EBYTE

Chengdu Ebyte Electronic Technology Co.,Ltd

Wireless Modem

User Manual



E95/E96-DTU(400Fxxx) Series

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1 Product introduction

1.1 Brief introduction

E95/E96-DTU (400Fxxx) is a cost-effective wireless data transmission radio station with multiple transmission methods. It works in the (410～510MHz) frequency band (default 433MHz). The radio provides a transparent RS485/RS232 interface, adopts a plastic shell, and a guide rail. Type installation structure, support 8～28V(DC)/85～265V(AC) voltage input. It has the advantage of strong anti-interference ability.

As a communication medium, DTU, like optical fiber, microwave, and open wire, has a certain scope of application: it provides real-time and reliable data transmission of monitoring signals in private networks under certain special conditions, with low cost, convenient installation and maintenance, and winding With strong radio capability, flexible network structure, and long coverage, it is suitable for many and scattered locations and complex geographical environment. It can be connected with PLC, RTU, rain gauge, level gauge and other data terminals.

1.2 Features

★ Flame-retardant plastic shell, guide rail type installation structure, convenient and efficient installation;
★ Support GFSK debugging method;
★ Hidden buttons are used to switch the working mode to avoid false triggering, and the equipment is more reliable in operation;
★ Simple high-efficiency power supply design, support power supply configuration or line pressure mode, support 8 ~ 28V (DC) / 85 ~ 265V (AC) power supply;
★ The transmit power can reach up to 20dBm, and supports multi-level adjustment, and all technical indicators meet industrial standards;
★ Working temperature range: -40℃～+85℃, suitable for various harsh working environments, real industrial grade products;
★ Multiple protection functions such as power reverse connection protection, over-connection protection, antenna surge protection, etc., greatly increase the reliability of the radio;
★ Powerful software function, all parameters can be set by programming: such as power, frequency, air rate, address ID, etc.;
★ Built-in watchdog, and accurate time layout, once an abnormality occurs, the radio will automatically restart, and can continue to work according to the previous parameter settings.

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1.3 Quick Test

Before connecting DTU to your own devices. Please do a quick test to get familiar with the DTU.

Step1: Prepare hardware for E95/E96-DTU(400Fxxx)



Step2: connect power and antenna



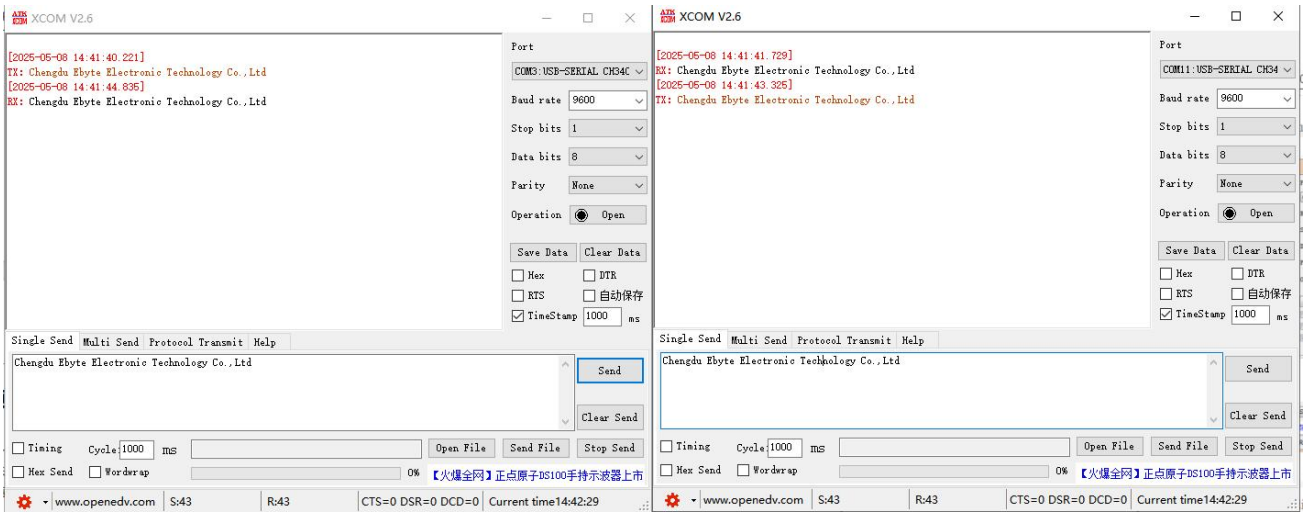
Step3: Connect DTU to Computer by USB to RS485/RS232.



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Step4 Install two Serial Port COM test tool on the computer and do a transparent transmission test. Defult parameters for serial port: 9600 baud rate, 8N1 Parity.



