

1. Introduction

P-14-B pinpad family are mainly used as pin input devices for banks, POS terminal, payment centers and securities. Typical applications are as below:

- Point of Sale PIN input device
- Password pinpad in the bank counters
- Access Control PIN input device
- Stock price checking pinpad in securities houses
- Manufacturing control instrument input device
- Road toll input device

2. Main Features

- 12 Numeric keys with additional 2 user customized keys
- Using high quality conducting rubber, operating life of individual keys > 5 million operations
- Equipped with password-shield, protecting the pin from being seen during input
- With several value added functions available
- Support many connecting interfaces
- RS232 interface
- Support Windows 95, 98, ME, 2000, NT, XP
- Demo software running on PC

3. Installation

If you want to power up the pinpad 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 pinpad. 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 pinpad.

4. Protocol

4-1. 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

4-2. Communication protocol

Format:

Host to Reader:

| Header | Len | Command | Data | Checksum |
|--------|-----|---------|------|----------|
|--------|-----|---------|------|----------|

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 |
|---------|-------------------------------|
| 0x30 | Get ATR from smart card |
| 0x31 | Power down smart card |
| 0x32 | Exchange APDU with smart card |
| 0x36 | Set Memory Card Type |
| 0x37 | Reset Memory Card |

| | |
|------|--|
| 0x38 | Reset Main Memory of Memory Card |
| 0x39 | Write Main Memory of Memory Card |
| 0x3A | Read Protection Memory of Memory Card |
| 0x3B | Write Protection Memory of Memory Card |
| 0x3C | Read Programmable Security Card (PSC) of Memory Card |
| 0x3D | Change Programmable Security Card (PSC) of Memory Card |
| 0x3E | Verify Programmable Security Card (PSC) of Memory Card |
| 0x3F | Read Error Counter of Memory Card |
| 0x42 | Change baud rate |
| 0x43 | Clear LCD |
| 0x44 | Display English string |
| 0x45 | Display Chinese |
| 0x4B | Play a beep sound |
| 0x4E | Play a voice speech |
| 0x60 | Get input from keypad |
| 0x61 | Cancel input |
| 0x62 | Get PIN with DES encryption |
| 0x80 | Change main key |
| 0x81 | Change user key |
| 0x70 | Display large English string |
| 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 |
| 0x34 | Communication timeout |
| 0x35 | Parity error |
| 0x36 | No stop bit |
| 0x37 | Invalid TS format |
| 0x38 | Unsupported protocol |
| 0x39 | Invalid TCK |
| 0x3A | Slot out of range |
| 0x3B | APDU length error |
| 0x3C | CLA error |
| 0x3D | INS error |
| 0x3E | LC error |
| 0x3F | LE error |
| 0x40 | Unknown smart card error |
| 0x41 | Key mismatch |
| 0x42 | Dialog out of range |
| 0x51 | Address out of range |
| 0x52 | Data_num out of range |
| 0x53 | Verify success |
| 0x54 | Verify fail |
| 0x55 | No PSC |
| 0xF0 | Checksum error |
| 0xF1 | Invalid command |
| 0xF2 | Communication line error |

4-2-1. Get ATR from smart card

| | | | | |
|------|-----|------|------|----------|
| 0xBA | Len | 0x30 | Slot | Checksum |
|------|-----|------|------|----------|

Slot: The smart card slot ID
0x00 - Main smart card

0x01 - SAM card 1

0x02 - SAM card 2

0x03 - SAM card 3

Return:

| 0xBD | Len | 0x30 | Status | ATR | Checksum |
|------|-----|------|--------|-----|----------|
|------|-----|------|--------|-----|----------|

Status: 0x00: Operation success
0x3A: Slot out of range
0x34: Communication timeout
0x35: Parity error
0x36: No stop bit
0x37: Invalid TS format
0x38: Unsupported protocol (not T=0 or T=1)
0x39: TCK checksum error
0x2B: No smart card
0xF0: Checksum error
0xF2: Communication line error

ATR: The answer to reset returned from the smart card

4-2-2. Power down smart card

| 0xBA | Len | 0x31 | Slot | Checksum |
|------|-----|------|------|----------|
|------|-----|------|------|----------|

Slot: The smart card slot ID
0x00 - Main smart card
0x01 - SAM card 1
0x02 - SAM card 2
0x03 - SAM card 3

