Chengdu Ebyte Electronic Technology Co.,Ltd

Wireless Modem

User Manual

E90-DTU(900SL33)

Contents

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1 Introduction

1.1 Brief Introduction

E90-DTU (900SL33) is a wireless digital transmission station using military LoRa modulation technology, with a variety of transmission modes, working in 850.125~930.125MHz) frequency band (default 868.125MHz). The station provides transparent RS232 / RS485 interface and supports 8~28V voltage input. LoRa direct sequence expansion technology will bring further communication distance, and has the advantages of concentrated power density and strong anti-interference ability. The module has the software FEC forward error correction algorithm, which has high coding efficiency and strong error correction ability. In the case of sudden interference, it can actively correct the disturbed data packets, greatly improving the reliability and transmission distance. In the absence of FEC, such packets can only be discarded. The radio station has the function of data encryption, and the data transmitted by the radio station is random, which makes the data interception meaningless through strict encryption and decryption algorithm; supports the subcontracting length setting and supports different real-time and data packets.

Wireless digital radio as a kind of communication media, and optical fiber, microwave, open line, have certain scope of application: it provides some special conditions of private network monitoring signal of real-time and reliable data transmission, with low cost, convenient installation and maintenance, shooting ability, flexible network structure, far coverage characteristics, suitable for point and scattered, complex geographical environment, and PLC, RTU, rainfall gauge, liquid level meter data terminal connection.

1.2. Certificates

E90-DTU has obtained the "Radio Transmitter Equipment Model Approval Certificate" with the approval code: CMII T ID: 2017FP5780.

E90-DTU has obtained the "Explosion-proof Certificate" with its number: Test Word No.201711000975.

E90-DTU has obtained the "Electrostatic Surge Detection Report" issued by the China National Test Institute, whose number is: CNEx18.1461.

E90-DTU has obtained the "Design Patent Certificate", and its patent number is: ZL 2016 3 0501980.3.

E90-DTU has obtained the "Utility Model Patent Certificate", and its patent number is: ZL 2016 2 1410691.3.

E90-DTU has obtained the "CE Certificate" (EU mandatory certification) with the verification number: CCISE180514601V.

E90-DTU has obtained the "FCC Certificate" (certified by the FCC), with its ID: 2 ALPH-E90-DTU.

E90-DTU has obtained the "RoHS Certificate" (EU mandatory environmental certification) with the report number: DTI201807025245.

1.3. Features

★ Using the latest Lo R a technology, than the traditional Lo R a digital radio distance is farther, more powerful performance;

★ Support AT instruction, more convenient to use;

★ Support serial port upgrade firmware, update firmware is more convenient;
★ Under ideal conditions, the communication distance can reach 16km;
★ Support for the global license-free ISM 868 / 915 MHz frequency band;
★ Support data encryption, the subcontract length can be set;
★ Super large single package, single package support up to 240 bytes, suitable for Modbus protocol;
★ Simple efficient power supply design, support power supply device or voltage mode, support 8~28V power supply;
★ Launch power up to 2W, and support multi-stage adjustable, all technical indicators meet the European industrial standards;
★ Support LBT function, the station automatically sends according to the current ambient noise intensity. Greatly improve the communication success rate of the module in the harsh environment;
★ Support wireless sending command packet, remote configuration or reading wireless module parameters;
★ Support the communication key function, and effectively prevent the data from being intercepted;
★ It can realize the multi-stage relay networking, effectively expand the communication distance, and realize the ultra-long distance communication;
★ Using the temperature compensation circuit, the frequency stability is better than ± 1.5 PPM;
★ Working temperature range: -40℃ ~ + 85℃, adapt to a variety of harsh working environment, real industrial-grade products;
★ Aluminum alloy shell, compact volume, convenient installation, good heat dissipation; perfect shielding design, good electromagnetic compatibility, strong anti-interference ability;
★ Power reverse connection protection, adoptive protection, antenna surge protection and other multiple protection functions, greatly increase the reliability of the station;
★ Powerful software functions, all parameters can be programmed by setting: such as power, frequency, air rate, address ID, etc.;
★ Ultra-low power consumption, waiting current is only 15 mA (power saving mode and sleep mode power consumption is lower);
★ Built-in watchdog, and precise time layout, in the event of abnormalities, the module will automatically restart, and can continue to work according to the previous parameter settings.

2. Quick start

You need to prepare

E90-DTU

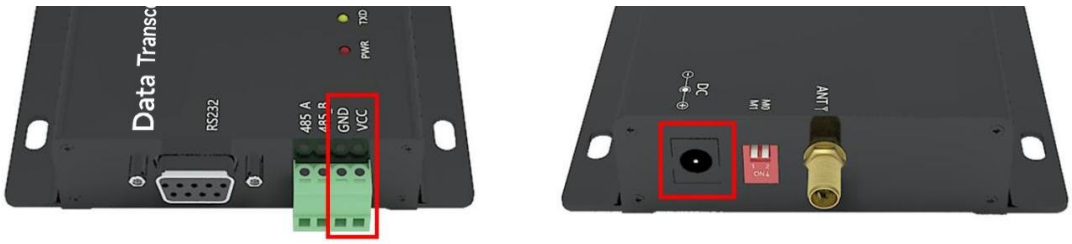

电源适配器


天线

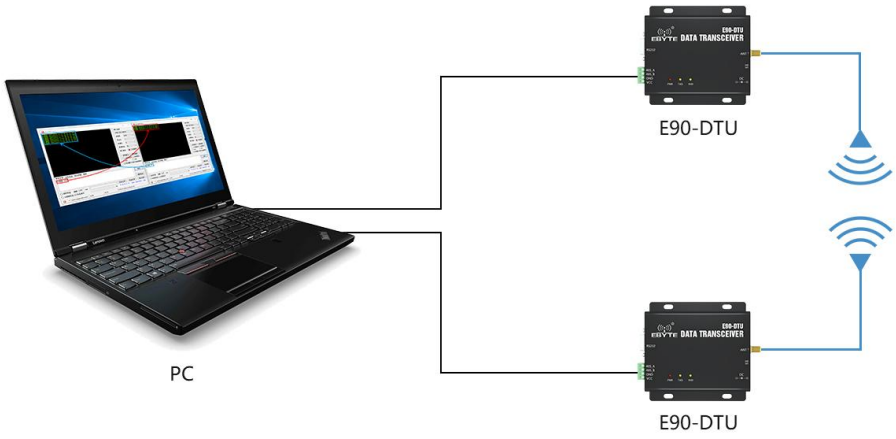

连接线

1、 First, install the antenna to the digital radio, and then install the power supply, and ensure that the dial switch status is correct, the user according to the demand to choose the voltage line mode or power adapter power supply, the two