Working mode setting: If the user needs to switch the working mode, it can be controlled by the Mode button to switch between different working modes (M0 indicator, M1 indicator). Long press the Mode button for 1ms and release it to switch the mode once. The details of the mode switch are shown in the table below:

Mode	**Working Mode**	**M1**	**M0**	**Status**
Mode 0	Transparent transmission mode	Lights off	Lights off	The serial port is opened, the wireless is opened, and the radio transmits and receives data according to the set transmission mode
Mode 1	RSSI mode	Lights off	Light	Wireless off, serial port on, the radio will output RSSI signal strength value for 100ms
Mode 2	Configuration mode	Light	Lights off	You can use the configuration software to program the radio (fixed 9600 baud rate)
Mode 3	Sleep mode	Light	Light	The radio enters dormant standby, the serial port and wireless are both closed

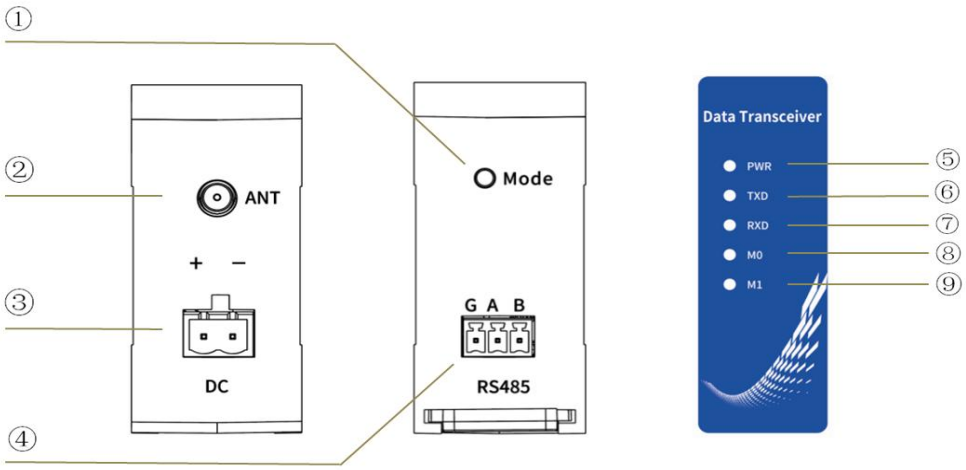
Note: DTU will save the working mode even after power-off (the factory default setting is transparent transmission mode), and the user needs to switch the corresponding mode according to the M1 and M0 LED indicators (effective immediately).

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1.4 Ports and Indicators

1.4.1 RS485 Interface

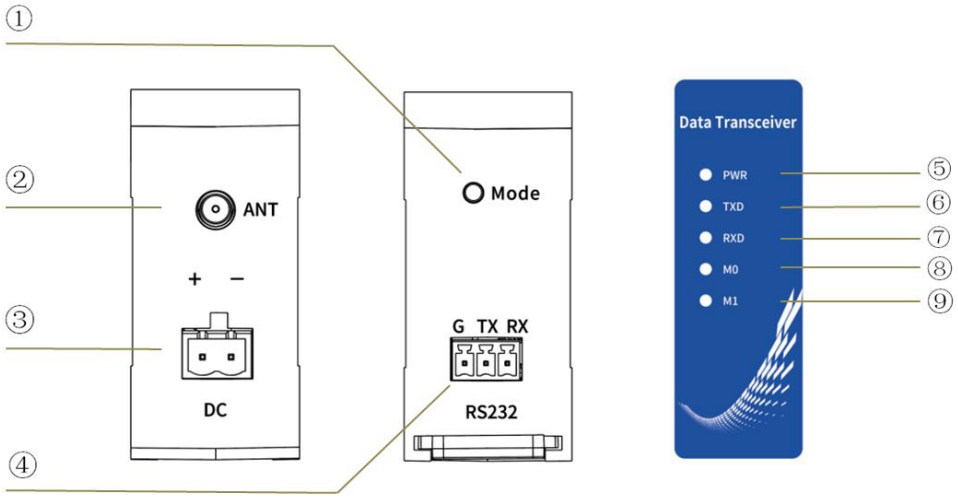


No.	Name	Function	Functions
1	Mode	Mode switch button	Change working mode
2	ANT	RF interface	SMA-K, external thread inner hole
3	DC	Power connector	DC power input port, pressure line port
4	RS485	RS485 communication port	Standard RS485 interface
5	PWR	Power Indicator	Lights up when the power is on
6	TXD	Send indicator	Flashes when sending data
7	RXD	Receive indicator	Flashes when receiving data
8	MO	Mode indicator	Working mode indicator
9	M1	Mode indicator	Working mode indicator

