U.S. Converters LLC

# Wireless Modem

## User Manual




**E90-DTU(2G4HD12)**

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# 1. Overview

## 1.1 Introduction

E90-DTU (2G4HD12) is a high-quality, industrial-grade wireless data transceiver designed for reliable operation in environments with complex electromagnetic interference. Compared with conventional wireless data radios, it provides low latency, full-duplex communication, automatic frequency hopping, and high-speed continuous transmission. Its strong anti-interference capability helps provide stable and reliable wireless communication in industrial applications.

E90-DTU (2G4HD12) is a point-to-point, frequency-hopping, full-duplex wireless data transceiver operating in the license-free 2.4 GHz ISM band. It provides up to +12 dBm transmit power, transparent data transmission, RS-232 and RS-485 interfaces, and an 8-28 VDC input range. The wireless link incorporates CRC checking, FEC (Forward Error Correction), packet retransmission, and automatic frequency hopping. These technologies improve transmission reliability and help maintain communication when interference occurs.

The transceiver supports continuous bidirectional data transmission, allowing data to be sent through the serial interface whenever the wireless link is established. As a wireless communication medium, it is well suited for applications requiring reliable real-time data transmission where cabling is impractical or costly. Typical connections include PLCs, RTUs, rain gauges, level sensors, and other industrial data terminals.

## 1.2 Features

- Uses automatic frequency-hopping technology for strong interference resistance and stable communication;
- Supports continuous bidirectional data transmission;
- Supports AT commands and PC-based configuration;
- Industrial-grade port protection;
- Simple high-efficiency power supply design, support power supply configuration or pressure line mode, support 8 ~ 28V power supply;
- Transmit power up to +12 dBm; technical specifications meet European industrial standards;
- Operating temperature: -40°C to +85°C, suitable for harsh industrial environments;

Operating temperature: -40°C to +85°C, suitable for harsh industrial environments;

- All aluminum alloy shell, compact size, easy installation, good heat dissipation; perfect shielding design, good electromagnetic compatibility, strong anti-interference ability;
- Multiple protection functions such as power reverse connection protection, over-connection protection, and antenna surge protection greatly increase the reliability of the radio;
- Simple plug-and-play operation; communication begins after the wireless link is established;

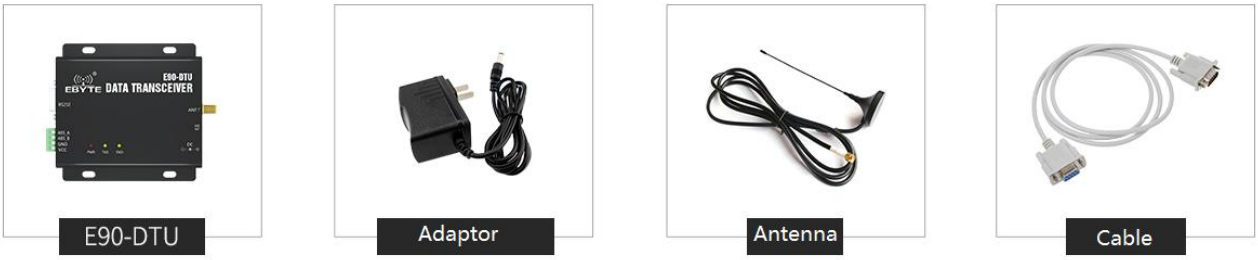
- Built-in hardware watchdog, and accurate time layout, once an exception occurs, the module will automatically

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restart, and can continue to work according to the previous parameter settings.

# 2. Quick Start

The user needs to prepare the following items:




## 2.1 Configuration Software Guide

First, connect the antenna to the DTU. Then connect the DTU to the computer using a USB-to-RS-232 or USB-to-RS-485 adapter. Set M1 to the UP position; M0 may be in either position. This places the DTU in Configuration Mode.

The configuration software is used to read and modify DTU parameters. The DTU must be in Configuration Mode before parameters can be read or changed. The software interface is shown below:

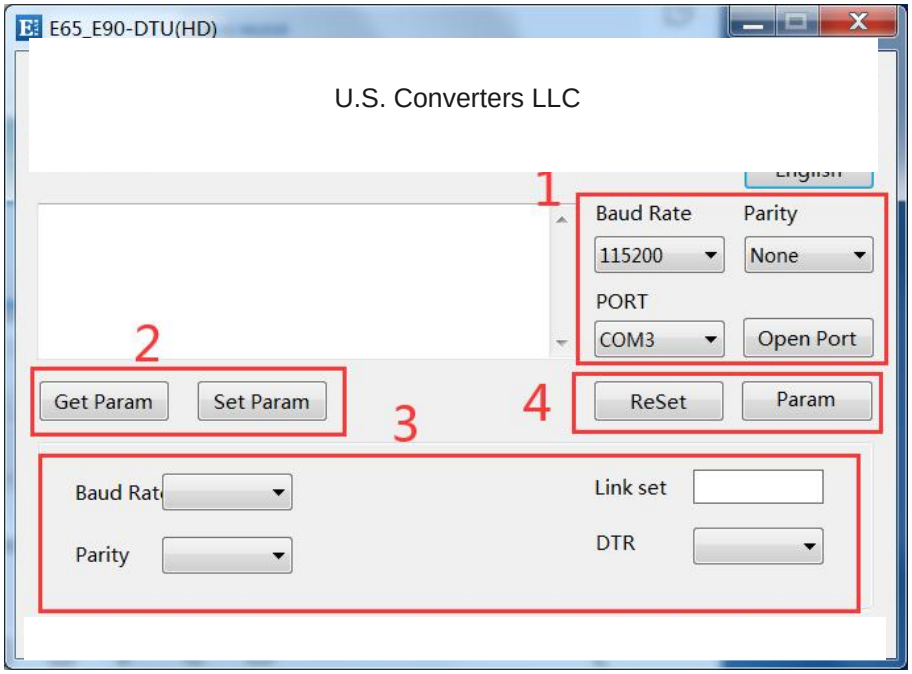



Figure 2-1 PC software interface

Software Description

| No | Description |
|---|---|
| 1 | Serial port parameter area |
| 2 | Command execution area |

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| | |
|---|---|
| 3 | Parameter area |
| 4 | Special command area |

1. Select the DTU's current baud rate and parity setting, select the appropriate COM port, and open the serial port. The DTU must be in Configuration Mode and the correct serial-port settings must be selected; otherwise, commands will fail.

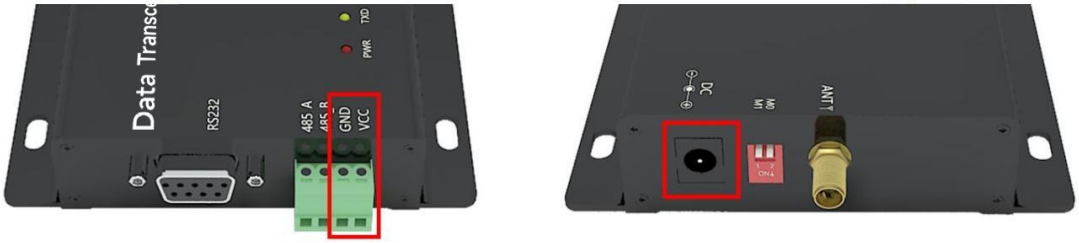
2. Read and write parameters: Click "Read Parameters" to retrieve the current DTU settings. The values will be displayed in the parameter area. After changing the desired values, click "Write Parameters" to save them to the DTU.

3. The parameter area displays the current settings after they are read and allows values to be changed before they are written to the DTU.

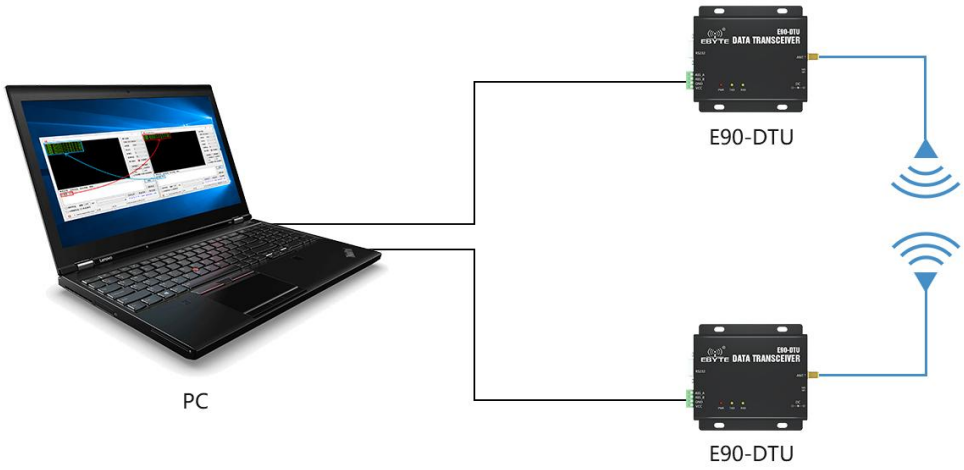
4. The Restart and Restore Factory Settings commands are used to restart the DTU or return its parameters to the factory defaults.

## 2.2 Setting Steps

1. Install the antenna and connect the power supply. Set M1 to the DOWN position; M0 may be in either position. The DTU will enter Transparent Transmission Mode. The DTU can be powered through the RS-485 terminal block or the DC power connector.

