Chengdu Ebyte Electronic Technology Co.,Ltd

Wireless Modem

User Manual



E90-DTU(2G4L27)

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1. Introduction

1.1 Brief introduction

E90-DTU (2G4L27) is a data transceiver with military-grade LoRa modulation technology. With multiple transmission modes, it works in the (2400MHz~2500MHz) frequency band (default 2424MHz). The transceiver provides transparent RS232/RS485 interface and supports 8～28V voltage input. LoRa direct-sequence spread spectrum technology will bring longer communication distances, and has the advantages of concentrated power density and strong anti-interference ability. It features a software FEC forward error correction algorithm, which has high coding efficiency and strong error correction capability. In the case of sudden interference, it can proactively correct the interfered data packets, greatly improving reliability and transmission distance. In the absence of FEC, such packets can only be discarded. It has data encryption. The data transmitted by the transceiver over the air is random, and the data interception is meaningless through strict encryption and decryption algorithms. 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

- Using the latest LoRa technology;
- Using military-grade LoRa modulation technology, with data encryption;
- Simple high-efficiency power design, support power supply configuration or pressure line mode,8 ~ 28V power;
- The transmit power is up to 27dBm,multi-level adjustment,all technical indicators meet European industrial standards;
- 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;
- With temperature compensation circuit, the frequency stability is better than ±1.5PPM;
- Operating temperature range: -40 ° C ~ +85 ° C, to adapt to a variety of harsh working environment;
- All-aluminum alloy casing, compact size, easy installation and good heat dissipation; perfect shielding design, with good electromagnetic compatibility and strong anti-interference ability;
- Multiple protection functions such as power reverse connection protection, over-current protection, and antenna surge protection greatly increase the reliability of the device;
- Powerful software functions, all parameters can be programmed: such as power, frequency, air data rate, address ID, etc;
- with built-in watchdog and precise time layout, once an exception occurs, the transceiver will automatically restart, and continue to work according to the previous parameters.

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2. Quick Start

You need to prepare items below:





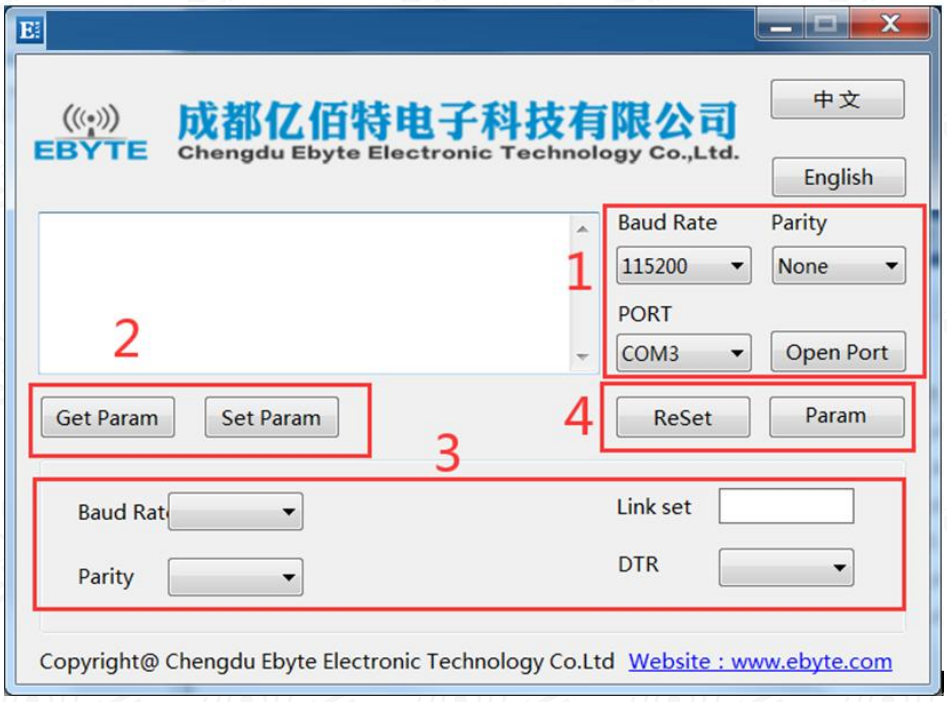




2.1 PC configuration instructions

First install an antenna for the digital radio, and then use USB to RS-232 or USB to RS-485 to connect the computer to the digital radio, the radio M1 dials up, M0 is arbitrary, and enters the configuration mode.

The upper computer software is used to query and set the module parameters, and the radio station needs to work in configuration mode. The software interface is shown in the figure below:



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Software window description

Num	Description
1	Serial port parameter area
2	Command execution area
3	Parameter area
4	Special command area

1：Select the current baud rate and parity bit of the module and the corresponding port number, then open the serial port. You must make the module work in configuration mode and select the correct serial port parameters, otherwise the operation instructions will fail.

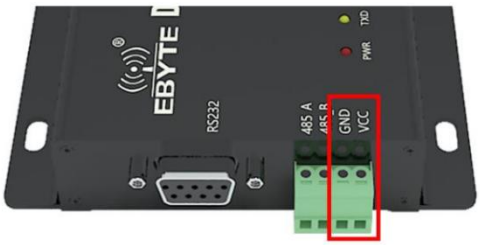
2：Click to read parameters, it prompts that the read parameters are successful, and the current parameters of the module are displayed in the parameter area. Click Write parameters to prompt that the write parameters are successful. The parameters selected/filled in the parameter area have been written to the module.

3：The parameter area is used with the "Read Parameters" button to display the current module parameters, or to modify the parameters with the "Write Parameters" button to set the module parameters.

4：Special commands for restarting and restoring factory settings are used to reset the module and restore the module parameters to the factory state respectively.