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1.4.2 RS232 Interface

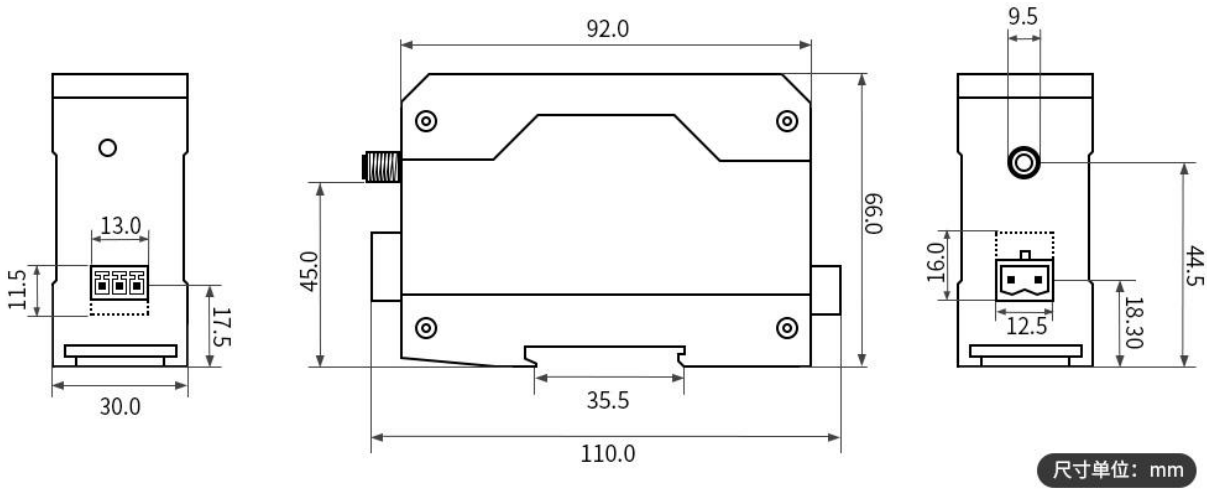


No.	Name	Function	Functions
1	Mode	Mode switch button	Change working mode
2	ANT	RF interface	SMA-K, external thread inner hole
3	DC	Power connector	DC power input port, pressure line port
4	RS232	RS485 communication port	Standard RS232 interface
5	PWR	Power Indicator	Lights up when the power is on
6	TXD	Send indicator	Flashes when sending data
7	RXD	Receive indicator	Flashes when receiving data
8	MO	Mode indicator	Working mode indicator
9	M1	Mode indicator	Working mode indicator

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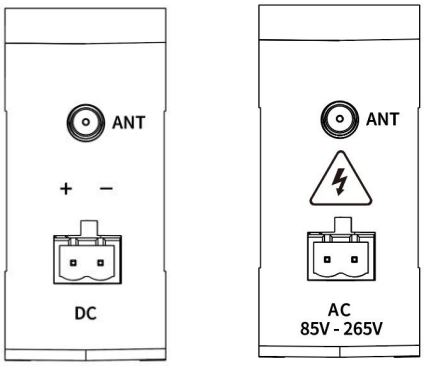
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1.5 Size and Dimension



2. Pin Definition

2.1 Power Interface



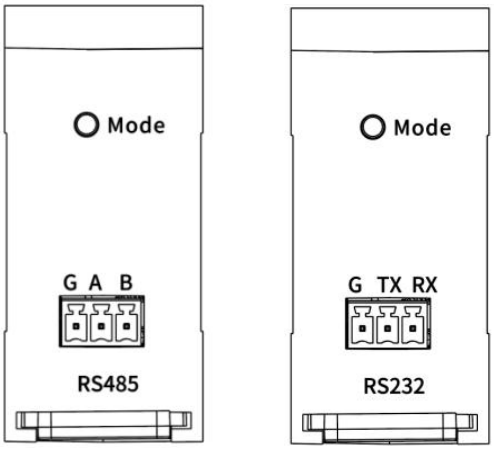
E95/E96-DTU(400Fxxx) is optional to be powered by 8～28V(DC)/85～265V(AC) power supply, and the wiring terminal is connected by 2-Line terminal.

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2.2 Communication Interface

E95/E96-DTU (400Fxxx) uses RS485/RS232 to connect with the target device through the terminal block.



No	Mark	Name	Functions
1	G	Signal wire ground	Anti-interference line, ground
2	A	RS485 bus A interface	RS485 interface A interface is connected to device A interface
3	B	RS485 bus B interface	RS485 interface B interface is connected to device B interface
4	TX	RS232 bus TX interface	RS232 interface TX interface is connected to the RX interface of the device
5	RX	RS232 bus RX interface	RS232 interface RX interface is connected to the TX interface of the device

★ Note: If multiple DTUs have poor communication, but two DTUs communicate normally, please try to connect a 120Ω resistor in parallel between the 485_A terminal and the 485_B terminal.

