

# A810C-L400M22 Manual

RS485 interface, 5km transmission , 410-525MHz LoRa spread spectrum

Star networking, auto-relay, AES encryption, ModBus protocol



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# RS485 interface, 5km transmission , 410-525MHz LoRa spread spectrum

## Star networking, auto-relay, AES encryption, ModBus protocol

### 1. Product Overview

A810C-L400M22 is a 410-525MHz, 158mW, high stability, industrial grade wireless digital radio. The core module of the radio adopts new generation LORA spread spectrum modulation technology with RS485 interface. The built-in multiple operation detection mechanisms greatly improve the radio's anti-interference and high stability.

### 2. Product Features

- With data broadcasting, data listening
- Receiving sensitivity up to -129dBm, transmission distance of 5000 meters<sup>[1]</sup>
- AES encryption
- Readable module RSSI<sup>[2]</sup>
- Built-in multiple exception handling mechanisms to ensure long and stable operation of the module
- Maximum transmit power about 22dBm (about 158mW)
- Multi-level baud rate<sup>[1]</sup>  
Eight common baud rates, default baud rate is 9600bps  
Baud rate range: 1200bps~115200bps
- Multi-level air speed<sup>[1]</sup>  
Eight levels of adjustable air rate, default air rate 4.8kbps  
1.2~62.5kbps
- Frequency 410~525MHz<sup>[4]</sup> Provides 116 channels with 1MHz interval per channel<sup>[4]</sup>  
410MHz + CHAN \* 1MHz  
CHAN: 0x00~0x73H (corresponding to 410~525MHz)  
Operates in the 433MHz application-free band by default
- Supply voltage range  
8.0V~28VDC  
Built-in power management module to ensure stable power supply to the radio, able to meet a variety of system requirements
- 512 byte ring FIFO  
512 bytes of send FIFO  
Internal automatic subcontracting of transfers  
Some combinations of airspeed and baud rate can send infinitely long packets<sup>[3]</sup>

Remark.

[ 1 ] test conditions: clear, open, maximum power, antenna gain 5dBi, height greater than 2m, 2.4k air rate

[ 2 ] Radio RSSI is internal intelligent processing, the user does not need to care, special needs can be read by command

[ 3 ] See the SPEED register in Chapter 7, Section 7.2 Radio Parameter Registers for details

### 3. Series Products

| Radio Model  | Carrier frequency (Hz) | Interface   | Size (mm) | Maximum transmit power (dBm) | Communication distance (km) | Antenna Form            |
|--------------|------------------------|-------------|-----------|------------------------------|-----------------------------|-------------------------|
| A810-L400M21 | 410M~525M              | RS232/RS485 | 95*84*25  | 21                           | 5.0                         | Glue stick, suction cup |
| A810-L400M30 | 410M~490M              | RS232/RS485 | 95*84*25  | 30                           | 10                          | Glue stick, suction cup |
| A810-L433M21 | 410M~441M              | RS232/RS485 | 95*84*25  | 21                           | 5.0                         | Glue stick, suction cup |
| A810-L433M30 | 410M~441M              | RS232/RS485 | 95*84*25  | 30                           | 10                          | Glue stick, suction cup |
| A810-L470M21 | 441M~490M              | RS232/RS485 | 95*84*25  | 21                           | 5.0                         | Glue stick, suction cup |