2.2 Quick to use

1. First install the antenna for device, then install the power supply, Radio M1 dials down, M0 is arbitrary, enter the transparent transmission mode,The user can select the crimping method or the power adapter to supply power according to the requirements；

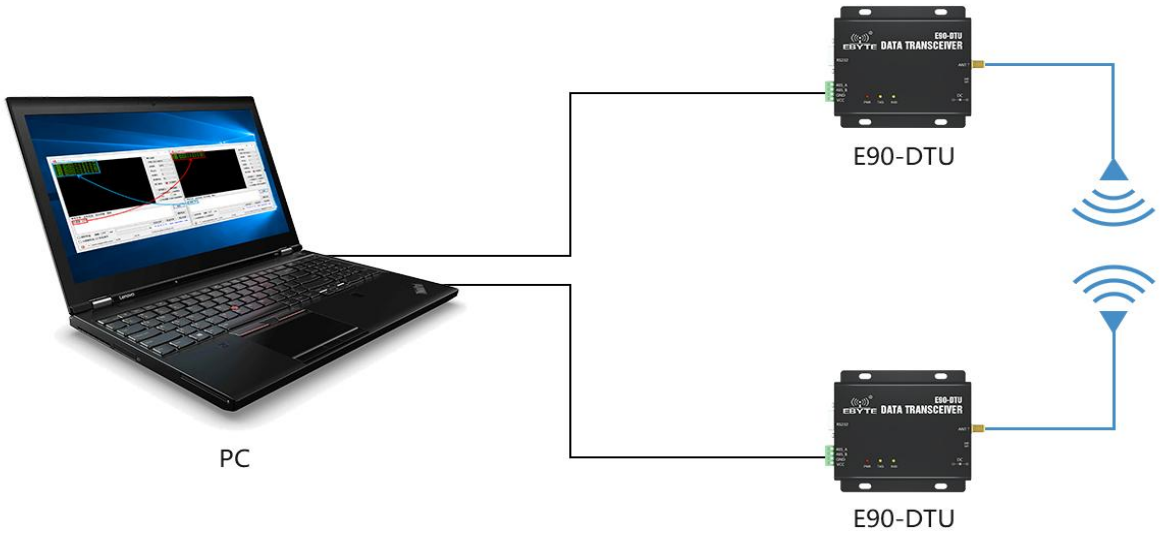




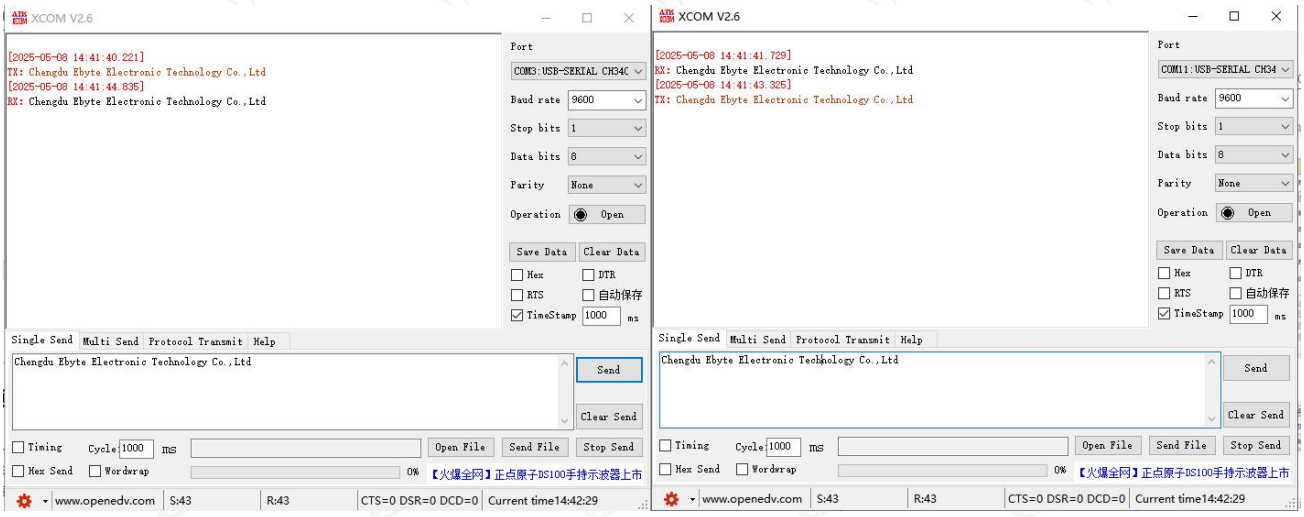
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2 . Use USB to RS-232 or USB to RS-485 to connect the computer to the digital radio; hen turn on the power of the radio, and it will automatically establish a connection with another radio. If the connection is successful, the LINK light is always on to communicate.



3 . Start two serial port debugging assistants, select the baud rate 115200bps, check mode as 8N1 to realize transparent transmission;



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4 . If customer needs to modify the parameters, please dial the switch in the configuration mode and connect to the computer. Open the E90-DTU SL configuration software, you can modify the relevant parameters. After completing the configuration;



