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| F8L10T LoRa Terminal User Manual | Document Version | Page |
| | V1.1.0 | |
| | Product Name: F8L10T | Total:18 |

F8L10T LoRa Terminal User Manual

The user manual is suitable for the following model:

| | |
|----------|--|
| F8L10T-N | LoRa data transmission terminal (Without PA) |
| F8L10T-E | LoRa data transmission terminal (With PA) |



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Files Revised Record

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| 2016-12-19 | V1.0.0 | Initial version | WSP |
| 2017-02-20 | V1.1.0 | According to the product line , modify the radio frequency description. Adjust the parameter configuration section with multiple details. | ZDD |
| | | | |

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Chapter 1 Brief Introduction of Product

1.1 General

F8L10T LoRa data transmission terminal is a wireless data transmission terminal based on LoRa spread spectrum technology. At the same time using Lora wireless transmission technology for short distance data transmission.

This product adopts industrial grade Lora scheme with high performance, based on embedded real-time operating system as the software platform, while providing RS232 and RS485 (or RS422) interface, can be directly connected to the serial device, realize the transparent data transmission function; low power design, lowest power consumption is less than 5ma@ 12VDC; 5 I/O, can achieve the digital input output, analog input, pulse counting function.

It has been widely used on M2M fields, such as electric power, intelligent traffic, wireless metering, industrial automation, telemetry, water supply, environment protection, weather, and so on.

1.2 Features and Benefits

Design for Industrial Application

- ◆ High-powered industrial LoRa chip and MCU
- ◆ High-powered industrial 32 bits CPU
- ◆ Support low power consumption mode, including multi-sleep and trigger modes to reduce the power dissipation farthest
- ◆ Housing: iron, providing IP30 protection
- ◆ Power range: DC 5~36V

Stability and Reliability

- ◆ Support hardware and software WDT
- ◆ RS232/RS485/RS422 port: 15KV ESD protection
- ◆ Power port: reverse-voltage and overvoltage protection
- ◆ Antenna port: lightning protection(optional)

Standard and Convenience

- ◆ Adopt terminal block interface, convenient for industrial application
- ◆ Support standard RS232 and RS485(or RS422) port that can connect to serial devices directly
- ◆ TTL logic level RS232 interface can be customized, ADC interface can be customized
- ◆ Support intellectual mode, enter into communication state automatically when powered

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- ◆ Provide management software for remote management
- ◆ Support several work modes
- ◆ Convenient configuration and maintenance interface

High-performance

- ◆ Support Lora wireless short-range data transmission capabilities, with self-organizing network capabilities
- ◆ Relay routing and terminal device functionality
- ◆ Network capacity: 65000 nodes (typical number of 300)
- ◆ Send mode flexible: Broadcast send or destination address send mode optional
- ◆ Supply 5 I/O channels, can achieve the analog input of the 3 channels, the digital input and output of the 2 channels; compatible with the pulse count function of the 2 channels

1.3 Working Principle

The principle chart of the LoRa Terminal is as following:

1.4 Specifications

LoRa Specification

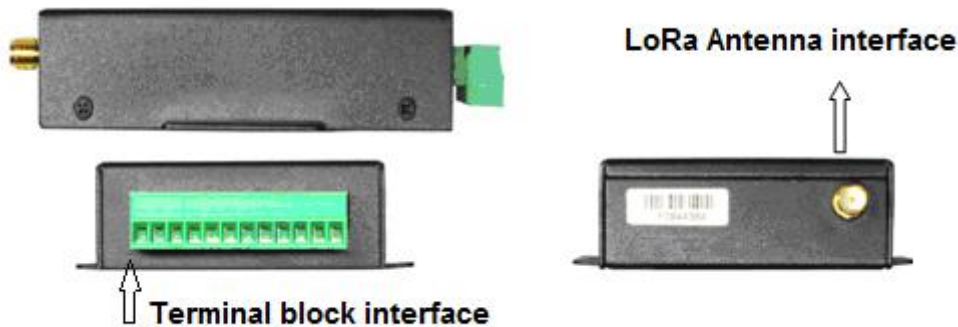
| Item | Content |
|---------------------------------------|--|
| Module | Industrial LoRa module |
| Communication Frequency Band | The product family supports a wide range of frequency bands around the world (433/470/780/868/915 MHz) |
| Indoor/Urban Communication Distance | F8L10T-N:1km F8L10T-E:2km |
| Outdoor/Visual Communication Distance | F8L10T-N:3.5km F8L10T-E:11.5km |
| Bandwidth | 6 level adjustable (0.3、0.6、1.0、1.8、3.1、5.5Kbps) |
| TX Power | F8L10T-N:20dBm(100mW) F8L10T-E:30dBm(1W) |
| RX Sensitivity | -140dBm |
| Channel Number | 32 |