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3 Parameters

3.1 Model number and Parameters

Model Number	Freq.	TX P	Ideal Range*	Main Features	Typical Applications
	MHz	dBm	km		
E95-DTU(400F20-485)	410M ～ 510	20	1	GFSK modulation, cost-effective, DC power supply	Suitable for short-distance, stable high-speed transmission
E95-DTU(400F20-232)	410M ～ 510	20	1	GFSK modulation, cost-effective, AC power supply	Suitable for short-distance, stable high-speed transmission
E96-DTU(400F20-485)	410M ～ 510	20	1	GFSK modulation, cost-effective, AC power supply	Suitable for short-distance, stable high-speed transmission
E96-DTU(400F20-232)	410M ～ 510	20	1	GFSK modulation, cost-effective, AC power supply	Suitable for short-distance, stable high-speed transmission

***Ideal Range is realized at ideal conditions:**

1.Two DTUs with antennas in a line of sight, without obstacles between them, at good weather.

2.Set Max TX power.

3.Set 2.4kbps or lower air data rate, other parameters are default.

4.Antenna gain 5dbi

5.Antenna height: 2 meters.

6.12V1A DC Power supply.

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3.2 Common Parameters for E95/E96-DTU(400Fxxx)

No.	Para.	Value	Note
1	Product Size	92*66*30 mm	See chapter 1.5 for more details
2	product weight	95 g	Weight tolerance 5g
3	Operating temperature	-40℃～+85℃	Industrial grade
4	voltage range	8～28V (DC)	It is recommended to use 12V or 24V for DC version
7	Communication Interface	85～265V (AC)	AC version can use 110V/220V
8	Baud rate	RS485/RS232	Choose one of RS485 or RS232, subject to product identification
9	address code	Factory default 9600	Baud rate range 1200～115200

3.3 Frequency and Channels

Model Number	Band	Frq. Range	Band Width	Channel Quantity.
	Hz	Hz	Hz	
E95/E96-DTU(400Fxxx)	433M	410～510M	0.5M	200 Channels, Half-Duplex

★ Note: In the same area, if multiple groups of DTU are used for one-to-one communication at the same time, it is recommended that each group of DTU should use different channels with at lease 2MHz difference.

3.4 Transmitting Power Options

Model Number	20dBm	17dBm	14dBm	10dBm
E95/E96-DTU(400Fxxx)	Factory Default	√	√	√

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

3.5 Air Rate Options

Model Number	Default Air Rate	Options	Air Rate Options
	bps		bps
E95/E96-DTU(400Fxxx)	2.4k	8	1.2k,2.4k,4.8k,9.6k,19.2k,50k,100k,200k

★ Note: The higher the air speed setting, the faster the transmission rate and the shorter the transmission distance; therefore, when the speed meets the requirements of use, it is recommended that the airspeed be as low as possible.

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3.6 Voltage and Transmitting Current

Model Number	TX mA		Stand by mA	
	12V	24V	12V	24V
E95/E96-DTU(400Fxxx)	45	26	10	7

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

3.7 Data Packet

Model Number	Cache Capacity	Packet Length
E95/E96-DTU(400Fxxx)	500 Bytes	Automatically seperating data packet after received data exceeding 54 Byte

Notice:

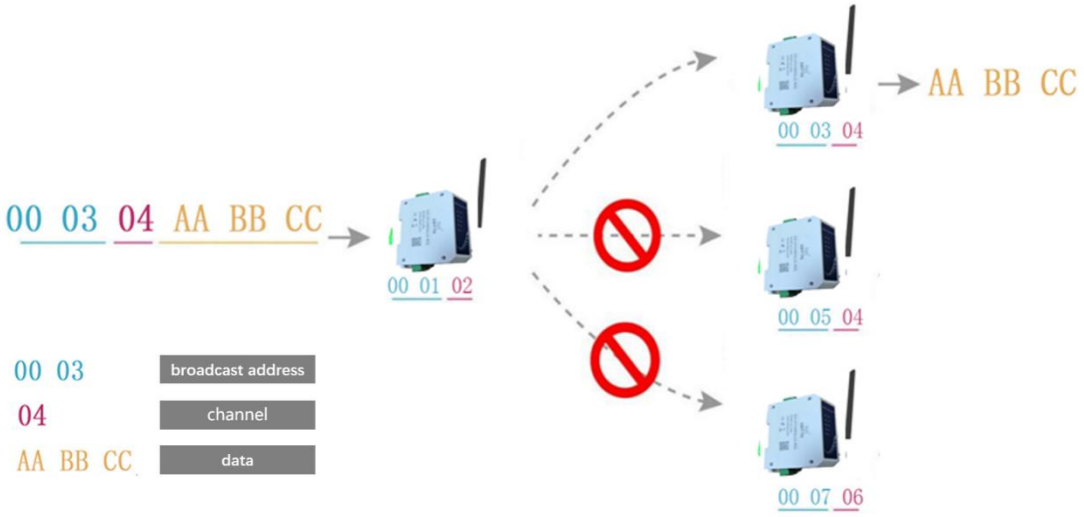
1. If the DTU received data is larger than the single-packet capacity of 54 bytes, the excess data will be automatically allocated to the second, third, fourth transmission, etc., until the transmission is completed.
2. The DTU received data cannot be larger than the cache capacity, otherwise the data will be completely lost.

