Wireless Modem

User Manual

NB-IoT Serial Server
E840-DTU（EA01）

Contents

1. Introduction

1.1 Brief Introduction

E840-DTU (EA01) is a NB-IOT produced by Ebyte. The product has complete software functions and covers most of the conventional application scenarios. Users can make two-way transparent data transmission from the UART to the network server through simple settings.

E840-DTU (EA01) is a product developed to realize serial port device and network server transfer data through NB network. You can easily use this product to make two-way transparent data transmission from serial port to network by AT command.

The radio uses a DC power socket or RS485 terminal to supply power, and uses a wide voltage of 5V～36V for power supply, and supports 5.0V power supply. RS485 and RS232 circuits use electrical isolation schemes, which have anti-interference ability and can be adapted to be used in some environments with strong electromagnetic interference, such as some power industries.

1.2 Features

- Support transparent data transmission, TCP/UDP transparent transmission; Support heartbeat packet, registration packet function;
- Support TCP, UDP, MQTT, COAP, LwM2M and other protocols;
- Support Telecom Cloud CTWING, Huawei Cloud OceanConnect, China Unicom Cloud, China Mobile Onenet Cloud platform, Alibaba Cloud, Baidu Cloud and Ebyte Cloud transparent transmission;
- Support two Socket links to send and receive simultaneously;
- Support Modbus RTU/TCP conversion;
- Support 5~36V wide voltage power supply, using DC power socket and terminal two power supply modes;
- The RS485 circuit uses electrical isolation, lightning protection, and anti-surge solutions, with anti-interference ability.

1.3 Parameters

Name	Parameter	Description
Characteristic	Frequency	B3 B5 B8 frequency bands Device can automatically search frequency
Hardware Features	Antenna Type	SMA
	Data Interface	RS485 /RS232
	Baud Rate	Factory Default 9600bps
	Maximum Transmitting Power	20dBm±2dB
	Current Consumption (Typical Value)	Send： 105mA@12V Receive： 15mA @12V
	Working Voltage	DC 5V~36V
	Working Temperature	-40℃- 70℃
	Storage Temperature	-40℃- 85℃
	Size	82×84×24mm
	RS485 /RS232	Electrical Isolation RS485/RS232
Software Features	Wireless Data Rate	Single-tone：25.5kbps（Download）， 16.7kbps（Upload） Multi-tone：25.5kbps（Download）， 62.5kbps（Upload）
	Network Protocol	Support TCP、UDP、MQTT、COAP、LwM2M and other protocol
	Device ID	The device ID can be configured through AT commands

1.4 Interface Description

1.5 Pin Definition

Pin No.	Name	Description
1	RS232	RS232 Interface
2	485_A	Side A of external interface for other RS485 devices
3	485_B	Side B of external interface for other RS485 devices
4	GND	Ground electrode
5	VCC	Power supply, Default: 5~36V
6	PWR	Power indicator
7	WORK	UART communication indicator
8	NET	Networking indicator
9	DC-IN	Power adapter interface, default: 5~36V
10	RST	Reset switch (downward, reset)
11	Restore	Restore factory settings switch(downward, around 1 second）
12	SIM	SIM card slot
13	ANT	Antenna interface（SMA-K，50Ω）

2. Quick Start

2.1 Device Preparation

The hardware equipment needed for this test is as follows:
Before testing, follow the recommended circuit to connect the serial cable, SIM card, antenna and other hardware.

E840-DTU(EA01)	12V power adapter
USB to RS485 adapter or USB to RS232 (choose one of them)	NB-LOT suction antenna

Before testing, connect the hardware such as power supply and antenna.

1. Use a computer browser to visit the official website of Chengdu Ebyte: www.ebyte.com, download the latest serial port tool, install the USB to serial driver, and run the software!
2. Select the corresponding COM port number, the factory default serial port baud rate of the product is 9600, 8N1, configure the module according to the instruction manual;
3. Query the signal strength, set the device connection server IP and port number as: 116.62.42.192, 8124; (Ebyte test server);
4. Then restart the module and wait for the LINK light of the device to be on.
5. Follow the WeChat official account of "Ebyte IoT Application Expert" on your mobile phone, enter the page, and click: Customer Support -> Equipment Test,
6. Use the PC serial port tool to send data, and use the mobile phone to send data to the device

2.2 Data Transmitting Test

Software is needed for data transmitting test:

Xcom is applied here for the test and you can download it at our website. Users can also apply other test tools that are available.