Hardware System

| Item | Content |
|-------|-----------------------|
| CPU | Industrial 32bits CPU |
| FLASH | 128KB |
| RAM | 16KB |

Interface type

| Item | Content |
|-----------|--|
| Serial | 1 RS232 port and 1 RS485(orRS422) port, 15KV ESD protection Data bits: 8 Stop bits: 1, 2 Parity: none, even, odd, space, mark Baud rate: 300、600、1200、2400、4800、9600、19200、38400、57600、115200bps |
| Indicator | “Power”, “ACT”, "Online” |
| Antenna | LoRa : Standard SMA female interface, 50 ohm, lightning protection(optional) |
| Power | Terminal block interface, reverse-voltage and overvoltage protection |



The diagram illustrates two key interfaces of the device. On the left, the 'Terminal block interface' is shown as a green PCB-mounted terminal block with multiple pins. On the right, the 'LoRa Antenna interface' is shown as a gold SMA female connector on the device's casing. Arrows point from the text labels to their respective physical components.

Power supply

| Item | Content |
|----------------|-------------|
| Standard Power | DC 12V/0.5A |
| Power range | DC 5~36V |

Consumption

| Item | Working condition | Consumption |
|----------|-------------------|---------------------|
| F8L10T-N | Sleep | 3.1~3.2mA@12 VDC |
| | Receive data | 13.2~13.4mA@12 VDC |
| | Transmit data | 60.3~61.2mA@12 VDC |
| | Sleep | 7.3~7.4mA@5 VDC |
| | Receive data | 26.1~26.2mA@5 VDC |
| | Transmit data | 107.3~115.1mA@5 VDC |
| F8L10T-E | Sleep | 3.1~3.3mA@12 VDC |
| | Receive data | 13.2~13.4mA@12 VDC |
| | Transmit data | 110-125mA@12 VDC |
| | Sleep | 7.2~7.4mA@5 VDC |
| | Receive data | 26.3~26.5mA@5 VDC |
| | Transmit data | 210~213mA@5 VDC |

Physical Characteristics

| Item | Content |
|------------|---------------------------------|
| Housing | Iron, providing IP30 protection |
| Dimensions | 91x58.5x22 mm |
| Weight | 205g |

Environmental Limits

| Item | Content |
|-----------------------|-------------------------|
| Operating Temperature | -40~+85°C (-40~+185°F) |
| Storage Temperature | -40~+125°C (-40~+257°F) |
| Operating Humidity | 95% (unfreezing) |

Chapter 2 Installation Introduction

2.1 General

The LoRa Terminal must be installed correctly to make it work properly.

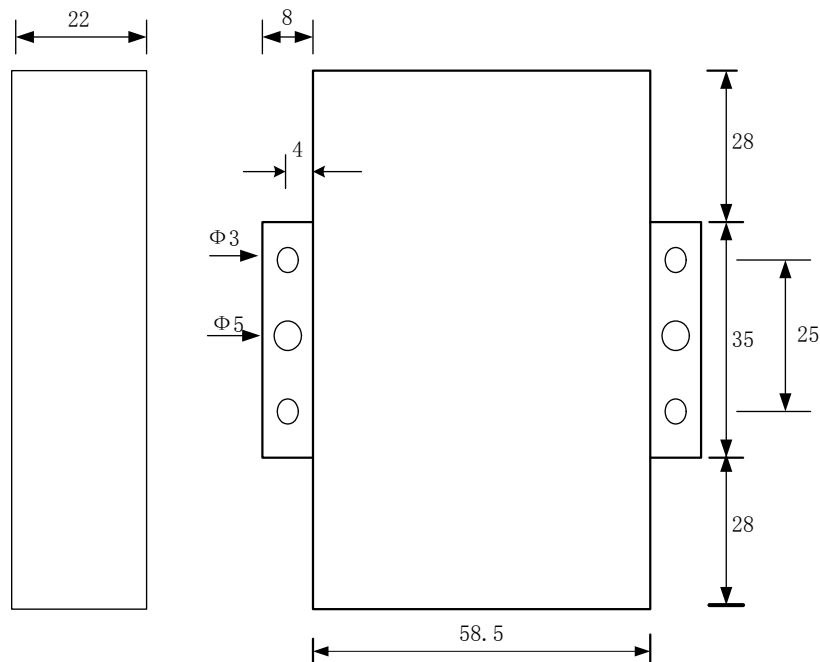
Warning: Forbid to install the MODEM when powered!

