UIC681

Contactless Smart Card Reader Module
-RS232 Interface-

Programmer's Manual

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NOTICE

The issuer of this manual has made every effort to provide accurate information contained in this manual. The issuer shall not be held liable for any technical and editorial omissions or errors made herein; nor for incidental consequential damages resulting from the furnishing, performance or use of this material.

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AGENCY APPROVED

- Specification for FCC Class B
- Specification for UL/CUL
- Specification for CE Class B, CISPR 22 Class B
- Product Certificate by Taiwan BSMI (Bureau of Standards, Metrology and Inspection)

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.

WARNING

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

WARRANTY

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

PREFACE

This manual provides detailed information relating to the overall operational, electrical, mechanical, environmental and functional aspects of the UIC681. 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 UIC681, 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

Section1: General Description

1-1

This section presents general information about the basic characters of the UIC681.

1.1 Features

The UIC681 provides the following features:

1	Small footprint PCB size: 50 L* 40 W (mm) without antenna board
2	Support ISO 14443 type A & B standard
3	Support American Express® ExpressPay, MasterCard® PayPass™, Visa® MSD applications.
4	Read/write Philips Mifare® classical contactless smart card
5	Provide the options for the direct coupling antenna and the remote antenna
6	RS232, USB 1.1 and serial TTL (optional) Interface
7	RS232 data pass through function
8	TTL F2F magnetic stripe decode data pass through (optional)
9	F2F decoder data emulation (optional)
10	Firmware upgradeable

1.2 Application

The contactless smart card reader module UIC681 is mainly to support the contactless payment systems. The small footprint size of the module makes it easily to integrate to the current transaction system such as Point-of-Sale terminal, kiosk, and vending machine station as the part of the system. The module communicates with a host computer or terminal using a standard RS-232, USB or TTL interface.

At the meantime, UIC681 offers both RS232 and TTL magnetic stripe decoder pass-thru function to allow the terminal to share the same input port with other peripheral devices. The TTL interface output is in the F2F decoder data emulation. This benefits the existing system without change its hardware configuration to catch up the future payment trend.

1.3 Part Number Description

P/N	Description	1-2
TBD	UIC681 Contactless IC Card Reader/Writer Module	

Section2: Configurations

This section shows the dimensions and accessories of the UIC681.

2.1 Dimensions of UIC681 PCBA

Figure 2-1 Dimensions of UIC681
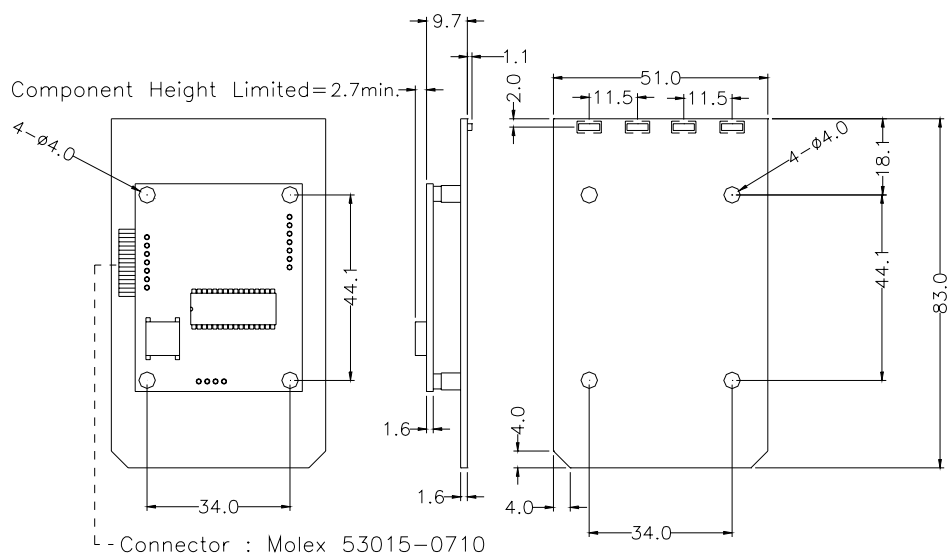
2.2 Dimensions of Remote Antenna PCBA

Figure 2-2 Dimensions of Remote Antenna PCBA
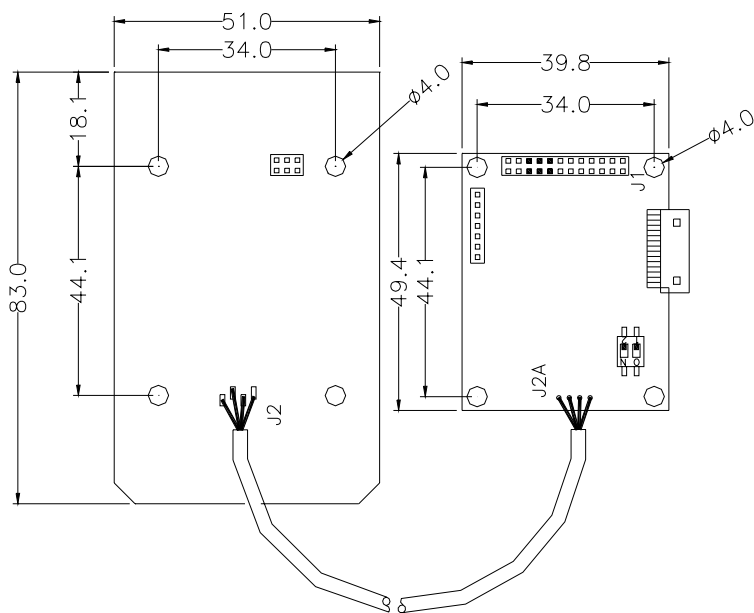
2.3 Accessories of UIC681

The following accessories should be supplied along with UIC681. Make sure all the following accessories are contained in your package.