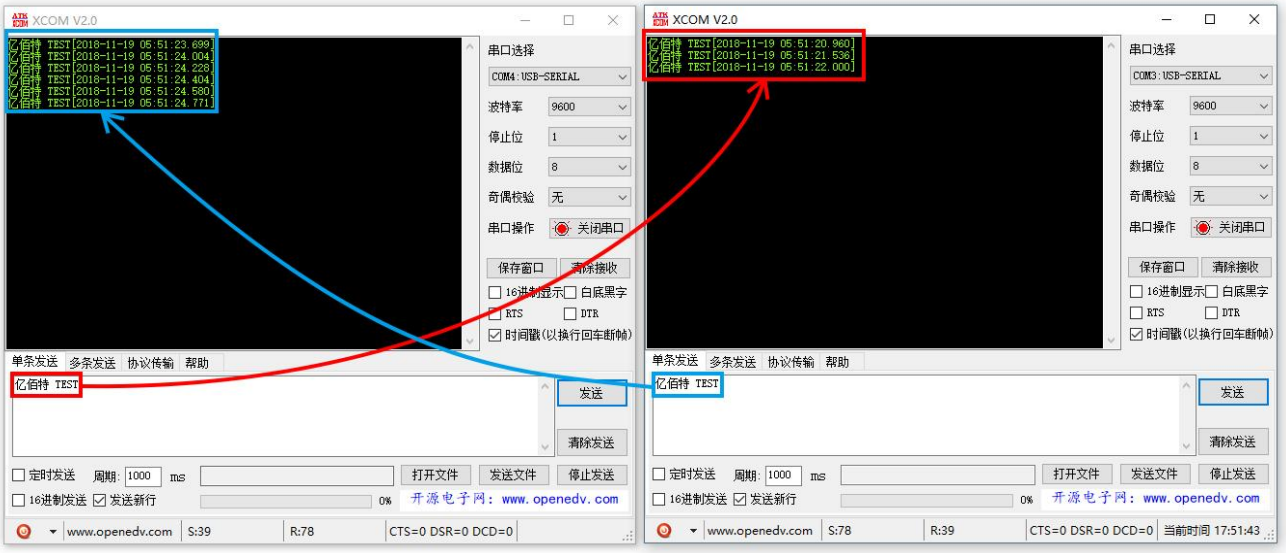
can choose one;



2、 Use USB to RS-232, USB to RS-485, or other means to connect the computer to the digital radio station;



3、 Start two serial port debugging assistants, select serial port port rate is 9600bps, check mode is 8N1, can realize serial port transmission;

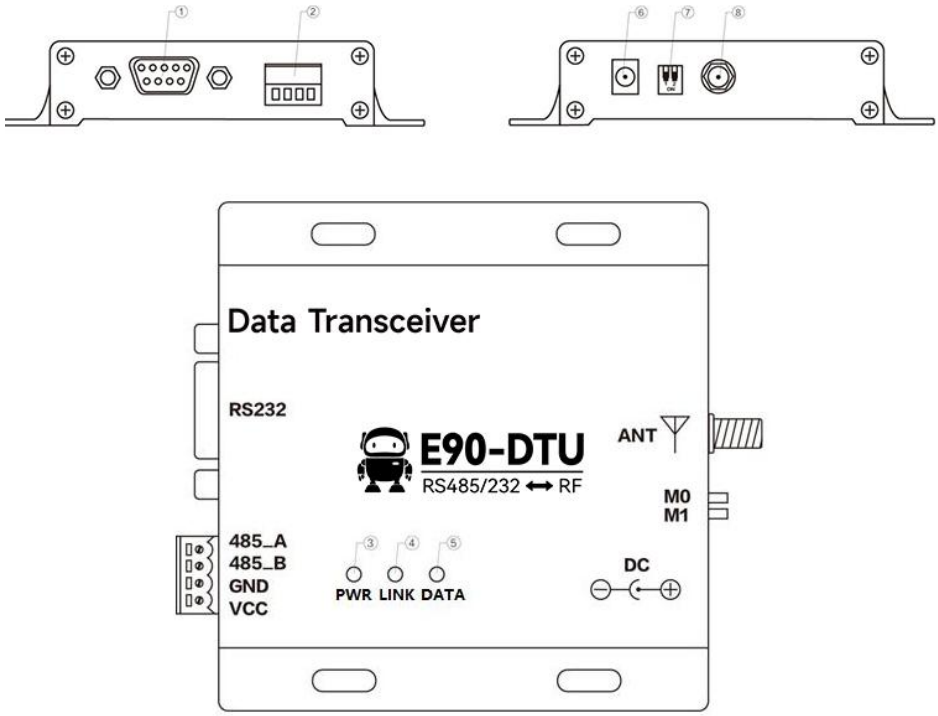


4、 If the customer needs to modify the parameters, please dial the radio station in the configuration mode and connect it to the computer. Open the E90-DTU radio station configuration software to modify the relevant parameters. After completing the configuration, always restore the dial switch status before communication.

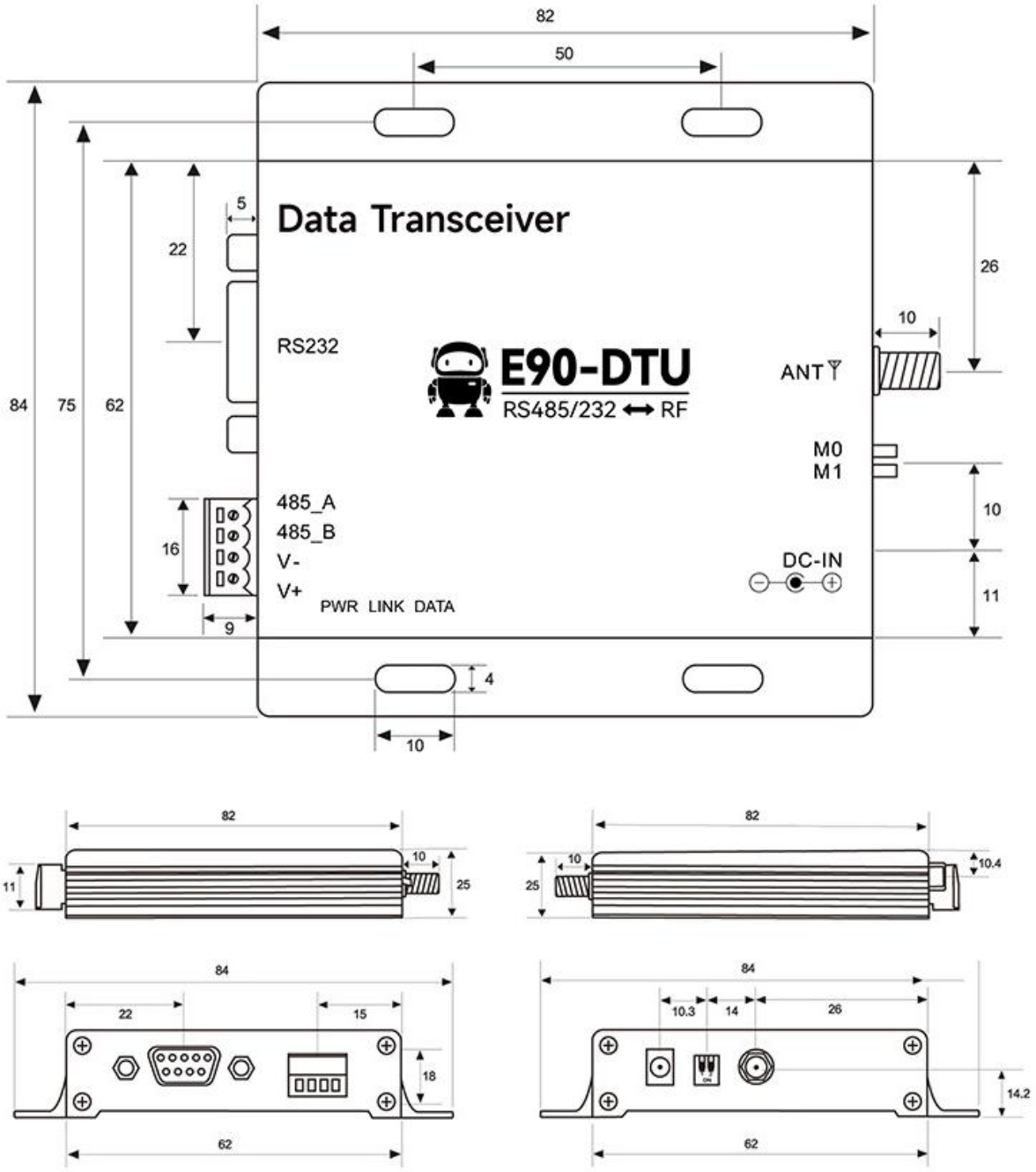
Mode 0 factory default state mode 2 for parameter configuration