1. Place the SIM card in the E840-DTU (EA01) card slot and connect to the computer serial port using the above connection method. Open the serial port assistant software, first select the corresponding serial port number, baud rate and other parameters (9600 baud rate), and open the serial port.
2. Use the power adapter configured by our company to supply power to E840-DTU (EA01), (please note that the reset pin is high), the POWER light is on to indicate that the radio is working normally.
3. E840-DTU (EA01) has two working modes: network transparent transmission mode and cloud platform working mode, it can be configured by AT command.
4. After the configuration is complete, data testing can be performed

3. Command Configuration and Function Description

3.1 AT Mode and Transparent Data Transmission Mode Switch

AT Command	Response
ATD*98/r/n	CONNECTING OK
+++	OK

1. By default, it works in AT command mode after power-on. In AT command mode, sending ATD*98/r/n or ATD*99/r/n will switch to transparent transmission mode;
2. <+++>: In transparent transmission mode, the last three bytes of user data are "+++", or sending three bytes "+++" after user data transmission is completed, it will end the transparent transmission mode;

3.2 Device Software Restart

AT Command	Response
AT+NRB/r/n	REBOOTING

After entering the AT command, the device will soft restart, and at the same time, the AT parameters will be saved in the flash. When the AT parameters need to be memorized after power-off, first, configure the parameters through the AT command, and then input the AT+NRB parameters to be memorized in the flash.

3.3 Application of WORKLOCK (Power Saving Lock)

AT Command	Response
AT+WORKLOCK =<enable>/r/n	OK

1. Since the NB module is in deep sleep mode for most of time (the chip is powered off), in order to ensure that data interaction fails when entering deep sleep earl, input AT+WORKLOCK=1 to prevent early deep sleep. After the data service interaction is completed, input AT+WORKLOCK=0 to release the lock module and enter deep sleep.
2. The module supports serial port wake-up, which can be waked up by inputting AT command. After the AT command wakes up the module, the WORKLOCK will be automatically added. Therefore, after each wake-up, you must input AT+WORKLOCK=0 to release the lock to enter deep sleep.

   Note: After power on again, you must also input AT+WORKLOCK=0 to enter deep sleep

3.4 UART Baud Rate Setting

AT Command	Response
AT+UARTSET =<rate>,<store>/r/n	OK

1. This command is similar to Quectel's "AT+ NATSPEED" function. It is used to set the AT UART baud rate and other parameters. The default is 9600 baud rate. When store is 0, the baud rate takes effect dynamically. When store is 1, At the time, divide the set baud rate by 2400, save it in the flash and automatically restart to take effect.
2. Parameter Configuration Instructions

◆<rate>：Baud Rate，current supports up to 115200。

◆<store>：Whether to save, the default is not to save, that is, to dynamically switch the baud rate; if it is set to 1, it will be saved in the NV and restart immediately; if it is set to 0, it means that it will take effect dynamically and the other party needs to switch the baud rate synchronously.

3.5 Communication Protocol Type Configuration

AT Command	Response
AT+PDUTYPE=<pdu_type>/r/n	OK
AT+PDUTYPE/r/n	type:<pdu_type> OK

1. Currently supports MQTT, COAP, TCP/UDP and Ebyte cloud protocols. The current module supports two sockets, allowing TCP/UDP to communicate with one of MQTT, COAP, and Ebyte cloud at the same time. TCP/UDP always opens one of socket0, MQTT, COAP, Ebyte cloud to open socket1.
2. Configuration Parameter Description

◆<pdu_type>, 0 means based on TCP or UDP protocol, 1 means based on MQTT protocol, 2 means based on COAP protocol, 3 means based on Ebyte cloud protocol

Note: When power-off saving is required, input AT+NRB command will save the parameters to flash, and automatically restart to take effect.