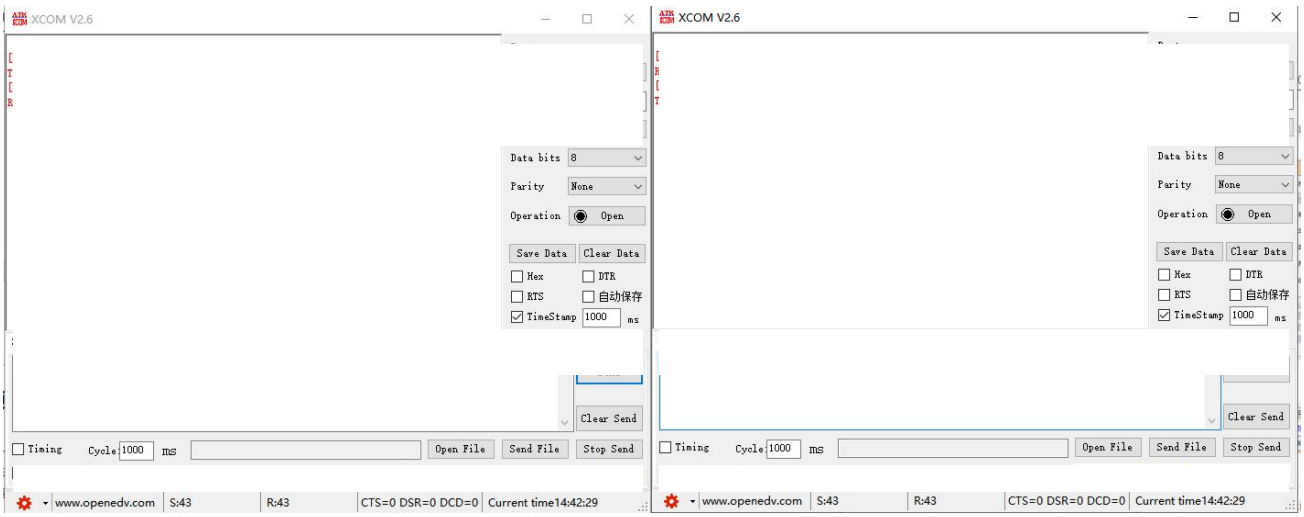



2. Connect the DTU to the computer using a USB-to-RS-232 or USB-to-RS-485 adapter, then apply power. The DTU will automatically search for and connect to another DTU with the same communication-link setting. When the connection is established, the LINK LED remains on and data communication can begin.




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3.Open two serial port debugging assistants on the computer, select the default serial port baud rate 115200bps, parity is 8N1, you can realize serial port transparent transmission.




4. If the user needs to modify the parameters, please pull down M0 and M1, connect to computer, open E65_E90-DTU(HD)DTU setting software to modify the parameters. After completing the configuration, the user must restore M0 and M1 to transceiving mode.



