Chengdu Ebyte Electronic Technology Co.,Ltd

Wireless Modem

User Manual

E90-DTU(400SL44)



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1. Introduction

1.1 Brief introduction

E90-DTU (400SL44) is a true high-quality industrial wireless data transceiver. The transceiver uses LORA spread spectrum technology. Its strong anti-interference ability makes wireless communication more stable and reliable in industrial sites.

It has multiple transmission modes, working in the (410.125 ～ 493.125MHz) frequency band (the default is 433.125MHz), and the radio provides a transparent RS232 / RS485 interface. LoRa Direct Sequence Spread Spectrum technology will bring longer communication distance and has the advantage of strong anti-interference ability. The module has software FEC forward error correction algorithm, which has high coding efficiency and strong error correction capability. In the case of sudden interference, it can actively correct the interfered data packets, which greatly improves reliability and transmission distance. Without FEC, such packets can only be discarded. The transceiver has a data encryption function. The data transmitted by the transceiver over the air is random. Through strict encryption and decryption algorithms, the data interception is meaningless. Packet length setting is available to support different real-time and data packets.

As a communication medium, wireless data transceiver has the same scope as optical fiber, microwave and bright line: it provides real-time and reliable data transmission of monitoring signals in private networks under certain special conditions, with low cost, installation and maintenance. It is convenient, has strong diffraction ability, flexible networking structure and long coverage. It is suitable for occasions with many points and scattered, complex geographical environment, etc. It can be connected with PLC, RTU, rain gauge, liquid level meter and other data terminals.

1.2 Features

- Environmental field strength dynamic indication, data packet RSSI dynamic indication;
- Dual watchdog of software and hardware;
- Dust-proof and moisture-proof;
- easy to use and configured by the host computer;
- Use the latest LoRa technology, longer distance and more powerful performance than traditional LoRa digital radio stations;
- Use military-grade LoRa modulation technology, with data encryption function, the packet length is available for configuration.
- Large single packet, single packet is up to 240 bytes;
- Simple and efficient power supply design, using crimping mode, support 12V power supply;
- Transmit power can reach up to 25W;
- Support LBT function, the transceiver automatically waits to send data according to the current ambient noise intensity. The communication success rate of the module in harsh environments is greatly improved;
- Support communication key function to effectively prevent data from being intercepted;
- Multi-level relay networking can be realized, which effectively extends communication distance for

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ultra-long-distance communication;

- With temperature compensation circuit, the frequency stability is better than ±1.5PPM;
- All-aluminum alloy casing, compact size, easy to install and good heat dissipation; perfect shielding design, with good electromagnetic compatibility and strong anti-interference ability;
- Powerful software functions, all parameters can be programmed: such as power, frequency, air data rate, address ID, etc;
- Temperature monitoring, antenna abnormality monitoring.

2. Quick start

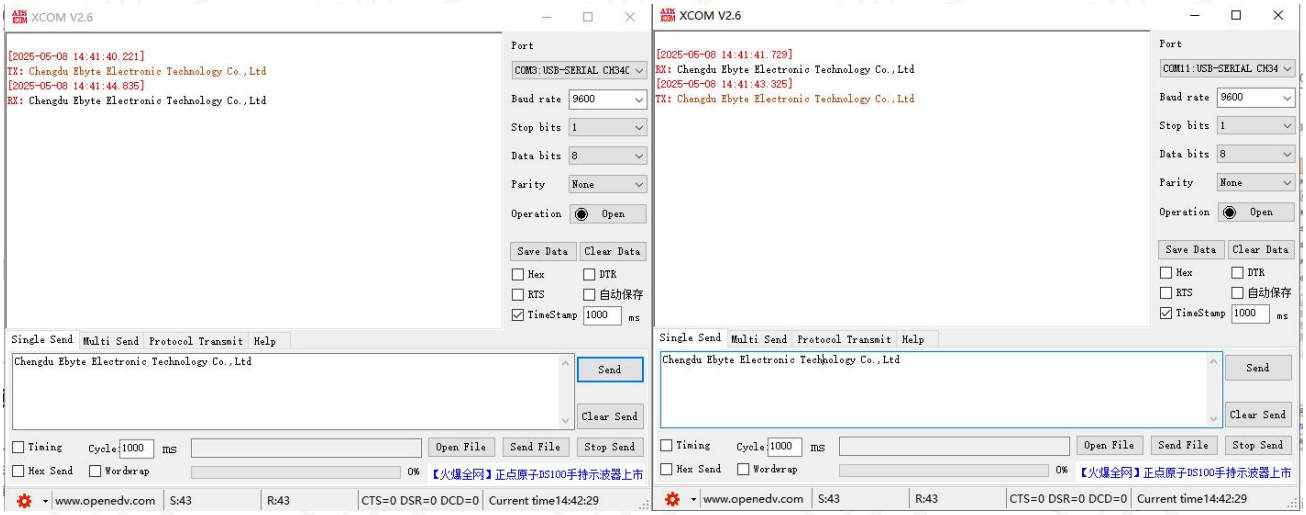
You need to prepare E90-DTU(400SL44) transceiver，Antenna，12V/10A power supply，Serial cable.