3. Installation size

3.1 Department instructions



Pin No.	Name	Function	Description
1	The DB-9 master-type socket	The RS-232 interface	Standard RS-232 interface
2	3.81 Terminal terminal	RS-485, power supply interface	Standard RS-485 interface and cable power interface
3	PWR-LED	Power light	Red, light on when the power is on
4	TXD-LED	Send indicator light	Yellow, blinking when sending the data
5	RXD-LED	Codan lamp	Yellow, flashing when receiving the data
6	DC power interface	Power interface	Straight inserted round hole, outer diameter of 5.5mm and inner diameter of 2.5mm
7	Dial switch	Dial switch	Work mode control
8	Antenna interface	SMA-K joggle	Outer thread and inner hole, 10mm long, characteristic impedance of 50 Ω


82
50
Data Transceiver
RS232
E90-DTU
RS485/232 ↔ RF
ANT
M0
M1
485_A
485_B
V-
V+
PWR LINK DATA
DC-IN
84
75
62
22
26
10
16
9
4
11
25
10.4
15
18
10.3
14
14.2

unit:mm

4. Interface definition

4.1 Power interface description

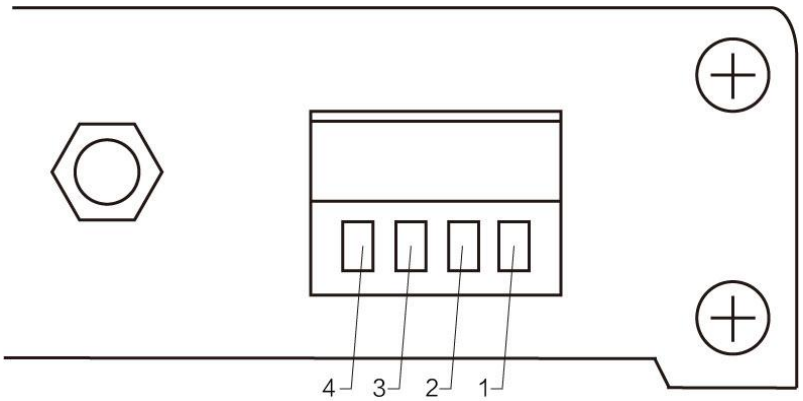
Users can choose ⑥ DC power interface power supply, using the interface for 5.5mm outer diameter, 2.5mm inner diameter power adapter power supply;
VCC terminal and GND terminal in ② can also power supply, only choose any power supply mode;
The E90-DTU can be powered from an 8 to 28 V DC power supply, with a 12V or 24V DC power supply recommended.

4.2 RS232 Interface definition

The E90-DTU can be connected to the device via the RS-232 using the standard DB-9 interface.

4.3 RS485 Interface definition

E90-DTU can be connected separately using the terminal 485_A and terminal 485_B in ② to the B terminal A of RS-485 of the device.



PIN No	Definition	Function	Description
1	VCC	Line-pressing power supply interface, positive electrode	DC 8 to 28 V, 12V or 24V
2	GND	Press line type power	The power supply negative electrode is connected

		interface, negative electrode	to the system ground and housing
3	485_B	RS-485 interface, B interface	The RS-485 Interface B interface is connected to the device B interface
4	485_A	RS-485 interface, A interface	The RS-485 interface A interface is connected to the device A interface

★ Note: When the radio station is connected to multiple devices, but not with a single device, try to parallel 120 Ω resistance between terminal 485_A and 485_B terminals.

5. Qualification

5.1 Model Specifications

Model	Frequency	Power	Distance	Specification	Recommend application scenarios
	Hz	W	km		
E90-DTU(900SL33)	868.125MHz	2	16	LoRa amplification of anti-interference	Suitable for distant, easily disturbed environments

★ Note: In sunny weather, no shelter in the open environment, 12V / 2A power supply, 5 dBi suction cup antenna, the antenna is 2 meters away from the ground height, using the factory default parameters.

5.2 General specification parameters

PIN No	Definition	Function	Description
1	product size	82*62*25 mm	See installation size for details
2	Product weight	150g	Weight tolerance of 4.5g
3	working temperature	-40℃～+85℃	Meet the needs of industrial-grade use
4	antenna impedance	50Ω	Standard 50 Ω characteristic impedance
5	voltage range	8～28V DC	Either 12V or 24V is recommended
6	communication interface	RS232/RS485	Standard DB9 hole type / 3.81 terminal
7	Baud rate	Factory default: 9600	The Baud rate range from 1200 to 115200
8	address code	Factory default 0	A total of 65,536 address codes can be set

5.3 Frequency range and channel number

Model	Default Frequency	Band Range	Channel Spacing	Description
	Hz	Hz	Hz	
E90-DTU(900SL33)	868.125MHz	850.125～930.125MHz	1M	81, Half duplex

★ Note: In the same area, multiple sets of transmission stations are used to communicate one to one at the same time. It is suggested that the channel interval be set above 2 MHz.

5.4 Transmit power level

Model	2W	1W	500m W	250m W
E90-DTU(900SL33)	Factory default	√	√	√

★ Note: The lower the transmission power is, the closer the transmission distance is, but the working current will not decrease in the same proportion, so it is recommended to use the maximum transmission power.

5.5 Air rate grade

Model	Default	Equal series	Air rate grade
	bps		bps
E90-DTU(900SL33)	2.4k	6	2.4、4.8、9.6、19.2、38.4、62.5k

★ Note: The higher the air speed setting, the faster the transmission rate, and the closer the transmission distance; so if the rate meets the usage requirements, the lower the air speed, the better.

5. 6 Current parameters

Model	Emission current mA		Waiting current mA	
	12V	24V	12V	24V
E90-DTU(900SL33)	650	330	10	6

★ Note: It is recommended to retain more than 50% of the current margin when selecting the power supply, which is conducive to the long-term and stable operation of the radio station.