Mode 0 Factory default

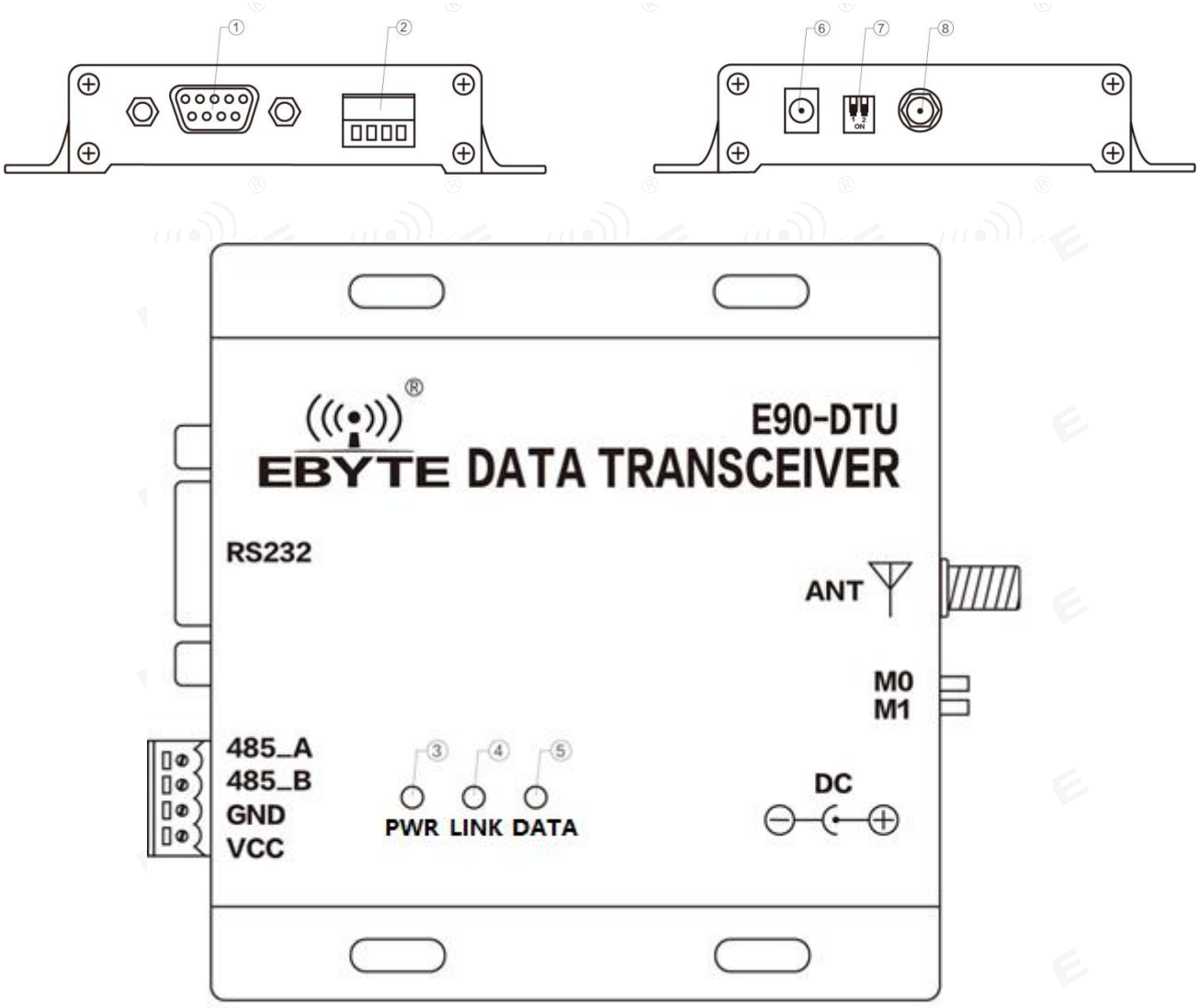


Mode 2 Parameter configuration

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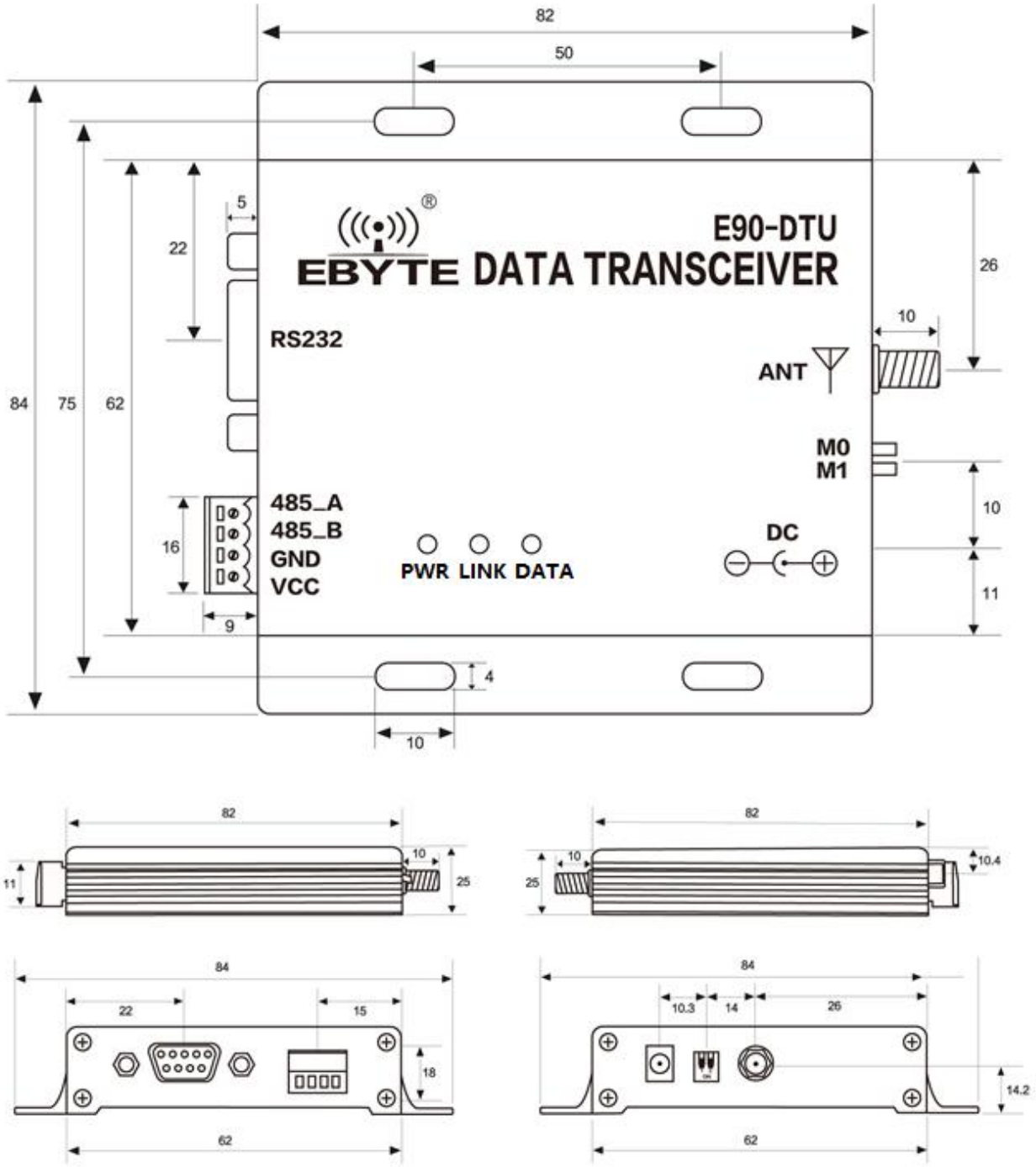
3. Dimensions