Return:

| 0xBD | Len | 0x31 | Status | Checksum |
|------|-----|------|--------|----------|
|------|-----|------|--------|----------|

Status: 0x00: Operation success
0x3A: Slot out of range

4-2-3. Exchange APDU with smart card

| 0xBA | Len | 0x32 | Slot | Command | Checksum |
|------|-----|------|------|---------|----------|
|------|-----|------|------|---------|----------|

Slot: The smart card slot ID
0x00 - Main smart card
0x01 - SAM card 1
0x02 - SAM card 2
0x03 - SAM card 3

Command: APDU sent to the smart card

Return:

| 0xBD | Len | 0x32 | Status | Response | Checksum |
|------|-----|------|--------|----------|----------|
|------|-----|------|--------|----------|----------|

Status: 0x00: Operation success
0x3A: Slot out of range
0x34: Communication timeout
0x35: Parity error
0x36: No stop bit
0x3B: APDU length error

0x3C: Invalid CLA

0x3D: Invalid INS

0x3E: LC error

0x3F: LE error

Response: The response to the APDU sent

4-2-4. Set Memory Card Type

| 0xBA | Len | 0x36 | Type | Checksum |
|------|-----|------|------|----------|
|------|-----|------|------|----------|

Type: 0x01: SLE 4432

0x02: SLE 4442

0x03: SLE 4418

0x04: SLE 4428

Return:

| 0xBD | Len | 0x36 | Status | Checksum |
|------|-----|------|--------|----------|
|------|-----|------|--------|----------|

Status: 0x00: Operation success

4-2-5. Reset Memory Card

| 0xBA | Len | 0x37 | Mode | Checksum |
|------|-----|------|------|----------|
|------|-----|------|------|----------|

Mode: 0x00: Power off the card only

0x01: Power off the card, then power up the card, lastly reset

Return:

| 0xBD | Len | 0x37 | Status | Data | Checksum |
|------|-----|------|--------|------|----------|
|------|-----|------|--------|------|----------|

Status: 0x00: Operation success

0x2B: No card

Data: The first 4 bytes of the memory card. If no card is inserted, these 4 bytes are all zero.

4-2-6. Reset Main Memory of Memory Card

| 0xBA | Len | 0x38 | Address_hi | Address_lo | Data_num | Checksum |
|------|-----|------|------------|------------|----------|----------|
|------|-----|------|------------|------------|----------|----------|

Address_hi: High byte address

Address_lo: Low byte address

Data_num: The number of data to read, maximum is 128 bytes

Return:

| 0xBD | Len | 0x38 | Status | Data | Checksum |
|------|-----|------|--------|------|----------|
|------|-----|------|--------|------|----------|

Status: 0x00: Operation success

0x51: Address out of range

0x52: Data_num out of range

Data: The memory card data read, the byte size is Data_num, if Status = 0x00. Otherwise, the byte size is 0.

4-2-7. Read Protection Memory of Memory Card

| 0xBA | Len | 0x3A | Address_hi | Address_lo | Data_num | Checksum |
|------|-----|------|------------|------------|----------|----------|
|------|-----|------|------------|------------|----------|----------|

Address_hi: High byte address

Address_lo: Low byte address

Data_num: The number of data to read, maximum is 128 bytes

Return:

| | | | | | |
|------|-----|------|--------|------|----------|
| 0xBD | Len | 0x3A | Status | Data | Checksum |
|------|-----|------|--------|------|----------|

Status: 0x00: Operation success
0x51: Address out of range
0x52: Data_num out of range

Data: The memory card data read, the byte size is Data_num, if Status = 0x00.
Otherwise, the byte size is 0.

4-2-8. Read Programmable Security Card (PSC) of Memory Card

| | | | |
|------|-----|------|----------|
| 0xBA | Len | 0x3C | Checksum |
|------|-----|------|----------|

For SLE 4442, SLE 4428 only

Return:

| | | | | | | |
|------|-----|------|--------|----------|-----|----------|
| 0xBD | Len | 0x3C | Status | Data_num | PSC | Checksum |
|------|-----|------|--------|----------|-----|----------|

Status: 0x00: Operation success
0x55: No PSC

Data_num: The length of Data.
For SLE 4442, this value is 3.
For SLE 4428, this value is 2.
Otherwise, this value is 0.

PSC: For SLE 4442, it is 3-byte Programmable Security Code.
For SLE 4428, it is 2-byte Programmable Security Code.
Otherwise, it is zero byte.