3.6 TCP/UDP Transparent Transmission Channel Function Configuration

3.6.1 TCP/UDP address and port configuration

AT Command	Response
AT+SOCKADDR =<addr>,<port>,<local_port>,<type> /r/n	OK
AT+SOCKADDR /r/n	address:< addr >,port:< port >,local port: <local_port>,type:<type> OK

1.   Socket0 address supports IP address and domain name, and the maximum byte length supports 50 bytes. The device is automatically connected to socket0 after soft restart, hardware reset and normal power-on. The device wakes up in deep sleep and needs to input the open and close command AT+SOCKONOFF to connect to socket0, If the server does not release the link before the connection, the terminal needs to successfully disconnect the link and then connect to socket0.

2.   Configuration parameter description

◆<addr>，Support IP address or domain name, the maximum byte length is 50 bytes.

◆<Port>，The port of the remote server.

◆<local_port>，Local port, 0 means freely selected by tcpip, the default is 0.

◆<type>，0 means TCP protocol, 1 means UDP protocol.

Note: When power-off saving is required, input AT+NRB command will save the parameters to flash, and automatically restart to take effect.

3.   Socket connection status changes will auto report +XSSTATE:<id>,<state>;

◆<id> Indicates the created socket ID, currently only supports 0 and 1, TCP/DUP channel can only use 0, COAP, MQTT, Ebyte cloud channel use 1

◆<state> Represents the socket connection status, 1 means the connection status, and 0 means the disconnection.

For example, after socket0 is successfully connected, it will auto report +XSSTATE:0,1, and when the server or terminal disconnects socket0, it will also auto report +XSSTATE:0,0.

3.6.2 Open and close TCP/UDP socket0 connection

AT Command	Response
AT+SOCKONOFF=<enable>,<on-off>/r/n	+XSSTATE:< id>,<state> OK

◆<enable>, Indicates whether to enable the TCP/UDP channel, 1 means enable, 0 means disable. The default is to enable the TCP/UDP channel to be opened.

◆<on-off>, Indicates to open or close socket0, 1 means open, 0 means closed.

Note: When power-off saving is required, input AT+NRB command will save the parameters to flash, and automatically restart to take effect.

3.7 Heartbeat Packet Function Configuration

3.7.1 Configure TCP/UDP heartbeat packet content

AT Command	Response
AT+HEARTINFO=\<type>,\<data>/r/n	OK
AT+HEARTINFO /r/n	\<data> OK

◆\<type >,0 means the heartbeat packet type is HEX format, 1 means the heartbeat type is ASCII code (string) format.

◆\<data>，The data content of the heartbeat packet sent, the maximum length is less than 40, and the default value is "Ebyte nbiot heart rate data".

Note: When power-off saving is required, input AT+NRB command will save the parameters to flash, and automatically restart to take effect.

3.7.2 Send heartbeat packet command

AT Command	Response
AT+SENDHEART=\<send>/r/n	OK

1. Input the AT command AT+SENDHEART=1 to complete the sending of the heartbeat packet.
2. If pdu_type selects TCP/UDP, the TCP/UDP heartbeat packet will be sent; if MQTT is selected, the MQTT heartbeat packet will be sent (the serial port will print "PINGRESP" after the transmission is successful), and if the Ebyte cloud is selected, it will send the Ebyte cloud heartbeat packet.

3.8 Registration Packet Function Configuration

3.8.1 Registration packet mode configuration

AT Command	Response
AT+REGMOD=\<mode>/r/n	OK
AT+REGMOD/r/n	OK mode: \<mode>

◆\<mode>,0 means to close the registration packet, 1 means to add IMEI registration packet before each packet of data sent, 2 means to add a custom registration packet before each packet of data sent, 3 means only when connecting to the server for the first time Send an IMEI registration packet; 4 means only send a custom registration packet when connecting to the server for the first time;

Note: When power-off saving is required, input AT+NRB command will save the parameters to flash, and automatically restart to take effect.

3.8.2 Custom registration packet data content configuration

AT Command	Response
AT+REGINFO=<type>,<data>/r/n	OK
AT+REGINFO /r/n	OK < data >

◆<type >,0 means the heartbeat packet type is HEX format, 1 means the heartbeat type is ASCII code (string) format.

◆<data>，The data content of the heartbeat packet sent, the maximum length is less than 40, and the default value is "Ebyte nbiot heart rate data".

Note: When power-off saving is required, input AT+NRB command will save the parameters to flash, and automatically restart to take effect.