No.	Name	Function	Note
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 LED	Red, lit when the power is on
4	LINK-LED	Data transceiver LED	Yellow, the connection is successful
5	DATA-LED	Serial data LED	Yellow, flashing during data transmission
6	DC power interface	Power interface	In-line round hole, outer diameter 5.5mm, diameter 2.5mm
7	DIP switch	Mode selection	M1=upward dialing, configuration mode when M0 is arbitrary, M1=downward dialing, transparent transmission mode when M0 is arbitrary
8	Antenna interface	SMA-K interface	external thread, 10mm, 50Ωcharacteristic impedance

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单位：mm

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4. Interface definition

4.1 Power interface



Users can choose ⑥ DC power interface,using the power adapter supply with the interface of the 5.5mm outer diameter , 2.5mm diameter ;

Also users can choose the VCC and GND terminal power supply from ② , both are optional;

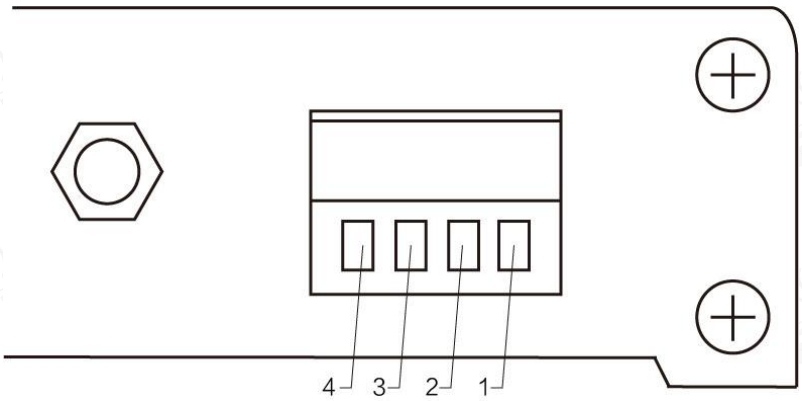
8~28V DC power supply, it is recommended to use 12V or 24V DC power supply for E90-DTU.

4.2 RS232

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

4.3 RS485

E90-DTU can be connected to the 485_A terminal and 485_B terminal from ② with the RS-485 A terminal and B terminal of other device respectively.



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Pin NO.	Definition	Function	Description
1	VCC	Crimping power interface, positive	8~28V DC, recommended 12V or 24V
2	GND	Crimping power interface, negative	The power supply negative pole is connected to the system ground and the housing
3	485_B	RS-485 interface, interface B	The RS-485 interface B is connected to the device interface B
4	485_A	RS-485 interface, interface A	The RS-485 interface A is connected to the device interface A

Note: The transceiver will be in poor communication when connected to multiple devices , it is recommended to be connected to a single device, please try to use parallel 120Ω resistor between 485_A terminal and 485_B.

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5. Technical specification

5.1 Model specification

Model No.	Frequency	TX power	Distance	Features	Recommended application
	Hz	W	km		
E90-DTU(2G4L27)	2400	27	7	LoRa, anti-interference	Suitable for environments with many obstacles, long distances, and easy interference

★ Note: in clear and open air without shelters, 12V /1A power supply, 5dBi gain sucker antenna over 2 meters height from the ground, with the factory default parameters.

5.2 General specification paramet

No.	Item	Value	Note
1	Size	82*62*25 mm	See more in Dimensions
2	Weight	130g	± 4.5g
3	Temperature	-40℃ ~ +85℃	Meet industrial request
4	Antenna impedance	50Ω	Standard 50 Ω characteristic impedance
5	Supply voltage	8 ~ 28V DC	It is recommended to use 12V or 24V
6	Communication interface	RS232/RS485	Standard DB9 hole / 3.81 terminal block
7	Baud rate	Default 115200	From 1200~115200

5.3 Frequency and channel numbers

Model No.	Default Frequency	Frequency Range	Channel Interval	Channel numbers
	Hz	**Hz**	**Hz**	
E90-DTU(2G4L27)	2424	2400 ~ 2500	1M	101

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5.4 Current parameter

Model No.	Average emission current mA		Waiting average current mA	
	12V	24V	12V	24V
E90-DTU(2G4L27)	226	110	22	15