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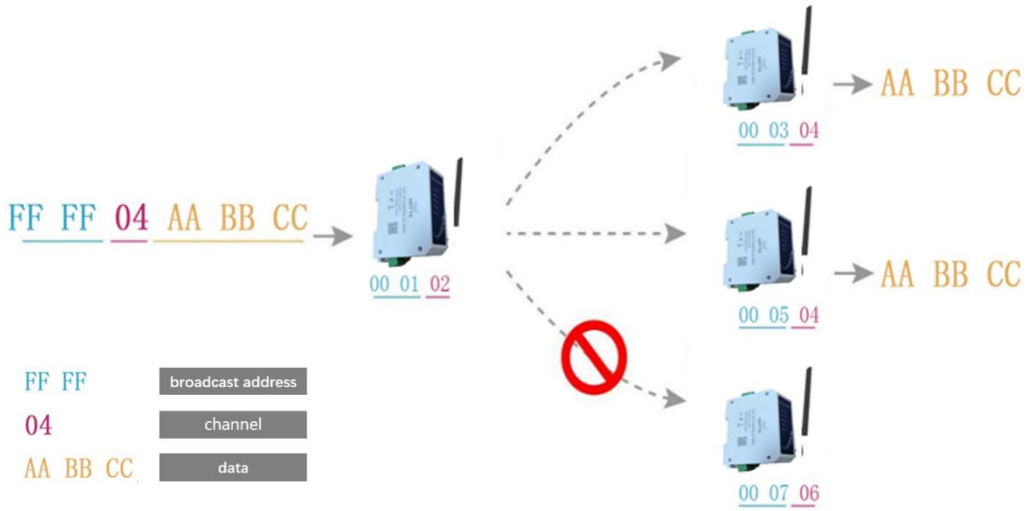
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4 Data Transmission Diagram

4.1 Point to Point Transmission(all inputs and outputs are in Hex)



4.2 Broadcasting Transmission(all inputs and outputs are in Hex)



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4.3 Address for Broadcasting

- Example:
- 1. Set the DTUA address to 0xFFFF and the channel to 0x04.
- 2. When DTUA is used as a transmitter (same working mode, transparent transmission mode), all DTUs under the 0x04 channel can receive data to achieve the purpose of broadcasting.

4.4 Address for Supervising/Listening

- Example:
- 1. Set the DTUA address to 0xFFFF and the channel to 0x04.
- 2. When DTUA is used as a receiver, it can receive all the data under the 0x04 channel to achieve the purpose of monitoring.

5 Working Mode

E95/E96-DTU has four working modes. If normal communication is required, it is recommended to configure DTU as transparent transmission mode (mode 0), DTU factory default setting is transparent transmission mode (mode 0).

Mode	**Working Mode**	**M1**	**M0**	**Status**
Mode 0	Transparent transmission mode	Lights off	Lights off	The serial port is opened, the wireless is opened, and the radio transmits and receives data according to the set transmission mode
Mode 1	RSSI mode	Lights off	Light	Wireless off, serial port on, the radio will output RSSI signal strength value for 100ms
Mode 2	Configuration mode	Light	Lights off	You can use the configuration software to program the radio (fixed 9600 baud rate)
Mode 3	Sleep mode	Light	Light	The radio enters dormant standby, the serial port and wireless are both closed

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5.1 Transparent transmission mode (mode 0)

TX/RX	When the M0 indicator light is off and the M1 indicator light is off, the DTU works in mode 0
Transmitting	DTU receives user data from the serial port. The maximum length of the wireless data packet transmitted by DTU is 54 bytes. When the user input data reaches 54 bytes, the DTU will start wireless transmission. At this time, the user can continue to input the data that needs to be transmitted.
Receiving	When the user needs to transmit less than 54 bytes, the DTU waits for about 20ms. If there is no user data to continue to input, the data is considered to be terminated, and the DTU sends all the data wirelessly. The user can continue to enter data. Data packets sent through mode 0 can only be received by the receiving DTU in mode 0.

5.2 RSSI mode (mode 1)

TX/RX	When the M0 indicator light is on and the M1 indicator light is off, the module works in mode 1
Transmitting	Wireless transmission is not allowed, and the received serial data will be discarded.
Receiving	Can not receive wireless data in the air, only scan the signal strength of the current channel, and output a strength value (relative value) through the serial port every 100ms.