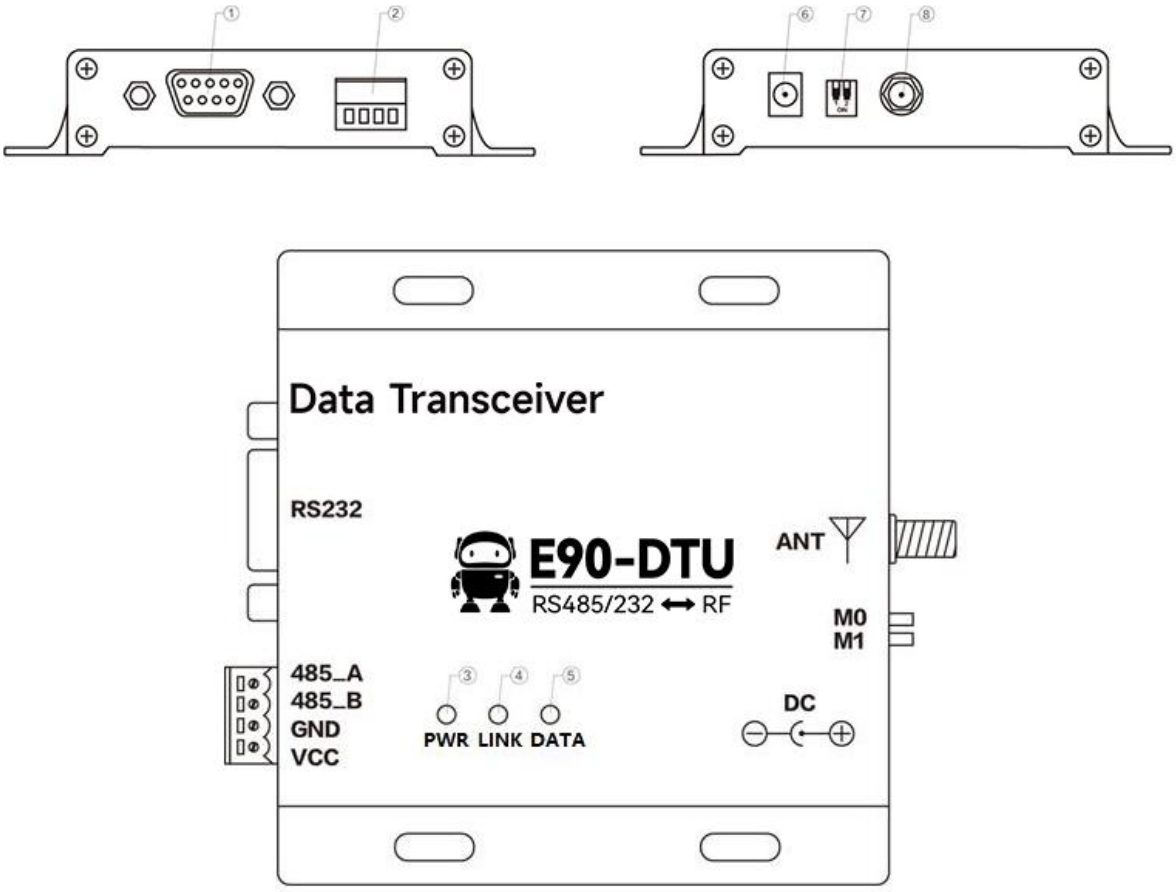

Transceiving Mode




Configuration Mode

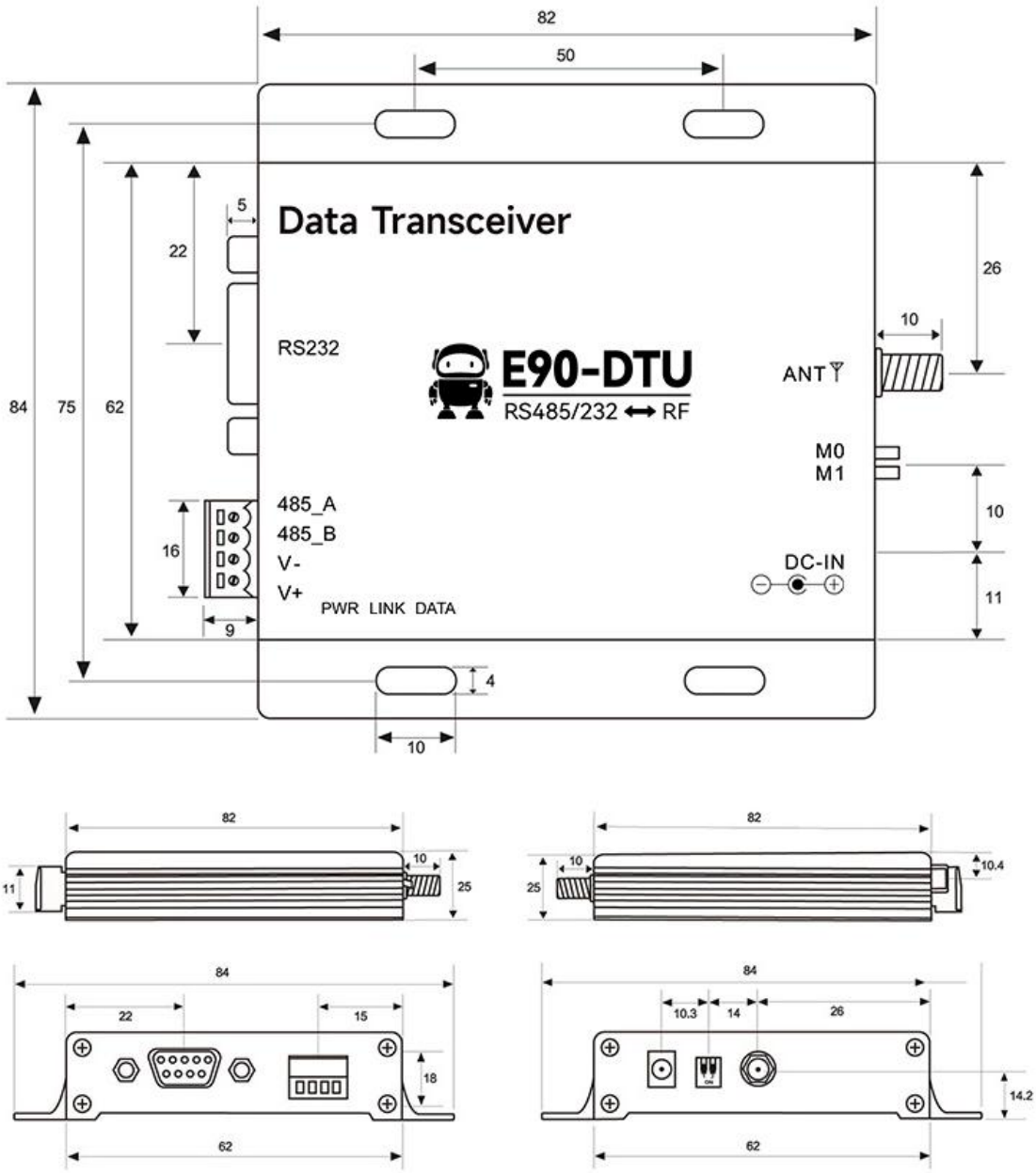
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# 3. Housing and Ports




| NO. | Name | Function | Notes |
|---|---|---|---|
| 1 | DB-9 female socket | RS-232 interface | Standard RS-232 interface |
| 2 | 3.81 terminal block | RS-485, power interface | Standard RS-485 interface and pressure line power interface |
| 3 | PWR-LED | Power Indicator | Red, lights up when the power is on |
| 4 | LINK-LED | Data transceiver indicator | Yellow, the connection is successful |
| 5 | DATA-LED | Serial data indicator | Yellow, flashing during data transmission |
| 6 | DC power interface | Power connector | Push-in round hole, outer diameter 5.5mm, inner diameter 2.5mm |
| 7 | DIP switch | Mode selection | Configuration mode: M1=UP, M0=any;<br>Transparent transmission mode: M1=Down, M0=Any |
| 8 | Antenna interface | SMA-K interface | External thread inner hole, length 10mm, characteristic impedance 50Ω |