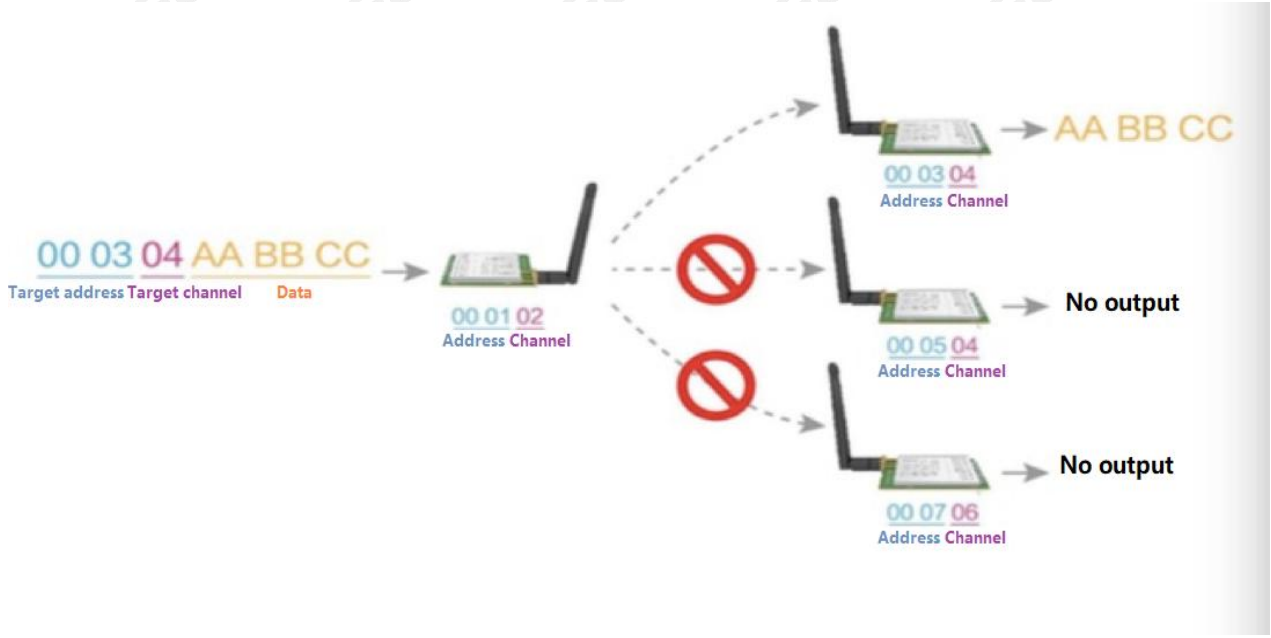
★Note: 12V transient transmission MAX current: 66mA, 24V transient transmission MAX current: 33mA, it is recommended to reserve ≥50% MAX current margin when selecting the power supply, which is beneficial to the long-term stable operation of the radio.

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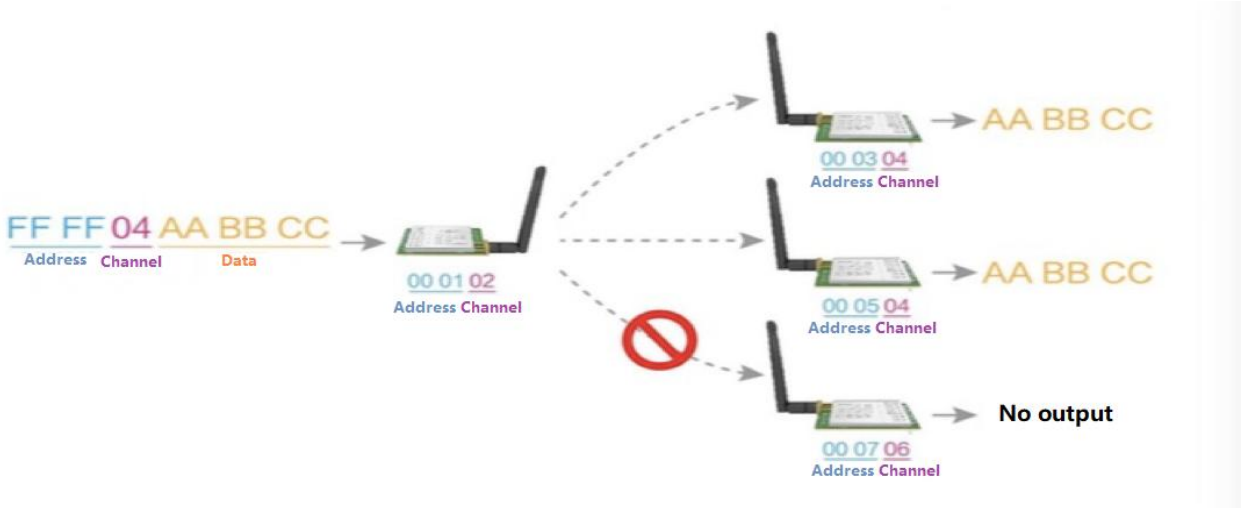
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6. Function Description

6.1 Fixed Transmission (Hexadecimal)



6.2 Broadcast Transmission (Hexadecimal)



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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.

6.5 Operating mode

The E90-DTU has two working modes. In normal communication, the radio is configured in the normal mode (mode 0); the default setting of the radio is also the normal mode (mode 0).

