

# Contactless Card Read/Write Module

## QM-201C-HF

### User's Manual

(version 1.4)

English

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# 1 Summary

QM-201C-HF contactless card Read/Write module was designed on high integrated reader ICs for contactless communication on 13.56MHz of Philips. QM-201 integrates MF RC500 RF base station. Engineers need not take care how to control MF RC500 RF base station. Just send command to module over IIC or UART.

QM-200 series contactless card Read/Write module support ISO14443-A Mifare One S50, S70, UltraLight, MifarePro, ISO14443-B SR176, ISO15693, ICODE SL2 and then other compatible card.

## 2 QM-200 Series Module

Type	Card Protocol	Vcc	Interface	Card supported	This Page
QM-201C-HF-A	ISO14443-A	+5V	IIC,UART(TTL)	Mifare S50,S70, Mifare Pro	√
QM-202-C	ISO14443-A ISO14443-B	+3.3V~+5V	IIC,UART(TTL)	Mifare S50,S70, Mifare Pro, ISO14443-B SR176	
QM-203-C	ISO15693	+3.3V~+5V	IIC,UART(TTL)	ICode SL2, ISO15693	
QM-204-C	ISO14443-A ISO14443-B ISO15693	+3.3V~+5V	IIC,UART(TTL)	Mifare S50,S70, Mifare Pro, ISO14443-B SR176, ICode SL2, ISO15693	

## 3 QM-201C-HF Characteristic

☞ Completely operation of Mifare One through simple command set.

☞ Communication Protocol:

1. UART: Baud Rate 19200bps.
2. IIC: Max rate 400Kbps.

☞ Auto request card: When the card put into antenna, the pin "CARDIN" will be low.

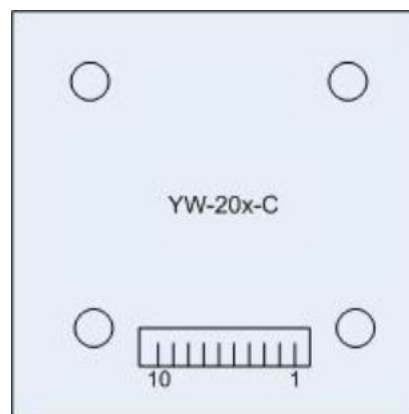
☞ Power supply :+4.5~+5.5V.

☞ Read Card distance 5~10cm. (Depend on the antenna)

☞ You can get C51 source code example with the module.

## 4 Function specification

### 4.1 Pin Function



Pic 1

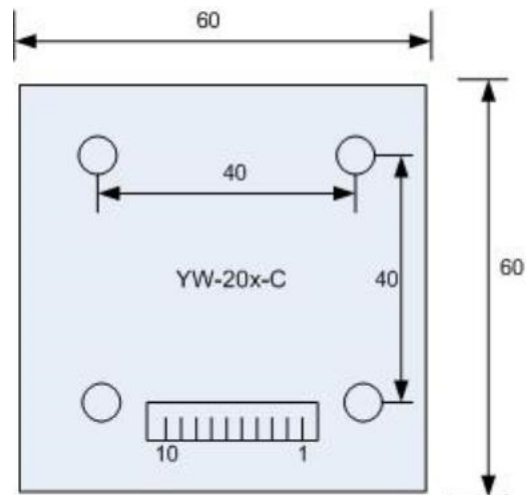
Pin function [Table 1]:

Pin	Function	Description
1	VCC	+5V VCC
2	GND	GND
3	RXD/SCL	UART RXD/ IIC SCL
4	TXD/SDA	UART TXD/ IIC SDA
5	CARDIN	Card In/Out Indicate(Only when auto request) 0:Card In. 1:Card Out.
6	PORTSEL	Communication Protocol Selector ( 0: IIC, 1: UART )
7	NC	Not Use
8	NC	Not Use

9	NC	Not Use
10	NC	Not Use

Table 1

## 4.2 Dimension



Pic 2

## 5 Protocols

### 5.1 UART Protocols of Commands

Uart Protocols of Commands use data blocks. The format of data block :

- 1) Format of TXD (MCU → QM-201C-HF Module)

	[STX]	[LEN]	[CMD]	[DATA]	[CHK]	[ETX]
Description	0x02	Package Length	Command	The Content of n bytes	Checksum	0x03
Number of Byte	1	1	1	n	1	1

Table 2

- a) Asynchronism half duplex, 1 Start bit + 7 Data bits + 1 Stop bit.
- b) The default transfer speed is 19200 bit/s.

