E103- RTL8711 Series Product Instruction Manual

WiFi + BLE 5.0 2.4GHz + 5.8GHz WiFi serial port module



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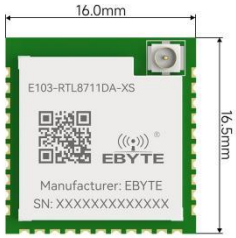
1. Overview

1.1 Introduction

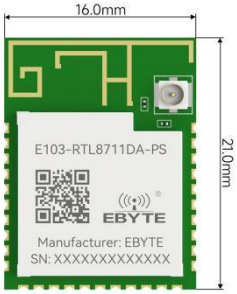
The E103-RTL8711 series is a high-performance 2.4 GHz & 5.8 GHz dual-band Wi-Fi UART module developed by Chengdu Ebyte Electronic Technology Co., Ltd. It complies with the BLE 5.0 and IEEE 802.11b/g/n standards. The module integrates complete hardware and software resources required for Wi-Fi and Bluetooth applications, supports three Wi-Fi operating modes (AP, STA, and STA+AP), as well as Bluetooth Low Energy (BLE), making it highly suitable for low-data-rate applications and data acquisition in smart home, industrial control, and other IoT scenarios.

Powered by the Realtek RTL8711DAF chipset, the module not only supports fundamental BLE features, including both Central and Peripheral modes, but also supports multiple network communication protocols such as TCP, UDP, HTTP, and MQTT, providing flexible and reliable wireless connectivity for a wide range of applications.

The image below shows a sample product appearance. For detailed dimensions and parameters, please refer to Sections 2.1 and 3 of this document .



E103-RTL8711DA-XS



E103-RTL8711DA-PS

1.2 Features

- **WiFi section:**
  - Compliant with WiFi IEEE 802.11b/g/n protocol standards;
  - WiFi operating frequency bands support 2.4GHz & 5.8GHz dual bands ;
  - Supports OTA firmware online upgrade function ;
  - Parameter settings can be configured using AT commands ;
  - Supports Web configuration and WebSocket protocols;
  - Supports character settings such as AP, STA, and hybrid mode;
  - Supports multiple security encryption protocols such as WPA/WPA2/WPA3 to ensure data transmission security;
  - multiple network communication protocols including TCP/UDP/HTTP/ SSL ;
  - Supports up to 20 socket connections;
  - The AP access point supports connection to multiple STA devices;
  - Supports SNTP network time acquisition (provided internet access is available);
  - Supports MQTT network protocol (Alibaba Cloud, Baidu Cloud, OneNet)
  - Supports both static IP address allocation and

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DHCP dynamic allocation;

- **Bluetooth section**
  - BLE operates in the 2.4GHz frequency band;
  - Compliant with BLE 5.0 protocol standard;
  - It meets the requirements for Bluetooth master/slave settings and can realize basic data pass-through and broadcast functions;
  - Supports automatic adjustment of Bluetooth packet length ;
  - Supports data and configuration information encryption to improve information security.
  - Meets the GATT communication protocol;
- It supports low-power functions to meet the needs of various application scenarios.
- Supports file systems for easier workflow;
- Compatible with RS485 communication;
- Supports secondary development; all I/O of the module has been brought out.

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1.3Application scenarios

-Medical and Healthcare

• Multi-parameter patient monitor

• Electrocardiogram (ECG)

• Hospital electronic beds and bed control systems

• Telemedicine system

- Building and Home Automation:

• Heating, ventilation and air conditioning systems and thermostats

• Video surveillance, video doorbells, and low-power cameras

• Building safety systems and low-power electronic locks

-Smart Appliances

-Smart Wearables

- Asset Tracking

-Factory Automation

- Power grid infrastructure

2. Specifications

2.1 Basic parameter selection comparison

Product Model		E103-RTL8711DA-XS	E103-RTL8711DA-PS
Product Appearance			
Chip solutions		RTL8711DAF	RTL8711DAF
WiFi protocol		IEEE 802.11b/g/n	IEEE 802.11b/g/n
Bluetooth protocol		BLE5.0	BLE5.0
Operating frequency band ①	WiFi	24 12 -248 4 MHz	24 12 -248 4 MHz
		5180-58 2 5MHz	5180-58 2 5MHz
	BLE	24 0 2 -248 0 MHz	24 0 2 -248 0 MHz
Operating voltage ②		3.0～3.6V	3.0～3.6V
Communication level ③		3.3V	3.3V
Transmission power ④		20 dBm	20 dBm
Emission current ⑤	2.4GHz band	≈265mA@3.3V power supply	≈265mA@3.3V power supply
	5GHz band	≈328mA@3.3V power supply	≈328mA@3.3V power supply
Received current⑥	2.4GHz band	≈43mA@3.3V power supply	≈43mA@3.3V power supply
	5GHz band	≈46mA@3.3V power supply	≈46mA@3.3V power supply
Average dormant current ⑦	Sleep CG	≈ 87u A	≈ 87u A
	Sleep PG	≈ 422u A	≈ 422u A
	Deep sleep	≈ 11u A	≈ 11u A
Reference distance ⑧	WiFi	710m	550m
	BLE	430m	260m
Operating temperature		-20～+70℃	-20～+70℃
Storage temperature		-40～+95℃	-40～+95℃
Antenna type		IPEX-1	PCB board onboard
Flash		2MB	2MB
Packaging method		SMD patch	SMD patch
Size 9		16.5*16*2.7mm	21.0*16*2.7mm
Weight 10		≈ 1.6 g	≈ 1.9 g

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Note:

(1)Operating frequency band: In WiFi mode, the operating frequency band supports 2.4GHz & 5GHz, while in Bluetooth mode, the operating frequency band supports 2.4GHz, and it supports the global unlicensed ISM 2.4GHz band.

(2)Operating voltage: Exceeding 3.6V poses a risk of permanently burning out the module.

(3)Communication level: Using 5V TTL carries a risk of burnout.

(4)Transmit power: 20 dBm by default, with an error range of ±1 dBm. The power varies under different WiFi protocols (20 dBm power was tested under 2.GHz@11b 11Mbps conditions) . The output power in Bluetooth mode is approximately 8 dBm.

(5)Transmit current: 20 dBm for data transmission in WiFi mode.

(6)Received current: Data transmission is performed in WiFi mode.

(7)Average sleep current: When operating in WiFi mode , there are three sleep modes. For details, please refer to the "AT Command Manual".

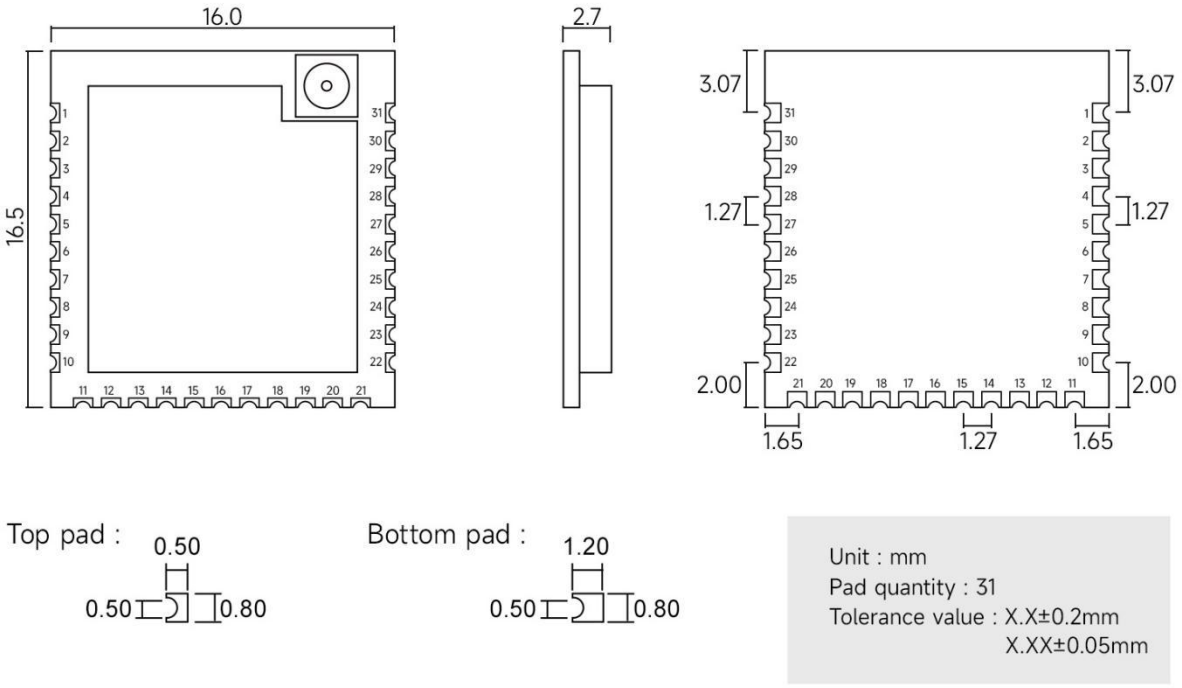
(8)Transmission distance: Under good, open, and sunny conditions (for reference only; actual testing is recommended).