### 4. Electrical parameters

Conditions: Tc = 25°C, VCC = 12VDC

| Radio Model   | Parameter Name           | Description                                                                                    | Minimum value | Typical values | Maximum value | Unit |
|---------------|--------------------------|------------------------------------------------------------------------------------------------|---------------|----------------|---------------|------|
| A810C-L400M22 | Supply voltage           |                                                                                                | 8.0           | 12             | 28            | VDC  |
| A810C-L400M22 | Emission current         |                                                                                                |               | 42             |               | mA   |
| A810C-L400M22 | Receiving current        |                                                                                                |               | 4              |               | mA   |
| A810C-L400M22 | Operating Frequency Band | 410~525MHz, 116 channels, 1MHz step, factory default 433MHz                                    | 410           | 433            | 525           | MHz  |
| A810C-L400M22 | Transmitting power       |                                                                                                |               | 22             |               | dBm  |
| A810C-L400M22 | airspeed                 | 8 levels adjustable (1.2kbps, 2.4kbps, 4.8kbps, 9.6kbps, 19.2kbps, 38.4kbps, 50kbps, 62.5kbps) | 1.2k          | 4.8k           | 62.5k         | bps  |
| A810C-L400M22 | Reception sensitivity    | Receiving sensitivity is independent of serial port baud rate and delay time                   |               | -129           |               | dBm  |
| A810C-L400M22 | Operating temperature    | Industrial Products                                                                            | -40           |                | +85           | °C   |
| A810C-L400M22 | Working humidity         | Relative humidity, non-condensing                                                              | 10%           |                | 90%           |      |
| A810C-L400M22 | Storage temperature      |                                                                                                | -40           |                | +125          | °C   |

## 5. Radio connection method

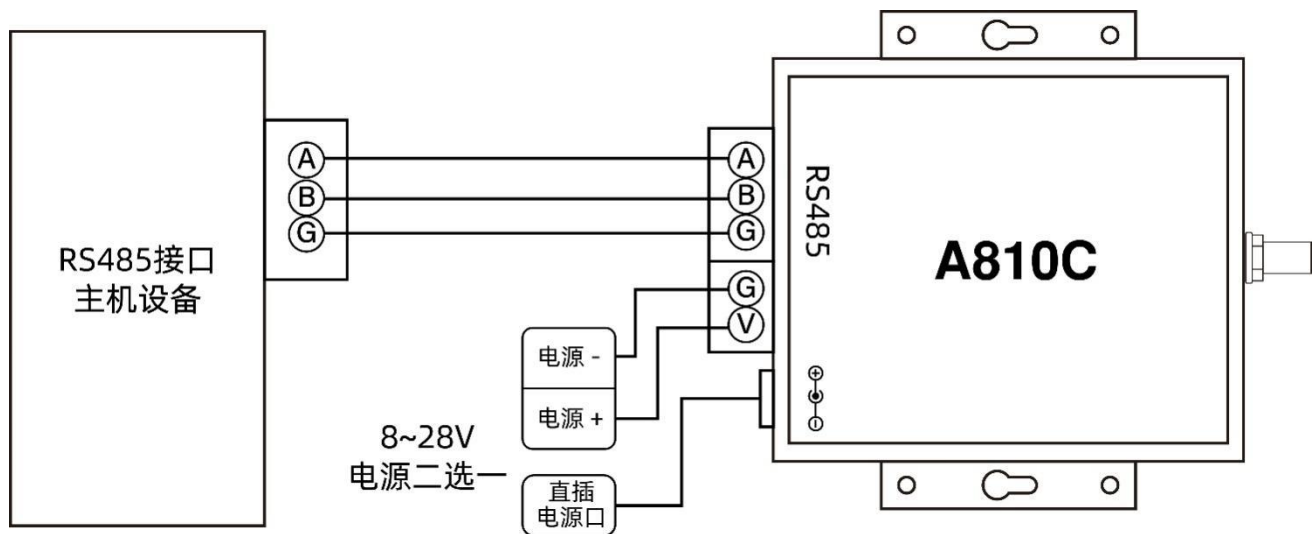


Figure 5-1 Recommended connection diagram

Note: [ 1 ] See DTU product manual for detailed connection methods and procedures

## 6. Radio Reset

Sending commands through the 485 interface enables the radio to restart and restore factory settings.

## 7. Radio orders

### 7.1 Command Format

The parameters of our digital transmission radio can be configured to support read and write command operation, and the detailed commands are as follows.

#### ➤ Operating mode command overview table

To configure parameters in operating mode, the configuration command needs to satisfy the following format.