5.7 Receiving length and subcontracting method

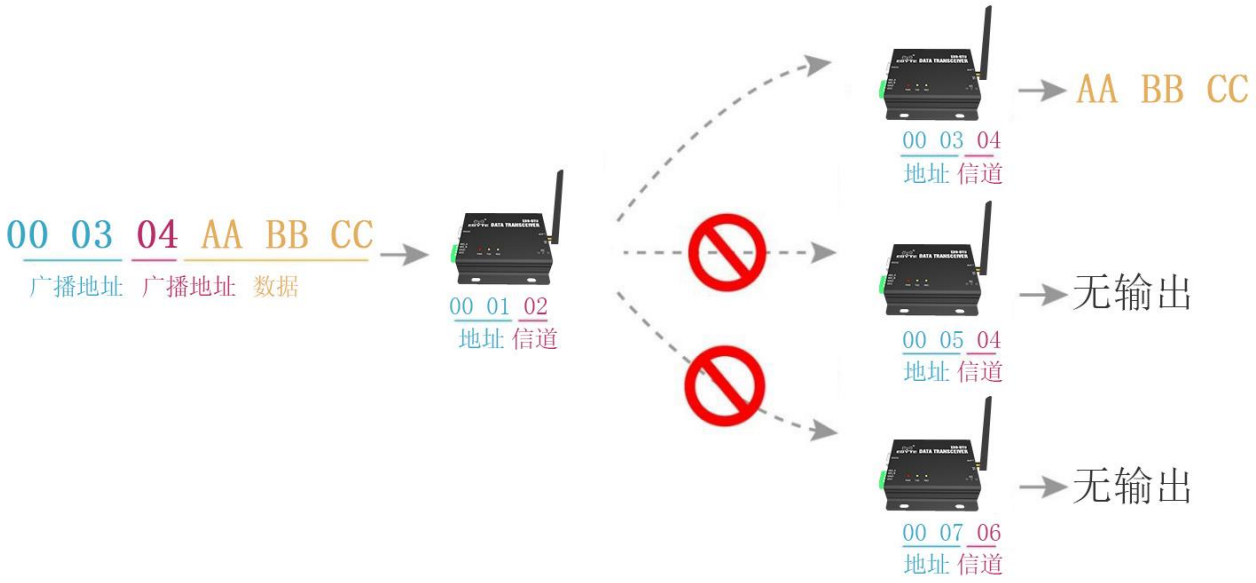
Model	Cache size	Subcontracting method
E90-DTU(900SL33)	1000 Bytes	Can be sent by instruction subcontracting 32 / 64 / 128 / 240 bytes

★ Note: 1. If the single data received by the radio station is greater than the single package capacity, the excess part of the data will be automatically allocated to the second transmission until the transmission is completed;

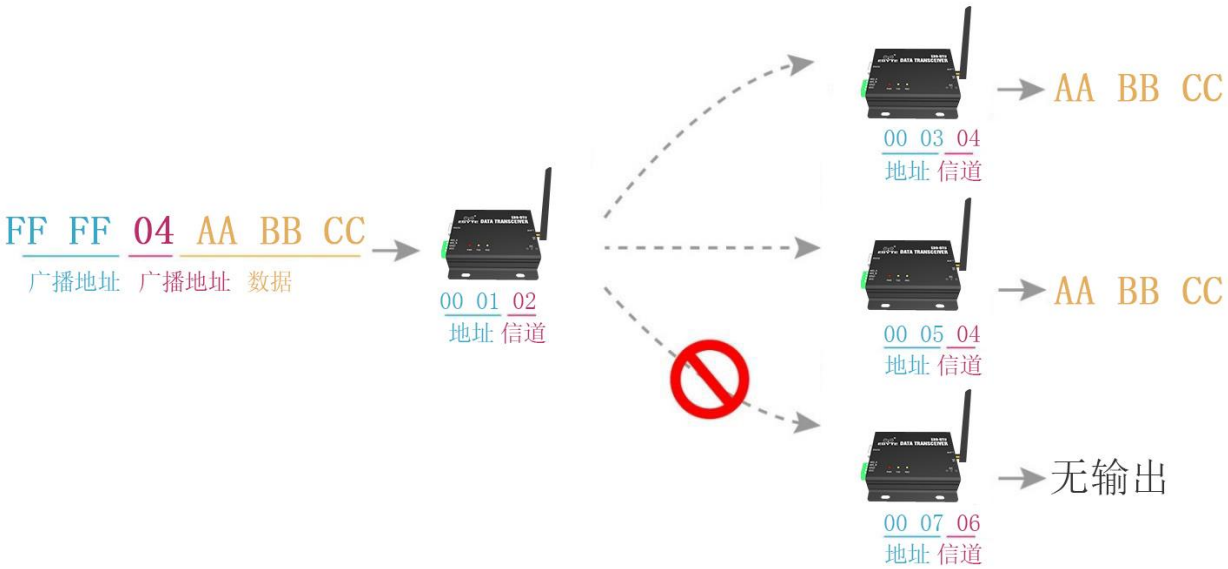
2. The single received data should not be greater than the cache capacity.

6 Function introduction

6.1 Fixed point transmission (hexadecimal)



6.2 Broadcast transmission (hexadecimal)



6.3 Broadcast address

- Example: Set module A address to 0xFFFF and channel to 0x04.
- When module A is used as transmission (the same mode, transparent transmission mode), all the receiving modules under the 0x04 channel can receive data to achieve the purpose of broadcasting.

6.4 Listening address

- Example: Set module A address to 0xFFFF and channel to 0x04.
- When module A is received as, all the data under the 0x04 channel to achieve the purpose of monitoring.

7. Working mode

E90-DTU has four working modes. When there is no harsh low power consumption demand, it is recommended to configure the radio station as a general mode (mode 0);
The default setting of the station is general mode (mode 0).

	Name	M1	M0	Description
Mode 0	General mode	ON	ON	Serial port open, wireless open, transparent transmission (factory default mode), support special command air configuration.
Mode 1	WOR mode	ON	OFF	Can be defined as WOR sender and WOR receiver, support aerial wake up
Mode 2	Configuration mode	OFF	ON	The user accthe register through the serial port to control the working status of the station. The user can configure the module through the upper computer configuration software.
Mode 3	Deep sleep mode	OFF	OFF	The station entered hibernation

模式0

模式1

模式2

模式3

★ Note: If no low power requirements, no concern about WOR mode (mode 1).

7.1 General Mode (Mode 0)

Type	When M 0 = ON and M 1 = ON, the module works in mode 0
send	The user can enter the data through the serial port, and the module will initiate the wireless transmission.
receive	The wireless receiving function of the module is turned on, and it is output through the serial port TXD pin after receiving the wireless data.

7.2 WOR Mode (Mode 1)

Type	When M 0 = OFF and M 1 = ON, the module works in mode 1
send	When defined as the transmitting side, the wake-up code is automatically added for a certain time before launch
receive	Data can be received normally, and the receiving function is equivalent to mode 0

7.3 Configuration mode (Mode 2)

Type	When M 0 = ON and M 1 = OFF, the module works in mode 2
send	Wireless launch closed
receive	Wireless receive closed
configure	The user can access the register to configure the module operating state

7.4 Depth sleep mode (mode 3)

Type	When M 0 = OFF and M 1 = OFF, the module works in mode 3
send	Unable to transmit the wireless data.
receive	Unable to receive the wireless data.
pay attention to	When entering from the hibernation mode to the other mode, the module will reconfigure the parameters, and the AUX remains low during the configuration process; After the output high level, it is recommended that the user detect the T _ BUSY rising edge.