(9)Shell dimensions: tolerance is ±0.2mm. For detailed dimensions, please refer to Chapter 3 of this document .

(10)Weight: The error is ±0.2g.

3. Mechanical dimensions and pin definitions

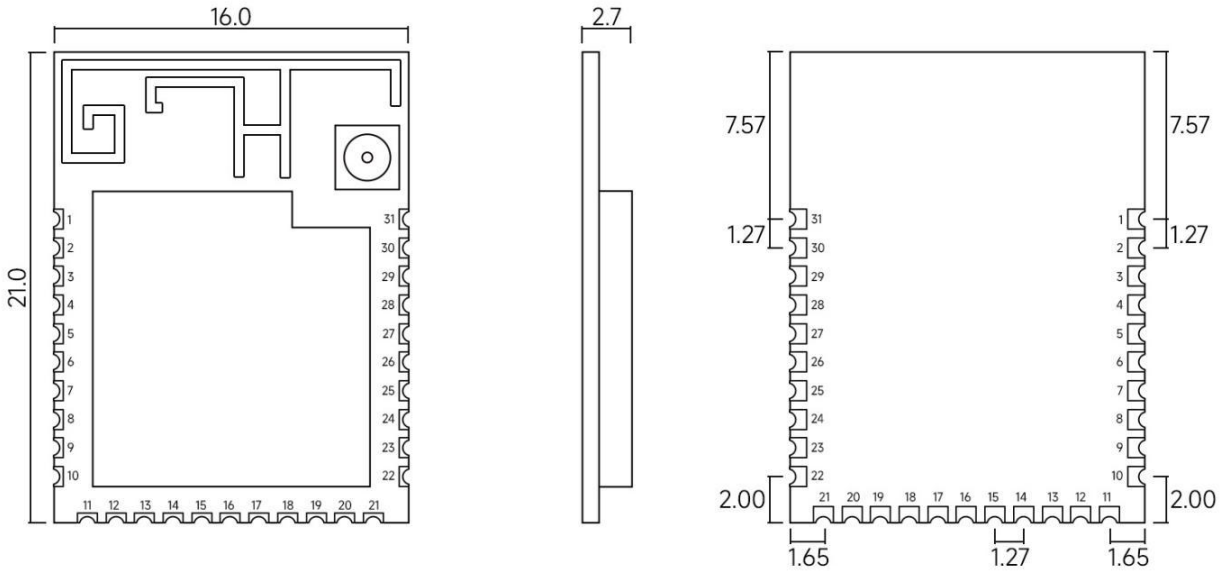
3.1 E103-RTL8711DA-XS Pin Diagram



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3.2 E103-RTL8711DA - PS Pin Diagram



The two modules differ only in their packages; their pins are compatible. Pin definitions are as follows:

