :

Host		HCR335
<ESC>\$D	→	
	←	<ACK> Deactivate the current smart card interface.

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

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

A SAM card can be used in an electronic-purse or electronic-cash application that contains the authentication mechanism for verifying the customer's card. One of the smart card payment systems, the MONDEX, uses a SAM card as the merchant card to receive the payment from the customer card. Some known smart card payment systems will install SAM card(s) to prevent fraudulent operations..

In normal operation, the reader will auto detect the customer card being inserted into the primary smart card reader.. However, if customer would like to access the SAM card, it is necessary to issue a SAM card selection command to the reader. If the customer would like to switch back to read the customer's card, the reader has to send out the Select Primary Smart Card Interface command.

For example :

Host		HCR335
<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 the active smart card interface to SAM card reader.

Since the HCR335 reader supports one primary smart card reader and four SAM card readers, it will only activate (or talk to) the current available interface (primary reader or SAM). In other words, it is up to the user to send a selection command to determine which card needs to be dealt with.

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

A SAM card can be used in an electronic-purse or electronic-cash application that contains the authentication mechanism for verifying the customer's card. One of the smart card payment systems, the MONDEX, uses a SAM card as the merchant card to receive the payment from the customer card. Some known smart card payment systems will install SAM card(s) to prevent fraudulent operations

Note : This is only effective when the optional SAM daughter board is included.

For example :

Host		HCR335
<ESC>\$S1	→	
	←	<ACK> Switch to SAM card reader, slot 1.
<ESC>\$A	→	
	←	<ACK>3B600000<CR>
		The reader reports the ATR sequence bytes as 3B600000 from the 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 the current interface after receiving this command. Since it supports one primary smart card and four SAM card readers, it will perform a warm start on the current available interface (primary reader or SAM).

The smart card must be activated before sending this command, otherwise, a <NAK> will be returned to the host.

Note : 1. It is only available for CPU card.

2. It will continue to use the same voltage as the Cold Start.

7.4 104-Type Card

7.4.1 Power Up

The card is powered up at 5V and will answer 8 bytes of Answer To Reset string.

Host to HCR335 : <ESC>% 00 00 D1

HCR335 to host : <ACK> X₁ X₂ X₃ X₄ <CR>

X₁ X₂ X₃ X₄ : The data sent by the card as its ATR.

After power up, the card is ready to operate.

For example :

Host		HCR335
<ESC>%0000D1	→	
	←	<ACK>17043132<CR>

7.4.2 Get Authentic Parameter {Question from Stanley: is it the 'Get' or 'Set' command?}

This command set 12 bytes of authentic request parameters

Host to HCR335 : <ESC>% 00 06 D2 AD_H AD_L CLK_H CLK_L Cal_H Cal_L

HCR335 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 the response bit calculation.
The recommended value is 160 (0x00A0).

For example :

Host		HCR335
<ESC>%0006D2006E00B100A0	→	
	←	<ACK>

7.4.3 Request Authentication

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

Host to HCR335 : <ESC>% 00 06 D3 C₁ C₂ C₃ C₄ C₅ C₆

HCR335 to host : <ACK> X₁ X₂ <CR>

C₁ C₂ ... C₆ : Challenge data.

X₁ X₂ : The calculation of response codes.

For example :

Host		HCR335
<ESC>%0006D313233343536	→	
	←	<ACK>9D3A<CR>

7.4.4 Request Extended Authentication

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

Host to HCR335 : <ESC>% 00 06 D0 C₁ C₂ C₃ C₄ C₅ C₆

HCR335 to host : <ACK> X_{1H} X_{1L} X_{2H} X_{2L} <CR>

C₁ C₂ ... C₆ : Challenge data.

X₁ X₂ : The calculated response codes.

7.4.5 Write Bit

This command allows writing a bit into the specified bit address of the card. The next counter stage of the specified bit address will be erased if the Val equal to 1.

Host to HCR335 : <ESC>% 00 03 D4 AD_H AD_L Val

HCR335 to host : <ACK>

AD_H AD_L : Indicate the bit address of writing.

Val : If 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		HCR335
<ESC>%0003D4006100	→	
	←	<ACK>

7.4.6 Write Bit with Backup

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

Host to HCR335 : <ESC>% 00 02 DC AD_H AD_L

HCR335 to host : <ACK>

AD_H AD_L : Indicate the bit address to write.

AD_H should be 00.

For example :

Host		HCR335
<ESC>%0002DC005E	→	
	←	<ACK>

7.4.7 Write Byte

This command allows writing a specified number of bytes of data to the specified address of the card.

Host to HCR335 : <ESC>% 00 NB DD AD_H AD_L X₁ X₂... X_n

HCR335 to host : <ACK>

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

X₁ X₂...X_n : The data to write into the card.

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

For example :

Host		HCR335
<ESC>%0005DD0080123456	→	
	←	<ACK>

7.4.8 Read Data

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

Host to HCR335 : <ESC>% 00 03 D5 AD_H AD_L NB

HCR335 to host : <ACK> X₁ X₂ ... X_n <CR>

AD_H AD_L : Indicate the bit address to read.

NB : This is the number of bytes to read.

X₁ X₂...X_n : These are the data to read from the card.

For example :

Host		HCR335
<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 HCR335 : <ESC>% 00 05 DB AD_H AD_L T_1 T_2 T_3

HCR335 to host : <ACK>

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

AD_H should be 00.

T_1 T_2 T_3 : The specified transport codes.

For example :

Host		HCR335
<ESC>%0005DB0048F3FFFF	→	
	←	<ACK>

7.5 S10 Card

7.5.1 Read/Write

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

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

If we want to write 6 bytes of data into 6 locations of consecutive addresses, normally we need to send 6 separate commands for writing these 6 bytes. To speed up the processing time, we can combine these 6 command packages into one package by arranging the first *Control Byte*, the first *Address Byte* and all *Data Bytes*. The HCR335 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 HCR335 : <ESC>% 00 04 C2 CF CB AD NF

HCR335 to host : <ACK> X₁ X₂ ... 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.

X₁ X₂ ... X_n : These are the data bytes read from the card

For example :

Host		HCR330
<ESC>%0004C20030FA00	→	
	←	<ACK>313233343536<CR>
IC card return the data from addresses 0xFA to 0xFF. (Clock Freq. : 20kHz)		

In case of a write command :Host to HCR335 : <ESC>% NB_H NB_L C2 CF CB AD X₁ X₂... X_n

HCR335 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

X₁ X₂... X_n : Data bytes to be written to the card (n ≥ 1)

For example :

Host		HCR330
<ESC>%0009C2003820393837363534	→	
	←	<ACK>
Update the main memory from address 0x20 to 0x25 with values 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, the 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 :

In the writing process, if the start address is in the range, but the data is more than can be written, then the reader will only write the data into the valid addresses.

For example :

Host		HCR330
<ESC>%0009C20038FE393837363534	→	
	←	<ACK>
Only update main memory from address 0xFE to 0xFF with value 0x39 0x38. (Clock Freq. : 20kHz)		

8 LED Indication

8.1 After Power On

LED color	Reader's State
Green	Normal Application
RED → Green	Normal Application with factory default setting
Red Blinking	Firmware Download Application

8.2 Generic Operation

LED color	Description
Green	Idle (waiting for card insertion)
Amber	Card is present.
Red	Error reading, user has to remove the card and insert again.
Red blinking	Ready for firmware upgrade.

8.3 Magnetic Card Reader Operation

LED color	Description
Green	Magnetic card read ok.
Amber	One or two tracks error.
Off	Reading MSR. (Not available in mode 3)
Red	Error reading, no data output.