1. Interface cable - DB9 male connector 1.5M (or USB type A plug, optional)
2. Programmer's manual or Simple manual
3. Power adapter 5VDC 500mA (RS232 interface only)

Section3: Technical Specifications

3-1

3.1 Functional Specifications

- Contactless communication at 13.56MHz
- Proximity operation distance of up to 100mm
- LED indication or 2 x 16 LCD display (support PayPass application)
- Audio buzzer
- USB 1.1 compliant interface to support USB HID (optional)
- Support RS232 data output baud rate up to 115.2K BPS
- Support RS232 pass through baud rate up to 38400 BPS
- Support TTL level for serial data output (optional)
- Support TTL level for F2F decoder data output emulation (optional)
- Support direct matching antenna
- Support Remote 50 ohm matching antenna (optional)
- Support all layers of 14443 including the type A and B communication scheme
- Support contactless communication using MIFARE higher baud rate up to 424KHz
- Support the MIFARE Classic products
- Support American Express ExpressPay transaction application
- Support MasterCard PayPass transaction application
- Support Visa MSD transaction application

3.2 Mechanical Specifications

- **Dimension**

Without antenna board
Length: 50 mm
Width: 40 mm

3.3 Electrical Specifications

3-2

- **Power Required**

5VDC

- **Power Consumption**

100mA in idle mode; 250mA in operating mode

- **Communication**

Standard RS232 signal level
Compatible with USB 1.1 specification (optional)
TTL 5V signal level (optional)

- **Communication Signal (RS232)**

Logic 1 = -3 volts to –15 volts or TTL level 5 volts
Logic 0 = +3 volts to +15 volts or TTL level 0 volt

3.4 Environmental Specifications

- **Temperature**

Operating: -10 ~ 50℃
Storage: -30 ~ 70℃

- **Humidity**

Operating: 10 ~ 85% (non condensing)
Storage: 10 ~ 90% (non condensing)

3.5 Pin Assignment

Table 3-1. Interface J3 Pin Assignment 3-3

DB9	Signal	Direction	PCB-J1	Signal
5	GND		1	GND
2	RxD	← Serial data to host	2	TXD1
3	TxD	→ Serial data from host	3	RXD1
			4	VCC
		Serial Pass-thru or USB data	5	TXD2 (or USB D-)
		Serial Pass-thru or USB data	6	RxD2 (or USB D+)
	Shield		7	Shield

Table 3-2. Extension Port J1 Pin Assignment

Pin	Signal	Comment
1	Extended IO	
2	Extended IO	
3	Extended IO	
4	Extended IO	
5	GND	
6	VCC	5Vdc
7	Extended IO	
8	Extended IO	
9	Extended IO	
10	Extended IO	
11	Buzzer + output	
12	Buzzer – output	
13	Extended IO	
14	Extended IO	
15	Extended IO	
16	Extended IO	
17	Extended IO	
18	Extended IO	
19	Extended IO	
20	Extended IO	
21	Extended IO	
22	Extended IO	
23	Extended IO	
24	Extended IO	

Table 3-3. 50 RF Antenna Port J2B Pin Assignment

Contact number	Signal
1	RF output
2	GND

Table 3-4. Direct Match Antenna Port J2A Pin Assignment

Contact number	Signal
1	RX
2	TX
3	GND
4	GND

3.6 Communication

- **RS232 Interface Data Output**
  Synchronization
  The interface receives and transmits serial asynchronous data at voltage levels compatible with the RS232 specification.

  Baud Rate
  9600 BPS default (optional: 1200/2400/4800/9600/19200/38400/56000/115.2K BPS)

- **RS232 Interface Pass Through**
  Baud Rate
  9600 BPS default (optional: 1200/2400/4800/9600/19200/38400 BPS)

- **USB Interface**
  Compatible with USB specification 1.1

- **F2F TTL Interface (Optional)**
  Each track has the clock and data. Please refer to command set for the detail setting.

- **Transmission Protocol**
  The user may select from three different protocols: Protocol 0, 1, and 2.
  Upon reset, the reader sends the power-on response ":", depending upon the configuration setting. The reader then configures itself to the protocol of the first command from the host. From this point on, the protocol is unchangeable until a reset occurs.

  Protocol 0
  In Protocol 0, all characters are transmitted and received using exactly the characters listed in section 4. There are no headers and Block Check Characters (BCC). Protocol 0 presumes no transmission errors. If the host detects an error, it may request a retransmission.