Pin number	Pin Name	Pin type	Pin Applications
1	BAT_MEAS		
2	PB4_LOGRXD	I/O	LOGRXD firmware download and log printing serial port
3	PB5_LOGTXD	I/O	LOG T XD firmware download and log printing serial port
4	PB17	I/O	Ordinary GPIO pins can be reused for other functions.
5	PB18	I/O	Ordinary GPIO pins can be reused for other functions.
6	PB19	I/O	Ordinary GPIO pins can be reused for other functions.
7	PB20	I/O	Ordinary GPIO pins can be reused for other functions.
8	PB21	I/O	Ordinary GPIO pins can be reused for other functions.
9	PB30	I/O	Wakeup Pin
10	PB31	I/O	Wakeup Pin
11	CHIP_EN	RST	Reset pin
12	VDD	P	Module power supply VDD
13	GND	G	Module power supply GND
14	PA8	I/O	Ordinary GPIO pins can be reused for other functions.
15	PA12	I/O	Ordinary GPIO pins can be reused for other functions.
16	PA13	I/O	Ordinary GPIO pins can be reused for other functions.
17	PA14	I/O	Ordinary GPIO pins can be reused for other functions.
18	PA15	I/O	Ordinary GPIO pins can be reused for other functions.
19	PA16	I/O	Ordinary GPIO pins can be reused for other functions.

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20	PA17	I/O	Ordinary GPIO pins can be reused for other functions.
21	PA18	I/O	Ordinary GPIO pins can be reused for other functions.
22	PA26	I/O	Ordinary GPIO pins can be reused for other functions.
23	PA27	I/O	Ordinary GPIO pins can be reused for other functions.
24	USB-	I/O	Standard GPIO pins can be reused for USB and other functions.
25	USB+	I/O	Standard GPIO pins can be reused for USB+ and other functions.
26	PA30	I/O	Ordinary GPIO pins can be reused for other functions, SWD CLK
27	PA31	I/O	Ordinary GPIO pins can be reused for other functions, SWD DATA
28	NC	/	/
29	GND	G	Module power supply GND
30	NC	/	/
31	GND	G	Module power supply GND

Note: AT commands use UART for communication by default. The pin functions are defined as follows:

Pin	Function	Remark
PB30	RX	● Baud rate: 115200 ● Data bits: 8 bits ● Stop bit: 1 bit ● Check digit: None ● Command suffix: Carriage Return/Line Feed (CRLF) ● For detailed instructions, please refer to the "AT Command Manual".
PB31	TX	

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4. Function Description

The module can be configured to operate in either Wi-Fi mode or BLE mode through AT commands.From the Wi-Fi perspective, the module supports three operating modes: AP (Access Point), STA (Station), and STA+AP (Concurrent Access Point and Station).From the BLE perspective, the module supports both Central and Peripheral roles.
At the network layer, the module supports multiple communication protocols, including TCP (Server/Client), TLS (Server/Client), UDP, HTTP, and MQTT, enabling flexible and reliable wireless data communication for various IoT applications.

4.1 Work Role

This section describes the working methods supported by the module.

4.2 Access Point (AP mode)

Access Point (AP) mode, similar to a router, allows wireless devices to connect and establish TCP/IP-based server, client, and UDP communication. This mode supports multiple stations and up to 20 TCP socket transmissions. The command AT+WLSTARTAP is used to configure the module to initialize the AP.

4.3 Station (STA mode)

Station mode, abbreviated as STA, allows the module to operate as a Wi-Fi client. In this mode, the module does not provide wireless access for other devices; instead, it connects to an Access Point (AP) or wireless router. When operating in STA mode, the module supports TCP Server, TCP Client, UDP, and up to 20 simultaneous socket connections. It also supports MQTT and HTTP Client protocols. The AT+WLCONN command is used to configure the module to operate as an STA and connect to a specified Access Point (AP).

4.4 Access Point + Station (STA + AP mode)

Access Point + Station mode, abbreviated as STA+AP, enables the module to operate simultaneously as both a Wi-Fi Access Point (AP) and a Station (STA). In this mode, the module can create its own wireless hotspot while also connecting to another Access Point or wireless router. By default, both AP and STA functions are enabled and operate concurrently..

4.5 Network function

The module supports multiple network communication protocols, including TLS Server, TLS Client, TCP Server, TCP Client, UDP, MQTT, and HTTP Client. All network functions can operate simultaneously. For example, the module can function as a TCP Server while concurrently establishing TCP Client connections to other devices.

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Note: The TLS function requires a significant amount of system resources. Therefore, TLS connections cannot be used simultaneously with other network services. When a TLS Server or TLS Client connection is active, it must operate independently.