4-2-9. Read Error Counter of Memory Card

| | | | |
|------|-----|------|----------|
| 0xBA | Len | 0x3F | Checksum |
|------|-----|------|----------|

For SLE 4442, SLE 4428 only

Return:

| | | | | | |
|------|-----|------|--------|---------|----------|
| 0xBD | Len | 0x3F | Status | Counter | Checksum |
|------|-----|------|--------|---------|----------|

Status: 0x00: Operation success
0x55: No PSC

Counter: 1 byte.
For SLE 4442, this value is from 0 to 3.
For SLE 4428, this value is from 0 to 8.
Otherwise, this value is 0.

4-2-10. Verify Programmable Security Card (PSC) of Memory Card

| | | | | |
|------|-----|------|-----|----------|
| 0xBA | Len | 0x3E | PSC | Checksum |
|------|-----|------|-----|----------|

For SLE 4442, SLE 4428 only

PSC: Either 3-byte or 2-byte Programmable Security Code.

Return:

| | | | | | |
|------|-----|------|--------|---------|----------|
| 0xBD | Len | 0x3E | Status | Counter | Checksum |
|------|-----|------|--------|---------|----------|

Status: 0x00: Operation success
0x54: Verify fail
0x55: No PSC

Counter: 1 byte.
The number of remaining times to verify PSC.

4-2-11. Write Main Memory of Memory Card

| 0xBA | Len | 0x39 | Addr_hi | Addr_lo | Verify | Data_no | Data | Checksum |
|------|-----|------|---------|---------|--------|---------|------|----------|
|------|-----|------|---------|---------|--------|---------|------|----------|

Addr_hi: High byte address

Addr_lo: Low byte address

Verify: 1: Perform reading after writing to verify write whether success or not.
0: Just writing, without verifying

Data_no: The number of data to write, maximum is 128 bytes

Data: The data to be written

Return:

| 0xBD | Len | 0x39 | Status | Result | Checksum |
|------|-----|------|--------|--------|----------|
|------|-----|------|--------|--------|----------|

Status: 0x00: Operation success

0x51: Address out of range

Result: 0 bytes for Status = 0x51 or Verify = 0
Otherwise, it has Data_num bytes. Each byte has value 0 or 1
0: Write success for a particular byte
1: Write fail for a particular byte

4-2-12. Write Protection Memory of Memory Card

| 0xBA | Len | 0x3B | Addr_hi | Addr_lo | Verify | Data_no | Data | Checksum |
|------|-----|------|---------|---------|--------|---------|------|----------|
|------|-----|------|---------|---------|--------|---------|------|----------|

Addr_hi: High byte address

Addr_lo: Low byte address

Verify: 1: Perform reading after writing to verify write whether success or not.
0: Just writing, without verifying

Data_no: The number of data to write, maximum is 128 bytes

Data: The data to be written

Return:

| 0xBD | Len | 0x3B | Status | Result | Checksum |
|------|-----|------|--------|--------|----------|
|------|-----|------|--------|--------|----------|

Status: 0x00: Operation success

0x51: Address out of range

Result: 0 bytes for Status = 0x51 or Verify = 0
Otherwise, it has Data_num bytes. Each byte has value 0 or 1
0: Write success for a particular byte
1: Write fail for a particular byte

4-2-13. Change Programmable Security Card (PSC) of Memory Card

| 0xBA | Len | 0x3D | PSC | Checksum |
|------|-----|------|-----|----------|
|------|-----|------|-----|----------|

PSC: 3 bytes for SLE 4404

2 bytes for SLE 4428

Return:

| 0xBD | Len | 0x3C | Status | Checksum |
|------|-----|------|--------|----------|
|------|-----|------|--------|----------|

Status: 0x00: Change success

0x05: Write fail

0x55: No PSC

4-2-14. 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

4-2-15. 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

4-2-16. 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

4-2-17. 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

4-2-18. Display large English string

| | | | | | | |
|------|-----|------|------|-----|--------|----------|
| 0xBA | Len | 0x70 | Line | Col | String | Checksum |
|------|-----|------|------|-----|--------|----------|

Line: The line to display (0 - 1)
 Col: The column to display (0 – 121)
 String: The ASCII string to display

