

C-820 User Manual

1. Introduction

C-820 is a Mifare reader with LCD. It can be widely used as the Mifare reader for identification application. Typical applications are as below:

- Access control system
- Time attendance machine
- PC logon/security
- E-Commerce

2. Mifare Standard

- 1024 bytes EEPROM, divided into 16 sectors with 64 bytes on each sector
- 100,000 write endurance cycles
- 10 years data retention
- ISO 14443 A
- 13.56MHz transponder frequency
- 106 kbit baud rate
- Bit-wise anti-collision
- Up to 10 cm operating distance
- 4 byte unique serial number
- Random number generator
- 2 bytes access key per sector
- Individual access condition for each sector
- Purse functionality

3. Main Features

- Full Mifare functionality
- Software library for easy integration within the application
- RS232 interface
- Support Windows 95, 98, ME, 2000, NT, XP
- Demo software running on PC

4. Installation

If you want to power up the Mifare reader using the PS/2 port, please use the provided cable to make the connection between the development board and the PC. Remember to switch off the PC before doing the following connection steps. At the back of the PC, please unplug your mouse or keyboard from the PS/2 port. Then you can plug in the cable with the 6-pin mini DIN male end. The unplugged mouse or keyboard should connect to the other 6-pin mini DIN female end. Please also plug in the DB9 female connector to either COM1 or COM2. The other end of the cable should be connected to the Mifare reader. You can now switch on your PC after all connections are done completely. Run the demo software and you should be able to operate the reader.

5. Mifare Protocol

5-1. Communication setting

The communication protocol is byte oriented. Both sending and receiving bytes are in hexadecimal format. The communication parameters are as follows,

Baud rate: 57600 bps
Data: 8 bits
Stop: 1 bit
Parity: None
Flow control: None

5-2. Communication protocol

Format:

Host to Reader:

Header	Len	Command	Data	Checksum
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Header: Communication header, 1 byte.

From host to module: 0xBA.

Len: Byte length counting from Command to Checksum inclusively, 1 byte.

Command: Command, 1 byte.

Data: Data, variable length depends on the command type.

Checksum: Exclusive ORed result from Header to Data inclusively, 1 byte.

Reader to Host:

Header	Len	Command	Status	Data	Checksum
--------	-----	---------	--------	------	----------

Header: Communication header, 1 byte.

From module to host: 0xBD.

Len: Byte length counting from Command to Checksum inclusively, 1 byte.

Command: Command, 1 byte.

Status: Command status, 1 byte

Data: Data, variable length depends on the command type.

Checksum: Exclusive ORed result from Header to Data inclusively, 1 byte.

Command Overview:

Command	Description
0x01	Select Mifare card
0x02	Login to a sector
0x03	Read a data block
0x04	Write a data block

0x05	Read a value block
0x06	Write a value block
0x07	Write master key (key A)
0x08	Increment value
0x09	Decrement value
0x0A	Copy value
0x0B	Halt
0x0D	Request Mifare card
0x0E	Auto login
0x12	Login with key stored
0x13	Store key
0x20	Get ATS
0x21	Deselect Mifare PRO card
0x22	Exchange APDU
0x40	Write to GPIO
0x41	Read from GPIO
0x42	Change baud rate
0x43	Clear LCD
0x44	Display English string
0x45	Display Chinese
0x49	Backlight and Relay control
0x4B	Play a beep sound
0x4C	Set time
0x4E	Turn on/off RED LED
0x4F	Turn on/off GREEN LED
0x50	Read flash
0x51	Write flash
0x52	Erase flash sector
0x53	Erase whole flash
0xA0	Enter ISP mode
0xFF	Reset

Status Overview:

Status	Description
0x00	Operation success
0x01	No tag
0x02	Login success
0x03	Login fail
0x04	Read fail
0x05	Write fail
0x06	Unable to read after write
0x07	Read after write error
0x08	Reset fail
0x0A	Collision occur
0x0B	No SAK