4.5.1 TCP server

The module can initialize a TCP server. In this mode, a maximum of 20 sockets can be connected. After the module initializes a server, the entire module shares 5 sockets. For example, if the server module connects to 5 clients, then the server module can no longer act as a client to connect to other server modules. Conversely, if the server module only connects to 4 clients, then the module can still act as a client to connect to a server.

4.5.2 TCP client

The module connects to other TCP servers. In single TCP client mode, it can connect to up to 20 sockets .

4.5.3 UDP

The module supports UDP communication through the UDP mode of the AT+SKTCLIENT command, allowing it to communicate with a remote device running a UDP service. The module supports up to 20 simultaneous socket connections.
Note: The module does not support UDP server (UDP listening) functionality. It can only operate as a UDP client.

4.5.4 MQTT

In MQTT mode, the module supports IoT platforms such as Alibaba Cloud, Baidu Cloud, and OneNet. Communication can be established by simply adding the service parameters created on the platform to the module.

4.5.4.1 Alibaba Cloud

Network communication based on the Alibaba Cloud platform requires logging into Alibaba Cloud to obtain relevant parameters, mainly including product key, device name, client ID, etc. See Chapter 7, Alibaba Cloud Configuration Tutorial, for details.

4.5.5 HTTP Client

When using this function, you only need to configure the corresponding server resource URL and initiate a single request to obtain the resource from the server response. There's no need to worry about the complex HTTP protocol layer; see the AT command manual for details.

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4.6 Low power consumption

This module has two low-power modes :

Low- power sleep (AT+LPOWER=1,1,0) is a relatively power-efficient sleep mode. In this mode, the power supply to the SOC domain is turned off ; only some hardware modules are working and can be woken up by peripherals in the AON and SYSON domains to restore the system to normal voltage and continue operation.

Deep sleep (AT+LPOWER=1,1,2) is a relatively power-efficient sleep mode. In this mode, only peripherals in the AON domain are active; all other hardware modules are powered down. The system exits deep sleep only when triggered by an AON domain peripheral interrupt wake-up signal. (**Note: Wake-up will reset the system.**)

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5. User Guide

- This module has many functions, and relevant parameters need to be configured before it can work properly . **For details, please refer to the "Quick Start Guide"** , which can be downloaded from the Ebyte website .
- The manual contains AT commands. For command usage specifications and details, please download **the "AT Command Manual" from the EBITE website** .