8. Register read/write and control

8.1 Command format

Under the configuration mode (mode 2: M 1 = OFF, M 0 = ON), the supported instruction list is as follows (when setting, only 9600,8N1 format is supported):

No	Instruction format	Define
1	Set the register	Instructions: C0 + starting address + length + parameter Response: C1 + starting address + length + parameter Example 1: The configuration channel is 0x09 Command start address length parameter Send to: C0 05 01 09 Return: C1 05 01 09 Example 2: simultaneously configure the module address (0x1234), network address (0x00), serial port (9600 8N1), empty speed (2.4K) Send to: C0 00 04 12 34 00 60 Return: C1 00 04 12 34 00 60

2	Read the register	Instructions: C1 + starting address + length Response: C1 + starting address + length + parameter Example 1: Read the access channel Command start address length parameter Send to: C1 05 01 Return: C1 05 01 09 Example 2: Read the module address, network address, serial port, and empty speed simultaneously Send to: C1 00 04 Return: C1 00 04 12 34 00 60
3	Set up the temporary register	Instructions: C2 + starting address + length + parameter Response: C1 + starting address + Length + parameter Example 1: The configuration channel is 0x09 Command start address length parameter Send to: C2 05 01 09 Return: C1 05 01 09 Example 2: simultaneously configure the module address (0x1234), network address (0x00), serial port (9600 8N1), empty speed (2.4K) Send to: C2 00 04 12 34 00 60 Return: C1 00 04 12 34 00 60
4	Wireless configuration	Instruction: CF CF + General instruction Response: CF CF + conventional response Example 1: The wireless configuration channel is 0x09 Wireless command header command starting address length parameter Send to: CF CF C0 05 01 09 Return: CF CF C1 05 01 09 Example 2: wireless simultaneous configuration module address (0x1234), network address (0x00), serial port (9600 8N1), and airspeed (2.4K) Send to: CF CF C0 00 04 12 34 00 60 Return: CF CF C1 00 04 12 34 00 60
5	format error	Format error response FF FF FF / “=ERR ”

8.2 Register description

No.	Read-write	Name	Description				Remarks
00H	Read / write	ADDH	ADDH (default 0)				Module address of high and low bytes; Note: When the module address is equal to FFFF, it can be used as a broadcast and listening address, that is, the module will not filter the address
01H	Read / write	ADDL	ADDL (default 0)				
02H	Read / write	NETID	NETID (default 0)				Network address, used to distinguish networks; When communicating with each other, set it as the same.
03H	Read /	REG0	7	6	5	UART Serial Rate (bps)	The two modules of mutual communication,

	write		0	0	0	The serial port port rate is 1200	the serial port port rate can be different, the calibration mode can also be different; When large data packets are launched continuously, users need to consider the data blocking caused by the same port rate, or may even be lost; It is generally recommended that the two parties should be the same.
			0	0	1	The serial port port rate is 2400	
			0	1	0	The serial port port rate is 4800	
			0	1	1	Serial port port rate of 9600 (default)	
			1	0	0	The serial port port rate is 19200	
			1	0	1	The serial port port rate is 38400	
			1	1	0	The serial port port rate is 57600	
			1	1	1	The serial port port rate is 115200	
			4	3	Serial check bit		The communication two sides serial port mode can be different;
			0	0	8N1 (by default)		
			0	1	8O1		
			1	0	8E1		
			1	1	8N1 (equivalent to 00)		
			2	1	0	Wireless aerial rate (bps)	Both parties to communicate, the air rate, must be the same; The higher the air rate, the smaller the delay, and a shorter the transmission distance.
			0	0	0	Aerial rate of 2.4k (default)	
			0	0	1	The air rate is 4.8k	
			0	1	0	The air rate is 9.6k	
			0	1	1	Aerial rate 19.2k	
			1	0	0	Aerial rate 38.4k	
			1	0	1	Aerial rate 62.5k	
04H	Read / write	REG1	7	6	Subcontract setting		The data sent by the user is less than the subcontract length, and the serial port output of the receiving end is presented as uninterrupted continuous output; If the data sent by the user is greater than the subcontract length, the serial port of the receiving end will subcontract the output.
			0	0	240 bytes (by default)		
			0	1	128 Bytes		
			1	0	64 Bytes		
			1	1	32 Bytes		
			5	The RSSI ambient noise is enabled			When enabled, instruction C0 C1 C2 C3 can read register in transmission mode or WOR transmission mode; Register 0x00: current ambient noise RSSI; Register 0X01: RSSI last received (The current channel noise is: dBm = -(256-RSSI)); Instruction format: C0 C1 C2 C3 + starting address + read length; Return: C1 + address + read length + read valid value; like send C0 C1 C2 C3 00 01 Return to C1 00 01 RSSI (address only starts
			0	Disable (default)			
			1	start using			

					from 00)
			4	Software mode switching	**If we use our upper position computer configuration parameters, we will actively close the bit.** If you do not want to use M0 M1 pins to switch working mode, you can enable this function, use specific serial instructions to switch mode. Format: C0 C1 C2 C3 02 + working mode Send C0 C1 C2 C3 02 00 to transmission mode The Send C0 C1 C2 C3 02 01 is switched to the WOR mode Send the C0 C1 C2 C3 02 02 to switch to the configuration mode Send the C0 C1 C2 C3 02 03 to switch to the sleep mode Return: C1 C2 C3 02 + working mode Note: When this function is enabled, only 9600 baud rate is supported in WOR mode and sleep mode.
			0	Disable (default)	
			1	start using	
			3	2 continue to have	
			1	0 transmitting power	Power and current are nonlinear relationship, when the maximum power, the power supply efficiency is the highest; The current will not decrease in equal proportion with the power decrease.
			0	0 33 dBm (by default)	
			0	1 30d B m	
			1	0 27d B m	
			1	1 24d B m	
05H	Read / write	REG2	Channel Control (CH) 0-80 represents a total of 81 channels (900 band applicable)		Actual frequency = 850.125 + CH * 1M
06H	Read / write	REG3	7	Enable the RSSI bytes	When enabled, the module receives wireless data and the output through the serial port TXD will follow an RSSI strength byte.
			0	Disable (default)	
			1	start using	
			6	transmission mode	During the fixed-point transmission, the module will identify the first three bytes of the serial port data as: address high + address low + channel, and take it as the wireless transmission target.
			0	Transparent transfer (by default)	
			1	Fixed-point transmission	
			5	Relay function	After the relay function is enabled, if the target address is not the module itself, the module will start a forward; To prevent data return, it is recommended to work with fixed point mode; namely, target address and source address are different.
			0	Disable Relay function (default)	
			1	Enable relay function	
			4	LBT enable	After enabling, the wireless data will be monitored before transmission, which can avoid interference to a certain extent, but may bring data delay; The maximum residence time of LBT is 2
			0	Disable (default)	
			1	start using	

<table>
<tr><td rowspan="13"></td><td rowspan="13"></td><td rowspan="13"></td><td></td><td colspan="3"></td><td>seconds, reaching two seconds.</td></tr>
<tr><td>3</td><td colspan="3">The WOR mode transceiver control</td><td rowspan="3">Only valid for mode 1;
1. In the receiving mode of word, the module can modify the delay time after wake up, and the default time is 0;
2. The receiving terminal needs to send instruction C0 09 02 03 E8 in configuration mode (C0 is a write command, 09 is the register initiator address, 02 is the length, 03 E8 is the set delay, the maximum FFFF is 65535ms, and set to 0, the wake up delay is closed.)
3. Data can be sent within the delay</td></tr>
<tr><td>0</td><td colspan="3">WOR recipient (default)
Working in WOR listening mode, the listening cycle see below (WOR cycle), can save a lot of power consumption.</td></tr>
<tr><td>1</td><td colspan="3">The WOR transmitter party
The module sends and receives open, and adds a certain time wake code when transmitting data.</td></tr>
<tr><td>2</td><td>1</td><td>0</td><td>WOR period</td><td rowspan="9">Only valid for mode 1;