0x0C	Load key fail
0x0D	Not authenticate
0x0E	Not a value block
0x0F	Unable to halt
0x10	Access denied
0x11	Invalid ATS
0x12	EEPROM access error
0x13	Key slot number out of range
0x14	Data number out of range
0x20	Sector out of range
0x21	Invalid key type
0x22	Block out of range
0x23	Baud rate out of range
0x24	Line out of range
0x25	Col out of range
0x26	Index out of range
0x27	Picture out of range
0x28	Offset out of range
0x29	Pixel write error
0x2A	Duration out of range
0x2B	No smart card
0x2C	Hour out of range
0x2D	Min out of range
0x2E	Sec out of range
0x2F	Erase fail
0x31	Year out of range
0x32	Month out of range
0x33	Day out of range
0xF0	Checksum error
0xF1	Invalid command
0xF2	Communication line error

5-2-1. Select Mifare card

0xBA	Len	0x01	Checksum
------	-----	------	----------

Return:

0xBD	Len	0x01	Status	Serial num	Type	Checksum
------	-----	------	--------	------------	------	----------

Status: 0x00: Operation success

0x01: No tag

0x0A: Collision occur

0x0B: No SAK

0xF0: Checksum error

0xF2: Communication line error

Serial num: Serial number of the card detected if the operation is success, 4 bytes.

Type: 0x01: Mifare Standard card

0x02: Mifare PRO card

5-2-2. Login to a sector

0xBA	Len	0x02	Sector	Type	Key	Checksum
------	-----	------	--------	------	-----	----------

Sector: Sector need to login (0x00 to 0x0F)

Type: Key type (AA: authenticate with key type A, BB: authenticate with key type B)

Key: Authenticate key, 6 bytes

Return:

0xBD	Len	0x02	Status	Checksum
------	-----	------	--------	----------

Status: 0x02: Login success

0x03: Login fail

0x0C: Load key fail

0x01: No tag

0x20: Sector out of range

0x21: Invalid key type

0xF0: Checksum error

0xF2: Communication line error

5-2-3. Read a data block

0xBA	Len	0x03	Block	Checksum
------	-----	------	-------	----------

Block: The block number to be read, 1 byte

Return:

0xBD	Len	0x03	Status	Data	Checksum
------	-----	------	--------	------	----------

Status: 0x00: Operation success

0x04: Read fail

0x0D: Not authenticate

0x01: No tag

0x22: Block out of range

0xF0: Checksum error

0xF2: Communication line error

Data: Block data returned if operation is success, 16 bytes.

5-2-4. Write a data block

0xBA	Len	0x04	Block	Data	Checksum
------	-----	------	-------	------	----------

Block: The block number to be written, 1 byte.

Data: The data to write, 16 bytes.

Return:

0xBD	Len	0x04	Status	Data	Checksum
------	-----	------	--------	------	----------

Status: 0x00: Operation success

0x05: Write fail

0x06: Unable to read after write

0x07: Read after write error

0x0D: Not authenticate

0x01: No tag

0x22: Block out of range

0xF0: Checksum error

0xF2: Communication line error

Data: Block data written if operation is success, 16 bytes.

5-2-5. Read a value block

0xBA	Len	0x05	Block	Checksum
------	-----	------	-------	----------

Block: The block number to be read, 1 byte.

Return:

0xBD	Len	0x05	Status	Value	Checksum
------	-----	------	--------	-------	----------

Status: 0x00: Operation success

0x04: Read fail

0x0D: Not authenticate

0x0E: Not a value block

0x01: No tag

0x22: Block out of range

0xF0: Checksum error

0xF2: Communication line error

Value: Value returned if the operation is success, 4 bytes.

5-2-6. Write a value block

0xBA	Len	0x06	Block	Value	Checksum
------	-----	------	-------	-------	----------

Block: The block number to be written, 1 byte.

Value: The value to write, 4 bytes.

Return:

0xBD	Len	0x06	Status	Value	Checksum
------	-----	------	--------	-------	----------

Status: 0x00: Operation success

0x05: Write fail

0x06: Unable to read after write

0x07: Read after write error

0x0D: Not authenticate

0x01: No tag

0x22: Block out of range

0xF0: Checksum error

0xF2: Communication line error

Value: Value written if the operation is success, 4 bytes.

5-2-7. Write master key (key A)

0xBA	Len	0x07	Sector	Key	Checksum
------	-----	------	--------	-----	----------

Sector: The sector number to be written, 1 byte.

Key: Authentication key, 6 bytes

Return:

0xBD	Len	0x07	Status	Key	Checksum
------	-----	------	--------	-----	----------

Status: 0x00: Operation success

0x05: Write fail

0x0D: Not authenticate

0x10: Access denied

0x01: No tag

0xF0: Checksum error

0xF2: Communication line error

Key: Authentication key written if the operation is success, 6 bytes.