Sync header + ID code + header + command code inverse + command code + data (length is not fixed, refer to command overview table) + CS + sync header inverse + ID code inverse + header inverse + end code

| Number of data bits | Value     | Description                                                                                                                                      |
|---------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| 0, 1                | 0xAF 0xAF | 2BYTE Sync Head                                                                                                                                  |
| 2, 3                | 0XX 0XX   | 2BYTE ID code, can be a random number, default 0x55 0x55                                                                                         |
| 4                   | 0x5A      | 1BYTE header                                                                                                                                     |
| 5                   | 0XX       | 1BYTE Command Code Inversion (Command Code Reference Command Overview Table)                                                                     |
| 6                   | 0XX       | 1BYTE command code (command code reference command overview table)                                                                               |
| 7                   | 0XX       | 1BYTE start address                                                                                                                              |
| 8                   | 0XX       | 1BYTE command length                                                                                                                             |
| 8~n                 | 0XX       | Command data, refer to the parameter register table                                                                                              |
| n+1, n+2            | 0XX 0XX   | 2BYTE check code, the high eight bits are the sum of all data before CS to take the low 8 bits, the low eight bits are all data before CS iso-or |
| n+3, n+4            | 0x50 0x50 | 2BYTE synchronous header reversal                                                                                                                |
| n+5, n+6            | 0XX 0XX   | 2BYTE ID code is inverted, default 0xAA 0xAA                                                                                                     |
| n+7                 | 0xA5      | 1BYTE header is reversed                                                                                                                         |
| n+8, n+9            | 0x0D 0x0A | 2BYTE end code                                                                                                                                   |

The working mode command function is detailed in the following table, taking the default factory configuration as an example.

| Command Format                                                                                                                                                          | Module Answer                                                                                                           | Description                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| AF AF 55 55 5A FF 00 02 0E 71 A9 50 50 AA AA A5 0D 0A                                                                                                                   | 00 00 25 80 02 F9 00 01 02 00 00 80 77 77 77 77 2E 61 73 68 69 6E 69 6E 67 2E 63 6F 6D 00 23 40 00 00 00 00 00 00 00 00 | The module returns the parameters of all currently writable registers in hexadecimal format |
| AF AF 55 55 5A 7F 80 02 0E 00 00 25 80 02 F9 00 00 02 00 00 00 77 77 77 77 2E 61 73 68 69 6E 69 6E 67 2E 63 6F 6D 00 00 00 00 00 00 00 00 64 FE 50 50 AA AA A5 A5 0D 0A | 80 02 0E                                                                                                                | Write all parameters                                                                        |
| AF AF 55 55 5A 7F 80 11 01 73 B5 50 50 AA AA A5 0D 0A                                                                                                                   | OK                                                                                                                      | Restore factory settings                                                                    |

## 7.2 Radio parameter register

Parameter registers (parameter registers cannot be used alone, they must be used in accordance with the command format )

| Serial number | Address | Register Permissions | Register Length | Register Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------|---------|----------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1             | 0x00    | R                    | 20              | Module Version Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 2             | 0x01    | R                    | 4               | The first two bytes indicate the current environment RSSI, and the last two bytes indicate the current packet RSSI                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 3             | 0x02    | R/W                  | 4               | Serial port baud rate of the module, customizable in the range of 1200~115200bps                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 4             | 0x03    | R/W                  | 2               | Bit10   Bit9   Bit8   Bit7   Bit6   Bit5 is the channel number, the default is 10111 (23) channels<br><br>Bit4   Bit3 for power                    11        : 22dBm<br>10        : 17dBm<br>01        : 14dBm<br>00        : 11dBm<br><br>Default is 11, power is 22dBm<br><br>Bit2   Bit1   Bit0 is null speed   111       : 62.5K<br>110       : 50K<br>101       : 38.4K<br>100       : 19.2K<br>011       : 9.6K<br>010       : 4.8K<br>001       : 2.4K<br>000       : 1.2K<br><br>Default is 010 with an airspeed of 4.8K [2] |
| 5             | 0x04    | R/W                  | 2               | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 6             | 0x05    | R/W                  | 1               | Serial port check bit.<br><br>0 for EVEN<br><br>1 for ODD<br><br>2 for NONE                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 7             | 0x06    | R/W                  | 1               | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 8             | 0x07    | R/W                  | 2               | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 9             | 0x08    | R/W                  | 16              | AES Key                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 10            | 0x09    | R/W                  | 2               | Serial port packing cycle in 0.1ms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 11            | 0x0A    | R/W                  | 1               | Use the length of the separator in bytes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 12            | 0x0B    | R/W                  | 1               | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 13            | 0x0C    | R/W                  | 1               | Local Group Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 14            | 0x0D    | R/W                  | 1               | Local Address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 15            | 0x0E    | R/W                  | 1               | Target group number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 16            | 0x0F    | R/W                  | 1               | Destination Address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 17            | 0x10    | X                    | 1               | Module reboot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 18            | 0x11    | X                    | 1               | Module restores factory settings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