  Table 3-5. Example for Protocol 0

Host Command	Reader Response	Comment
P		Ready to read
	^	Reader ACK

  Protocol 1
  In Protocol 1, all messages are preceded by the ASCII character <STX> and terminated with the ASCII character <ETX>, followed by a one byte <BCC>.
  <BCC> is an XOR of the 7 data bits, excluding parity, of each character in the entire message, including <STX>.

  Format: <STX><MESSAGE><ETX><BCC>

where STX=02Hex and ETX=03Hex.

Table 3-6. Example for Protocol 1

Host Command	Reader Response	Comment
02h 50h 03h 51h		Ready to read
	02h 5Eh 03h 5Fh	Reader ACK

Protocol 2
In Protocol 2, all messages are preceded by the ASCII character <SOH>, followed by a one byte reader address, two bytes character count and terminated with a one byte <BCC>.
The <BCC> is an XOR of the characters (8 bits) in the entire message, including <SOH>.

Format: <SOH><ADDRESS><00Hex><COUNT><MESSAGE><BCC>

Table 3-7. Example for Protocol 2

Host Command	Reader Response	Comment
01h 00h 00h 01h 50h 50h		Ready to read
	01h 00h 00h 01h 5Eh 5Eh	Reader ACK

The <ADDRESS> field is for a multi-reader system. This function is not currently supported. The recommended value for this field is NULL (00Hex), however, any value will work.

For Protocols 1 and 2, if the reader detects an error in an incoming transmission, it will respond with a "Communications Error" message. If the host detects a transmission error, it may request a retransmission. Besides, all protocols enforce a 10mSec timeout between characters.

- **Self – Arm Mode**
  The default reader configuration is the "Self-Arm Mode", which allows the payment cards (Including PayPass Magnetic Stripe, VISA MSD, ExpressPay card and the general magnetic stripe credit cards) reading functions to run automatically, reporting the card data to the host without instruction from the host.

  In the Self-Arm Mode, the reader also can accept commands from host. However, the reader can be configured to only "Host Polled Mode" by disabling Self-Arm Mode. The "Host Polled Mode" allows the card reading functions to run by commands.

- **Transmission Format**
  In Self-ARM mode, the default setting of card data output doesn't include the protocol envelope code. The user can turn on the envelope code by utilized the configuration command – SE, TO. (Please refer to the appendix section of UIC681 Configuration Guide)

Card output format (Self-ARM mode)

Preamble	Protocol Envelope code	Tk1 prefix	Tk1 Data	Tk1 suffix		
	Separator	Tk2 prefix	Tk2 Data	Tk2 suffix		
	Separator	Tk3 prefix	Tk3 Data	Tk3 suffix	Protocol Envelope code	Postamble

The preamble/postamble is only available in the card data output format under Self-ARM mode.

Read data for command (Host-Polled mode)
The reader replies the host command such as "Transmit Track Data" so called "Host-Polled". The requested message is encapsulated in the protocol envelope.

The response of Transmit Track Data command list as below:
Read tk1 data for command

Protocol Envelope code	Tk1 prefix	Tk1 Data	Tk1 suffix	Protocol Envelope code

Read tk2 data for command

Protocol Envelope code	Tk2 prefix	Tk2 Data	Tk2 suffix	Protocol Envelope code

Read tk3 data for command

Protocol Envelope code	Tk3 prefix	Tk3 Data	Tk3 suffix	Protocol Envelope code

NOTE1: Tkx data: SS (option) track data ES (option) LRC (option)
NOTE2: Preamble/Postamble, prefix/suffix are optional based on reader's configuration.
NOTE3: Protocol Envelope code can be <HEADERS>, <BCC> or NONE depended on what protocol is in used.

Section4: Commands and Responses

4-1

4.1 Reader Default Setting

Item Description	EEPROM Default Value
Interface type	RS232
UART1 setting (Txd1/Rxd1)	9600-8-N-1
Data pass through mode	Disable
UART2 setting (Txd1/Rxd2)	9600-8-N-1
Buzzer	Enable
Protocol format	USI0
Contactless Self-ARM mode	Enable
Contactless smart card manual type	Type A

NOTE1: When "Contactless self-arm mode" turns on, UIC681 will automatic read the payment card[1] in the reading zone for both type A and B cards.

NOTE2: The contactless card operation commands are invalid when "Self-ARM mode" is enabled. To switch manual operation mode, user needs to disable the "Self-ARM mode" first.

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[1] Payment card – the card with PayPass, ExpressPay, or MSD application.

4.2 Reader Command Description

- **% (25H) – Retransmit**
  COMMENT   Retransmits the last message sent by the reader.

  NOTE   Command is turned off in self-arm mode.

- **70 (3730H) or 90 (3930H) – Serial Number Report**
  COMMENT   Transmit serial number information.

  The serial number will be stored in the EEPROM and stored as an eight-digit ASCII character array.

  Example: "00000000"

- **71 (3731H) or 91 (3931H) – Copyright Report**
  COMMENT   Transmit version and copyright information.

  Send this when you want to know the version and copyright of the Model UIC681 firmware currently loaded. The response is an ASCII string giving the firmware date (yymmdd), reader type and the firmware version number followed by the firmware copyright statement. The firmware copyright statement is absent in OEM version.