Note: The distance between two high-power DTU antennas should be more than 1 meter, otherwise it may cause damage!

1. First install the antenna for the transceiver, and then install the power supply. Only the crimping mode is supported. At this time, the power light is on and the abnormal light has no indication;

2. Connect the DTU to computer via USB to RS-232 or USB to RS-485 converter;

3. Start two serial port debugging assistants, select the serial port baud rate 9600bps, and the verification mode 8N1, and realize transparent transmission.

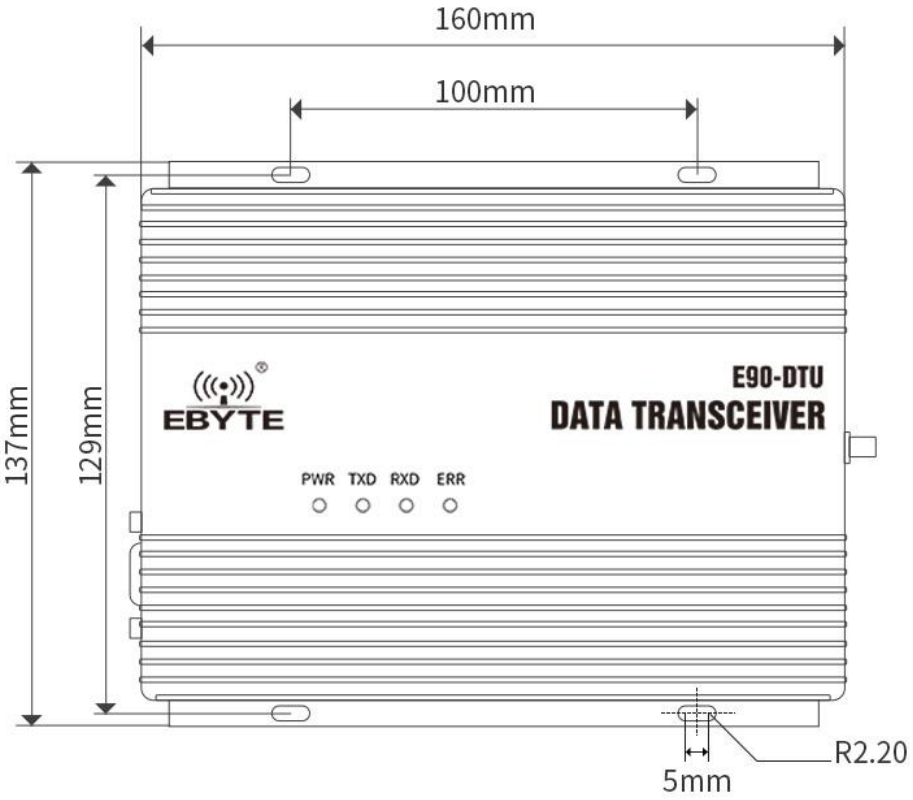


4. If customer needs to modify the parameters, please short the MOD pin to GND and enter the configuration mode. Open the E90-DTU SL configuration software to modify the relevant parameters. After completing the configuration, please leave the MOD pin in floating status.

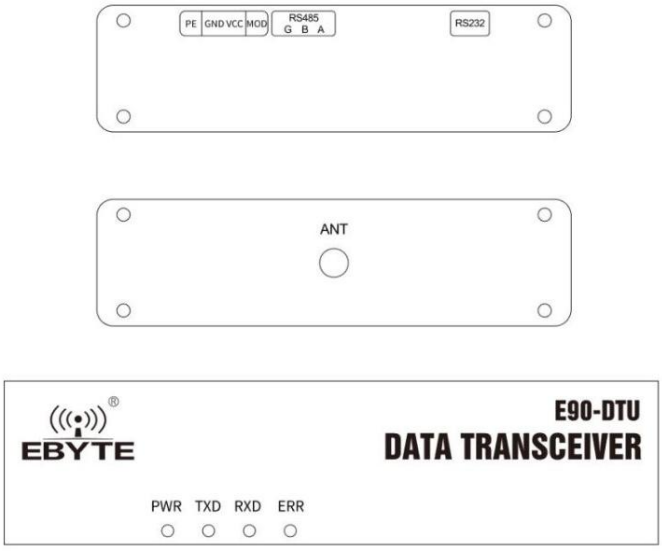
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3. Size