### 7.3 Radio factory settings

Register factory configuration table.

| Serial number | Address | Register Permissions | Register Length | Default Parameters                                                                                                                                                                                                                                                                      |
|---------------|---------|----------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1             | 0x00    | R                    | 20              | A810C-L400M22-V8.0.1, module version number                                                                                                                                                                                                                                             |
| 2             | 0x01    | R                    | 4               | 0x0000 (default), which means that the current environment RSSI is 0x00 and the current package RSSI is 0x00                                                                                                                                                                            |
| 3             | 0x02    | R/W                  | 4               | 0x00002580 (9600bps, default) serial port baud rate of the module, customizable, range 1200~115200                                                                                                                                                                                      |
| 4             | 0x03    | R/W                  | 2               | 0x02FC (default)<br>Bit10   Bit9   Bit8   Bit7   Bit6   Bit5 is the channel number, the default is 10111 (23) channels<br>Bit4   Bit3 is the power number, the default is 11, the power is 22dBm<br>Bit2   Bit1   Bit0 is the null speed number, default is 010, the null speed is 4.8K |
| 5             | 0x04    | R/W                  | 2               | Reserved                                                                                                                                                                                                                                                                                |
| 6             | 0x05    | R/W                  | 1               | Default Parameters<br>0x02 (default) NONE checksum                                                                                                                                                                                                                                      |
| 7             | 0x06    | R/W                  | 1               | Reserved                                                                                                                                                                                                                                                                                |
| 8             | 0x07    | R/W                  | 2               | Reserved                                                                                                                                                                                                                                                                                |
| 9             | 0x08    | R/W                  | 16              | 0x77 0x77 0x77 0x2E 0x61 0x73 0x68 0x69 0x6E 0x69 0x6E 0x67 0x2E 0x63 0x6F 0x6D (default)<br>Indicates that the packet is encrypted using the above AES key                                                                                                                             |
| 10            | 0x09    | R/W                  | 2               | 35 (default)<br>When the serial port data idle time exceeds 3.5ms, then the currently received data is treated as a packet                                                                                                                                                              |
| 11            | 0x0A    | R/W                  | 1               | 0x05 (default) means that the maximum valid length for using separators is 5                                                                                                                                                                                                            |
| 12            | 0x0B    | R/W                  | 1               | Reserved                                                                                                                                                                                                                                                                                |
| 13            | 0x0C    | R/W                  | 1               | 0x00, the local group number is 0x00                                                                                                                                                                                                                                                    |
| 14            | 0x0D    | R/W                  | 1               | 0x00 with a local address of 0x00                                                                                                                                                                                                                                                       |
| 15            | 0x0E    | R/W                  | 1               | 0x00, the target group number is 0x00                                                                                                                                                                                                                                                   |
| 16            | 0x0F    | R/W                  | 1               | 0x00, the destination address is 0x00                                                                                                                                                                                                                                                   |

Remark.