Mode （0-3）	M1	M0	Mode introduction	Remark
0 Transmission mode	ON	ON	Serial port open, wireless open, continuous transparent transmission	Airspeed supports manual configuration and self-adaptive automatic adjustment with the baud rate; the baud rate of both parties in the continuous transmission mode must be the same
1 RSSI mode	ON	OFF	Serial port open, wireless open, RSSI function open	The module outputs RSSI strength value every 100ms serial port
2 Ranging mode	OFF	ON	N/A	-
3 Configuration mode	OFF	OFF	Serial port open, wireless close, used for parameter configuration	Baud rate is fixed 9600 8N1



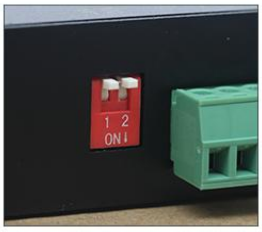
Mode 0



Mode 1



Mode 2



Mode 3

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7. Register read and write control

7.1 Command format

In configuration mode（mode 2：M1=OFF，M0=ON），supported commands are as follows（only **9600，8N1 are available**）：

NO	Command format	Description
1	C0 + parameters	Send C0+5 bytes of working parameters in hexadecimal format, a total of 6 bytes, must be sent continuously (save when power off)
2	C1+C1+C1	Three C1s are sent in hexadecimal format, and the module returns the saved parameters, which must be sent continuously.
3	C2+ parameters	Send C2+5 bytes in hexadecimal format. Working parameters, 6 bytes in total, must be sent continuously (not saved after power failure)
4	C3+C3+C3	Three C3s are sent in hexadecimal format, and the module returns version information, which must be sent continuously.
5	C4+C4+C4	When sending three C4s in hexadecimal format, the module will generate a reset and must be sent continuously.
6	E2+E2+E2	In transparent transmission mode, sending three E2s in hexadecimal format, the module will enter a 10S clock configuration window period, within which 10S clocks can configure the corresponding parameters of the module through the C0 command, after the 10S clock is over, the module uses the new parameters working.
7	E3+E3+E3	In transparent transmission mode, three E3s are sent in hexadecimal format, and the corresponding module that receives this instruction will enter a 10S configuration window period, within which 6 bytes of C0 command parameters can be sent to the air configuration module After 10S minutes, the receiving module will use the new parameters to work.

Working parameter reading

Instruction format	Detailed description
C1+C1+C1	Under configuration (M0=1, M1=1), send a command (HEX format) to the module serial port: C1 C1 C1, The module will return the current configuration parameters, such as: C0 00 00 13 18 04.

Version number read

Instruction format	Detailed description
C3+C3+C3	Under configuration (M0=1, M1=1), send a command (HEX format) to the module serial port: C3 C3 C3, The module will return the current configuration parameters, such as: C3 00 47 10 0C 09 01 00; where 00 28 represents the module model (E28 series), 10 represents the version number, 0C represents the module power, and other parameters represent other characteristics of the module.

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Reset command

Instruction format	Detailed description
C4+C4+C4	Under configuration (M0=1, M1=1,) send a command (HEX format) to the module serial port: C4 C4 C4, the module will generate a reset; During the reset process, the module performs self-check, and AUX outputs low level. After resetting, AUX outputs high level and the module starts to work normally. At this point, you can switch the mode or initiate the next instruction.

7.2 Register description

	Name	Description				Remark
0	HEAD	Fixed 0xC0 or 0xC2, indicating that this frame data is a control command				Must be 0xC0 or C2 C0: The set parameters will be saved after power-off. C2: The set parameters will not be saved after power-off.
1	ADDH	Module address high byte (default 00H)				00H-FFH
2	ADDL	Module address low byte (default 00H)				00H-FFH
3	SPED	7	6	Serial port check digit		The serial port mode of the communication parties can be different
		0	0	8N1（default）		
		0	1	8O1		
		1	0	8E1		
		1	1	8N1（Equal to 00）		
		5	4	3	TTL Serial port rate（bps）	In the normal mode, the serial port modes of the communication parties can be different; In continuous transmission mode, the baud rate of both parties must be the same;
		0	0	0	Serial port baud rate 1200	
		0	0	1	Serial port baud rate 4800	
		0	1	0	Serial port baud rate 9 600（default）	
		0	1	1	Serial port baud rate 19200	
		1	0	0	Serial port baud rate 57600	
		1	0	1	Serial port baud rate 115200	
		1	1	0	Serial port baud rate 460800	
		1	1	1	Serial port baud rate 921600	
		2	1	0	Wireless air rate（bps）	In the air rate non-continuous transmission mode, the serial port baud rate has nothing to do with wireless transmission parameters, and does not affect the wireless transceiver characteristics. In the air rate continuous transmission mode, the serial port baud rate determines the air rate. The faster the baud rate, the faster the transmission speed and the closer the transmission distance. The lower the air speed, the longer the distance, the stronger the anti-interference performance, and the longer the sending time. The air wireless transmission rate of both parties must be the same
		0	0	0	Air rate adaptation (continuous transmission)	
		0	0	1	Air speed 1k	
		0	1	0	Air speed 5k	
		0	1	1	Air speed 10k（default）	
		1	0	0	Air speed 50k	
		1	0	1	Air speed 100k	
		1	1	0	Air speed 1M（FLRC）	
		1	1	1	Air speed 2M（FSK）	
4	CHAN	Communication channel number				Default：0x13
		Normal mode: When the airspeed is 1k, 5k, 10k, the channel calculation formula is: 2400 + CHAN * 1MHz; When the airspeed is 50k or 100k, the channel calculation formula is: 2400 + CHAN * 2MHz;				