Cycle T= (1 + WOR) * 500ms, maximum 4000ms, minimum 500ms;

The longer the WOR monitoring interval period, the lower the average power consumption, but the greater the data latency;

It must be consistent (very important)</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>500ms</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1000ms</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1500ms</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>2000ms</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>2500ms</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>3000ms</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>3500ms</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>4000ms</td></tr>
<tr><td>07H</td><td>write</td><td>CRYPT_H</td><td colspan="4">Key High Bytes (default 0)</td><td rowspan="2">Write only, read back to 0;
For encryption, to avoid the aerial wireless data intercepted by similar modules;
These two bytes will be used as the calculation factor to encrypt the wireless signal in the air.</td></tr>
<tr><td>08H</td><td>write</td><td>CRYPT_L</td><td colspan="4">Key Low Bytes (default 0)</td></tr>
<tr><td>80H ～ 86H</td><td>a slight pause in reading</td><td>PID</td><td colspan="4">Product information is 7 bytes</td><td>Use has been suspended for reserved only.
Please refer to the AT + DEVTYPE and AT + FWCODE instructions in Section 9.1.</td></tr>
</table>

8.3 Factory default parameters

Model	Frequency	Address	Channel	Air rate	Baud rate	Serial port format	Transmitting power
E90-DTU (900SL33)	868.125MHz	0x0000	0x 23	2.4kbps	9600	8N1	2W

9. AT command

- AT instructions are used in configuration mode. AT instructions are divided into three categories: command instruction, setting instruction and query instruction;
- Users can go through the words " AT + HELP =?"Query to the AT instruction set supported by the module, the AT instruction adopts the port rate of 9600 8N0;
- When the input parameter exceeds the range, it will be limited. Please do not let the parameter exceed the range to avoid the unknown situation.

9.1 AT commands list

Command instruction	Description	Instance	Example description
AT + IAP (Use carefully, see article 9.3 serial port upgrade firmware considerations)	Enter the IAP upgrade mode	AT+IAP	Enter the IAP upgrade mode
AT+RESET	Equipment restart	AT+RESET	Equipment restart
AT+DEFAULT	Configuration parameters to restore the default And the device restarted	AT+DEFAULT	Configuration parameters to restore the default And the device restarted

Set instructions	Description	Instance	Example description
AT+UART=baud,parity	Set the port rate and check	AT+UART=3,0	Set the port rate to 9600,8N0
AT+RATE=rate	Set air rate	AT+RATE=7	Set the air rate to 16.4K
AT+PACKET=packet	Set the length of the package	AT+PACKET=0	Set the packet to 240 bytes
AT+WOR=role,period	Set the WOR roles and cycles	AT+WOR=0,3	Set to WOR receive for a period of 2000ms
AT+POWER=power	Set the sending power	AT+POWER=0	Set the transmission power to be 33 dBm
AT+TRANS=mode	Set the send mode	AT+TRANS=1	Set to point mode
AT+ROUTER=router	Set relay mode	AT+ROUTER=1	Set to the relay mode
AT+LBT=lbt	Set the Listen Before Talk function switch	AT+LBT=1	Set on, refer to section 8.2 LBT enable for details
AT+ERSSI=erssi	Set the ambient noise RSSI switch	AT+ERSSI=1	Set on, refer to section 8.2 RSSI environmental noise function for detail
AT+DRSSI=data_rssi	Sets the receiving data RSSI switch	AT+DRSSI=1	The receive data RSSI function is turned on
AT+ADDR=addr	Set module address	AT+ADDR=1234	Set the module address to 1234

AT+CHANNEL=channel	Set up the module working channel	AT+CHANNEL=23	Set the frequency to 433.125M
AT+NETID=netid	Set the network ID	AT+NETID=2	Set the network ID to 2
AT+KEY=key	Set the module key	AT+KEY=1234	Set the module key to 1234
AT+DELAY=delay	Set the WOR delay sleep time	AT+DELAY=1000	Set the WOR delay dormancy to 1000ms (during which send tasks can be performed. It is often used for the WOR receiver to perform wireless transmission without switching to the transtransmission mode.）
AT+SWITCH=switch	Set the software switching mode switch	AT+SWITCH=1	Set on to allow software switching

Query instructions	description	Return an example	Example description
AT+HELP=?	Query the AT timetable		Returns the AT repertoire
AT+DEVTYPE=?	Query module model	DEVTYPE=E90-DTU(900SL33)	Return Module Model
AT+FWCODE=?	Query firmware encoding	FWCODE=7432-0-10	Return firmware version
AT+UART=?	Query the baud rate and the check	AT+UART=3,0	Return to a port rate of 9600,8N0
AT+RATE=?	Query air rate	AT+RATE=7	The return to the air rate is 62.5k
AT+PACKET=?	Query the length of the package	AT+PACKET=0	Return packet is 240 bytes
AT+WOR=?	Query the WOR roles and cycles	AT+WOR=0,3	Return to WOR receive with a period of 2000ms
AT+POWER=?	Query send power	AT+POWER=0	The return sending power is 33 dBm
AT+TRANS=?	Query send mode	AT+TRANS=1	Returns to the fixed-point mode
AT+ROUTER=?	Query Relay Mode	AT+ROUTER=1	Returns to the relay mode
AT+LBT=?	Query the Listen Before Talk function switch	AT+LBT=1	Return to the LBT switch status
AT+ERSSI=?	Query the ambient noise RSSI switch	AT+ERSSI=1	Return to the ambient noise switch state
AT+DRSSI=?	Query the RSSI output	AT+DRSSI=1	The return channel RSSI function is turned on
AT+ADDR=?	Query module address	AT+ADDR=1234	The return module address is 1234
AT+CHANNEL=?	Query the module working	AT+CHANNEL=23	The return frequency is set

	channel		at 433.125M
AT+NETID=?	Query network ID	AT+NETID=2	The return network ID is 2
AT+KEY=?	Query module key	Read is not supported (security considerations)	return ERR
AT+DELAY=?	Query WOR delay dormancy time	AT+DELAY=1000	The return WOR delay sleep time is 1000ms

9.2 AT parameter analysis

When the serial port receives the correct instruction, the serial port returns "instruction =OK", otherwise it returns "= ERR"

Instruction parameters	Parameter meaning
Baud (serial port rate)	0:1200 1:2400 2:4800 3:9600 4:19200 5:38400 6:57600 7:115200
Parity (Serial port check bit)	0:8N1 1:8O1 2:8E1 3:8N1
Rate (air rate)	0:2.4K 1:2.4K 2:2.4K 3:4.8K 4:9.6K 5:19.2K 6:38.4K 7:62.5K
Packet (Packet length)	0:240 1:128 2:64 3:32
Role (WOR role)	0: receive 1: send
Period (WOR Cycle)	0:500ms 1:1000ms 2:1500ms 3:2000ms 4:2500ms 5:3000ms 6:3500ms 7:4000ms
Power (transmit power)[Note 1]	0:33dBm 1:30dBm 2:27dBm 3:24dBm
Mode (Transport mode)	0: transparent 1: fixed point
Router (Relay mode)	0: Off 1: On
LBT(listen before talk)	0: Off 1: On
Erssi (Environmental RSSI)	0: Off 1: On
Data _ rssi (Data RSSI)	0: Off 1: On
Addr (module address)	Module address 0~65535 (10 r)
Channel (Module channel)	Module channel 0~80 (10 decimal system)
Netid(network ID)	Module network 0~255 (10 r)
Key(cipher code)	Module key 0~65535 (10 r)
Delay (WOR delay dormancy)	Delay hibernation 0~65535 (10 decimal point)

Note 1: Different module sets for different powers. You can check the transmitting power in Section 8.2 of the manual.