3.1 Interface and instructions



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No.	Name	Function	Description
1	PE	Connect to ground	Connect to ground
2	GND	Crimped power input negative	Power reference ground
3	VCC	Crimped power input positive	power input(12V/10A)
4	MOD	Mode control	Floating, general mode; ground, configuration mode
5	RS485 G	RS485 interface G	RS485 interface G is connected to the device GND interface (recommended)
6	RS485 B	RS485 interface B	RS485 interface B is connected to device B interface
7	RS485 A	RS485 interface A	RS485 interface A is connected to device A interface
8	RS232	RS232 interface	Standard RS232 interface
9	ANT	SMA-K interface	External thread inner hole, 10mm, characteristic impedance 50O ohm
10	PWR	Power indicator	Red, lit when the power is on
11	TXD	Serial data sending indicator	Yellow, blinks when sending data
12	RXD	Serial data receiving indicator	Yellow, blinks when receiving data
13	ERR	Warning indicator	Red, the temperature exceeds 100 ℃ or the antenna is not connected or the antenna is not in good connection. After resolving, you need to power on again before working

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4. Interface definition

4.1 Power interface

Users uses the crimping method to supply power, 12V / 10A DC power supply.

4.2 RS232

E90-DTU can be connected to the device via RS232 using the standard DB-9 interface.

4.3 RS485

E90-DTU can use A, B, G of RS485 interface and A, B, G of equipment's RS485 respectively.

Note: When the radio is connected to multiple devices, communication is not smooth, but it is not the case with a single device. Please try to connect a 120 ohm matching resistor in parallel between the 485_A and 485_B terminals.

5. Technical specification

5.1 Model specification

Model No.	Frequency	TX power	Distance	Features	Recommended application
	Hz	W	km		
E90-DTU(400SL44)	433.125M	25	40	LoRa, anti-interference	Suitable for long distance and susceptible environments

Note: Test condition: in clear and open air without shelters, 12V /10A power supply, 5dBi gain sucker antenna over 2 meters height from the ground, with the factory default parameters.

5.2 General specification parameter

No.	Item	Value	Note
1	Size	160*137*44mm	See chapter 3.Size for details
2	Weight	846.2g	Weight tolerance 4.5g
3	Temperature	-40℃～+85℃	Meet the needs of industrial grade use

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4	Antenna impedance	50Ω	Standard 50 Ω characteristic impedance
5	Supply voltage	12V DC	Recommended to support instantaneous current 10A
6	Communication interface	RS232/RS485	Standard DB9 hole / 5.08 terminal block
7	Baud rate	Factory default 9600	Baud rate range 1200～115200
8	Address code	Factory default 0	65536 configurable address codes

5.3 Frequency and channel numbers

Model No.	Default Frequency	Frequency Range	Channel Interval	Channel numbers
	Hz	Hz	Hz	
E90-DTU(400SL44)	433.125M	410.125～493.125M	1M	84，half duplex

Note: In the same area when multiple data transceivers are communicating one to one at the same time , it is recommended to set the channel interval between each group of data transceivers at 2MHz or more.

5.4 Transmit power

Model No.	25W
E90-DTU(400SL44)	Factory default, not adjustable

5.5 Air data rate

Model No.	Default	Levels	Air data rate (bps)
	bps		bps
E90-DTU(400SL44)	2.4k	6	2.4、4.8、9.6、19.2、38.4、62.5k

Note: The higher the air data rate, the faster the transmission rate, the transmission distance is also closer; when the rate meets the requirements , the lower air data rate, the better quality.

5.6 Current parameter

Model No.	Supply voltage V	TX current mA	Standby current mA
E90-DTU(400SL44)	12	5500	84

Note: It is recommended to retain more than 50% of the current margin when selecting the power supply, which will help the data transceiver to work steadily for a long time.

5.7 TX and RX FIFO and sub-packing method

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Model No.	Buffer	Sub-packing method
E90-DTU(400SL44)	1000 bytes	Can be sub-packed to 32/64/128/240 byte transmission each time via command