5-2-8. Increment value

0xBA	Len	0x08	Block	Value	Checksum
------	-----	------	-------	-------	----------

Block: The block number to be increased, 1 byte.

Value: The value to be increased by, 4 bytes.

Return:

0xBD	Len	0x08	Status	Value	Checksum
------	-----	------	--------	-------	----------

Status: 0x00: Operation success

0x05: Write fail

0x06: Unable to read after write

0x0D: Not authenticate

0x0E: Not a value block

0x01: No tag

0xF0: Checksum error

0xF2: Communication line error

Value: The value after increment if the operation is success, 4 bytes

5-2-9. Decrement value

0xBA	Len	0x09	Block	Value	Checksum
------	-----	------	-------	-------	----------

Block: The block number to be decreased, 1 byte

Value: The value to be decreased by, 4 bytes

Return:

0xBD	Len	0x09	Status	Value	Checksum
------	-----	------	--------	-------	----------

Status: 0x00: Operation success

0x05: Write fail

0x06: Unable to read after write

0x0D: Not authenticate

0x0E: Not a value block

0x01: No tag

0xF0: Checksum error

0xF2: Communication line error

Value: The value after decrement if the operation is success, 4 bytes

5-2-10. Copy value

0xBA	Len	0x0A	Source	Destination	Checksum
------	-----	------	--------	-------------	----------

Source: The source block copy from, 1 byte

Destination: The destination copy to, 1 byte

The source and destination must in the same sector

Return:

0xBD	Len	0x0A	Status	Value	Checksum
------	-----	------	--------	-------	----------

Status: 0x00: Operation success

0x05: Write fail

0x06: Unable to read after write

0x0D: Not authenticate
 0x0E: Not a value block (Source)
 0x01: No tag
 0xF0: Checksum error
 0xF2: Communication line error

Value: The value after copy if the operation is success, 4 bytes

5-2-11. Halt

0xBA	Len	0x0B	Checksum
------	-----	------	----------

Put the Mifare card into halt state.

Return:

0xBD	Len	0x0B	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success
 0x0F: Unable to halt
 0x01: No tag
 0xF0: Checksum error
 0xF2: Communication line error

5-2-12. Request Mifare card

0xBA	Len	0x0D	Checksum
------	-----	------	----------

Return:

0xBD	Len	0x0D	Status	ATQA	Checksum
------	-----	------	--------	------	----------

Status: 0x00: Operation success
 0x01: No tag
 0xF0: Checksum error
 0xF2: Communication line error
 ATQA: Answer to request ISO-14443A, 2 bytes

5-2-13. Auto login

0xBA	Len	0x0E	Sector	Type	Key	Checksum
------	-----	------	--------	------	-----	----------

This command will invoke select first. Then do the normal login

Sector: Sector need to login (0x00 to 0x0F)

Type: Key type (AA: authenticate with key type A, BB: authenticate with key type B)

Key: Authenticate key, 6 bytes

Return:

0xBD	Len	0x0E	Status	Checksum
------	-----	------	--------	----------

Status: 0x0A: Collision occur
 0x0B: No SAK
 0x02: Login success
 0x03: Login fail
 0x0C: Load key fail
 0x01: No tag
 0x20: Sector out of range
 0x21: Invalid key type
 0xF0: Checksum error
 0xF2: Communication line error

5-2-14. Login with key stored

0xBA	Len	0x12	Sector	Type	Key_num	Checksum
------	-----	------	--------	------	---------	----------

Sector: Sector need to login (0x00 to 0x0F)

Type: Key type (AA: authenticate with key type A, BB: authenticate with key type B)

Key_num: The stored key number (0 to 31)

Return:

0xBD	Len	0x12	Status	Checksum
------	-----	------	--------	----------

Status: 0x02: Login success

0x03: Login fail

0x20: Sector out of range

0x21: Invalid key type

0x0C: Load key fail

0x13: Key number out of range

0xF0: Checksum error

0xF2: Communication line error

5-2-15. Store key

0xBA	Len	0x13	Key_num	Key	Checksum
------	-----	------	---------	-----	----------

Key_num: The stored key number (0 to 31)

Key: Authenticate key, 6 bytes

Return:

0xBD	Len	0x13	Status	Checksum
------	-----	------	--------	----------

Status: 0x13: Key number out of range

0x12: EEPROM access error

0xF0: Checksum error

0xF2: Communication line error

5-2-16. Get ATS

0xBA	Len	0x20	Checksum
------	-----	------	----------

Get the ATS from the Mifare PRO card.