3.9 Modbus RTU/TCP Conversion Function

3.9.1 Function Description

After the Modbus RTU/TCP conversion function is turned on, in the receiving state, when the Modbus RTU data format is received wirelessly, it will be automatically converted to Modbus TCP data format serial printing. When the Modbus TCP data format is received wirelessly, it will automatically be converted to Modbus RTU Data format serial printing; in the transmitting state, when the serial port receives Modbus RTU data format, it will automatically convert to Modbus TCP data format for wireless transmission. When the serial port receives Modbus TCP data format, it will automatically convert to Modbus RTU data format and send wirelessly;

3.9.2 Modbus RTU/TCP enable configuration

AT Command	Response
AT+MODBUS=<enable>,<Id> /r/n	OK
AT+MODBUS /r/n	OK enable:< enable>,Id:< Id >

1.   Parameter configuration description

◆<enable>,0 means turn off the Modbus RTU/TCP conversion function, 1 means turn on the Modbus RTU/TCP conversion function.

◆<Id>, Indicates Modbus TCP transaction processing identifier, (0~65535) 2 bytes in length

2.   Description of ID function

◆In the state of Modbus TCP to Modbus RTU, when Id=0, any ModbusTCP received will be converted to the corresponding RTU protocol, otherwise, only the transaction identification matching will be converted.

◆In the state of modbus RTU to modbus TCP, it means the converted modbus TCP transaction identifier

Note: When power-off saving is required, input AT+NRB command will save the parameters to flash, and automatically restart to take effect.

4.1 MQTT Application Configuration

4.1.1 MQTT instruction set instructions

Firstly, the AT+MQTTMODE command configures the MOTT working mode soft reset and restarts to take effect. Secondly, AT+PDUTYPE confirms whether the data frame type is MQTT transmission. Secondly, AT+MQTTCONN configures the three elements of the connection, and again the AT+MQTTSUBTOP and AT+MQTTPUBTOP commands configure subscribe to and publish topics, and finally ATD*98 enters the transmission mode for business interaction. After the interaction is complete, enter +++ to enter the AT command mode. For low-power services, you need to enter the AT+WORKLOCK=0 command to release the lock and enter the deep sleep mode.

4.1.2 MQTT mode configuration

AT Command	Response
AT+MQTTMODE=<mode>/r/n	OK
AT+MQTTMODE /r/n	OK mode:< mode >

◆<type>,0 means turn off the mqtt function, 1 means access to the Alibaba Cloud, 2 means access to the Onenet and other IoT platforms that support the standard MQTT protocol, 3 means access to the Baidu Cloud.

Note: When power-off saving is required, input AT+NRB command will save the parameters to flash, and automatically restart to take effect.

4.1.3 MQTT address and port configuration

AT Command	Response
AT+MQTTADDR=<addr>,<port>/r/n	OK
AT+MQTTADDR /r/n	OK address: <addr>,port: <port>

1. When the MQTT mode is 0, input this command will prompt "MQTT closed"; when the MQTT mode is 1, configure the address and port of the Alibaba Cloud; when the MQTT mode is 2, configure the address of the Onenet or other platforms and port; when MQTT mode is 3, configure the address and port of Baidu cloud;

    Note: The domain name addresses of the three major platforms of Baidu Cloud, Onenet, and MQTT will generally not change. If the domain name does change, it can also be modified through instructions.

2. Parameter configuration instructions

◆<addr>, Indicates the IP address or domain name of the server, up to 50 bytes.

◆<port>, Indicates the server port.

4.1.4 MQTT connection three elements configuration

AT Command	Response
AT+MQTTCONN=<value0>,<value1>,<value2>/r/n	OK
AT+MQTTCONN /r/n	OK <value0> <value1> <value2>

1.   The length of each of the three elements is no more than 40 bytes.

Note: When power-off saving is required, input AT+NRB command will save the parameters to flash, and automatically restart to take effect.

4.1.5 MQTT subscription topic configuration

AT Command	Response
AT+MQTTSUBTOP=< topicName>，<qos>/r/n	OK
AT+MQTTSUBTOP /r/n	OK qos:< qos > < topicName>

◆<topicName>：A string within 200 bytes of the content of the subscription topic.

◆<qos>：The quality of service supports qos=0, qos=1, qos=2.