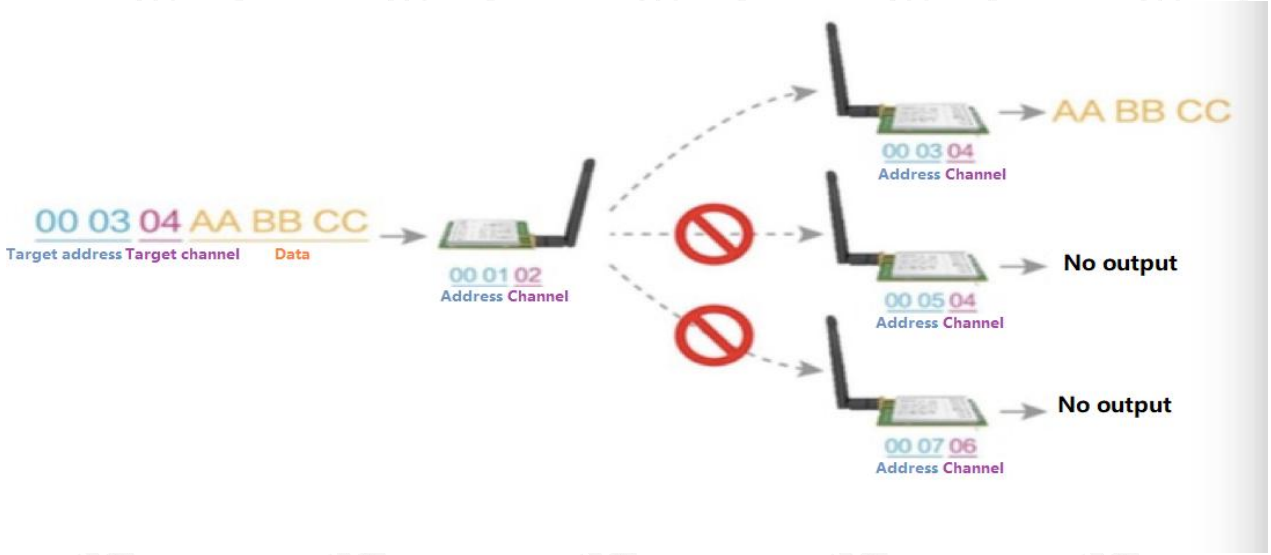
Note:1. When the receiving data is more than a single packet capacity, the beyond part will be automatically assigned to the second transmission until it is completed;

2. The data transceiver cannot receive data which is more than the buffer capacity.

6. Function description

6.1 Fixed Transmission (HEX)

During fixed-point transmission, the module recognizes the first three bytes of the serial data received as: Address high + address low + channel, and use it as a wireless transmission target.



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6.2 Broadcast Transmission (HEX)



6.3 Broadcast Address

- For example: Set the address of module A as 0xFFFF and channel as 0x04.
- When module A is the transmitter (same mode, transparent transmission), all modules under channel 0x04 will receive the data, the purpose of broadcast is realized.

6.4 Monitor Address

- For example: Set the address of module A as 0xFFFF and channel as 0x04;
- When module A is the receiver, it can receive the data sent from all modules under channel 0x04. The purpose of monitor is realized.

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7. Operating mode

E90-DTU has two operating modes. The MOD pin is left floating, is the general mode, that is, the transceiver communicates normally; the MOD pin is grounded, and that is the configuration mode.

Categories	Notes
General mode	Open UART port and RF，transparent transmission(Factory default mode)
Configuration mode	Users access the register through the serial port to control the working state of the device. The DTU can be configured through the configuration software on computer.

7.1 General mode

Type	Module works in general mode (MOD pin is floating)
Transmitting	Users can input data via UART. The device will start wireless transmission.
Receiving	Wireless receiving is enabled, data received will be output via pin TXD.

7.2 Configuration mode

Type	Module works in configuration mode (MOD pin grounded)
Transmitting	Wireless transmission is off.
Receiving	Wireless receiving is off.
Configuration	Users can visit register to configure the module working parameters.

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8. Register read and write control

8.1 Command format

In configuration mode, supported commands are as follows（only **9600，8N1 are available**）：

No.	Command format	Description
1	Configure register	command：C0+start address+length+parameter Response：C1+start address+length+parameter Example 1：set channel as 0x09 command start address length parameter Transmit：C0 05 01 09 Return：C1 05 01 09 Example 2：set module address（0x1234),network address (0x00),UART(9600 8N1),air data rate(1.2K) Transmit：C0 00 04 12 34 00 61 Return：C1 00 04 12 34 00 61
2	Read register	Command：C1+start address+length Response：C1+start address+length+parameter Example 1: read channel command start address length parameter Transmit：C1 05 01 Return：C1 05 01 09 Example 2: read module address, network address, UART and air data rate Transmit：C1 00 04 Return：C1 00 04 12 34 00 61
3	Format error	Response: FF FF FF

8.2 Register description

Address	Read/ Write	Name	Description	Remark
00H	Read/ Write	ADDH	ADDH（Default 0）	● High and low byte of the module address. Note： When the module address is FFFF, it can be used as the broadcast and monitor address, that is the module will not perform address filtering.
01H	Read/ Write	ADDL	ADDL（Default 0）	
02H	Read/ Write	NETID	NETID（Default 0）	● Network address, used to distinguish the network. When communicating with each other, they should be set to the same.