2.2 Encasement List

| Name | Quantity | Remark |
|--------------------|----------|----------|
| LoRa Terminal host | 1 | |
| LoRa Antenna | 1 | |
| Power adapter | 1 | |
| RS232 data cable | 1 | optional |
| RS485 data cable | 1 | optional |
| Manual CD | 1 | |
| Certification card | 1 | |
| Maintenance card | 1 | |

2.3 Installation and Cable Connection

Dimension: (unit: mm)



Installation of antenna:

Screw the SMA male pin of the LoRa antenna to the male SMA interface of the IP MODEM with sign “LoRa”.

Warning: The cellular antenna and the LoRa antenna can not be connected wrongly. And the antennas must be screwed tightly, or the signal quality of antenna will be influenced!

Antenna install note:

- 1, Install the antenna far away from the large area metal and ground.
- 2, Keep the antennas visual.
- 3, Minimize obstructions between the antennas.
- 4, Reduce the extension cords of the antenna.

The performance of different antenna installation types, as the figure 2-2.

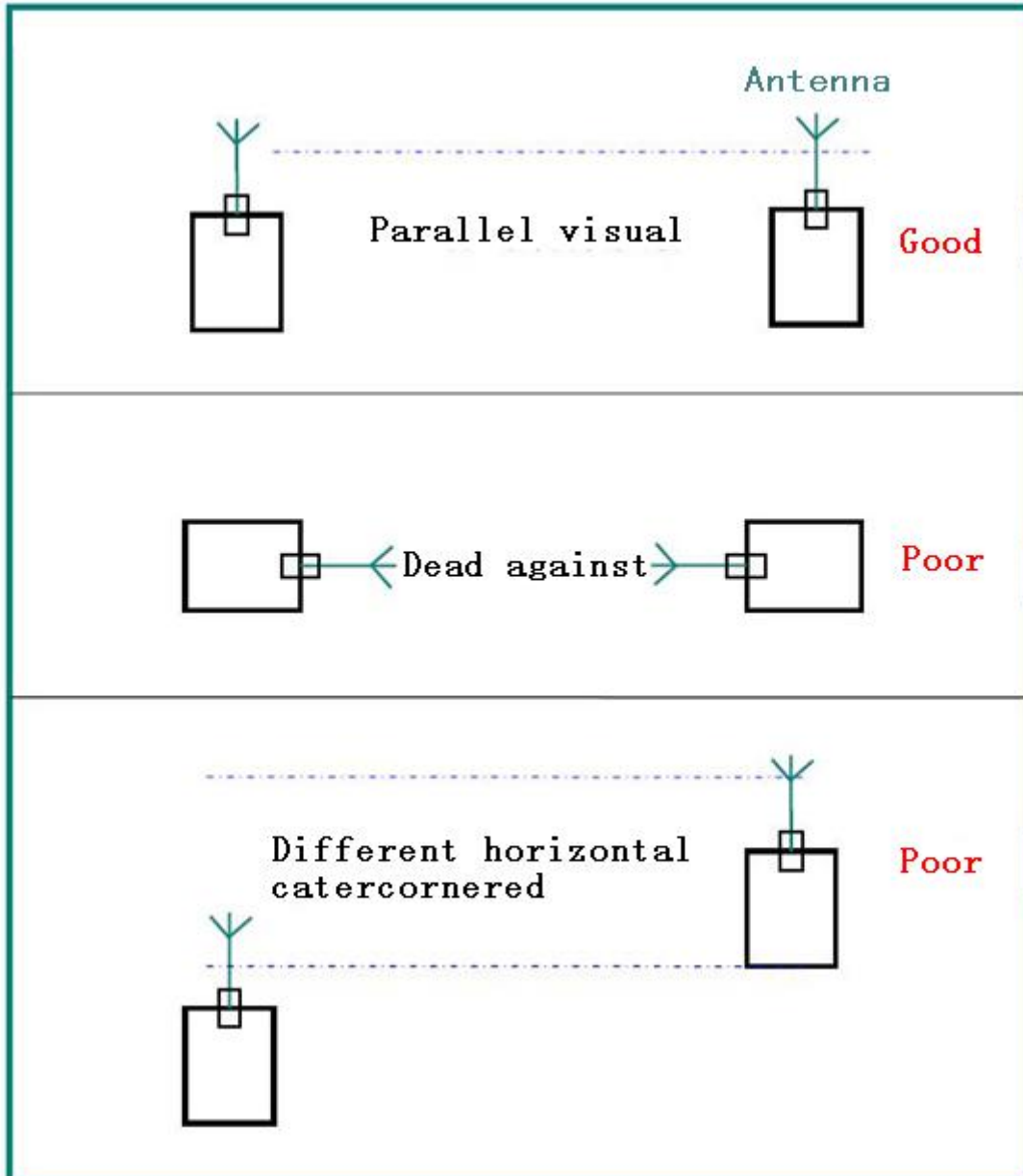


Figure 2-2 Installation antenna mode

User Interface Signal Definition

| Pin Number | Signal Name | Default Function | Extensible Function |
|------------|-------------|-------------------|---------------------|
| 1 | PWR | Power input anode | N/A |
| 2 | GND | Power Ground | N/A |