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		When the airspeed is 1M, the channel calculation formula is: 2400 + CHAN * 3MHz; When the airspeed is 2M, the channel calculation formula is: 2400 + CHAN * 5MHz;			
		Continuous transmission mode: When the baud rate is 1200, 9600, 19200, the channel calculation formula is: 2400+CHAN*2MHz; When the baud rate is 4800, 57600, 115200, the channel calculation formula is: 2400+CHAN*4MHz; When the baud rate is 460800, 921600, the channel calculation formula is: 2400+CHAN*5MHz;			
5	OPTION	7	Fixed-point transmission enable bit (like ModBus)		When it is 1, the first 3 bytes of each user data frame are used as high and low addresses and channels. The module changes its address and channel during transmission, and restores the original settings after completion; the continuous transmission mode is transparent transmission.
		0	Transparent transmission mode		
		1	Fixed-point transmission mode		
		6	N/A		
		5	N/A		
		4	Test mode device type (reserved)		The slave address in the ranging mode is confirmed by ADDH and ADDL.
		0	Slave (default)		
		1	Host		
		3	LBT switch		After turning on LBT, the current channel quality will be checked before sending each packet of data. If it is good, send it directly. If there is interference in the channel, wait for the interference to disappear before sending. Support for air speeds below 115200, which may affect the continuous transmission function after opening.
		0	Turn off LBT (default)		
		1	Open LBT		
		2	IO drive mode		This bit is used to enable the internal pull-up resistor of the module; the open-drain mode has stronger level adaptability. In some cases, an external pull-up resistor may be required.
		1	TXD, AUX push-pull output, RXD pull-up input (default)		
		0	TXD, AUX open circuit output, RXD open circuit input		
		1	0	Transmitting power (approximate value)	The external power supply must provide a current output capability of more than 100mA and ensure that the power supply ripple is less than 100mV. It is not recommended to use lower power transmission, and its power utilization efficiency is not high.
		0	0	27dBm (default)	
		0	1	23dBm	
		1	0	20dBm	
		1	1	17dBm	

For example (the meaning of serial number 3 "SPED" byte):

Binary bits of the byte	7	6	5	4	3	2	1	0
Specific value (user configuration)	0	0	0	1	0	0	1	1
Representative meaning	Serial parity bit 8N1		The serial port baud rate is 9600			Air rate 10kbps		
Corresponding hexadecimal	0			13				

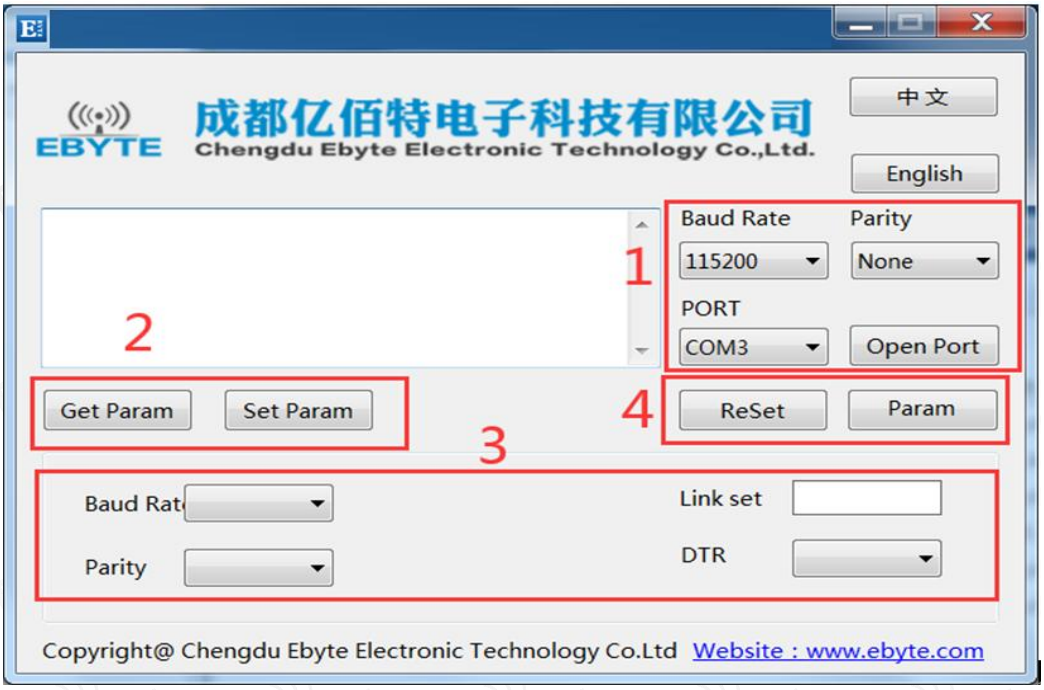
7.4 Configuration instructions on computer

The following figure shows the E90-DTU configuration interface on computer, users can switch to the command mode

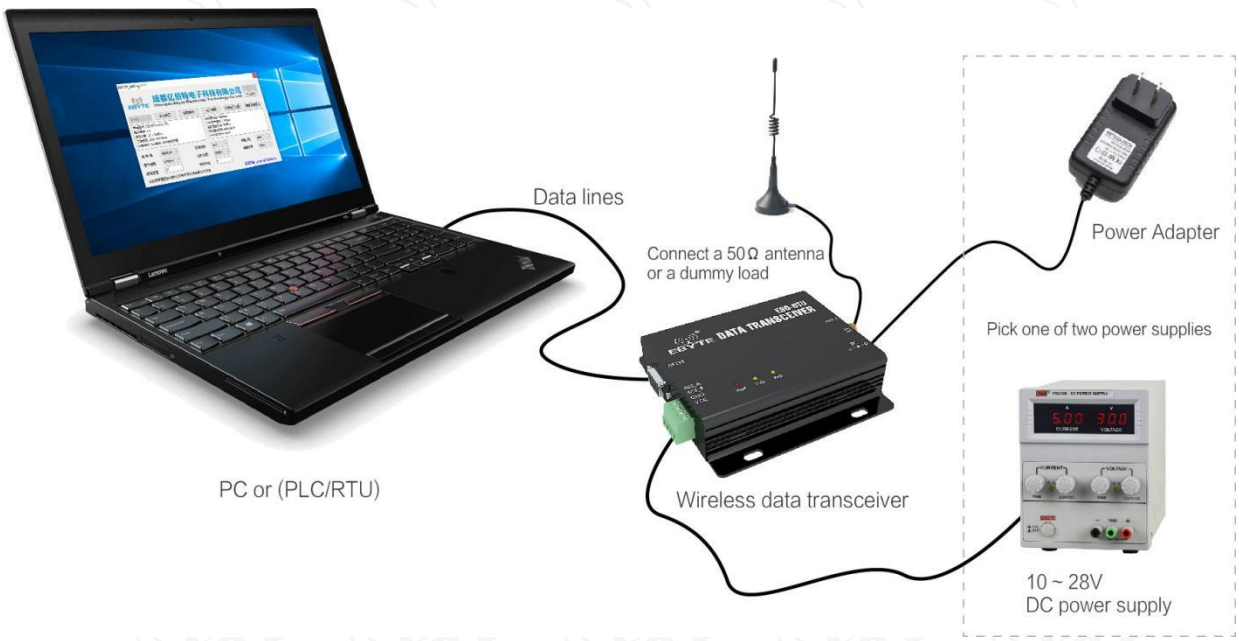
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through M0M1, and quickly configure and read the parameters on computer.