1、 The configuration of the radio parameters can use the parameter configuration software ASDS provided by the company, the configuration process and steps are detailed in the DTU product manual

2、 Fast communication test of the radio and detailed procedures are described in the DTU product manual

## 8. Radio Function

### 8.1 Radio Features Overview

Radio Menu

| Radio Function                                               | Data format of the sender            | Data format of the receiver | Function Introduction                                                                                                                                                                                                               |
|--------------------------------------------------------------|--------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Transparent Broadcasting                                     | User Data                            | User Data                   | Any station that sends data can be received by stations with the same address and the same channel. Sending data is transparent, and what you send is what you receive.                                                             |
| Broadcast and Monitoring<br>(under fixed-point transmission) | 0xFF+0xFF+receiver channel+user data | User Data                   | Broadcast: any station sends data, and all stations under the same channel can receive data at the same time.<br>Listening: a radio with a 0xFFFF address can receive data sent by a radio with any address under the same channel. |

### 8.2 Radio function detailed explanation

#### 8.2.1 Transparent Broadcasting

##### Function Description

Any station sends data, and any station with the same address and the same channel can receive data at the same time.

Data is sent and received transparently, and what is sent is what is received.

##### Radio settings

1. Bit 7 of the OPTION special function register needs to be configured to 0. Transparent transmission mode
2. Sending and receiving radio addresses are set to the same value
3. The channels of the transmitting and receiving radio are set to the same value

##### Examples

|                | Sender                   |                | Receiver                 |
|----------------|--------------------------|----------------|--------------------------|
| Radio Address  | 0x1234 (factory default) | Radio Address  | 0x1234 (factory default) |
| Radio Channels | 0x17 (factory default)   | Radio Channels | 0x17 (factory default)   |
| Sending data   | User Data                | Output Data    | User Data                |
|                | 0x11 0x22 0x33           |                | 0x11 0x22 0x33           |
|                |                          |                |                          |

#### 8.2.2 Master-slave mode

##### Function description

The master can send data to the specified slaves, and all slaves can receive the data sent by the master.

##### Module settings

1. MD0 = 0, MD1 = 0
2. Need to configure 0x07 special function register to 0x0004, master-slave mode
3. The addresses of the transmitter and receiver modules can be set differently
4. The channels of the transmitter and receiver modules are set to the same

Examples:

| Transmitter                 |                                                   | Receiver                   |                  |
|-----------------------------|---------------------------------------------------|----------------------------|------------------|
| Target group number address | 0xFFFF                                            | Local group number address | 0x5678           |
| Modular channels            | 0x18                                              | Modular channels           | 0x18             |
| Master-Slave                | Mainframe                                         | Master-Slave               | From the machine |
| Sending data                | Receive address high + receive address low + data | Output Data                | User Data        |
|                             | 0x56 0x78 0x11 0x22 0x33                          |                            | 0x11 0x22 0x33   |

### 8.2.3 Target transmission

#### Function description

Data can be sent from any station and received from a specified station. When multiple receiving stations have the same address channel, data can be received.

#### Module settings

- Bit 7 of the OPTION special function register needs to be configured to 1, target transmission mode
- The addresses of the transmitting and receiving stations can be set differently
- The channels of the transmitting and receiving module can be set differently
- The first 3 bytes of the sender's data must be the receiver's address high + address low + channel

Examples:

| Transmitter     |                                                                     | Receiver        |                |
|-----------------|---------------------------------------------------------------------|-----------------|----------------|
| Module Address  | 0xFFFF                                                              | Module Address  | 0x5678         |
| Module Channels | 0xFFFF                                                              | Module Channels | 0x18           |
| Sending data    | Receive address high + receive address low + receive channel + data | Output Data     | User Data      |
|                 | 0x56 0x78 0x18 0x11 0x22 0x33                                       |                 | 0x11 0x22 0x33 |

### 8.2.4 Broadcast under target transmission

#### Function description

Any station sends data, and all stations under the same channel can receive data.

#### Module settings

- Bit 7 of the OPTION special function register needs to be configured to 1, target transmission mode
- The addresses of the transmitting and receiving stations can be set differently
- The channels of the transmitting and receiving module can be set differently
- The first 3 bytes of the sender's data must be 0xFF+0xFF+receiver channel

Examples:

| Transmitter     |                                     | Receiver        |                        |
|-----------------|-------------------------------------|-----------------|------------------------|
| Module Address  | 0XXXXX                              | Module Address  | 0XXXXX                 |
| Module Channels | 0XXXXX                              | Module Channels | 0x17 (factory default) |
| Sending data    | 0xFF+0xFF+receive channel+user data | Output Data     | User Data              |
|                 | 0xFF 0xFF 0x17 0x11 0x22 0x33       |                 | 0x11 0x22 0x33         |

### 8.2.5 Monitoring under target transmission

#### Function description

Any module with a 0xFFFF address can receive data from a module with any address on the same channel.