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03H	Read/ Write	REG0	7，6，5 UART baud rate（bps） 000：baud rate is 1200 001：baud rate is 2400 010：baud rate is 4800 011：baud rate is 9600（Default） 100：baud rate is 19200 101：baud rate is 38400 110：baud rate is 57600 111：baud rate is 115200 --- 4，3： UART parity bit 00：8N1（Default） 01：8O1 10：8E1 11：8N1（same as 00） --- 2，1，0，air data rate 000：air data rate is 2.4k 001：air data rate is 2.4k 010：air data rate is 2.4k（Default） 011：air data rate is 4.8k 100：air data rate is 9.6k 101：air data rate is 19.2k 110：air data rate is 38.4k 111：air data rate is 62.5k	● For the two modules that communicate with each other, the serial port baud rate can be different, and the verification method can also be different. ● When transmitting large packets continuously, users need to consider the data blocking caused by the same baud rate, and data may even be lost. It is generally recommended that both parties have the same baud rate. --- ● It should be the same for both communication parities. ● The higher the rate, the shorter the distance.
04H	Read/ Write	REG1	7，6： sub-packing setting 00：240byte （Default） 01：128byte 10：64byte 11：32byte --- 5 ： enable RSSI environmental noise 1：on 0：off（Default） --- 4，3，2 reserve --- 1，0： TX power 00：44dbm（Default） 01：44dbm 10：44dbm 11：44dbm	● When the data is smaller than the sub packet length, the serial output of the receiving end is an uninterrupted continuous output. ● When the data is larger than the sub packet length， the receiving end serial port will output the sub-packet. --- ● When enabled, the C0 C1 C2 C3 command can be sent in the transmitting mode or WOR transmitting mode to read the register. Register 0x00: Current ambient noise rssi Register 0X01: rssi when the data was received last time. （Current channel noise is: dBm =-RSSI/2） Command format: C0 C1 C2 C3 + starting address + read length Return: C1 + address address + read length + read valid value E.g: send C0 C1 C2 C3 00 01 Return C1 00 01 rssi --- ● Power and current are nonlinear, and power efficiency is highest at maximum power. ● The current does not decrease in proportion to the decrease in power.

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05H	Read/ Write	REG2	Channel control（CH） 0-83 stands for 84 channels respectively	● Actual frequency= 410.125 + CH *1.0M
06H	Read/ Write	REG3	7 enable RSSI byte 1：on 0：off（Default） --- 6, fixed transmission 1：fixed transmission 0: transparent transmission（Default） --- 5 enable repeater 1：on 0：off --- 4 enable LBT（monitor before transmit） 1：on 0：off（Default） --- 3 WOR TX and RX control 1：WOR transmitter TX and RX are enabled, certain preamble code is added when transmitting date. Data receiving is on. 0：WOR receiver（Default） Transmission is unavailable. Module works in WOR monitoring mode, (see details about WOR time below) to save power. --- 2，1，0，WOR period 000：500ms 001：1000ms 010：1500ms 011：2000ms（Default） 100：2500ms 101：3000ms 110：3500ms 111：4000ms	● When enabled, the module receives wireless data and it will follow an RSSI strength byte after output via the serial port TXD --- ● The module recognizes the first three bytes of the serial data as: address high + address low + channel and takes it as the wireless transmitting target. --- ● After the reply function is enabled, if the target address is not the module itself, the module will forward it once. ● In order to prevent data return-back, it is recommended to use it in conjunction with the fixed point mode. That is: the target address is different from the source address. --- ● When enabled, wireless data will be monitored before it is transmitted, which can avoid interference to a certain extent, but may cause data delay. ● The maximum lingering time of LBT is 2 seconds, and it will be be forced to sent out when it reaches 2 seconds. --- ● Invalid ● After the WOR receiver receives the wireless data and outputs it through the serial port, it will wait for 1000ms before entering the WOR again. Users can input the serial port data and return it via the wireless during this period. Each serial byte will be refreshed for 1000ms. Users must transmit the first byte within 1000ms. --- ● Invalid ● Period T= （1+WOR）*500ms，Max 4000ms，Min 500ms ● The longer the WOR monitoring interval period, the lower the average power consumption, but the greater the data delay ● Both the transmitter and the receiver must be the same (very important).
07H	Write	CRYPT_H	key high byte（Default 0）	● Write only, read and return 0.