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Unit: mm

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# 4. Definitions

## 4.1 Power Connection Ports




The DTU can be powered using either of the following connections:

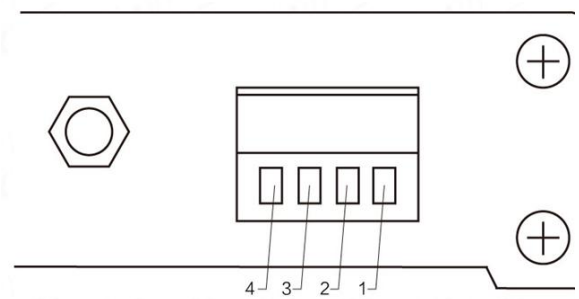
Port ⑥ to connect to the DC power port whose interface is 5.5mm in outer diameter and 2.5mm in inner diameter
Or Port② RS485 by VCC and GND.
The DTU can be powered by 8～28V DC power supply, and 12V or 24V DC power supply is recommended.

## 4.2 RS232 Interface

The E90-DTU uses a standard DB-9 connector for RS-232 communication.

## 4.3 RS485 Interface

E90-DTU can use the 485_A terminal and 485_B terminal in ② to connect to the RS-485 A terminal and B terminal of the device respectively.




| NO. | Name | Function | Notes |
|---|---|---|---|
| 1 | VCC | Screw type power connector, positive | DC 8～28V, 12V or 24V is recommended |
| 2 | GND | Screw type power connector, negative | The negative pole of the power supply is connected to the ground and the shell |
| 3 | 485_B | RS-485 B interface | RS-485 interface B interface is connected to device B interface |
| 4 | 485_A | RS-485 A interface | RS-485 interface A interface is connected to device A interface |

★ Note: If the DTU is connected to multiple devices, communication may not be smooth. Please try to connect a 120Ω resistor in parallel between the 485_A terminal and the 485_B terminal. There is no such phenomenon when connecting a single device.

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# 5. Parameters

## 5.1 Model details

| Model | Freq. | TX Power | Test range | feature | Application feature |
|---|---|---|---|---|---|
| | Hz | dbm | m | | |
| E90-DTU(2G4HD12) | 2.4G | 12 | 800 | Point-to-point frequency hopping, bidirectional continuous transmission | Suitable for applications with long communication distance and radio interference |

★ **Test range conditions:** sunny and clear sky, test environment is open and unobstructed, 12V/1A power supply, 5dBi antenna, the antenna is 2 meters above the ground, and the default parameters are used.

## 5.2 Other parameters

| No | Name | Value | Description |
|---|---|---|---|
| 1 | Product Size | 82*62*25 mm | See installation dimensions for details |
| 2 | Product Weight | 130g | Weight tolerance 4.5g |
| 3 | Operating temperature | -40℃～+85℃ | Suitable for industrial applications |
| 4 | Antenna impedance | 50Ω | Standard 50Ω characteristic impedance |
| 5 | Voltage Range | 8～28V DC | 12 V or 24 V recommended |
| 6 | Communication Interface | RS232/RS485 | Standard DB9 hole/3.81 terminal block |
| 7 | Baud rate | Default 115200 | Baud rate range 1200～921600，Please refer to 6.4 Hardware baud rate control for more information. |

## 5.3 Frequency range and Channels

| Mode | Main Freq. | Range | Channel Width | Channels |
|---|---|---|---|---|
| | Hz | Hz | Hz | |
| E90-DTU(2G4HD12) | 2.4G | 2.4～2.48G | 1M | 80(full duplex) |

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## 5.4 Electronic Parameters

| Mode | Ave. Tx Current mA | | Ave. Standby Current mA | |
|---|---|---|---|---|
| | 12V | 24V | 12V | 24V |
| E90-DTU(2G4HD12) | 35 | 18 | 35 | 18 |

★ Note: 12V transient transmission MAX current: 66mA, 24V transient transmission MAX current: 33mA, it is recommended to reserve ≥50% MAX current margin when selecting the power supply, which is beneficial to the long-term stable operation of DTU.

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# 6. Working Mode

## 6.1 Modes

The M1 switch selects between two operating modes. vitch.

Transparent Transmission Mode - M1 = 0 (LOW): The serial port is active and the DTU can transmit and receive data transparently when the wireless link is established.

Configuration Mode - M1 = 1 (HIGH): Parameters can be read or configured through the serial port. RF data transmission and reception are disabled in this mode.