5.3 Configuration mode (mode 2)

TX/RX	When the M0 indicator light is off, the M1 indicator light is on, and the DTU works in mode 2
transmitting	No wireless transmission is allowed, the received serial data will be discarded.
receiving	Unable to receive wireless data
configuration	Can be used for module parameter setting, use serial port 9600, 8N1, set module working parameters according to specific instruction format

5.4 Sleep mode (mode 3)

TX/RX	When the M0 indicator light is on and the M1 indicator light is on, the module works in mode 3
Transmitting	Unable to transmit wireless data.
Receiving	Cannot receive wireless data.
Function	In the ultra-low power consumption state, all other functions of the module are turned off, and the sleep mode can only be exited through the state switch of M1M0.

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6 Register Codes for Reading and Writing

6.1 Register Format

In command mode (mode 2: M0 indicator light is off, M1 indicator light is on), the supported command list is as follows (when setting, only 9600, 8N1 format is supported)

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 of working parameters in hexadecimal format, a total of 6 bytes, must be sent continuously (not saved after power off)
4	C3+C3+C3	Three C3s are sent in hexadecimal format, and the module returns version information, which must be sent continuously.

6.2 Reading Parameters

Command	Details
C1+C1+C1	In the setting mode (M0 indicator light is off, M1 indicator light is on), send a command to the module serial port (HEX format): C1 C1 C1, the module will return the current configuration parameters, such as: C0 00 00 18 20 00.

6.3 Reading Version Number

Command		Details
C3+C3+C3		In the setting mode (M0 indicator light is off, M1 indicator light is on), send a command to the module serial port (HEX format): C3 C3 C3, the module will return the current configuration parameters, such as: C3 49 xx yy; here 49 stands for Module model (E49 series), xx is the version number, yy refers to other features of the module (users can ignore it).
TX	Unable to transmit wireless data.	
RX	Cannot receive wireless data.	
Other	In the ultra-low power consumption state, all other functions of the module are turned off, and the sleep mode can only be exited through the state switch of M1M0.	

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6.4 Register Description

No.	Name	Description	Notes
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 failure. 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	Speed parameters, including serial port speed and air speed 7, 6: Serial parity bit 00：8N1(Default) 01：8O1 10：8E1 11：8N1 ---------- 5, 4, 3 TTLSerial Baud Rate(bps) 000: Serial Baud Rate 1200 001: Serial Baud Rate 2400 010: Serial Baud Rate 4800 011: Serial Baud Rate 9600(Default) 100: Serial Baud Rate 19200 101: Serial Baud Rate 38400 110: Serial Baud Rate 57600 111: Serial Baud Rate 115200 ---------- 2, 1, 0 Air Rate (bps) 000: Air Rate 1.2k 001: Air Rate 2.4k(Default) 010: Air Rate 4.8k 011: Air Rate 9.6k 100: Air Rate 19.2k 101: Air Rate 50k 110: Air Rate 100k 111: Air Rate 200k	---------- The baud rate of the communication parties can be different The serial port baud rate has nothing to do with the wireless transmission parameters, and does not affect the wireless transceiver characteristics. ---------- 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.
4	CHAN	Channels: 7, 6, 5, 4, 3, 2, 1, 0 Frequency=(410Mhz + CHAN * 0.5Mhz) (Default 0x2E: 433Mhz)	00H-C8H, Correspond to 410~510 MHz
5	OPTION	7, Fixed-point transmission enable bit (modbus-type) 0: Transparent transmission mode (Default) 1: Fixed-point transmission mode ---------- 6, 5, 4, 3, 2 Reserved bit, write 0 ---------- 1, 0 Transmitting power (approximate value) 00： 20 dBm(Default) 01： 17 dBm 10： 14 dBm 11： 10 dBm	When it is 1, the first 3 bytes of each user data frame are used as the channel, high and low addresses. Change your own address and channel during transmission, and restore the original settings after completion. ---------- ---------- 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.

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

The binary bits of the byte	7	6	5	4	3	2	1	0
Specific value (user's configuration)	0	0	0	1	1	0	0	1
Meaning	Serial parity bit 8N1		Serial port baud rate 9600			The air speed is 2.4k		
Corresponding hexadecimal	1				9			

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6.5 Factory default parameters

Model	Factory default parameter value: C0 00 00 19 2E 00					
DTU	Frequency	Address	Channel	Air Rate	Baud Rate	TX Power
E95/E96-DTU(400Fxxx)	433MHz	0x0000	0x2E	2.4kbps	9600	20 dBm

7 Configuration Software

- Download link: E95/E96-DTU Configuration Software.
- The following picture shows the display interface of the E95/E96-DTU (400Fxxx) configuration host computer. The user can switch to the configuration mode through the MODE button, and quickly configure and read the parameters on computer.