  Example: "60706,UIC 6800104C:V4.C"

- **72 (3732H) or 92 (3932H) – Reader Model Number Report**
  COMMENT   Transmit reader model information.

  The model number will be stored in the reader code area.

  Example: "UIC681-RR"

- **73 (3733H) or 93 (3933H) – Reader PCB Number Report**
  COMMENT   Transmit reader PCB number.

  The PCB number will be stored in the EEPROM and stored as an eight-digit ASCII character array.

  Example: "680-REV1"

- **77 (3737H) or 97 (3937H) – Reader Configuration Data Report**
  COMMENT   Transmit the reader configuration data.

  The data from the reader configuration area will be transmitted to the host as hex values with the command "77" [offset] [num]. The reader will return any or all the bytes from the reader configuration. The offset is an optional byte and the available value is from 0x00 to 0x3F. The num is an optional byte specifying the number of configuration bytes to be returned. If the offset and length bytes are omitted then the current configuration starting at offset 0 is transmitted.

  Example:

  >   BE 4C 03 03 00 00 00 61 30 35 30 35 30 36 82 00
  >
  >   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  >
  >   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  >
  >   00 00 00 00 00 00 00 00 3A 36 38 30 2D 52 48 00

- **78 (3738H) or 98 (3938H) – Reader Customer Configuration Data Report**
  COMMENT   Transmit the reader customer configuration data.

  The data from the reader customer configuration area of the EEPROM will be transmitted to the host as hex values with the command "78¨ [offset] [num]. The reader will return any or all the bytes from the reader configuration. The offset is an optional byte and the available value is from 0x00 to 0x3F. The num is an optional byte specifying the number of configuration bytes to be returned. If the offset and length bytes are omitted then the current configuration starting at offset 0 is transmitted.

  Example:

  >   00 30 30 30 30 30 30 30 30 36 38 30 2D 52 45 56
  >
  >   31 03 04 03 02 00 3C 00 80 00 00 00 00 00 00 00
  >
  >   00 00 00 00 00 00 00 45 00 2B FF FF FF FF FF FF
  >
  >   FF FF FF FF FF FF 3F 3F 12 FF 06 3F 05 13 50 03

- **79 (3739H) or 99 (3939H) – Reader Manufacturing Configuration Data Report**
  COMMENT   Transmit the reader manufacturing configuration data.

  The data from the reader manufacturing configuration area of the flash will be transmitted to the host as hex values with the command "79" [offset] [num]. The reader will return any or all the bytes from the reader configuration. The offset is an optional

byte and the available value is from 0x00 to 0x7F. The num is an optional byte specifying the number of configuration bytes to be returned to the host. If the offset and length bytes are omitted then the current configuration starting at offset 0 is transmitted.

Example:

BE 4C 03 03 00 00 00 61 30 35 30 35 30 36 82 00

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

00 00 00 00 00 00 00 00 3A 36 38 30 2D 52 48 00

- **9 (39H) – Version Report**
  COMMENT   Transmit version information.

  Send this when you want to know the version of UIC681 firmware currently loaded. The response is an ASCII string giving the firmware date (mmddyy), reader type and firmware version number.

  Example: "060706,UIC681-RR:V4.C¨.

- **? (3FH) – Select Verbose Responses Command**
  COMMENT   Most error responses until the reader receives a reset command
                         will include a short descriptive message.

- **$ (24H) – Reader Status Request**
  COMMENT   Interrogate the reader about its operational status. Two bytes of status
                         information will be returned.

  First Status Byte

Bit	Value: 0	Value: 1
0 – 4	Reserve for future use	Reserve for future use
5	No Magnetic Stripe Card data	Magnetic Stripe Card data
6	Not armed to read	Armed to read
7	Reserve for future use	Reserve for future use

  Second Status Byte (reserve for future use)

- **L (4CH) – LED ON**
- **l (6CH) – LED OFF**
- **((28H) – LED Flash**

  COMMENT   1.Turn first/second LED ON/OFF/Flash, as specified.

  2.Transmits an acknowledgement "^" (5EH).

  NOTE   1.These commands are disabled in the self-arm mode.

  2.These commands only use in LED model.

- **# (23H) – Configuration Request**

  COMMENT   Return standard one byte or extended 16-byte string with configuration.

  NOTE   Using the configuration setting command to select standard or extended format.

Standard One Configuration Byte

Bit	Value: 0	Value: 1
0	Track 1 not present	Track 1 present
1	Track 2 not present	Track 2 present
2	Track 3 not present	Track 3 present
3-7	Reserved for future use	Reserved for future use

Extended Configuration Bytes (16 bytes)

Byte	0	1	2	3	4	5-15
Remark	Equip.0	Equip.1	Protocol	Speed	Address	Reserved

Protocol: 0=USI0; 1=USI1; 2=USI2.

Speed: 0=1200, 1=2400, 2=4800, 3=9600, 4=19.2k, 5=38.4k, 6=56k, and 7=115.2k bps.

Address: Always 00H.