Note: Transparent Transmission Mode is available only after the LINK LED remains continuously on.

### 6.1.1 Transparent transceiving mode

When M1 is set to Transparent Transmission Mode, data can be transmitted and received after the LINK LED remains continuously on. If the LINK LED is off, the DTU is searching for another device with the same communication-link setting and data communication is not available. When a matching device is found and the connection is established, the LINK LED remains on.

### 6.1.2 Configuration Mode

In configuration mode, DTU cannot transmit or receive data via radio frequency. Users can send AT commands to DTU.

### 6.1.3 Mode Switching

The M1 switch selects the operating mode. A mode change takes effect approximately 100 ms after the M1 position is changed.

### 6.1.4 DTU Reset

After a hardware reset or software restart, the LINK LED turns off while the DTU searches for a matching device. Once the wireless connection is established, the LINK LED remains on and the DTU operates according to the mode selected by M1. Wireless data should be transmitted only after the LINK LED remains on.

## 6.2 DATA LED Indicator

The DATA LED indicates serial-interface activity in Transparent Transmission Mode. It flashes whenever data is being transmitted or received through the DTU communication interface.

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## 6.3 Point-to-point communication mechanism

? The communication-link value can be set from 1 to 9999 using AT commands or the configuration software. The factory-default value is 1.
? If the connection is lost because of a power interruption, excessive distance, or strong interference, correct the cause if possible. The DTU will automatically return to search mode until it finds a device with the same link value and re-establishes the connection.
? If two or more E90-DTU (2G4HD12) units use the same communication-link value and are powered on at the same time, pairing may occur randomly. For installations with multiple DTU pairs, assign a unique link value to each pair.

## 6.4 Hardware baud rate control

? Flow control can be enabled or disabled using the AT commands in Chapter 7 or the configuration software. Hardware flow control is disabled by default.
? Hardware flow control is supported only by the RS-232 interface. It can be used for continuous bidirectional transfer of large amounts of data. The RS-232 interface supports baud rates up to 115200 bps.
? The RS-485 interface supports baud rates from 1.2 kbps to 3 Mbps without hardware flow control.

## 6.5 Full duplex/high-speed continuous transmission

? During bidirectional communication, especially during file transfers, the available channel capacity may differ in each direction. As a result, the transfer rate in one direction may be lower than in the other; this is normal.
? For continuous transmission of large amounts of data, maintain a continuous data stream whenever possible. Frequent interruptions between small data frames may reduce wireless transmission efficiency.

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# 7. AT command

## 7.1 Default Parameter for AT command

| | |
|---|---|
| Baud rate | 115200 bps |
| Parity | 0（parity disabled） |
| Flow Control | 0（off） |
| Communication link | 1 |

## 7.2 AT Command Description

1. AT commands are ASCII text;
2. The AT command ends with "\r\n" (the description of \r\n will not be repeated later).
3. AT commands are not case-sensitive.
4. The numeric type of the unspecified type parameter in the AT command is a decimal string.

## 7.3 AT Command Error Code

| Error Code | Description | Possible reason for the error |
|---|---|---|
| -1 | The parameter length is wrong or empty | Compare the instruction parameter range described in the instruction table, the instruction does not carry parameters |
| -2 | Parameter data error | Compare the instruction parameter range described in the instruction table |
| -3 | Command does not exist | Compare the instruction format described in the instruction table |
| -4 | No terminator (\r\n) | Serial port tool not selected: send a new line |

## 7.4 AT Command List

### 7.4.1 AT Test

| Command | Reply |
|---|---|
| **AT** | +OK |
| Note: +OK indicates that the DTU has entered AT command mode. | \T mode |

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### 7.4.2 AT+RESET: Restart

| Command | Reply |
|---|---|
| **AT+RESET** | +OK |
| Note: Takes effect immediately. diately | |

### 7.4.3 AT+RESTORE: Restore Factory Defaults

| Command | Reply |
|---|---|
| **AT+RESTORE** | OK |
| **Note:**<br>**After resetting, it will restart automatically;**<br>**In the process of restoring factory settings, any form of reset is prohibited, and power off before the operation is completed is prohibited;** | |

### 7.4.4 AT+BAUD: Set Baud Rate

| Command | | Reply |
|---|---|---|
| Query | AT+BAUD? | +OK=[baud] |
| Setting | AT+BAUD=[baud] | +OK：Success<br>+ERR=[NUM]：Fail |
| NO | **BAUD** | **Value（bps）** |
| | 0 | 1200 |
| | 1 | 2400 |
| | 2 | 4800 |
| | 3 | 9600 |
| | 4 | 19200 |
| | 5 | 38400 |
| | 6 | 57600 |
| | 7 | 115200（factory default） |
| | 8 | 230400 |
| | 9 | 256000 |
| | 10 | 460800 |
| | 11 | 921600 |
| | 12 | 1000000 |
| Note | Effective after reboot, still effective when next power on | |
| Example | AT+BAUD=7: to set baud rate to 115200 | |