#### Module settings

1. Bit 7 of the OPTION special function register needs to be configured to 1, target transmission mode
2. The address of the monitoring module must be set to 0xFFFF
3. The channels of the monitoring and transmitting stations must be set to the same
4. The first 3 bytes of the sender's data must be 0xXX+0xXX+monitoring channel

Examples:

| Transmitter     |                                                                              | Receiver        |                        |
|-----------------|------------------------------------------------------------------------------|-----------------|------------------------|
| Module Address  | 0x1234 (factory default)                                                     | Module Address  | 0xFFFF                 |
| Module Channels | 0x17 (factory default)                                                       | Module Channels | 0x17 (factory default) |
| Sending data    | arbitrary address high + arbitrary address low + receive channel + user data | Output Data     | User Data              |
|                 | 0xXX 0xXX 0xXX 0x17 0x11 0x22 0x33                                           |                 | 0x11 0x22 0x33         |

### 8.2.6 Relay

#### Function description

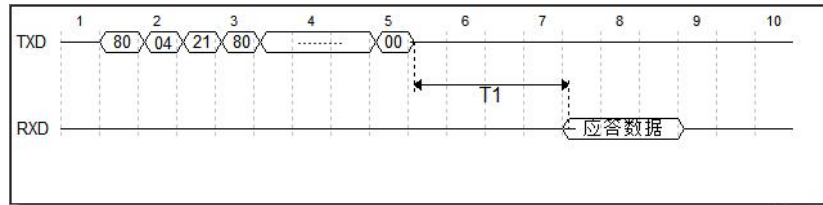
The device in relay mode will forward the received data backward according to the set path until the Fixed device for the purpose of extending the transmission distance.

#### Module settings

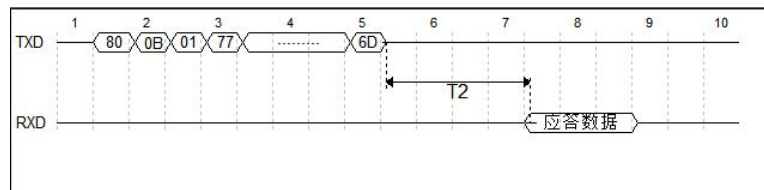
1. MD0 = 0, MD1 = 0. MD0 = 1, MD1 = 0
2. Need to configure 0x07 special function register to 0x0020, relay mode
3. Set the previous group number address and the next group number address in relay mode (0x1B~0x1E registers)
4. The channels of the relay module and the transmitter module must be set to the same

## 9. Timing Chart

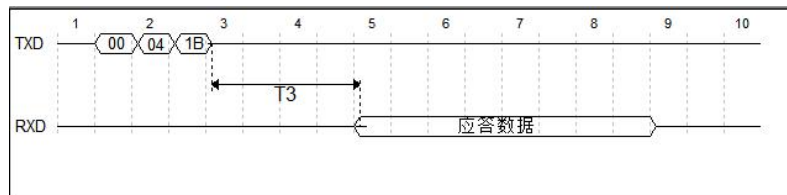
### 1. Module parameter configuration commands



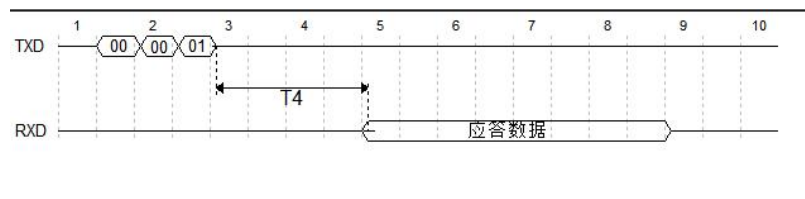
### 2. Module encryption key setting command