Return:

| | | | | |
|------|-----|------|--------|----------|
| 0xBD | Len | 0x70 | Status | Checksum |
|------|-----|------|--------|----------|

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

4-2-19. 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

4-2-20. Play a voice speech

| | | | | |
|------|-----|------|--------|----------|
| 0xBA | Len | 0x4E | Dialog | Checksum |
|------|-----|------|--------|----------|

Dialog: The dialog to play (1 – 4)

Return:

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

Status: 0x00: Operation success
 0x42: Dialog out of range
 0xF0: Checksum error
 0xF2: Communication line error

4-2-21. Get input from keypad

| | | | | | |
|------|-----|------|------|------|----------|
| 0xBA | Len | 0x60 | Beep | Mask | Checksum |
|------|-----|------|------|------|----------|

Beep: 0x00 – Disable beep sound for any key pressed
 0x01 – Enable beep sound for any key pressed
 Mask: 0x00 – Display the number being pressed

0x01 – Mask the number being pressed with ‘*’

Return:

| 0xBD | Len | 0x60 | Status | Key string | Checksum |
|------|-----|------|--------|------------|----------|
|------|-----|------|--------|------------|----------|

Status: 0x00: Operation success

0xF0: Checksum error

0xF2: Communication line error

Key string: The ASCII code for the key being pressed, 8 bytes. For input less than 8 bytes, the reset of string will be filled zero.

4-2-22. Cancel input

| 0xBA | Len | 0x61 | Checksum |
|------|-----|------|----------|
|------|-----|------|----------|

Cancel the keypad input mode being invoked by command 0x60

Return:

| 0xBD | Len | 0x61 | Status | Checksum |
|------|-----|------|--------|----------|
|------|-----|------|--------|----------|

Status: 0x00: Operation success

0xF0: Checksum error

0xF2: Communication line error

4-2-23. Get PIN with DES encryption

| 0xBA | Len | 0x62 | Beep | Mask | Index | Checksum |
|------|-----|------|------|------|-------|----------|
|------|-----|------|------|------|-------|----------|

Beep: 0x00 – Disable beep sound for any key pressed

0x01 – Enable beep sound for any key pressed

Mask: 0x00 – Display the number being pressed

0x01 – Mask the number being pressed with ‘*’

Index: The user key index used for DES encryption. There are 16 user keys stored inside the pinpad. The default value is 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00. They can be changed through commands

Return:

| 0xBD | Len | 0x62 | Status | DES string | Checksum |
|------|-----|------|--------|------------|----------|
|------|-----|------|--------|------------|----------|

Status: 0x00: Operation success

0xF0: Checksum error

0xF2: Communication line error

DES string: The DES encrypted PIN, 8 bytes.

4-2-24. Change main key

| 0xBA | Len | 0x80 | Index | Old_key | New_key | Checksum |
|------|-----|------|-------|---------|---------|----------|
|------|-----|------|-------|---------|---------|----------|

Index: The main key index to change. There are 16 main keys matched with 16 user keys stored inside the pinpad. All the default main key is 0x38, 0x38, 0x38, 0x38, 0x38, 0x38, 0x38, 0x38.

Old_key: The old main key. In order to change the main key, the old key must matched the with the main being stored inside the pinpad. Both old key and new key must be 8 bytes long.

New_key: The new key to change to.

Return:

| 0xBD | Len | 0x80 | Status | Checksum |
|------|-----|------|--------|----------|
|------|-----|------|--------|----------|

Status: 0x00: Operation success

0x26: Index out of range
 0x41: Key mismatch.
 0x05: Write key fail
 0xF0: Checksum error
 0xF2: Communication line error

4-2-25. Change user key

| | | | | | |
|------|-----|------|-------|---------|----------|
| 0xBA | Len | 0x81 | Index | New_key | Checksum |
|------|-----|------|-------|---------|----------|

Index: The user key index to change. There are 16 main keys matched with 16 user keys stored inside the pinpad. All the default user key is 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00.

New_key: The new key given should be DES encrypted with the corresponding main key. The pinpad will DES decrypt the new key and store it properly.

Return:

| | | | | |
|------|-----|------|--------|----------|
| 0xBD | Len | 0x81 | Status | Checksum |
|------|-----|------|--------|----------|

Status: 0x00: Operation success
 0x26: Index out of range
 0x05: Write key fail
 0xF0: Checksum error
 0xF2: Communication line error

4-2-26. 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

4-2-27. 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