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08H	Write	CRYPT_L	key low byte（Default 0）	● Used for user encryption to avoid intercepting airborne wireless data by similar modules. ● The module will internally use these two bytes as a calculation factor to transform and encrypt the over-the-air wireless signal.
80H~ 86H	Read only	PID	7 bytes of product information	● product information: 7 bytes

8.3 Factory default parameter

No.	**Default parameter：62 00 17 03 00 00**						
Model No.	Frequency	Address	Channel	Air data rate	Baud rate	Parity bit	TX power
E90-DTU (400SL44)	433.125MHz	0x0000	0x17	2.4kbps	9600	8N1	44dbm

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9. Repeater networking mode

No.	Description
1	After setting the repeater mode by configuration, switch to the general mode and the repeater starts working.
2	In the repeater mode, ADDH, ADDL are no longer used as the module address, but is correspondingly paired with the NETID. If the data of one of the networks is received, it is forwarded to another network. The network ID of the repeater itself is invalid.
3	In the repeater mode, the repeater module UART cannot transmit and receive data, and cannot perform low-power operation.

Repeater networking rules:

1. Forwarding rules, the repeater can forward data in both directions between two NETIDs.

2. In repeater mode, ADDH\ADDL is no longer used as the module address, but as a NETID forwarding pairing.

3. In the repeater mode, please do not send more than the set single packet sub-byte.

As shown in the Figure:

① Primary repeater

“Node 1” NETID is 08.

“Node 2” NETID is 33.

Primary repeater 1‘s ’ADDH\ADDL are 08，33.

So the signal sent by node 1 (08) can be forwarded to node 2 (33)

At the same time, node 1 and node 2 have the same address, so the data transmitted by node 1 can be received by node 2.

② Secondary repeater

Secondary repeater’s ADDH\ADDL are 33，05.

Therefore, Repeater 2 can forward the data of Repeater 1 to the network NETID: 05.

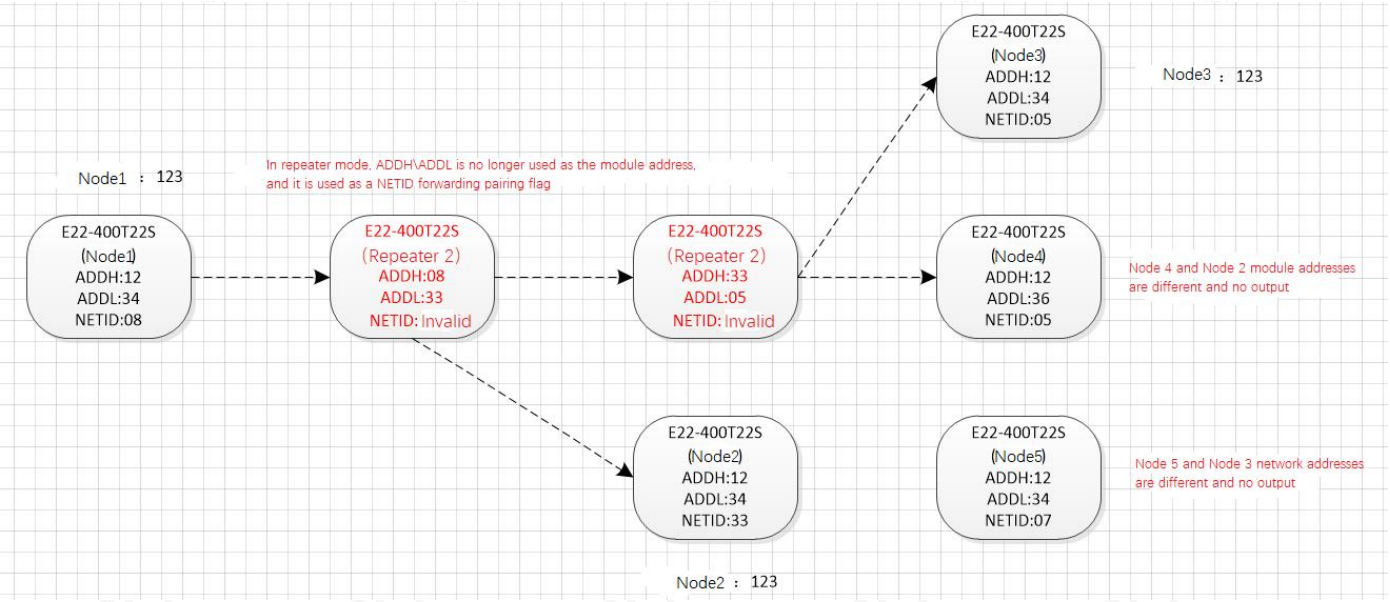
Thus node 3 and node 4 can receive node 1 data. Node 4 outputs data normally, and node 3 has a different address than node 1, so no data is output.

③ Two-way repeater

As shown in the figure: the data sent by node 1, the nodes 2, 4 can receive the data sent by node 2, 4, and node 1 can also receive it.