- c) Block Header STX=0x02, Block End ETX=0x03. From header to end , but not include the header STX and the end ETX, if there is 0x02, 0x03 or 0x10 , then must add 0x10 before it.
- d) Block Header STX=0x02.
- e) Package Length: the byte from Length itself to Checksum, but not include the added byte 0x10 due to 0x02, 0x03 or 0x10.
- f) Command: Refer to the Command List.
- g) The Content of n bytes: the parameter.
- h) CheckSum: XOR result from [Length] to then last byte of [Content], but not include the added byte 0x10 due to 0x02, 0x03 or 0x10.
- i) Block End ETX=0x02.

**Example:**

CMD: 0x10, DATA:0x00

Block Header:0x02.

LEN:0x04(=1Byte(Len) +1Byte(CMD)+1Byte(DATA)+1Byte(CHK))

CMD:0x10, 0x10. (Add 0x01 before 0x10)

DATA:0x00.

CHECKSUM:0x14(=0x04^0x10^0x00)

Package Send:0x02, 0x04, 0x10, 0x10, 0x00, 0x14, 0x03.

**2) Respond Format (QM-201C-HFmodule → MCU)**

	[STX]	[LEN]	[CMD]	[STATUS]	[DATA]	[CHK]	[ETX]
Content	0x02	Package Length	Command	0x00: Success 0xFF: Fail	The Content of n bytes	Checksum	0x03
Num of Byte	1	1	1	1	n	1	1

Table 3

- a) Asynchronism half duplex, 1 Start bit + 7 Data bits + 1 Stop bit.
- b) The default transfer speed is 19200 bit/s.

- c) Block Header STX=0x02, Block End ETX=0x03. From header to end , but not include the header STX and the end ETX, if there is 0x02, 0x03 or 0x10 , then must add 0x10 before it.
- d) Block Header STX=0x02.
- e) Package Length: the byte from Length itself to Checksum, but not include the added byte 0x10 due to 0x02, 0x03 or 0x10.
- f) Command: Refer to the Command List. When the MCU send the command to the module, the module send back this command to the MCU.
- g) Status: Operation result. Success: 0x00. Fail: 0xFF.
- h) During the communication, command content.
- i) CheckSum: XOR result from [Length] to then last byte of [Content], but not include the added byte 0x10 due to 0x02, 0x03 or 0x10.
- j) Block End ETX=0x02.

## 5.2 IIC Protocol

### 1) Format of TXD(MCU → QM-201C-HF Module)

	[Address of module] (W/R)	[LEN]	[CMD]	[DATA]	[CHK]
Content	Write: 0xA0	Package Length	Command	The Content of n bytes	CheckSum
	Read: 0xA1				
Num of Byte	1	1	1	n	1

Table 4

- a) Address of module (W/R):
- b) When Write to module, the Address is 0xA0.
- c) When Read from module, the Address is 0xA1.
- d) Package Length: the byte from Length itself to Checksum.
- e) Command: Refer to the Command List.
- f) The Content of n bytes: the parameter.

g) CheckSum: XOR result from [Length] to then last byte of [DATA].

## 2) Respond Format(QM-201C-HFmodule → MCU)

	[LEN]	[CMD]	[STATUS]	[DATA]	[CHK]
Content	Package Length	Command	0x00:Success 0xFF: Fail	The Content of n bytes	CheckSum
Num of Byte	1	1	1	n	1

Table 5

h) Package Length: the byte from Length itself to Checksum.

i) Command: Refer to the Command List.

j) Status: Operation result. Success: 0x00. Fail: 0xFF.

k) The Content of n bytes: the parameter.

l) CheckSum: XOR result from [Length] to then last byte of [DATA].

## 5.3 Switch of Uart and IIC

QM-201C-HF Contactless card read/write module support UART and IIC, they

can be switched by the port PORTSEL  
PORTSEL = 1(High), UART is selected.

PORTSEL = 0(Low), IIC is selected.

## 6 Command List

	[CMD Name]	[Dir ]	[LEN ]	[CMD ]	[STATUS and DATA]	[Description]
<b>System Command</b>						
1	Module Setting	Send	0x04	0x01	0x00 0x01 0x02	4 combination with bit0 and bit1: Antenna Status (BIT0) 0: Turn off Antenna 1: Turn on Antenna