6. Welding Operation Instructions

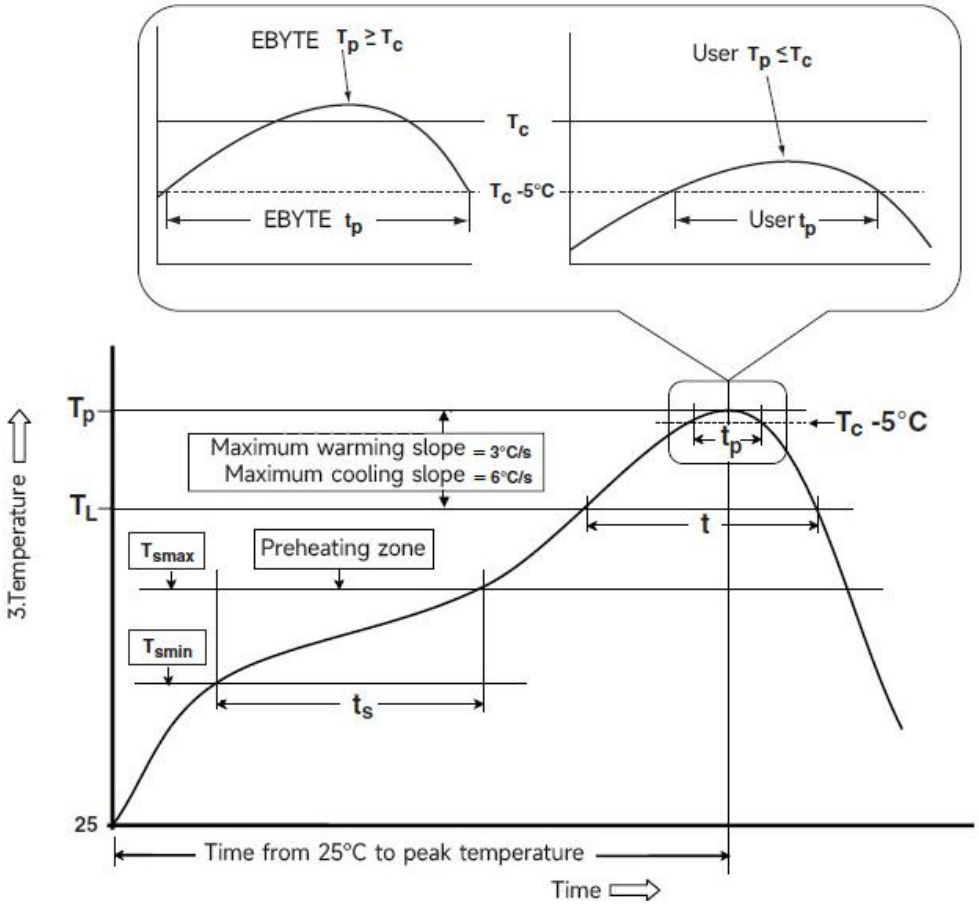
6.1 Reflow soldering temperature

Reflow soldering profile characteristics		Lead-based assembly	Lead-free assembly
Preheating/Insulation	Minimum temperature (Tsmin)	100℃	150℃
	Maximum temperature (T _{smax})	150℃	200℃
	Time (T smin ~ T smin)	60-120 seconds	60-120 seconds
Temperature rise slope (TL ~ Tp)		3℃/second, maximum value	3℃/second, maximum value
Liquid phase temperature (TL)		183℃	217℃
T L above the holding time		60~90 seconds	60~90 seconds
Package peak temperature Tp		Users must not exceed the temperature specified on the product's "humidity sensitivity" label.	Users must not exceed the temperature specified on the product's "humidity sensitivity" label.
Tp) within 5°C of the specified grading temperature (Tc) is shown in the figure below.		20 seconds	30 seconds
Cooling slope (Tp ~ TL)		6℃/second, maximum value	6℃/second, maximum value
Time from room temperature to peak temperature		6 minutes, the longest	8 minutes, the longest
* The peak temperature (Tp) tolerance of the temperature profile is defined as the user's upper limit.			

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7.2 Reflow Soldering Profile



7. Frequently Asked Questions

7.1Transmission distance is not ideal

- When there are obstacles in line-of-sight communication, the communication distance will be reduced accordingly;
- Temperature, humidity, and co-channel interference can all lead to increased packet loss rates in communications.
- The ground absorbs and reflects radio waves, and the test results are poor when the ground is close to the ground.
- Seawater has a strong ability to absorb radio waves, so testing results are poor at the seaside.
- If there are metal objects near the antenna, or if it is placed inside a metal casing, the signal attenuation will be very severe.
- Power register settings are incorrect; air speed is set too high (the higher the air speed, the shorter the distance).
- At room temperature, the power supply voltage is lower than the recommended value; the lower the voltage, the lower the power output.
- The antenna may be poorly matched with the module or have quality issues.

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7.2 Module is easily damaged

- Please check the power supply and ensure it is within the recommended voltage range. Exceeding the maximum value will cause permanent damage to the module.
- Please check the power supply stability; the voltage should not fluctuate significantly or frequently.
- Please ensure anti-static operation during installation and use, as high-frequency devices are sensitive to electrostatic discharge.
- Please ensure that the humidity is not too high during installation and use, as some components are humidity-sensitive.
- Unless there are special requirements, it is not recommended to use it at excessively high or low temperatures.

7.3 Too high error rate

- If there is interference from a co-channel signal nearby, move away from the source of interference or change the frequency or channel to avoid the interference.
- An inadequate power supply can also cause garbled characters, so it is essential to ensure the reliability of the power supply.
- Poor quality or excessive length of extension lines or feeders can also lead to a high bit error rate.

Revision History

Version	Revision Date	Revision Notes	maintainer
1.0	2026-06-12	Initial version	Hao

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