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### 7.4.5 AT+PARITY, Parity Setting

| Command | | Reply |
|---|---|---|
| Query | AT+PARITY? | +OK=[ parity] |
| Format | AT+PARITY=[parity] | +OK：Success<br>+ERR=[NUM]：error |
| data | **Parity** | **Description** |
| | 0 | No Parity (default) |
| | 1 | Even parity |
| | 2 | Odd parity |
| note | Reboot to take effect, save when power off | |
| example | AT+PARITY=0, no parity | |

### 7.4.6 AT+HWFC , Serial flow control

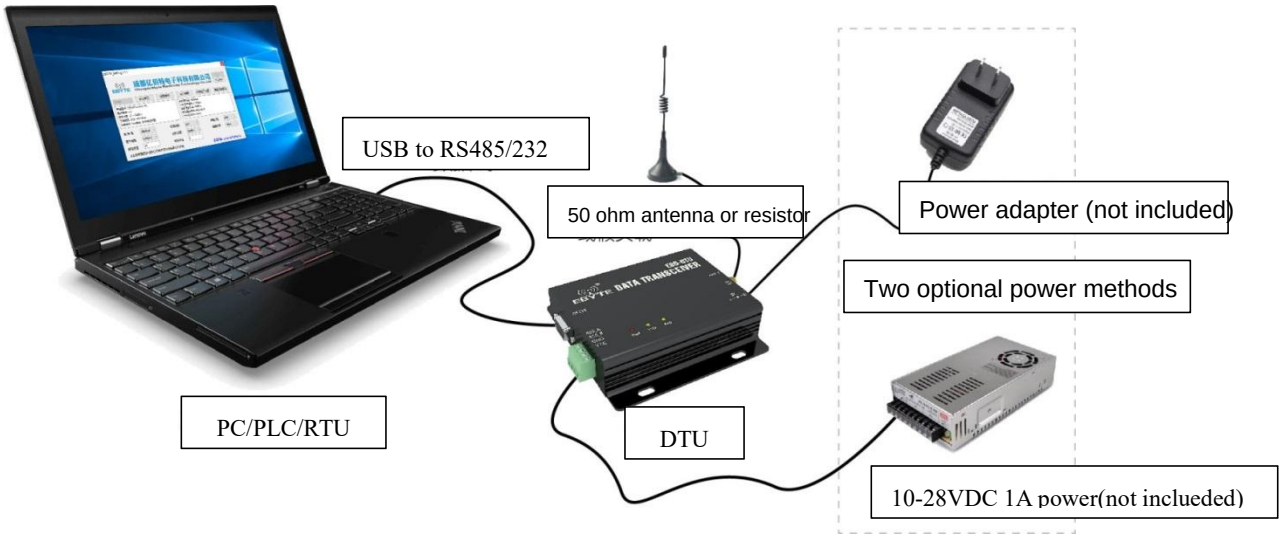
| Command | | Reply |
|---|---|---|
| Query | AT+HWFC? | +OK=[para] |
| Format | AT+ HWFC =[para] | +OK：success<br>+ERR=[NUM]：error |
| data | **Para** | **Description** |
| | 0 | Flow control off (default) |
| | 1 | Flow control on |
| note | Reboot to take effect, save when power off | |
| example | AT+HWFC=0 | |

### 7.4.7 AT+LINK , Communication link setting

| Command | | Reply |
|---|---|---|
| Query | AT+LINK? | +OK=[para] |
| Format | AT+ LINK =[para] | +OK：success<br>+ERR=[NUM]：error |
| data | Para: Communication link. The value range is 1 to 9999, and the default value is 1 | |
| note | Take effect immediately (and automatically restart), save when power off; | |
| example | | |

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# 8. Device Connection Reference