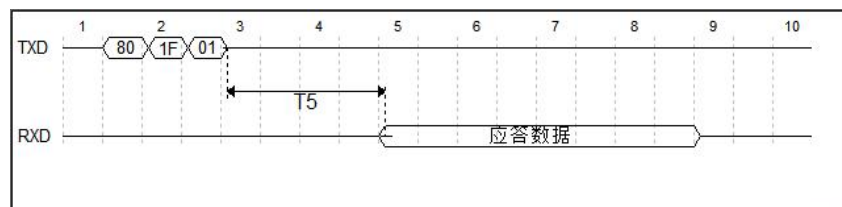
### 3. Read module configuration parameters command



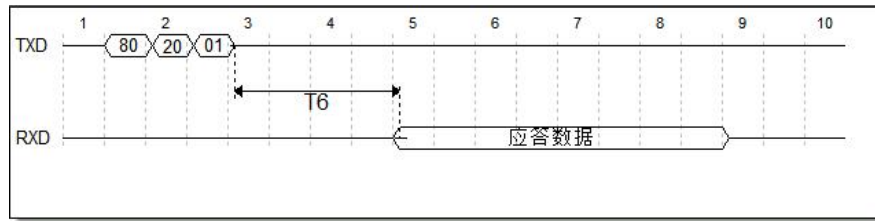
### 4. Read module hardware version number command



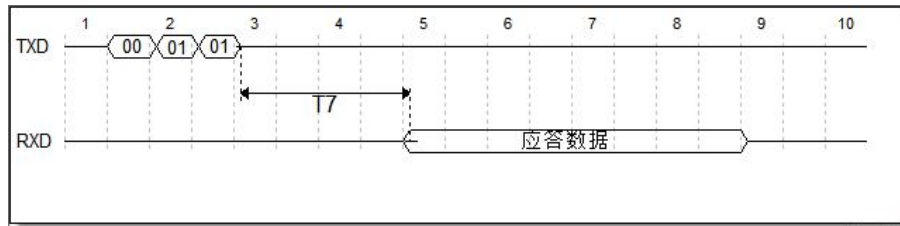
### 5. Module reset command



### 6. Restore module default parameter command



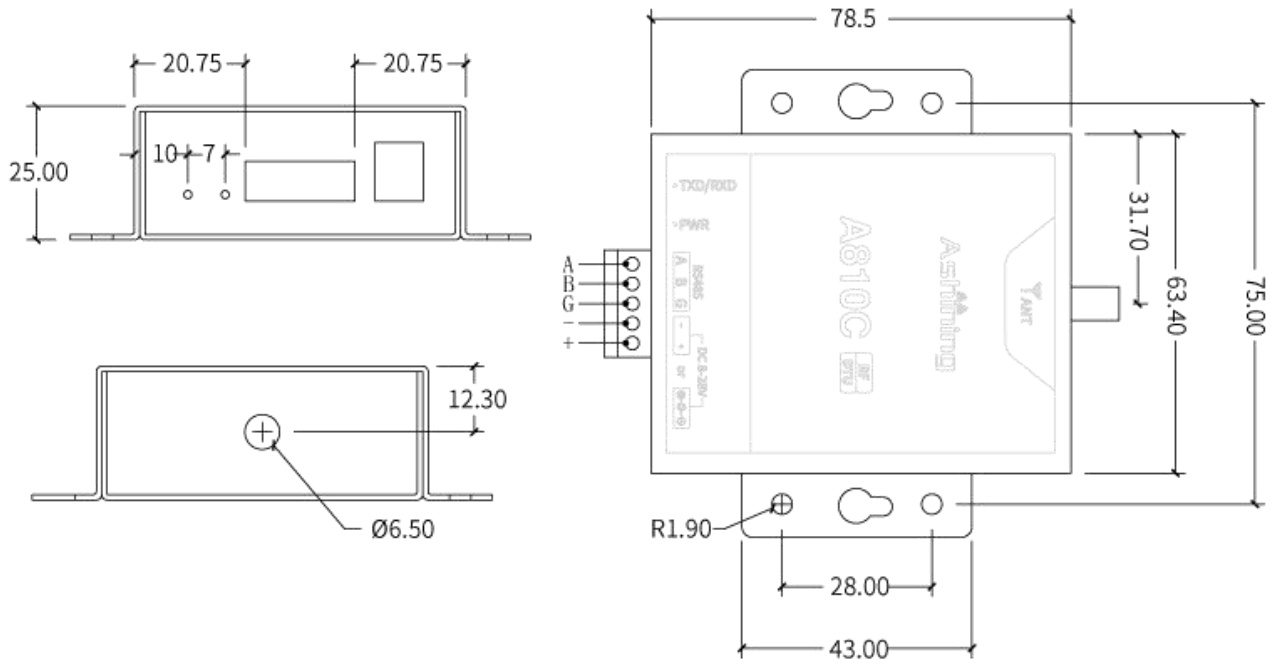
7. Read current data signal RSSI and environment RSSI commands directly