4.1.6 MQTT publish theme configuration

AT Command	Response
AT+MQTTPUBTOP=< topicName>，<qos>/r/n	OK
AT+MQTTPUBTOP /r/n	OK qos:< qos > < topicName>

◆<topicName>：Post a string within 200 bytes of the content of the subject.

◆<qos>：The quality of service supports qos=0, qos=1, qos=2.

4.1.7 MQTT and server keepalive settings

AT Command	Response
AT+MQTTALIVE=< alive_time >/r/n	OK
AT+MQTTALIVE /r/n	OK keep alive time:< alive_time >

◆<alive_time> ：Keep alive with the server, the unit is second, the data range is 2 bytes, the default is 600 seconds (10 minutes)

Note: When power-off saving is required, input AT+NRB command will save the parameters to flash, and automatically restart to take effect.

5.1 COAP Function Configuration

5.1.1 COAP Function Description

◆Firstly, the AT+COAPADDR command configures the address and port of the COAP server to enable the COAP function at the same time, and the AT+NRB soft reset restarts to take effect;

◆Secondly, the AT+PDUTYPE command selects the data protocol type as COAP

◆Thirdly, AT+ADDOPTION, AT+ADDTOKEN, AT+COAPMINUS instructions add or delete option or token in the message;

◆Finally, the AT+COAPHEADER command sends a message without load; ATD*98 enters the transparent transmission mode and inputs the serial port transparent transmission data. At this time, the data sent is a COAP message with a load (the serial port transparent transmission data is the COAP message Effective load).

5.1.2 COAP address parameter configuration

AT Command	Response
AT+COAPADDR=\<addr\>,\<port\>,\<local_port\>,\<enable\>/r/n	OK
AT+COAPADDR /r/n	OK address: \<addr\>,port: \<port\>，local port:\< local_port \>,enable\<enable\>

◆\<addr\>，Support IP address or domain name, the maximum byte length is 50 bytes

◆\<port\>，Server port

◆\<local_port\>，Local port

◆\<enable\>，COAP is enabled, 0 means to close the COAP function, 1 means to open the COAP function

Note: When power-off saving is required, input AT+NRB command will save the parameters to flash, and automatically restart to take effect.

5.1.3 COAP add option command to the message

AT Command	Response
AT+ADDOPTION=\<index\>,\< type\>,\< value\>/r/n	OK
AT+ADDOPTION /r/n	OK index：\<index\>，type:\<type\>, value:\<value\>

◆\<index\>，The serial number of option, ranging from 0 to 7, a maximum of 8 options can be configured, and the storage space is 1024 bytes.

◆\<type\>，The number of option, as shown in the figure below:

```
+-----+---+---+---+---+----------------+--------+--------+----------+
| No. | C | U | N | R | Name           | Format | Length | Default  |
+-----+---+---+---+---+----------------+--------+--------+----------+
|  1  | x |   |   | x | If-Match       | opaque | 0-8    | (none)   |
|  3  | x | x | - |   | Uri-Host       | string | 1-255  | (see     |
|     |   |   |   |   |                |        |        | below)   |
|  4  |   |   |   | x | ETag           | opaque | 1-8    | (none)   |
|  5  | x |   |   |   | If-None-Match  | empty  | 0      | (none)   |
|  7  | x | x | - |   | Uri-Port       | uint   | 0-2    | (see     |
|     |   |   |   |   |                |        |        | below)   |
|  8  |   |   |   | x | Location-Path  | string | 0-255  | (none)   |
| 11  | x | x | - | x | Uri-Path       | string | 0-255  | (none)   |
| 12  |   |   |   |   | Content-Format | uint   | 0-2    | (none)   |
| 14  |   | x | - |   | Max-Age        | uint   | 0-4    | 60       |
| 15  | x | x | - | x | Uri-Query      | string | 0-255  | (none)   |
| 17  | x |   |   |   | Accept         | uint   | 0-2    | (none)   |
| 20  |   |   |   | x | Location-Query | string | 0-255  | (none)   |
| 35  | x | x | - |   | Proxy-Uri      | string | 1-1034 | (none)   |
| 39  | x | x | - |   | Proxy-Scheme   | string | 1-255  | (none)   |
| 60  |   |   |   | x | Size1          | uint   | 0-4    | (none)   |
```

For example, type=11, which means the option resource type is Uri-Path.