Return:

0xBD	Len	0x20	Status	ATS	Checksum
------	-----	------	--------	-----	----------

Status: 0x00: Operation success

0x01: No tag

0xF0: Checksum error

0xF2: Communication line error

ATS: Answer to Select

5-2-17. Deselect

0xBA	Len	0x21	Checksum
------	-----	------	----------

Deselect the Mifare PRO card and put it into halt state.

Return:

0xBD	Len	0x21	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success
 0x01: No tag
 0xF0: Checksum error
 0xF2: Communication line error

5-2-18. Exchange APDU

0xBA	Len	0x22	Command	Checksum
------	-----	------	---------	----------

Exchange: APDU with the Mifare PRO card.

Command: APDU command

Return:

0xBD	Len	0x22	Status	Response	Checksum
------	-----	------	--------	----------	----------

Status: 0x00: Operation success
 0x01: No tag
 0xF0: Checksum error
 0xF2: Communication line error

Response: APDU response

5-2-19. Write to GPIO

0xBA	Len	0x40	Mask	Value	Checksum
------	-----	------	------	-------	----------

Mask: The mask for the IO pin to be changed.

Value: The output value of the IO.

Return:

0xBD	Len	0x40	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success
 0xF0: Checksum error
 0xF2: Communication line error

5-2-20. Read from GPIO

0xBA	Len	0x41	Mask	Checksum
------	-----	------	------	----------

Mask: The mask for the IO pin to be read.

Return:

0xBD	Len	0x41	Status	Value	Checksum
------	-----	------	--------	-------	----------

Status: 0x00: Operation success
 0xF0: Checksum error
 0xF2: Communication line error

Value: The input value from the IO.

5-2-21. Change baud rate

0xBA	Len	0x42	Baud	Checksum
------	-----	------	------	----------

Baud: The baud rate to change to.

0x00 – 600bps
 0x01 – 1200 bps
 0x02 – 2400 bps
 0x03 – 4800 bps
 0x04 – 9600 bps
 0x05 – 14400 bps

0x06 – 19200 bps
 0x07 – 38400 bps
 0x08 – 57600 bps
 0x09 – 115200 bps

Return:

0xBD	Len	0x42	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success
 0x23: Baud rate out of range
 0xF0: Checksum error
 0xF2: Communication line error

5-2-22. LCD Clear

0xBA	Len	0x43	Checksum
------	-----	------	----------

Clear the LCD.

Return:

0xBD	Len	0x43	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success
 0xF0: Checksum error
 0xF2: Communication line error

5-2-23. Display English string

0xBA	Len	0x44	Line	Col	String	Checksum
------	-----	------	------	-----	--------	----------

Line: The line to display (0 - 7)
 Col: The column to display (0 – 127)
 String: The ASCII string to display

Return:

0xBD	Len	0x44	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success
 0x24: Line out of range
 0x25: Col out of range
 0xF0: Checksum error
 0xF2: Communication line error

5-2-24. Display Chinese

0xBA	Len	0x45	Line	Col	Index	Checksum
------	-----	------	------	-----	-------	----------

Line: The line to display (0- 7)
 Col: The column to display (0 – 127)
 Index: The Chinese index for the actual character

Return:

0xBD	Len	0x45	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success
 0x24: Line out of range
 0x25: Col out of range
 0x26: Index out of range
 0xF0: Checksum error
 0xF2: Communication line error

5-2-25. Backlight and Relay control

0xBA	Len	0x49	Mode	Duration	Checksum
------	-----	------	------	----------	----------

Mode: 0: Backlight and Relay off

1: Backlight on only

2: Relay on only

3: Both Backlight and Relay on

Duration: Time to turn on the Backlight and/or Relay in the unit of 100ms (0-100)

Return:

0xBD	Len	0x49	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success

0x2A: Duration out of range

0xF0: Checksum error

0xF2: Communication line error

5-2-26. Play a beep sound

0xBA	Len	0x4B	Duration	Checksum
------	-----	------	----------	----------

Duration: Time to play the beep sound in the unit of 100ms (0 – 100)