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10. Configuration instructions on computer

- The following picture shows the E90-DTU SL configuration interface on computer, users can switch to the configuration mode through M0D pin ground, and quickly configure and read the parameters on computer.



- In the configuration on computer, the module address, frequency channel, network ID, and key are all in decimal mode. The range of values of each parameter is:

  Network address: 0-65535

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Frequency channel: 0-83

Network ID: 0-255

Key: 0-65535

- When users configure the repeater mode using the host computer, special attention must be paid. Since the parameters are in decimal mode in the host computer, the module address and network ID need to be converted into hexadecimal. For example, if the network ID input by the transmitting end A is 02, and the network ID input by the receiving end B is 10, when the repeater end R sets the module address, the hexadecimal value 0X020A is converted into the decimal value 522 as the repeater end R. Module address. That is, the module address value of the repeater terminal R is 522 at this time.

11. E90-DTU

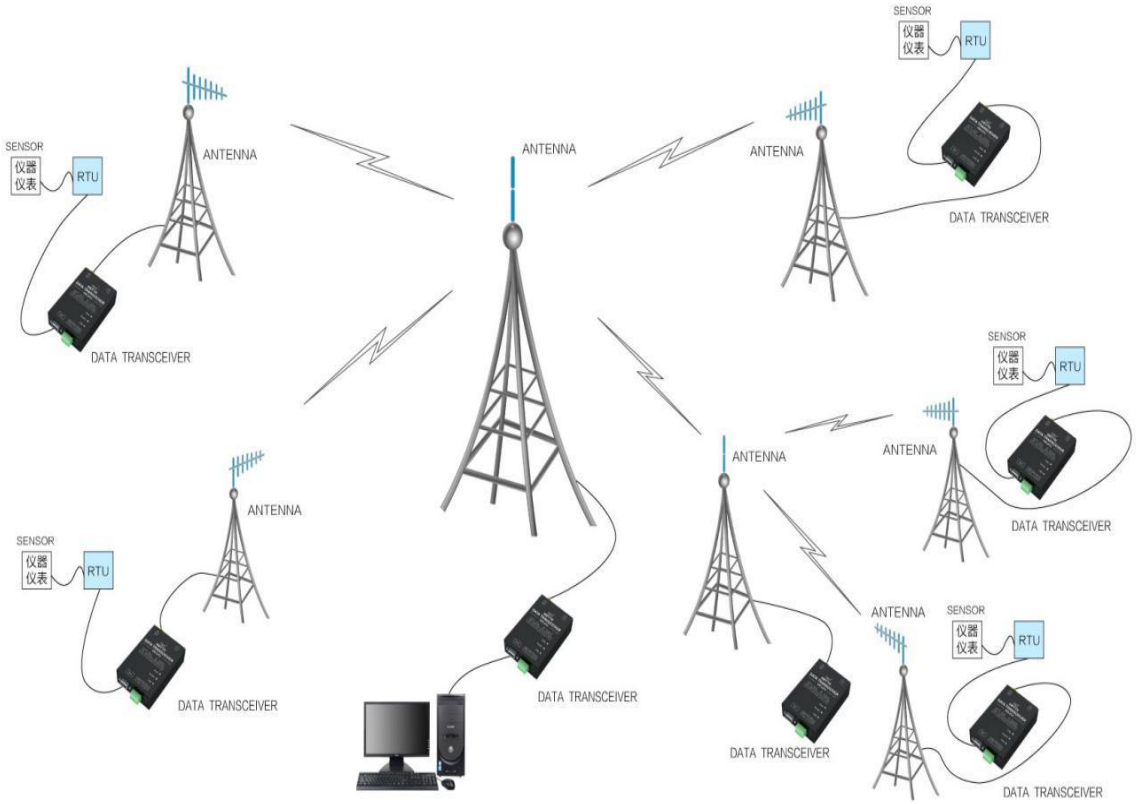
Model No.	Interface	Frequency Hz	TX Power dBm	Distance km	Features
E90-DTU(230SL22)	RS232 RS485	230M	0.16	5	Low frequency LoRa, wireless configuration, networking transmission, ultra strong diffraction ability for complex environment
E90-DTU(230SL30)	RS232 RS485	230M	1	10	Low frequency LoRa, wireless configuration, networking transmission, ultra strong diffraction ability for complex environment
E90-DTU(400SL22)	RS232 RS485	433\470M	0.16	5	LoRa,wireless configuration，networking transmission, long distance, anti-inference
E90-DTU(400SL30)	RS232 RS485	433\470M	1	10	LoRa,wireless configuration，networking transmission, long distance, anti-inference
E90-DTU(900SL22)	RS232 RS485	868\915M	0.16	5	LoRa,wireless configuration，networking transmission, long distance, anti-inference
E90-DTU(900SL30)	RS232 RS485	868\915M	1	10	LoRa,wireless configuration，networking transmission, long distance, anti-inference
E90-DTU(170L30)	RS232 RS485	170M	1	8	LoRa，strong diffraction ability
E90-DTU(433L30)	RS232 RS485	433M	1	8	LoRa，long distance, anti-inference
E90-DTU(433L37)	RS232 RS485	433M	5	20	LoRa，20km ultra long distance, anti-inference
E90-DTU(433C30)	RS232 RS485	433M	1	3	High-speed continuous transmission，ModBus protocol
E90-DTU(433C33)	RS232 RS485	433M	2	4	High-speed continuous transmission，ModBus protocol
E90-DTU(433C37)	RS232 RS485	433M	5	10	High-speed continuous transmission，ModBus protocol，long distance
E90-DTU(230N27)	RS232 RS485	230M	0.5	5	Low frequency narrow band，for complex environment
E90-DTU(230N33)	RS232 RS485	230M	2	8	Low frequency narrow band，for complex environment
E90-DTU(230N37)	RS232 RS485	230M	5	15	Low frequency narrow band，for complex environment，strong diffraction ability