| Parameter Name                                 | T_answer | Description                                            | Minimum value | Typical values | Maximum value | Unit |
|------------------------------------------------|----------|--------------------------------------------------------|---------------|----------------|---------------|------|
| Module Command Answer Delay                    | T1       | Parameter configuration delay                          |               | 100            |               | ms   |
|                                                | T2       | Read module configuration parameters delay             |               | 40             |               | ms   |
|                                                | T3       | Read module hardware version number delay              |               | 100            |               | ms   |
|                                                | T4       | Waiting for module reset delay                         |               | 40             |               | ms   |
|                                                | T5       | Read module voltage delay                              |               | 60             |               | ms   |
|                                                | T6       | Configure module encryption key delay                  |               | 60             |               | ms   |
|                                                | T7       | Recovery module default parameter delay                |               | 50             |               | ms   |
| Waiting for data transmission completion delay | T_Packet | Delay time required to finish sending a packet of data |               |                |               | ms   |

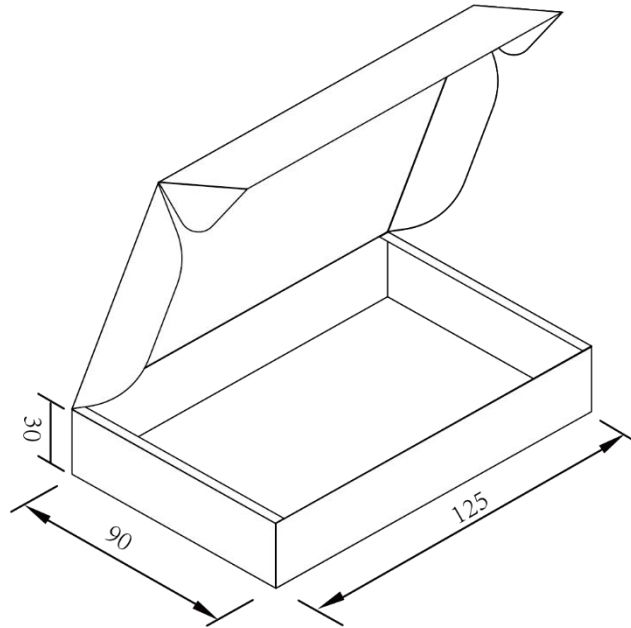
## 10. Package Information

### 10.1 Mechanical size



## 11. Packaging method

### 11.1 DTU tooling(unit:mm)



## Important Notes and Disclaimers

Due to the continuous improvement of hardware and software of the product, this specification is subject to change, and the latest version of the specification shall prevail in the end.

Users who use this product need to pay attention to the product dynamics at the official website so that users can get the latest information of this product in time.

The pictures and diagrams used in this specification are for illustrating the functions of this product and are for reference only.

The measurement data in this specification are measured by our company at room temperature for reference only, please refer to the actual measurement.

Chengdu Ashining Technology Co., Ltd. reserves the right of final interpretation and modification of all contents in this specification.