Return:

0xBD	Len	0x4B	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success

0x2A: Duration out of range

0xF0: Checksum error

0xF2: Communication line error

5-2-27. Set time

0xBA	Len	0x4C	Hour	Min	Sec	Year	Month	Day	Checksum
------	-----	------	------	-----	-----	------	-------	-----	----------

Hour: The hour of current time (0 – 23)

Min: The minute of current time (0 – 59)

Sec: The second of current time (0 – 59)

Year: The year of current date (0 – 99)

Month: The month of current date (1 – 12)

Day: The day of current date (1 – 31)

Return:

0xBD	Len	0x4C	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success

0x28: Hour out of range

0x29: Min out of range

0x2A: Sec out of range

0x31: Year out of range

0x32: Month out of range

0x33: Day out of range

0xF0: Checksum error

0xF2: Communication line error

5-2-28. Turn on/off RED LED

0xBA	Len	0x4E	On_off	Checksum
------	-----	------	--------	----------

On_off: 0: Turn off LED
1: Turn on LED

Return:

0xBD	Len	0x4E	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success
0xF0: Checksum error
0xF2: Communication line error

5-2-29. Turn on/off GREEN LED

0xBA	Len	0x4F	On_off	Checksum
------	-----	------	--------	----------

On_off: 0: Turn off LED
1: Turn on LED

Return:

0xBD	Len	0x4F	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success
0xF0: Checksum error
0xF2: Communication line error

5-2-30. Read flash

0xBA	Len	0x50	Page	Addr_hi	Addr_lo	Data_num	Checksum
------	-----	------	------	---------	---------	----------	----------

Page: The flash page (0 – 3)
Addr_hi: The high byte for address (0x00 – 0x7F)
Addr_lo: The low byte for address (0x00 – 0xFF)
Data_num: The number of data to read, the data read should not cross one page. (1 – 16)

Return:

0xBD	Len	0x50	Status	Data	Checksum
------	-----	------	--------	------	----------

Status: 0x00: Operation success
0x14: Data number out of range
0xF0: Checksum error
0xF2: Communication line error

Data: The data read

5-2-31. Write flash

0xBA	Len	0x51	Page	Addr_hi	Addr_lo	Data_num	Data	Checksum
------	-----	------	------	---------	---------	----------	------	----------

Page: The flash page (0 – 3)
Addr_hi: The high byte for address (0x00 – 0x7F)
Addr_lo: The low byte for address (0x00 – 0xFF)
Data_num: The number of data to write, the data written should not cross one page. (1 – 16)
Data: The data to write

Return:

0xBD	Len	0x51	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success
0x14: Data number out of range

0x05: Write fail
0xF0: Checksum error
0xF2: Communication line error

5-2-32. Erase flash sector

0xBA	Len	0x52	Sector	Checksum
------	-----	------	--------	----------

Sector: The flash sector (0 – 7)

Return:

0xBD	Len	0x52	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success
0x20: Sector out of range
0x2F: Erase fail
0xF0: Checksum error
0xF2: Communication line error

5-2-33. Erase whole flash

0xBA	Len	0x53	Checksum
------	-----	------	----------

Erase the whole flash

Return:

0xBD	Len	0x53	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success
0x2F: Erase fail
0xF0: Checksum error
0xF2: Communication line error

5-2-34. Enter ISP

0xBA	Len	0xA0	Checksum
------	-----	------	----------

Enter ISP mode

Return:

0xBD	Len	0xA0	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success
0xF0: Checksum error
0xF2: Communication line error

5-2-35. Reset

0xBA	Len	0xFF	Checksum
------	-----	------	----------

Return:

0xBD	Len	0xFF	Status	Checksum
------	-----	------	--------	----------

Status: 0x00: Operation success
0x08: Reset fail
0xF0: Checksum error
0xF2: Communication line error

6. Technical Specification

- Power supply: Retrieve from PS/2 keyboard interface, 5V, 40-120mA
- Interface: RS232
- Transmission speed: 57600 bps
- Reading distance: Up to 75mm, depending on TAG
- Storage temperature: -40 °C ~ +85 °C
- Operating temperature: 0 °C ~ +70 °C
- Dimension (LxWxH, mm): 144 x 110 x 24