Equip. 0 － Extended Configuration Byte 0

Bit	Value: 0	Value: 1
0-3	Reserved for future use	Reserved for future use
4	Track 1 not present	Track 1 present
5	Track 2 not present	Track 2 present
6	Track 3 not present	Track 3 present
7	Reserved for future use.	Reserved for future use

Equip. 1 － Extended Configuration Byte 1

Bit	Value: 0	Value: 1
0 - 7	Reserved for future use	Reserved for future use

- **<DC2> (12H) – RS232 pass through enable**
  COMMENT   Enable RS232 data Pass Through (PT) function temporarily.
  FORMAT   The command characters are followed by an ASCII 'P' to enable the
            RS232 pass through function. It is only valid in RS232 model.

  NOTE   Once the pass through mode is enabled, UIC681 passes all data
            between COM1 and COM2 and do nothing. Power cycling (if the default
            of PT is disable) or send the string "<DC2>P<DC2>a<DC2>s<DC2>S"
            brings UIC681 back to normal operation. Before sending this command,
            the user must assure the PT function is desired.

- **<CAN> (18H) – Clear Data Buffer**
  COMMENT   Clear the card data buffer.

- **<7FH> – Warm Reset**
  COMMENT   Abort all current actions and cause the device to execute all initialization
            functions. The device will respond as it would for a "power up" cycle, but
            always returning a ":" (3AH). This operation will take at least 3 seconds.

- **<09H> – Configuration Setting**
  COMMENT   This command is used to set configuration in EEPROM.
  FORMAT   The command (09H) is followed by the configuration data format to set
            the configuration in EEPROM. Please see "UIC681 Configuration Guide"
            for more details.

- **P (50H) – Arm to Read**
  COMMENT   1.Clear read data buffers.
            2.Transmit command acknowledgement ("^" 5EH).
            3.Wait for card approached.
            4.Transmit read acknowledgement ("^") after card read.
            After an "Arm to Read" command is received and acknowledged the only
            commands that will be accepted for execution are: <ESC> (Abort), "$"
            (Status), LED control commands and Reset command.
            In self-arm mode, it is not necessary to send this command, if sent it will
            temporarily override self-arm mode.

- **p (70H) – Arm to Read (Used for Manufacturing Test Only)**
  COMMENT   1.Clear read data buffers.
  2.Transmit command acknowledgement ("^" 5EH).
  3.Wait for card read.
  4.If the card media is detected a "(" (28H) byte is sent, when
     media detect goes inactive a ")" (29H) byte is sent.
  This is similar to the 'P' command but send '(' at start of magnetic stripe
  card data and ')' at end.

- **<ESC> (1BH) – Abort Arm to Read**
  COMMENT   1.Clear read data buffers.
  2.Abort Arm to Read Command.
  3.Transmit command acknowledge ("^" 5EH).

- **Q (51H) – Transmit Track 1 data**
- **R (52H) – Transmit Track 2 data**
- **S (53H) – Transmit Track 3 data**
  COMMENT   1.Detect the card type automatically and process data in the read buffer.
  2.If error is detected, transmit proper error response ('*' or '+'),
     refer to "Responses to the Host" section.
  3.Else, transmit data in ASCII.

- **H (48H) – Self-ARM function disable/enable**
  COMMENT   Disable auto read function temporarily if Self-Arm is enabling.

  H [Enable/Disable, 1 byte]

  [Enable/Disable]
  0 (30h, ASCII Hex) - Self-Arm disable
  1 (31h, ASCII Hex) - Self-Arm enable

  NOTE   UIC681 cannot perform the Self-ARM enable command for the contactless
  payment card reading under below conditions:
  1.The payment card is decoded successful and the UIC681 is waiting the
  card to be removed from the reading zone.
  2.The payment card is failed to decode and the UIC681 is waiting the card
  to be removed from the reading zone.

RESPONSE '^' – Acknowledgement

'*' – Cannot execute

'!' – Bad parameter

4.3 Contactless Card Operation Command Description

- **G (47H) – ISO14443 type protocol select**
    COMMENT   Select ISO 14443 type A or B which manual command operated.

    G[Type, 1 byte]

    [Type]
    0 (30h, ASCII Hex) - ISO14443 A
    4 (30h, ASCII Hex) - ISO14443 B

    The default contactless smart card type is type A after power up.

    RESPONSE '^' – Acknowledgement
                    '!' – Bad parameter

- **O (4FH) – Antenna power ON**
    COMMENT   Apply power on the antenna. This command is for manual command
                    operation.

    RESPONSE '^' – Acknowledgement
                    '*' – Failed, the reader is in Self-Arm mode. The antenna power cannot
                        be turned off.

- **o (6FH) – Antenna power OFF**
    COMMENT   Turn the antenna power off.

    RESPONSE '^' – Acknowledgement
                    '*' – Failed, the reader is in Self-Arm mode. The antenna power cannot
                        be turned off.

- **b (62H) – Request**
    COMMENT   Request command.

    b[Req command, 1 byte]   -   If reader is set to ISO14443 type A
    [Req command] (optional)

The request command code is ISO14443 type A. It can be either 26 (REQA) or 52 (WUPA)

NOTE   If the [Req command] field does not appear in the request command, reader will set the request mode to WUPA automatically.

b[AFI, 1 byte][Parameter, 1 byte] - If reader is set to ISO14443 type B
[AFI](optional) - Binary hex (00h to FFh), please refer to ISO 14443-3 for the detailed information
[Parameter](optional) - Binary hex (00h to FFh), please refer to 14443 for the detailed information.