| 3 | GND | Power Ground | N/A |
| 4 | RX | RS232 RX | N/A |
| 5 | TX | RS232 TX | N/A |
| 6 | A | RS485 anode | N/A |

| | | | |
|----|-----|---|---------------|
| 7 | B | RS485 cathode | N/A |
| 8 | IO1 | GPIO | sleep control |
| 9 | IO2 | GPIO | N/A |
| 10 | IO3 | ADC, analog input function (voltage acquisition 0 ~ 5 V) | GPIO |
| 11 | IO4 | ADC, analog input function (current collection 0 ~ 20 mA) | GPIO |
| 12 | IO5 | ADC, analog input function (current collection 0 ~ 20 mA) | GPIO |



Installation of cable:

IP MODEM adopts industrial terminal block interface. The recommendatory cable is 28-16AWG. The detail description of standard layout adapter and communication cables as is following:

Adapter (Rating Output 12VDC/0.5A) :

| Cable Color | Power Output Polarity |
|-------------------------|-----------------------|
| Black & White Alternate | Anode |
| Black | Cathode |

RS232 Cable:

| Cable Color | Corresponding DB9-M Pin Number |
|-------------|--------------------------------|
| Brown | Pin 2 |
| Blue | Pin 3 |
| Black | Pin 5 |

RS485 Cable:

| Cable Color | Signal definition |
|-------------|-------------------|
| Red | RS485(A) |
| Black | RS485(B) |

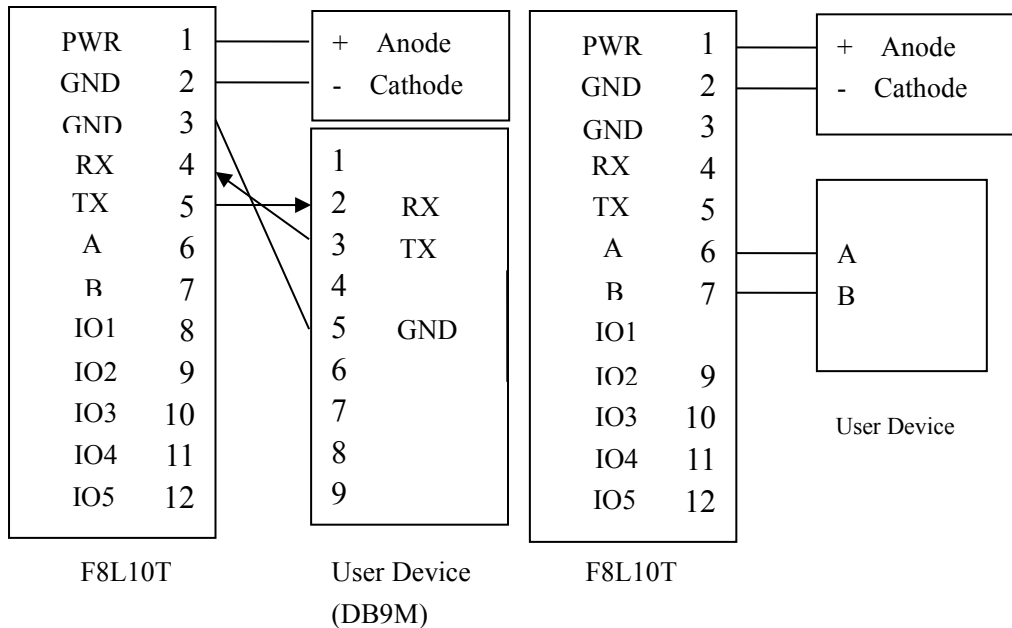
Power adapter and communication cable connection chart as following:

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Connect via RS232

Connect via RS485



2.4 Power

The power range of the LoRa Terminal is DC 5~36V.

Warning: When we use other power, we should make sure that the power can supply power above 4W.

We recommend user to use the standard DC 12V/0.5A power.

2.5 Indicator Lights Introduction

The LoRa Terminal provides three indicator lights: "Power", "ACT", "Online".

| Indicator Light | State | Introduction |
|-----------------|-------|--|
| Power | ON | LoRa Terminal is powered on |
| | OFF | LoRa Terminal is powered off |
| ACT | BLINK | Data is communicating |
| | OFF | No data |
| Online | ON | LoRa Terminal has logged on network |
| | OFF | LoRa Terminal hasn't logged on network |

Chapter 3 Configuration

3.1 Configure connection

In the Lora digital transmission terminal configuration, the need to pass the factory configuration RS232 serial cable or rs232-485 conversion line Lora data transmission terminal and configured to connect the PC together, as follows:



Figure 3-1 F8L10T configuration connection with PC

3.2 Introduction of parameter configuration

F8L10T parameter configuration in two ways:

Through the Four-Faith configuration software LoRaConfig: all configuration is configured with the corresponding entry software interface, this configuration is only suitable for users to facilitate the configuration of PC Case.

By extending the at command (hereinafter referred to as the AT command) way to deploy: in this configuration, the user only needs to have the serial communication program can configure all parameters such as F8L10T, windows of the super terminal, Linux minicom, putty, or directly by the user's SCM system to node configuration. In the use of extended at command to configure F8L10T to bring F8L10T into the configuration state.

Among them, AT command configuration can refer to "AT command manual".

Configure the f8l10t parameters by configuration software, as shown in Figure 3-2.