◆<value>，The specific content of the option, such as the specific value of the Uri-Path option is \temperature,

If the data type of value is Uint, the data range is 0-4294967295, and the data length only supports 0-4 bytes.

You can configure multiple options, up to 8 can be configured, for example, enter the instructions in sequence below:

AT+ADDOPTION=0,3, iot.eclipse.org

AT+ADDOPTION=1,7, 5683

AT+ADDOPTION=2,11,\temperature

AT+ADDOPTION read command return

index：0，type：3，value: iot.eclipse.org

index：1，type：7，value: 5683

index：2，type：11，value: \temperature

5.1.4 COAP add Token instruction in the message

AT Command	Response
AT+ADDTOKEN =<token>/r/n	OK
AT+ADDTOKEN /r/n	OK <token>

◆<token>，Data format is HEX。

For example, the parameter that needs to be input is 0x7A5B69EF

AT+ADDTOKEN=7A5B69EF

Read Command AT+ADDTOKEN

AT+ADDTOKEN

7A5B69EF

5.1.5 Remove the option or token command in the message

AT Command	Response
AT+COAPMINUS=<token>,<option>/r/n	OK

◆<token> =1，Remove the token in the message

◆<option>=1, Remove the option in the message

5.1.6 COAP send command without load message

AT Command	Response
AT+COAPHEADER =<type>,<code>/r/n	OK
AT+COAPHEADER /r/n	OK type:<token>,code:<code>

◆<type>，Configure the type of sent packets.

Type=0，CON frame, a request that needs to be confirmed. If a CON request is sent, the other party must respond.

Type=1，NON frame, a request that does not need to be confirmed, if the NON request is sent, then the other party does not need to respond

Type=2，ACK frame, response message, response to receiving CON message.

Type=3，RST frame, reset message, when the message received by the receiver contains an error, the receiver parses the message or no longer cares about the content sent by the sender, then the reset message will be sent.

◆<code>，Configure the function code for sending messages.

code =1，GET method, used to obtain a resource

code =2，POST method, used to create a resource

code =3，PUT method, used to update a resource

code =4，DELETE method, used to delete a resource

For example, input AT+COAPHEADER=0,1 to send a COAP get message. The message includes a fixed header and may have option or token.

5.1.7 COAP Data reception instructions

◆Serial port prints the header information of the received COAP data frame: response code:<code>,type:<type>,tid:<tid> ends with carriage return and line feed.

<code>, indicates the function code of the server response; <type>, indicates the type of the received message; <tid>, indicates the message id (decimal format) of the received message;

◆If there is a token in the received message, the serial port will print the token: <token> ends with a carriage return and line feed, and <token> is in the form of a HEX string.

◆If there is option in the received message, the serial port will print option type:<type>,value:<value> and end with carriage return and line feed.

◆If there is Payload in the received message, the serial port will print Payload:<Payload> and end with carriage return and line feed.

6.1 Ebyte Cloud Function Configuration

6.1.1 Address and port configuration

AT Command	Response
AT+EIOTADDR=<addr>,<port>/r/n	OK
AT+EIOTADDR /r/n	OK address: <addr>,port: <port>

◆<addr>，Support IP address or domain name, the maximum byte length is 50 bytes

◆<port>，Server port

6.1.2 Turn on/off and SN configuration

AT Command	Response
AT+EIOT=<onoff>,<keysn>/r/n	OK
AT+EIOT /r/n	OK onoff: <onoff>,keysn: <keysn>

◆<onoff>，1 means open the connection to the Ebyte Cloud, 0 means close the connection to the Ebyte Cloud.

AT+CIMI command to get the CIMI number and fill it in the red box, the green box will get the keysn sequence value.

Note: before using Ebyte Cloud, first configure AT+PDUTYPE=3 to set the data protocol type to Ebyte Cloud.

Important Statement

- Ebyte reserves the right of final interpretation and modification of all contents in this manual.
- Due to the continuous improvement of product hardware and software, this manual may be changed without prior notice. The latest version of the manual shall prevail.
- Users who use this product need to follow the product news on the official website so that users can get the latest information about this product in time.

Revision History

Version	Date	Description	Issued by
1.0	2020-08-12	Original Version	Linson

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