NOTE   If the [AFI] and [Parameter] do not appear in the request command, reader will set the request mode to WUPB automatically.

RESPONSE ATQA (2 bytes, type A, Binary Hex) or ATQB (16 bytes, type B, Binary Hex) if command executed successfully
        '*' – No card response or No power on the antenna

- **c (63H) – Anticollision(type A)/Slot-Marker(type B)**
  COMMENT   In type A mode, the reader sends the Anti-collision command to the card.
            In type B mode, the reader sends the Slot-Marker command to the card.

  c – ISO 14443 type A
  c[APn] – ISO14443 type B
  [APn] – Anti-collision prefix byte.(type B only)

  NOTE   Slot-Marker is not a mandatory command for type B card.
  RESPONSE If the command executed successfully, the reader returns
            PICC serial number for type A (Binary Hex)
            or
            PICC send ATQB (12 bytes, Binary Hex) for type B
            '*' – No card response or or No power on the antenna
            '!' – Bad parameter

- **f (66H) – Select(type A)/Attrib(type B)**
  COMMENT   In type A mode, the reader sends the SELECT command to the card.
            In type B mode, the reader sends the ATTRIB command to the card.

RESPONSE If the command executed successfully, the reader returns

      '^' + SAK(1 byte)

      or

      '^' + MBLI/CID(1 byte)

      '*' – No card response or No power on the antenna

- **g (67H) – Mifare classical card authentication (Support Mifare classical card only)**

  COMMENT   Mifare classical card authentication.

  g[Block number, 3 bytes][Key number, 1 byte][Key type]

  Authenticate the card with the key stored in EEPROM.

  or

  g[Block number, 3 bytes]][Key type] [Key, 12 bytes]

  Authenticate the card with the key in [key field].

  [Block number]

  There are two types of block format

  000 to 255 (30h30h30h to 32h35h35h, ASCII Hex)

  or

  B<00><00> to B<00><FF> (42h00h00h to 42h00hFFh, ASCII Hex)

  [Key number]

  0 to 4 (30h to 35h, ASCII Hex)

  [Key]

  0 to 9 or A to F (30h - 39h or 41h - 46h, ASCII Hex)

  [Key type]

  A or B (41h or 42h)

  RESPONSE '^' – acknowledgement

        '*' – No card response or No power on the antenna

- **h (68H) – Mifare classical card read block (Support Mifare classical card only)**

  COMMENT   Mifare classical card read command.

  h[Block number, 3 bytes]

[Block number]

There are two types of block format

000 to 255 (30h30h30h to 32h35h35h, ASCII Hex)

or

B<00><00> to B<00><FF> (42h00h00h to 42h00hFFh, ASCII Hex)

RESPONSE block data (16 bytes, Binary Hex) if command executed successfully

'*' – No card response or No power on the antenna

- **i (69H) – Mifare classical card write block (Support Mifare classical card only)**
  COMMENT   Mifare classical card write command.

  i[Block number, 3 bytes][Block data, 4 bytes or 16 bytes]

  [Block number]

  There are three types of block number format

  000 to 255 (30h30h30h to 32h35h35h, ASCII Hex) General Mifare Block

  or

  B<00><00> to B<00><FF> (42h00h00h to 42h00hFFh, ASCII Hex) General Mifare Block

  or

  U<00><00> to B<00><FF> (55h00h00h to 42h00hFFh, ASCII Hex)

  Mifare Ultralight

  [Block data]

  For Mifare Ultralight, the block data should be 4 bytes, others are using 16 bytes block data.

  RESPONSE '^' – Acknowledgement

  '*' – No card response or No power on the antenna

- **t (74H) – Mifare Value Operation (Support Mifare classical card only)**
  COMMENT   Mifare classical card value operation command.

  t[Block number, 3 bytes][Operation mode, 1 byte][Value, 4 bytes][transfer block, 3 bytes]

[Block number]

There are two types of block number format

000 to 255 (30h30h30h to 32h35h35h, ASCII Hex)

or

B<00><00> to B<00><FF> (42h00h00h to 42h00hFFh, ASCII Hex)

[Operation mode]

0 (30h, ASCII Hex) – Decrement

1 (31h, ASCII Hex) – Increment

2 (32h, ASCII Hex) – Restore

3 (33h, ASCII Hex) – Decrement and transfer to the different block.

4 (34h, ASCII Hex) – Create Mifare Value in the block.

[Value]

Binary Hex from 0h to FFh

For option 3 only, the data format is same as [block number]

RESPONSE '^' – Acknowledgement

'*' – No card response or No power on the antenna

'!' – Bad parameter

- **X (58H) – Mifare classical card activation**

COMMENT Perform request/anticollision/select command to activate the card.

It is also can be used for any ISO14443 compatible card.