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12. Application field

The data transceiver of CDEBYTE is applied for all kinds of point to point, one point to multiple points wireless data transmission system, such as smart home, Internet of things transformation, power load monitoring, distribution network automation, hydrological forecasting, water pipe network monitoring, urban street lamps Monitoring, air defense alarm control, railway signal monitoring, centralized control of railway water supply, oil supply pipe network monitoring, GPS system, remote meter reading, electronic crane, automatic reporting, seismic forecasting, fire prevention, environmental monitoring and other industrial automation system, as shown below:



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13. Notes for use

1. Please keep the warranty card of this equipment safely. The factory number (and important technical parameters) of the equipment is on the warranty card, which has important reference value for future maintenance and new equipment.
2. During the warranty period, if the radio is damaged due to the quality of the product itself, not caused by human damage or lightning, please enjoy the free warranty. Please do not repair it yourself. If there is any problem, please contact us. After sales service.
3. The device may not be operated in the vicinity of some flammable places (such as coal mines) or explosive dangerous objects (such as detonators for detonators).
4. Appropriate DC stabilized power supply should be selected, which requires strong anti-high frequency interference, small ripple, and sufficient load capacity; it also has functions such as overcurrent, overvoltage protection and lightning protection to ensure data transmission.
5. Do not use it in a working environment that exceeds the environmental characteristics of data transceiver, such as high temperature, humidity, low temperature, strong electromagnetic field or dusty environment.
6. Do not let the data transceiver continuously be in full-load transmission state, otherwise the transmitter may be burned out.
7. The ground wire of the data transceiver should be well connected with that of the external equipment (such as PC, PLC, etc.) and of the power supply. Otherwise, it is easy to burn the communication interface; do not plug or unplug the serial port when electrified.
8. When testing the data transceiver, it must be connected with a matching antenna or a 50Ω dummy load, otherwise it will easily damage the transmitter; if the antenna is connected, the distance of the human body from the antenna should preferably exceed 2 meters to avoid injury and cut. Do not touch the antenna while launching.
9. Wireless modem often has different communication distances in different environments. The communication distance is often affected by temperature, humidity, obstacle density, obstacle volume, and electromagnetic environment. In order to ensure stable communication, it is recommended to reserve, Communication distance margin above50. %.
10. If the measured communication distance is not ideal, it is recommended to check the antenna quality and the installation method of the antenna. You can also contact support@cdebyte.com for assistance.
11. Power supply is required to remain 50% of current, it should be noted that the ripple should not exceed 100mV.
12. Wireless communication products need to be connected with an impedance matching antenna to work properly, even for short-term testing.

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Important statement

1. EBYTE reserves the right of final interpretation and modification of all contents in this manual.
2. As the hardware and software of the product continue to improve, this manual may be subject to change without further notice, and the final version of the manual shall prevail.
3. To protect the environment, everyone is responsible: in order to reduce the use of paper, this manual only prints the Chinese part, the English manual only provides electronic documents, if necessary, please go to our official website to download; in addition, if the user does not require special, when the user orders in bulk, We only provide product specifications according to a certain percentage of the order quantity. Not every digital radio station is equipped with one by one, please understand.

Revision history

Version	Description	Issued by
1.0	Initial version	huaa
1.1	Format adjustment	Ren
1.2	Initial version	LY
1.3	-	-
1.4	Update the size diagram	Hao
1.5	Content correction	Hao
1.6	Content correction	Hao

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