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					0x03	Auto Request (BIT1) 0: Turn off Auto Request 1: Turn on Auto Request	
		Return	0x04	0x01	0x00	Status: 0x00: Success	
					0xFF	0xFF: Fail	
2	Power Setting	Send	0x03	0x02	/		
		Return	0x04	0x02	0x00	Status: 0x00: Success	
					0xFF	0xFF: Fail	
<b>Contactless card Command</b>							
3	Request Card	Send	0x04	0x10	0x00	Request card mode: 0x00: request all card in antenna area	
					0x01	0x01: request card that have not halted in antenna area	
		Return	0x08	0x10	0x00	Serial No	Status: 0x00: Request success + Card Serial No(4 bytes). 0xFF: Request Fail.
			0x04		0xFF		
4	Read Block	Send	0x0B	0x11	8Byte		Key Set (1Byte)+Block No (1Byte) + Key (6Bytes) a. Key Set (1Byte): Select Key A, B (BIT0) -> 0: Key A; 1: Key B Key Mode (BIT1) -> 0: Use key passed. 1: Use key downloaded. b. Index of Key Downloaded (BIT2~BIT7) -> 0~31
		Return	0x14	0x11	0x00	Data	0x00: Success, 16 bytes of data return.
			0x04		0xFF		0xFF: Fail
5	Write Block	Send	0x1B	0x12	24bytes		Key set (1Byte)+Block No (1Byte) + Key (6Bytes) + Data (16Bytes) a. Key Set (1Byte): Select Key A, B (BIT0) -> 0: Key A; 1: Key B Key Mode (BIT1) -> 0: Use key passed. 1: Use key downloaded. b. Index of Key Downloaded (BIT2~BIT7)

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								->0~31
		Return	0x04	0x12	0x00			Status: 0x00: Success 0xFF: Fail
					0xFF			
6	Read Sector	Send	0x0B	0x13	8bytes			Key Set (1Byte) + Index of Sector (1Byte) + Key (6Bytes) a. Key Set (1Byte): Select Key A, B (BIT0) -> 0: Key A; 1: Key B Key Mode (BIT1) -> 0: Use key passed. 1: Use key downloaded. b. Index of Key Downloaded (BIT2~BIT7) ->0~31
		Return	0x44	0x13	0x00	Data	0x00: success, 64bytes of data return.	
			0x04	0x13	0xFF		0xFF: Fail	
7	Initialize purse	Send	0x0F	0x14	12Bytes			Key Set (1Byte) + Index of Block (1Byte) + Key (6Bytes) + Purse Initial Value (4Bytes, LSB) a. Key Set (1Byte): Select Key A, B (BIT0) -> 0: Key A; 1: Key B Key Mode (BIT1) -> 0: Use key passed. 1: Use key downloaded. b. Index of Key Downloaded (BIT2~BIT7) ->0~31
		Return	0x04	0x14	0x00		Status: 0x00: Success 0xFF: Fail	
					0xFF			
8	Read purse	Send	0x0B	0x15	8Bytes			Key Set (1Byte) + Index of Block (1Byte) + Key (6Bytes) a. Key Set (1Byte): Select Key A, B (BIT0) -> 0: Key A; 1: Key B Key Mode (BIT1) -> 0: Use key passed. 1: Use key downloaded. b. Index of Key Downloaded (BIT2~BIT7) ->0~31
		Return	0x08	0x15	0x00	Data	0x00: Success, 4bytes of purse value (LSB)	
			0x04		0xFF		0xFF: Fail	

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9	decrement	Send	0x0F	0x16	12Bytes	<p>Key Set (1Byte) + Index of Block (1Byte) + Key (6Bytes) + value of decrement (4Bytes, LSB)</p> <p>a. Key Set (1Byte): Select Key A, B (BIT0) → 0: Key A; 1: Key B Key Mode (BIT1) → 0: Use key passed. 1: Use key downloaded.</p> <p>b. Index of Key Downloaded (BIT2~BIT7) → 0~31</p>
		Return	0x04	0x16	<table border="1"> <tr> <td>0x00</td> <td rowspan="2"><b>Status:</b> 0x00: Success 0xFF: Fail</td> </tr> <tr> <td>0xFF</td> </tr> </table>	0x00
0x00	<b>Status:</b> 0x00: Success 0xFF: Fail					
0xFF						
10	Increment	Send	0x0F	0x17	12Bytes	<p>Key Set (1Byte) + Index of Block (1Byte) + Key (6Bytes) + value of Increment (4Bytes, LSB)</p> <p>a. Key Set (1Byte): Select Key A, B (BIT0) → 0: Key A; 1: Key B Key Mode (BIT1) → 0: Use key passed. 1: Use key downloaded.</p> <p>b. Index of Key Downloaded (BIT2~BIT7) → 0~31</p>
		Return	0x04	0x17	<table border="1"> <tr> <td>0x00</td> <td rowspan="2"><b>Status:</b> 0x00: Success 0xFF: Fail</td> </tr> <tr> <td>0xFF</td> </tr> </table>	0x00
0x00	<b>Status:</b> 0x00: Success 0xFF: Fail					
0xFF						
11	Purse backup	Send	0x0C	0x18	9Bytes	<p>Key Set (1Byte) + Index of Block (1Byte) + Index of Block Backup (1Byte) + Key (6Byte)</p> <p>a. Key Set (1Byte): Select Key A, B (BIT0) → 0: Key A; 1: Key B Key Mode (BIT1) → 0: Use key passed. 1: Use key downloaded.</p> <p>b. Index of Key Downloaded (BIT2~BIT7) → 0~31</p> <p>ps: the index of block and the backup block must be in the same sector.</p>
		Return	0x0C	0x18	<table border="1"> <tr> <td>0x00</td> <td rowspan="2"><b>Status:</b> 0x00: Success 0xFF: Fail</td> </tr> <tr> <td>0xFF</td> </tr> </table>	0x00
0x00	<b>Status:</b> 0x00: Success 0xFF: Fail					
0xFF						
12	Card Halt	Send	0x03	0x19		