RESPONSE ATQA/SAK/serial number if the command executed successfully for type A card

ATQB (12 bytes) if the command executed successfully for type B card

'*' – No card response or No power on the antenna

- **x (78H) – Card halt**

COMMENT Card halt command.

RESPONSE '^' – acknowledgement

'*' – No card response or No power on the antenna

- **J (4AH) – Activate PICC cpu card**
  COMMENT   Activate PICC cpu card command. The Antenna POWER ON command
                     has to be sent first.

  RESPONSE ATS (type A) or PUPI (type B) if command executed successfully
                     '*' – No card response or No power on the antenna

- **j (6AH) – Load Mifare key (Support Mifare classical card only)**
  COMMENT   Save up to 5 key sets for Mifare classical card application
  NOTE   For security reason, there is no way to retrieve the key back.

  j[Key number, 1 byte][Key data, 12 bytes]

  [Key number]
  0 to 4 (30h to 39h, ASCII Hex)

  [Key data]
  0 to 9 or A to F (30h - 39h or 41h - 46h, ASCII Hex)

  RESPONSE '^' – acknowledgement
                     '*' – No card response or No power on the antenna

- **y (79H) – Send DESELECT command**
  COMMENT   Send ISO14443 layer 4 DESELECT command to card

  RESPONSE '^' – acknowledgement
                     '*' – No card response or No power on the antenna

- **Z (5AH) – I/O to contactless CPU card with APDU format**
  COMMENT   The command is used to pass an APDU to the card where both data and
                     an ISO status are expected in the response.

  Z[APDU, variant, 262 bytes max]
  [APDU]   Binary hex (00h to FFh)

  If successful, the data from the ICC and the two byte SW1/SW2 ISO 7816-4 response
  are returned.

If unsuccessful, reader transmits '*'.

APDU Command Structure

CLA	INS	P1	P2	P3 Lc or Le	Data (If Lc present)

APDU Response Structure

Data (optional)	SW1	SW2

- **z (7AH) – I/O to contactless card for block data exchange**
  COMMENT   The command is used to pass a block data to a card.

  z[CRC mode, 1 bytes][Wait time, 4 bytes][Block data, 384 bytes max.]

  [CRC mode]
  0 (30h, ASCII Hex) – Block data contain 2 bytes CRC and enable CRC transmission.
  1 (31h, ASCII Hex) – No CRC in block data and disable CRC transmission.

  [Wait time]
  0000 to 9999 (30h30h30h30h to 39h39h39h39h, ASCII Hex) Waiting time in ms.

  [Block data]
  Binary hex (00h to FFh), Maximum accepts 384 bytes.

  If successful, the data from the ICC are returned.
  If unsuccessful, reader transmits '*'.

4.4 <u>Responses to the Host</u>

^ (5EH)   Acknowledge. Acknowledges correct completion of most recent command.

* (2AH)   Command was received correctly. But could not be completed.

+ (2BH)   No Magnetic Stripe Card Data. Command was received correctly.

? (3FH)   Communication Error. Command was not received correctly.

! (21H)   Invalid Command or bad parameter.

: (3AH)   Power On report.

~ (7Eh)   Unavailable. Hardware not available to complete this request.

Section5: Application Example

5-1

The default setting of UIC681 reader, Self-ARM mode, is mainly to simplify the process for the host that doesn't need to communicate to each other. In this situation, the UIC681 acts like a general magnetic stripe card reader whenever it senses the card, it will try to decode the card data automatically and send the decoded data to the host if the process is successful. Otherwise, no information is sent out.

If the application would like to take whole control on the reader, it is recommended using the "Host Polled" mode instead of the "Self-ARM" mode. It can be done by either sending "Self-ARM" disable command or changing default setting in the reader configuration.

Once UIC681 receives the Self-ARM disable command, H0 (see the command description section), it turns off auto-read function and waits for the "Arm-to-Read" command, P, for next transaction. Since the Self-ARM disable command won't change the EEPROM setting, UIC681 will turn back to Self-ARM for next power cycling. Besides, the Self-ARM enable command, H1, can also bring UIC681 back to Self-ARM.

To disable Self-ARM mode permanently, the host needs to set the EEPROM value of UIC681. The configuration command SAx (x = E or D, see the Configuration Guide) saves the setting into the EEPROM of UIC681 and keep the value until next changed.

Meanwhile, it is recommended using the Protocol 2 (USI2) for "host polled" application because USI2 contains the header, message counter and block check character. It is better than Protocol 0 (USI0) and Protocol 1 (USI1) to prevent the data to be misinterpreted but needs more redundant bytes.