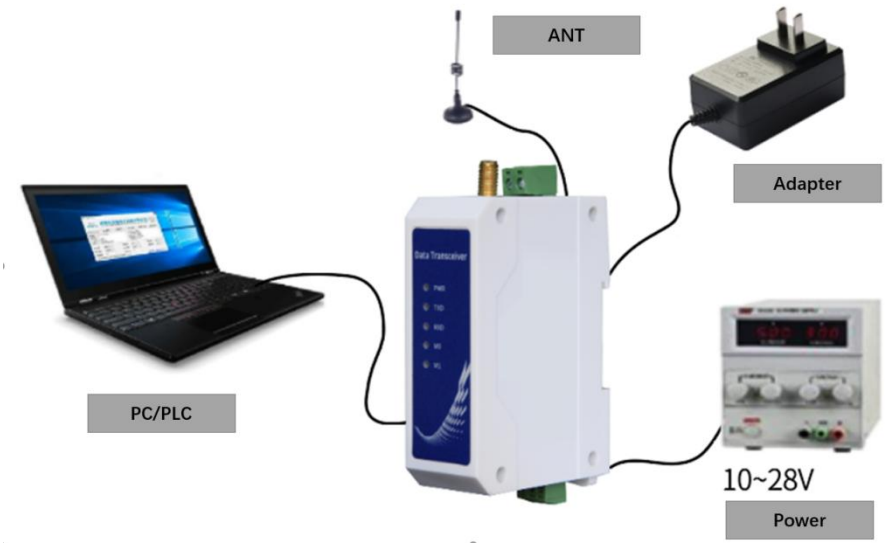
When DTU is configured, the module address, frequency channel, etc. are all in decimal, and the value range of each parameter is:

Module address: 0～65535

Frequency channel: 0～200

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8. Setting Working Mode



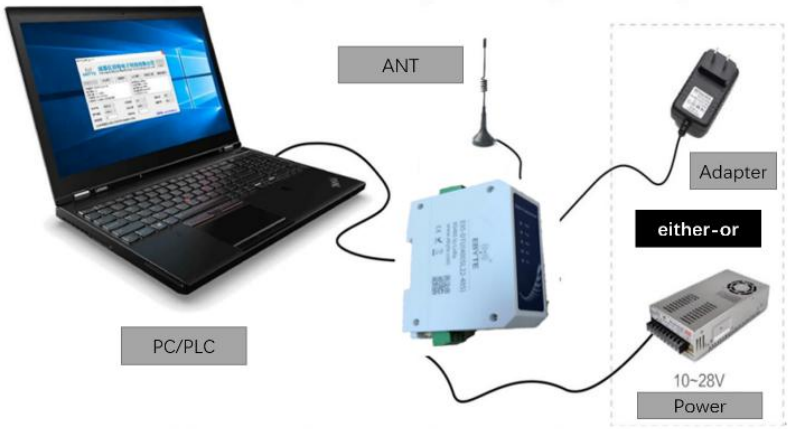
Working Mode	M1	M0	Status
Configuration Mode	LED On	LED Off	DTU can be programmed using configuration software (default 9600, 8N1)

Configuration can only be carried out in configuration working mode (see the above table). If the configuration fails, please check whether the DTU working mode is correct.

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9.Power supply by RS485 or Power Interface



10 Related Products

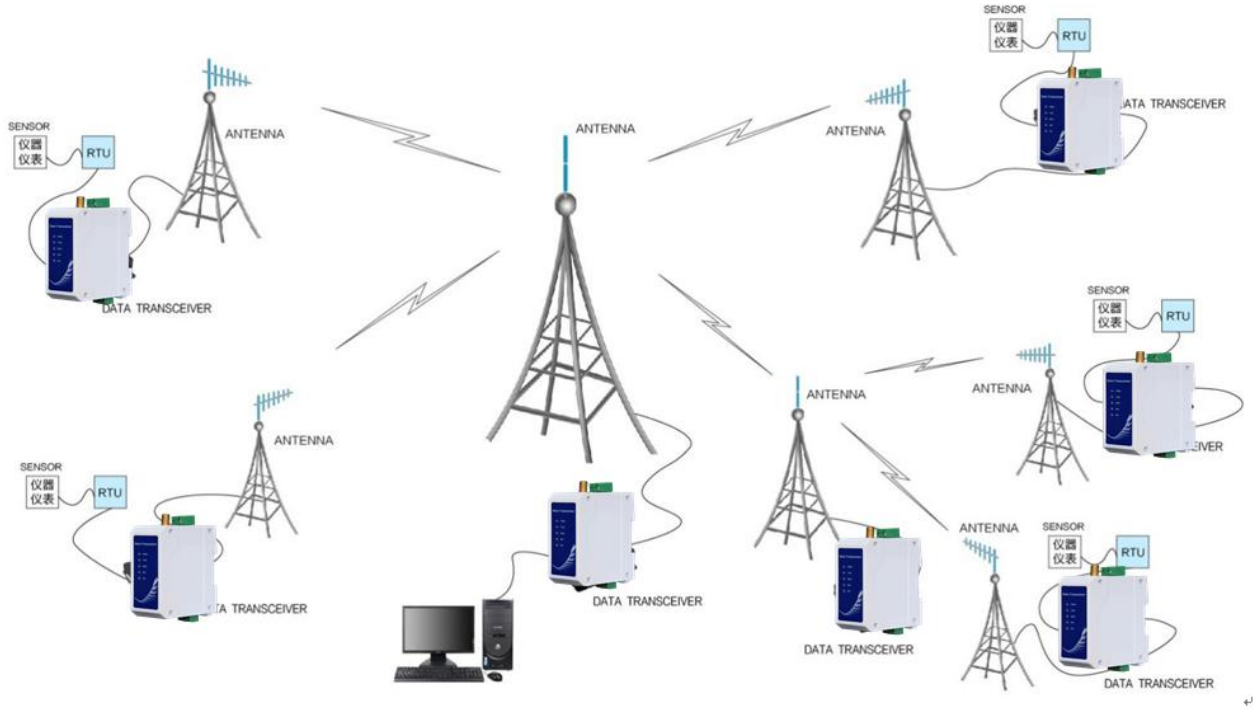
Model Number	Input Interface	Freq. Range MHz	TX Power dBm	Ideal Range km	Main Features
E95-DTU(400F20-485)	RS485	410 ～ 510	20	1	High cost performance, suitable for short distance, stable high-speed transmission, F series intercommunication, DC power supply
E95-DTU(400F20-232)	RS232	410 ～ 510	20	1	High cost performance, suitable for short distance, stable high-speed transmission, F series intercommunication, DC power supply
E96-DTU(400F20-485)	RS485	410 ～ 510	20	1	High cost performance, suitable for short distance, stable high-speed transmission, F series intercommunication, AC power supply
E96-DTU(400F20-232)	RS232	410 ～ 510	20	1	High cost performance, suitable for short distance, stable high-speed transmission, F series intercommunication, AC power supply