7.5 Schematic diagram



Operating mode	M1	M0	Note
Configuration mode	OFF	OFF	Programming via the configuration software is available only in this mode

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Programming can only be carried out in a specific working mode (see the above table). If the programming fails, please confirm whether the working mode of the radio is correct.

7.6 Factory default parameter

	Default parameter:						
Model NO.	Frequency	Address	Channel	Air data rate	Baud rate	Parity bit	TX power
E90-DTU(2G4L27)	2.4GHz	0x0000	0x13	10kbps	9600	8N1	27dbm

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8. E90-DTU

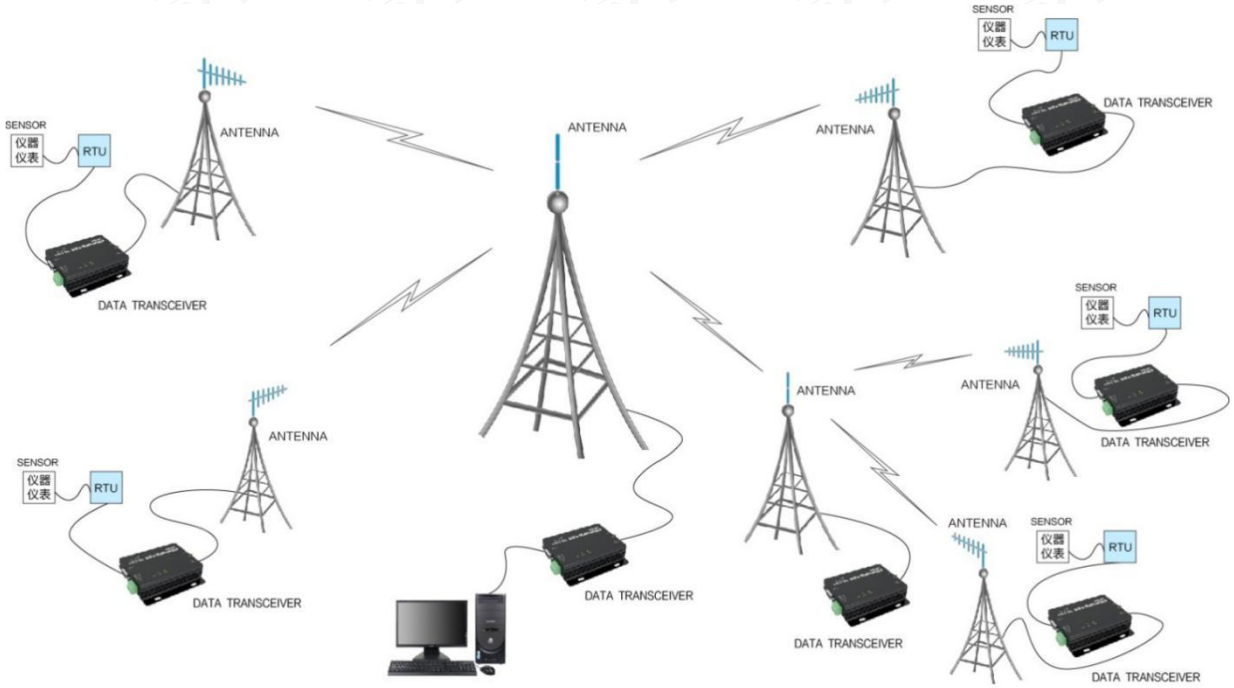
Model No.	Interface	Frequency Hz	TX Power dBm	Distance km	Features
E90-DTU(230SL22)	RS232 RS485	230M	22	5	Low frequency LoRa，ultra strong diffraction ability for complex environment
E90-DTU(400SL22)	RS232 RS485	433\470M	22	5	LoRa,wireless configuration，networking transmission, long distance, anti-inference
E90-DTU(400SL30)	RS232 RS485	433\470M	30	10	LoRa, wireless configuration，networking transmission，long distance, anti-inference
E90-DTU(900SL22)	RS232 RS485	868\915M	22	5	LoRa, wireless configuration，networking transmission，long distance, anti-inference
E90-DTU(900SL30)	RS232 RS485	868\915M	30	10	LoRa, wireless configuration，networking transmission，long distance, anti-inference
E90-DTU(170L30)	RS232 RS485	170M	30	8	LoRa，strong diffraction ability
E90-DTU(433L30)	RS232 RS485	433M	30	8	LoRa，long distance, anti-inference
E90-DTU(433L37)	RS232 RS485	433M	37	20	LoRa，20km ultra long distance, anti-inference

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9. 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 and 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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10. Operation notes

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 have 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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11. 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	Li
1.1	Initial version	LY

About us

Technical support: support@cdebyte.com

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