Host Polled Application Example

A. UIC681 setting changed

In this example, it assumes UIC681 is in factory default and the user would like to change it to protocol USI2 and Self-ARM disable.

```
                    ┌─────────────────┐
                    │   Initial State  │
                    └─────────────────┘
                             │
                             ▼
    ┌──────────────────────────────────────────────────┐
    │  1.  Send the configuration command to set         │
    │      UIC681 to protocol 2.                          │
    │  2.  Send the configuration command to set         │
    │      UIC681 to Self-ARM disable.                    │
    │                                                    │
    └──────────────────────────────────────────────────┘
                             │
                             ▼
                    ┌─────────────────┐
                    │      Done        │
                    └─────────────────┘
```
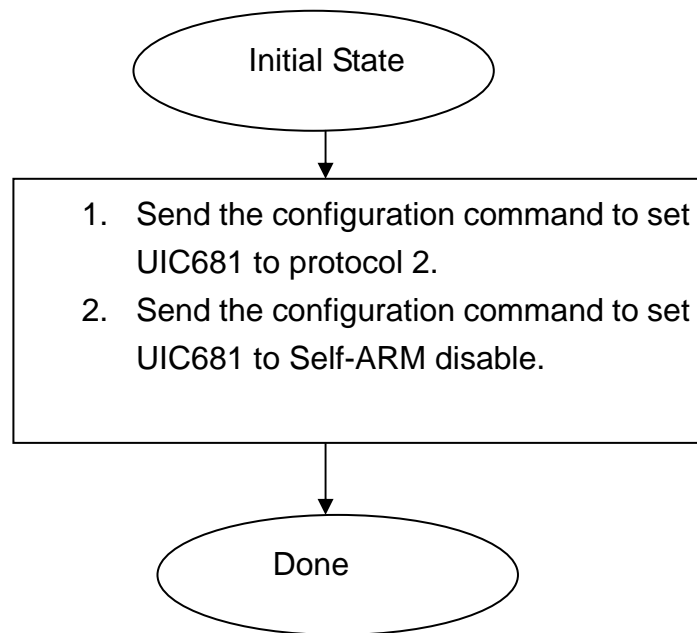
This process should be done only once to set the UIC681 to the proper state.

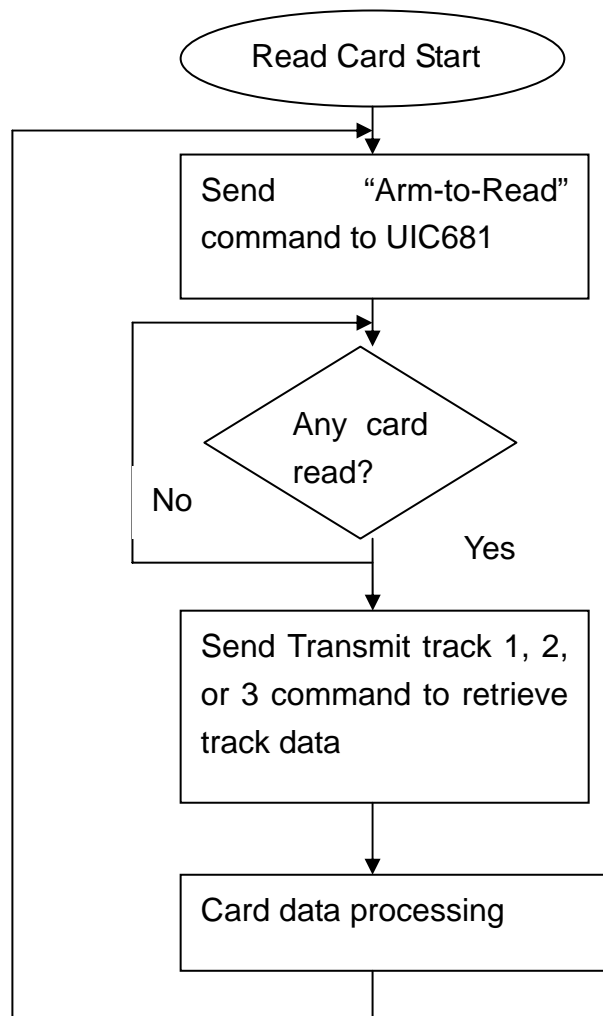Due to the EEPROM life limitation, it is recommended that don't change the EEPROM value very frequently. Normally, the configuration setting has done in the factory production stage, please contact UIC Sales representative for more detail information.

B. Operation Example

In this example, it assumes UIC681 is in protocol USI2 and Self-ARM disable.

```
                    ┌─────────────────────┐
                   (    Read Card Start    )
                    └─────────────────────┘
                                │
          ┌─────────────────────▼──────────┐
          │  ┌──────────────────────────┐  │
          │  │ Send      "Arm-to-Read"  │  │
          │  │ command to UIC681        │  │
          │  └──────────────────────────┘  │
          │                 │              │
          │         ┌───────▼───────┐      │
          │         │   Any  card    │     │
          │    No   │    read?       │     │
          │◄────────┤                │     │
          │         └───────┬───────┘      │
          │                 │ Yes          │
          │  ┌──────────────▼───────────┐  │
          │  │ Send Transmit track 1, 2,│  │
          │  │ or 3 command to retrieve │  │
          │  │ track data               │  │
          │  └──────────────────────────┘  │
          │                 │              │
          │  ┌──────────────▼───────────┐  │
          │  │ Card data processing     │  │
          │  └──────────────────────────┘  │
          └────────────────────────────────┘
```

For next transaction

After host issues the Arm-to-Read command, UIC681 will check if any payment card in the reading read zone or any magnetic stripe card swiped (the magnetic stripe reader is optional device). No matter the card is decoded succeed or failed, it will return '^' to indicate the card has been read. The host can issue Q, R, S command to retrieve the card data.