9.3 Notes for serial port upgrade firmware

If the customer needs to upgrade the firmware, it needs to find the corresponding BIN file provided by the official, and then use the official provided upper machine to upgrade the firmware. Generally, the user does not need to upgrade the firmware, so do not use the "AT + IAP" command.

The necessary pins for upgrade must be introduced (M1, M0, AUX, TXD, RXD, VCC, GND), and then send "AT + IAP" command into the upgrade mode. If you need to exit the IAP upgrade mode, you need to stay on and wait for 60 seconds, the program will automatically exit, otherwise even if the restart, it will enter the upgrade mode indefinitely.

After entering the upgrade mode, the port rate will automatically switch to 115200 until you automatically exit, with a log output.

10. Relay mode

No	Relay mode description
1	After setting the relay mode through the configuration mode, switch to the general mode, and the relay starts working.
2	In relay mode, ADDH, ADDL is no longer used as the module address, but corresponds to NETID forwarding pairs. If one of the networks is received, it is forwarded to another network. The repeater's own network ID is invalid.
3	In relay mode, the relay module cannot send and receive data and cannot perform low-power operation.
4	The user enters another mode from mode 3 (sleep mode), or during the reset process, the module resets the user parameters, during which the AUX outputs a low level.

Description of the relay networking rules:

1、 Forward rules, the relay can forward data between two NETIDs.

2、In relay mode, ADDH \ ADDL is no longer used as a module address and serves as a NETID forwarding pairing.

as shown in the figure:

① Level 1 Relay

"Node 1" NETID is 08.

"Node 2" NETID is 33.

The ADDH \ ADDL for relay 1 was 08,33, respectively.

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 sent by node 1 can be received by node 2.

② Secondary Relay

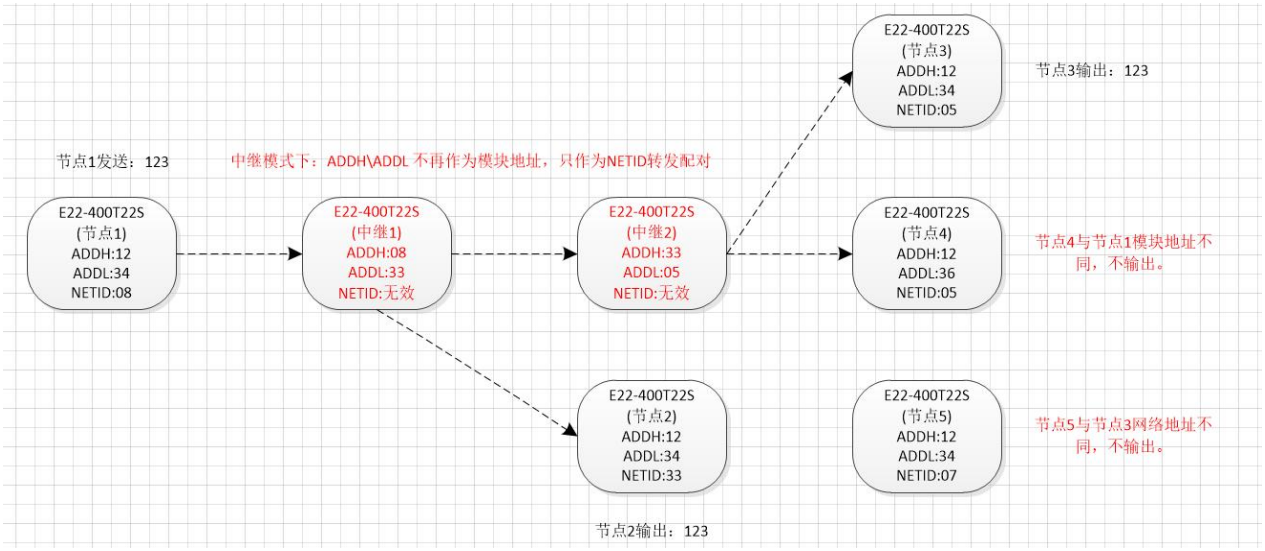
The ADDH \ ADDL for relay 2 was 33,05, respectively.

So the relay 2 can forward the data of the relay 1 to the network NETID: 05.

Thus, the nodes 3 and the node 4 can receive the node 1 data. Node 4 normally outputs data, and node 3 has different addresses from node 1, so it does not output data.

③ bi-directional relay

As configured, data nodes 2 and 4 sent by nodes 1 may be received, and data sent by nodes 2 and 4 can also be received by nodes 1.



11. Description of the configuration software

- The following figure shows the configuration display interface of E90-DTU (900SL33). Users can switch to command mode through M0 and M1, and quickly configure and read parameters in the upper computer.

- In the configuration computer, the module address, frequency channel, network ID and key are all decimal display mode; taking the values of each parameter:

  Network address: 0~65535

  Frequency channel: 0~80

network ID:0~255

Key: 0~65535

- When the user uses the upper computer configuration relay mode, they need to pay special attention to, because in the upper computer, each parameter is decimal display mode, so the module address and network ID need to be filled in through the conversion input system;

  If the network ID input by the transmitter A is 02 and the network ID input by the receiver B is 10, then the relay R sets the module address, convert the hex value 0X020A into the decimal value 522 as the module address filled in by the relay R;

  That is, the module address value of the relay terminal R that needs to be filled in is 522.

12. Configure device

12.1. Connection diagram

Mode	M1	M0	Description
Configuration mode	OFF	ON	Stations can only be programmed by using the configuration software in the current mode

1. Programming can only be carried out in a specific working mode (see the table above). If the programming fails, please confirm that the radio working mode is correct.
2. If there is no need to open the E90-DTU SL digital transmission station configuration software, you can modify the relevant parameters.