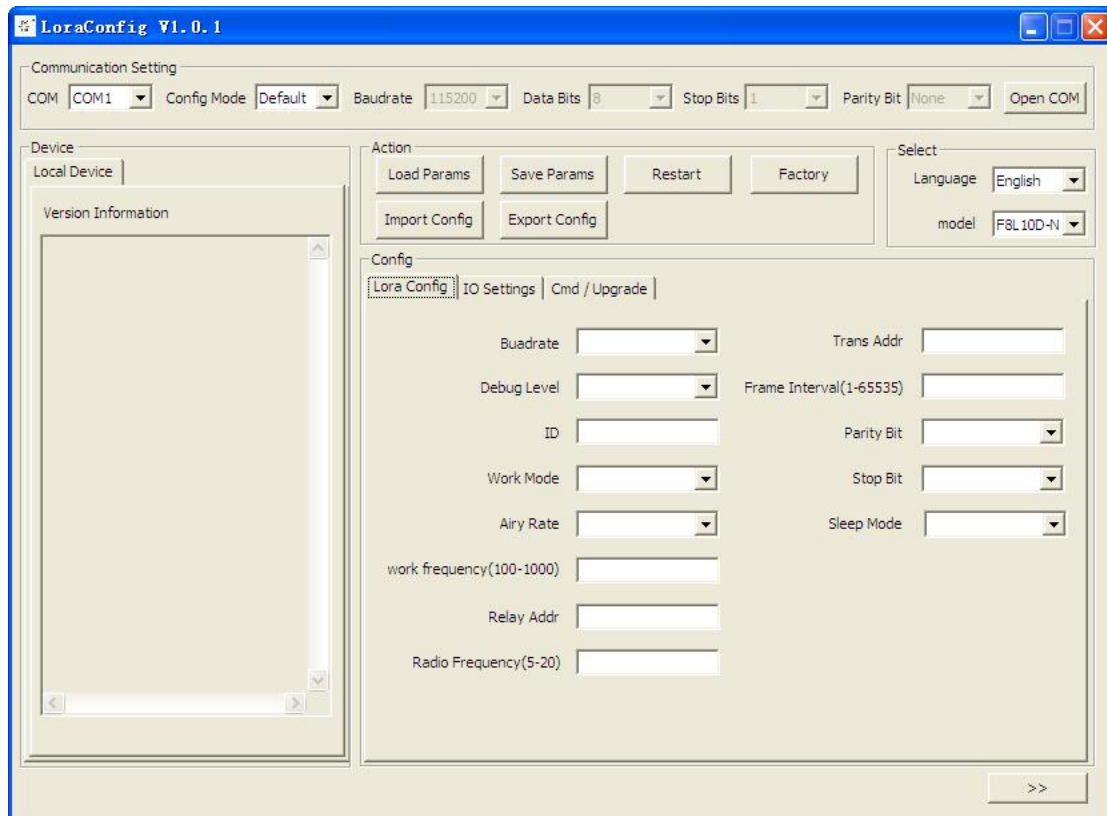


Figure 3-2 configuration interface

Column display serial parameters currently open serial port settings in the serial port parameters, please choose the correct value of this configuration, at the same time, open the serial port. The serial port parameter settings column if the right button is displayed as "closed serial". That serial port has been opened, otherwise please open the serial port.

The equipment again after power, configuration software f8l10t into the configuration state, and automatically load the current configuration parameters of equipment, in the area on the right side of the display parameters, thus can start all configuration parameters in the configuration f8l10t, as shown in Figure 3-2.

3.3 Detailed parameters

3.3.1 serial port configuration

It can configure the baud rate, data bit, parity bit and stop bit of the communication serial port.

Default: 115200 Baud rate, Attributes 8N1.

3.3.2 serial port work mode

Module serial data work can be divided into "TRNS","AT" and "API".

"TRNS": data transmission, when the need to pass through the address configuration, namely the destination address.

"AT": protocol format reference "Lora AT commands manual",usually used for parameter configuration and manual testing.

"API": serial data must be based on a certain data format for sending and receiving, protocol format reference "Lora API commands manual". The maximum length is 100 bytes.

Default: TRNS

3.3.3 ID

Set the module ID, configurable range 0~65535.

3.3.4 working frequency

Module data transmission frequency, different hardware modules can work different frequency bands, roughly divided into low frequency band (525MHz below) and high frequency band (525MHz above) two categories. Typical operating frequency band is 410M ~ 441MHz, 470M ~ 510MHz, 850 ~ 950MHz, etc., 1000KHz for a channel. Different application areas have different frequency band restrictions, as well as different channel interference factors, the error rate is different, so need to adjust the value according to the actual situation.

The default value for the low-band hardware module is 433, and the default for the high-band module is 868.

3.3.5 Air speed

The rate of data in the air can be divided into 6 levels, The higher the level, the higher the rate. Under the same conditions, the higher the rate, the closer the transmission distance. Therefore, you need to adjust this value according to the actual environment.

Attention: all devices must be at the same rate, otherwise they can not communicate.

Default: 3 Level

3.3.6 Transmitting power

The hardware module without PA can set the transmit power of 5 ~ 20dBm. The power of the hardware module with PA is fixed at 30dBm.

Default: 20

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3.3.7 Relay address

When the transmission distance between nodes is too far, this parameter is set to the relay node' ID, and the relay node will help the node forward the data to the final destination node.

Default: 1000

3.3.8 sleep mode

When the device is in low power mode, can be set to NONE(not dormant), TIME(timing dormant) and DEEP(deep sleep). Regular sleep, you need to configure the "wake up time" and "sleep time"; the depth of dormancy, only through the IO1 pin to wake up.

Default: NONE

In regular sleep, keep the device wake-up time, unit MS, when the device wake up super this time will go to sleep.

In regular sleep, keep the device dormant time, unit MS, when the device sleep over this time will wake up, in a normal working state.

3.3.9 Debug level

Debug level control module log display, can be divided into three debugging levels, which:

0 do not output any log information

1 output Key log information

2 output detailed log information

Default: 1