		Return	0x04	0x19	0x00		Status: 0x00: Success 0xFF: Fail
13	Key Download	Send	0x0A	0x1A	Index of key (1Byte, 0~31) + Key (6Bytes)		
		Return	0x04	0x1A	0x00		Status: 0x00: Success 0xFF: Fail
14	Read RC500 EEPROM	Send	0x06	0x1B	Address(2Bytes) + Length(1Bytes) Ps: Address: High byte afront Length: not more than 16		
		Return	n+4	0x1B	0x00	Data	0x00: success, n(Length) bytes of data return.
			0x04			0xFF	0xFF: fail
15	Write RC500 EEPROM	Send	n+5	0x1C	N bytes data		Address(2Bytes)+Data(nBytes) Ps: Address: High byte afront Data: not more than 16 bytes.
		Return	0x04	0x1C	0x00		Status: 0x00: Success 0xFF: Fail
					0xFF		

Table 6



**Turn on the antenna before the operation of contactless card.**

## 7 Command test sample

Samples below are based on uart protocol.

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7.1. request card

Send: 02 04 10 10 00 14 03

Receive: 02 08 10 10 00 4D 56 A2 57 F6 03

7.2. read block

Send: 02 0B 11 00 3E FF FF FF FF FF FF 24 03

Receive: 02 14 11 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 04 03

7.3. write block

Send: 02 1B 12 00 3E FF FF FF FF FF FF 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 36 03

Receive: 02 04 12 00 16 03

7.4. download key

Send: 02 0A 1A 00 FF FF FF FF FF FF 10 10 03

Receive: 02 0A 1A 00 FF FF FF FF FF FF 10 10 03

7.5. initial purse

Send: 02 0F 14 00 3D FF FF FF FF FF FF 01 00 00 00 27 03

Receive: 02 04 14 00 10 10 03

7.6. read purse

Send: 02 0B 15 00 3D FF FF FF FF FF FF 23 03

Receive: 02 08 15 00 10 02 00 00 00 1F 03

7.7. increment of purse

Send: 02 0F 16 00 3D FF FF FF FF FF FF 01 00 00 00 25 03

Receive: 02 04 16 00 12 03

7.8. decrement of purse

Send: 02 0F 17 00 3D FF FF FF FF FF FF 01 00 00 00 24 03

Receive: 02 04 17 00 13 03

7.9. purse backup

7.9.1 initial purse 1

Send: 02 0F 14 00 3D FF FF FF FF FF FF 01 00 00 00 27 03

Receive: 02 04 14 00 10 10 03

7.9.2 initial purse 2

Send: 02 0F 14 00 3C FF FF FF FF FF FF 05 00 00 00 22 03

Receive: 02 04 14 00 10 10 03

7.9.3 purse backup from 1 to 2

Send: 02 0C 18 00 3D 3C FF FF FF FF FF FF 15 03

Receive: 02 04 18 00 1C 03

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### 7. 9. 4 read purse 2

Send: 02 0B 15 00 3C FF FF FF FF FF FF 22 03

Receive: 02 08 15 00 FF 04 00 00 E6 03

### 7. 10. card halt

Send: 02 10 03 19 1A 03

Receive: 02 04 19 00 1D 03

### 7. 11. read RC500EEPROM

Send: 02 06 1B 00 70 10 10 7D 03

Receive: 02 14 1B 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0F 03

### 7. 12. write RC500EEPROM

Send: 02 15 1C 00 70 FF FF FF FF FF FF FF FF FF FF FF FF FF FF 79 03

Receive: 02 04 1C 00 18 03

### 7. 13. module IDLE

Send: 02 10 03 10 02 01 03

Receive: 02 04 10 02 00 06 03

### 7. 14. module set

Send: 02 04 01 00 05 03(turn off antenna)

Receive: 02 04 01 00 05 03

Send: 02 04 01 01 04 03(turn on antenna)

Receive: 02 04 01 00 05 03

## 8 Order

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