13. Connection diagram

14. Related products

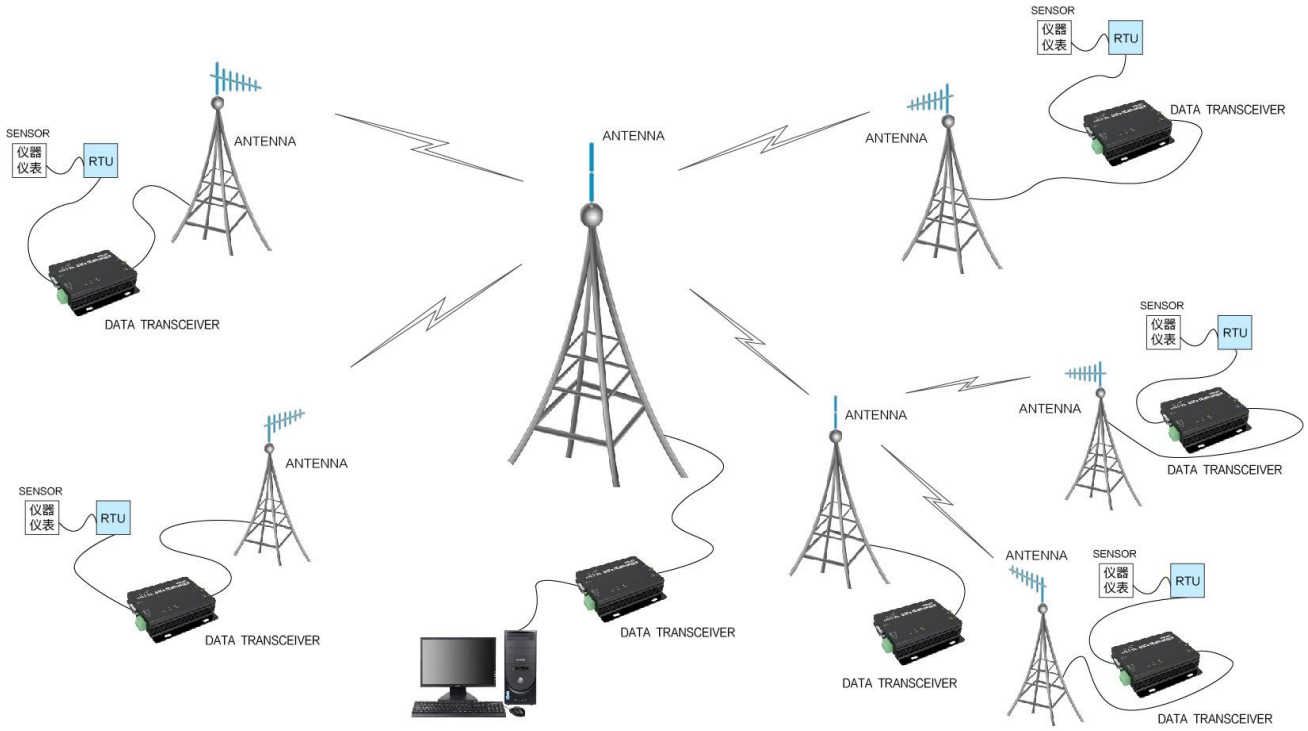
Model	Interface	Frequency Hz	Power W	Distance km	Features
E90-DTU(230SL22)	RS232 RS485	230M	0.16	5	LoRa frequency expansion, wireless configuration, network transmission, applicable to complex

					environment
E90-DTU(230SL30)	RS232 RS485	230M	1	10	LoRa frequency expansion, wireless configuration, network transmission, applicable to complex environment
E90-DTU(400SL22)	RS232 RS485	433\470M	0.16	5	LoRa frequency expansion, wireless configuration, networking transmission, long-distance anti-interference
E90-DTU(400SL33)	RS232 RS485	433\470M	1	10	LoRa frequency expansion, wireless configuration, networking transmission, long-distance anti-interference
E90-DTU(900SL22)	RS232 RS485	868\915M	0.16	5	LoRa frequency expansion, wireless configuration, networking transmission, long-distance anti-interference
E90-DTU(900SL30)	RS232 RS485	868\915M	1	10	LoRa frequency expansion, wireless configuration, networking transmission, long-distance anti-interference
E90-DTU(170L30)	RS232 RS485	170M	1	8	LoRa expansion, super-penetrating diffraction
E90-DTU(433L30)	RS232 RS485	433M	1	8	LoRa spread frequency, remote anti-interference
E90-DTU(433L37)	RS232 RS485	433M	5	20	LoRa spread frequency, 20km ultra-long distance, anti-interference
E90-DTU(433C30)	RS232 RS485	433M	1	3	High-speed continuous transmission, with support for the ModBus protocol
E90-DTU(433C33)	RS232 RS485	433M	2	4	High-speed continuous transmission, with support for the ModBus protocol
E90-DTU(433C37)	RS232 RS485	433M	5	10	High-speed continuous transmission, support for ModBus protocol, long distance
E90-DTU(230N27)	RS232 RS485	230M	0.5	5	Low-frequency narrow-band, suitable for complex environment
E90-DTU(230N33)	RS232 RS485	230M	2	8	Low-frequency narrow-band, suitable for complex environment
E90-DTU(230N37)	RS232 RS485	230M	5	15	Low frequency narrow band, suitable for complex environment, super strong diffraction

15. Practical application fields

Radio is suitable for all kinds of point-to-point, multi-point wireless data transmission system, such as intelligent home, Internet of things, power load monitoring, distribution network automation, hydrological hydrologic monitoring, water pipe network monitoring, city street lamp monitoring, air defense alarm control, railway signal monitoring, railway water supply centralized control, oil gas supply network monitoring, GPS positioning system, remote meter reading, electronic weighing, report automatic target, earthquake detection, fire prevention, security, environmental monitoring

and other industrial automation system, the chart below:



16. Using Tips

1. Please take good care of the warranty card with the factory number (and important technical parameters) of the equipment, which has important reference value for the future maintenance and new equipment of the user.
2. During the warranty period, the station shall enjoy free warranty for natural disasters, such as damage, contact our company and provide first-class after-sales service.
3. This radio station may not be operated near some flammable places (such as coal mine) or explosive dangerous objects (such as detonator).
4. Suitable DC voltage power supply should be selected for strong high frequency interference resistance, small ripple, and sufficient load capacity; it is best to have overcurrent, overvoltage protection and lightning protection functions to ensure the normal operation of digital transmission station.
5. Do not use it in a working environment beyond the environmental characteristics of the digital transmission radio station, such as high temperature, humidity, low temperature, strong electromagnetic field, or large dust environment.
6. Do not let the radio station continuously at full capacity, otherwise it may burn the transmitter.
7. The ground wire of digital transmission station should be well connected with the ground wire of external equipment (such as PC, PLC, etc.) and the ground wire of power supply, otherwise it is easy to burn out the communication interface; do not plug or pull the serial port.
8. During the test, the matching antenna or 50 Ω false load must damage the transmitter. If the antenna is connected, the distance between the human body should be more than 2 meters to avoid damage, do not touch the antenna during transmission.
9. Wireless data transmission stations often have different communication distances in different environments, which is often affected by temperature, humidity, obstacle density, obstacle volume and electromagnetic environment. In

order to ensure stable communication, it is suggested to reserve more than 50% communication distance margin.

10. If the measured communication distance is not ideal, it is suggested to analyze and improve the communication distance from the antenna quality and antenna installation mode. Also available with support@cdebyte.com get in touch and seek help.
11. When selecting the power supply, in addition to keeping the 50% current allowance as recommended, it should be noted that the ripple should not exceed 100 mV.
12. Wireless communication products need to be connected to an impedance matching antenna to work properly, even for a short time test, it can not be omitted, if the product damage will not be covered by the warranty.

Revise the history

Version	Date	Description	Issued by
1.0	2023-8-18	The initial version	Hao

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