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11.Typical Applications

Ebyte digital transmission DTU is suitable for all kinds of point-to-point, point-to-multipoint wireless data transmission systems, such as smart homes, IoT transformation, power load monitoring, distribution automation, hydrology and water regime monitoring and reporting, tap water pipe network monitoring, urban street lights Industrial automation such as monitoring, air defense alarm control, railway signal monitoring, railway water supply centralized control, oil and gas supply pipeline network monitoring, GPS positioning system, remote meter reading, electronic hoisting scale, automatic target reporting, earthquake measurement and reporting, fire prevention and theft prevention, environmental monitoring, etc. System, as shown below:



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12 Notice and Warning

1. 1. Please take good care of the warranty card of the device. The warranty card has the factory number (and important technical parameters) of the device, which has important reference value for the user's future maintenance and new equipment.
2. 2. During the warranty period, if DTU is damaged due to the quality of the product itself rather than man-made damage or natural disasters such as lightning strikes, it enjoys free warranty; please do not repair it by yourself, and contact our company if there is a problem, provided by Ebyte First-class after-sales service.
3. 3. Do not operate this DTU in the vicinity of some flammable places (such as coal mines) or explosive dangerous objects (such as detonators for detonation).
4. 4. A suitable DC stabilized power supply should be selected, which requires strong anti-high frequency interference capability, small ripple, and sufficient load capacity; it is best to have overcurrent, overvoltage protection and lightning protection functions to ensure data transmission DTU works normally.
5. 5. Do not use it in a working environment that exceeds the environmental characteristics of the digital DTU, such as high temperature, humidity, low temperature, strong electromagnetic field or dusty environment.
6. 6. Don't let the digital transmission DTU continuously be in the full-load transmission state, otherwise the transmitter may be burnt out.
7. 7. The ground wire of the digital transmission DTU should be well connected with the ground wire of the external equipment (such as PC, PLC, etc.) and the ground wire of the power supply, otherwise it is easy to burn the communication interface, etc.; do not plug or unplug the serial port with power on.
8. 8. When testing the digital transmission DTU, a matching antenna or 50Ω dummy load must be connected, otherwise the transmitter will be easily damaged; if the antenna is connected, the distance between the human body and the antenna should be more than 2 meters to avoid injury. Do not touch the antenna while transmitting.
9. 9. DTU 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 more than 50% Communication distance margin.
10. 10. If the measured communication distance is not ideal, it is recommended to start from the antenna quality and antenna installation method to analyze and improve the communication distance. You can also contact support@cdebyte.com for help.
11. 11. When selecting the power supply, in addition to retaining 50% current margin as recommended, it should also be noted that its ripple should not exceed 100mV.
12. Wireless communication products need to be connected to an impedance-matched antenna to work normally. Even short-term tests cannot be omitted. If the product is damaged due to this reason, it will not be covered by the warranty.

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Revision history

Version	Description	Issued by
1.0	Initial version	ken
1.1	F series Version	ken
1.2	Content revision	XXN
1.3	Content revision	Hao

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Web: https://www.cdebyte.com

Address: B5 Mould Industrial Park, 199# Xiqu Ave, High tech Zone, Chengdu, Sichuan, China

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