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# 9.0 Similar Products

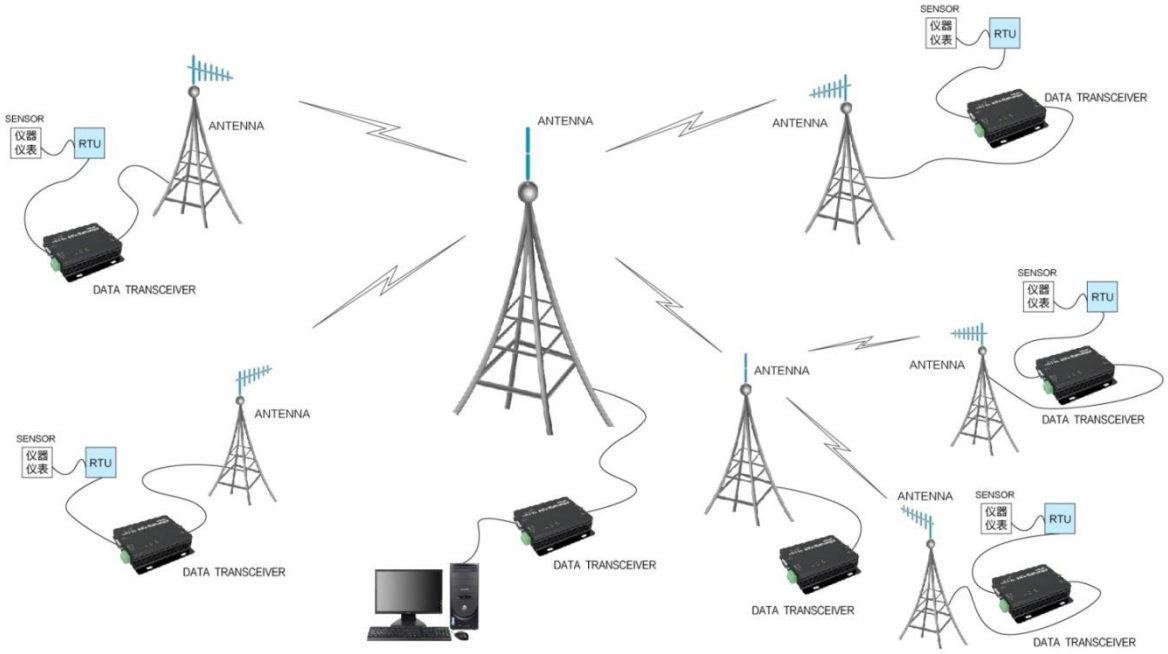
| Model | interface | Freq(Hz) | Tx Power | Test Range | Main Features |
|---|---|---|---|---|---|
| E34-DTU(2G4H27) | RS232/RS485 | 2.4G | 27dBm | 5km | Automatic frequency hopping, retransmission if any packets lost. |
| E34-DTU(2G4H20) | RS232/RS485 | 2.4G | 20dBm | 2.5km | Automatic frequency hopping, retransmission if any packets lost. |

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# 10. Applications :

The E90-DTU is suitable for point-to-point wireless data transmission in a wide range of applications, including smart-home and IoT systems, power-load monitoring, distribution automation, hydrology and water-level monitoring, municipal water-network monitoring, street-light control, alarm systems, railway signal monitoring, centralized water-supply control, oil and gas pipeline monitoring, GPS systems, remote meter reading, electronic weighing systems, environmental monitoring, fire and theft prevention, and other industrial automation applications. Typical application examples are shown below:

As shown below:




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# 11. User Notes and Safety Information

1. Keep the device warranty information for future reference. The factory number and important technical parameters may be required for maintenance, service, or equipment replacement.

equipment.

2. During the warranty period, product failures caused by manufacturing defects may be covered by the warranty. Do not attempt unauthorized repairs. Contact U.S. Converters LLC for technical support or service assistance.

3. Do not operate the DTU in flammable or explosive environments, such as coal mines or areas containing explosive materials.

4. Use a suitable regulated DC power supply with low ripple, adequate load capacity, and good resistance to high-frequency interference. Overcurrent, overvoltage, and surge protection are recommended for reliable operation.

5. Do not operate the DTU outside its specified environmental limits, including excessive heat, cold, humidity, dust, or strong electromagnetic fields.

6. Avoid continuous full-load transmission for extended periods, as excessive operation may damage the transmitter.

7. The ground wire of the DTU should be well connected with the ground wire of the external equipment (such as PC, PLC, etc.) and the ground wire of the power supply, otherwise it is easy to burn out the communication interface, etc.; do not plug or unplug the serial port with power on.

8. When testing the DTU, always connect a properly matched antenna or a 50-ohm dummy load. Operating the transmitter without a suitable load may cause damage. When an antenna is connected, maintain appropriate separation from people and do not touch the antenna while transmitting.

9. Wireless communication range varies with the operating environment. Temperature, humidity, obstacles, antenna placement, and electromagnetic interference can all affect range. For reliable operation, design the installation with adequate communication-range margin.

10. If the measured communication distance is not ideal, it is recommended to analyze and improve the communication

help.

11. When selecting the power supply, in addition to retaining 50% of the current margin as recommended, it should be noted that its ripple should not exceed 100mV.
12. Wireless communication products need to be connected to an impedance-matched antenna to work normally. Even a short-term test cannot be omitted. If the product is damaged due to this reason, it will not be covered by the warranty.

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1. U.S Copyright Notice to revise this manual.

**12.**

2. Due to the continuous improvement of product hardware and software, this manual may be changed without prior notice, and the latest version of the manual shall prevail.
3. It is everyone's responsibility to protect the environment: In order to reduce the use of paper, this manual only prints the Chinese part, and the English manual only provides electronic documents. If necessary, please download from our official website; in addition, if not specifically requested by users, users can order in bulk At the time, we only provide product manuals according to a certain proportion of the order quantity, not every DTU is matched one by one, please understand.

# Revision History

| Version | Description | Issued by |
|---|---|---|
| 1.0 | Initial version | Li |
| 1.1 | Modified 6.1.2 Baud Rate Fixed 115200 in Configuration Mode 7.4.8 Content added | ken |
| 1.2 | Initial version | LY |
| 1.3 | Error corrected | Bin |
| 1.4 | Error corrected | Hao |
| 1.5 | Example Modify the baud rate description | Hao |

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