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E18 Series command manual (ZigBee3.0 ad-hoc network module)

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1. Introduction to the module

1.1 ZigBee Introduction

ZigBee technology is a close range, low complexity, low power consumption, low rate, low cost of two-way wireless communication technology.

There are three logical device types in ZigBee networks: Coordinator (coordinator), Router (router), and End-Device (terminal device). The ZigBee network consists of one Coordinator along with multiple Router and multiple End_Device.

The functions of each type of equipment are as follows:

(1) Coordinator

The coordinator is responsible for starting the entire network. It was also the first device of the network. The coordinator selects a channel and a network ID (also known as PAN ID, or Personal Area Network ID), and then starts the entire network.

Coordinators can also be used to assist in the binding (bindings) of security and application layers in the network.

Note that the role of the coordinator mainly involves the startup and configuration of the network. Once this is done, the coordinator works like a router (or disappearing go away). Due to the distribution properties of the ZigBee network itself, the following operation of the whole network does not depend on the coordinator.

(2) Router

The router's functions is to allow other devices to join the network, skip routes and assist its own battery-powered son terminal communications.

Usually, the router wants to be active, so it must be powered by the main power supply. But when using a network mode such as the tree group, the route is allowed to operate once at certain intervals, so that the battery can be used to power it.

(3) End-Device

The terminal device has no specific responsibility for maintaining the network structure. It can sleep (sleep the dormant terminal) or wake up, so it can be a battery-powered device.

1.2 Product characteristics

SN	Product characteristics	Feature description
1	Role switching	Serial port instructions allow the device to switch between the three types of coordinator, router and terminal.
2	On-demand networking	Support the keys and instructions to establish the network and find to join the network.
3	Network self-healing function	Loss of the network automatic reconnection function. Network intermediate nodes are lost, and other networks automatically join or maintain the original network.(Isolated nodes automatically join the original network, while non-isolated nodes maintain the original network.) The coordinator is lost, the original network has non-isolated nodes, and the coordinator can rejoin the network, or the coordinator of the original network, PAN_ID, set by the same user, to join the original network.

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4	Ultra low power consumption	In the terminal state, the device can be set to the low power mode, and the device sleep time can be changed according to the user's use time. In the low power mode, the standby power consumption is less than 2.5uA. During the parent node data storage time, you can receive the message within the user set time.
5	Data retention mechanism	The device is used with the terminal in hibernation mode in the coordinator and the router state to save the data of the terminal device and send the data to the terminal after the dormancy wakes up. Save up to 4 pieces of data, if exceeded, the received data will not be saved! After the data save time, the data heap is automatically emptied.
6	Automatic re-release function	In unicast (on-demand) mode, the device automatically reissues when sending to the next node fails, resending each message twice.
7	Automatic routing	The module supports the network routing function. The router and coordinator host the network data routing function, and users can conduct multi-hop networking. If the module side sets the target address unconditionally, the coordinator can assign a transmission target to any module.
8	Encryption protocols are supported	The module uses the AES 128 bit encryption function, which can change the network encryption and prevent monitoring. The equipment with the same network key can only communicate normally.
9	Support serial port configuration	The module has built-in serial port command, and users can configure (view) the parameters and functions of the module through the serial port command.
10	Multi-type data communication	Support the whole network broadcast, multicast and on-demand (unicast) functions. Several transmission modes are also supported in broadcast mode, please refer to Section 5.3.3 for details.
11	Channel changes	Support for 16 channel changes including 11~26 (~ 2405~2480MHZ), with different channels corresponding to different frequency bands.
12	Network PAN_ID change	Network PAN_ID of any switch, users can customize the PAN_ID to join the corresponding network or will automatically select the PAN_ID to join the network.
13	Serial port port rate change	Users can set the baud rate, up to 1M, default digit of 8 bits, 1 stop bit, no check bit.
14	Short address collection	Users can find out the corresponding short address according to the module MAC address (unique, fixed) that has been added to the network.
15	Module reset	The user can reset the module through the serial port command.
16	factory data reset	The user can restore the factory settings of the module through the serial port command.
17	Baud rate reset	Baud rate reset (115200) can be achieved through P1.7 pin to keep P1.7 pulled down until the network indicator and matching indicator are on, the P1.7 pin button is released, the indicator light is off, and the reset is completed. Note that this process is performed before the protocol stack initializes, so after the indicator light is off, please wait for 1S before instructing the module.

1.3 Support for the product family

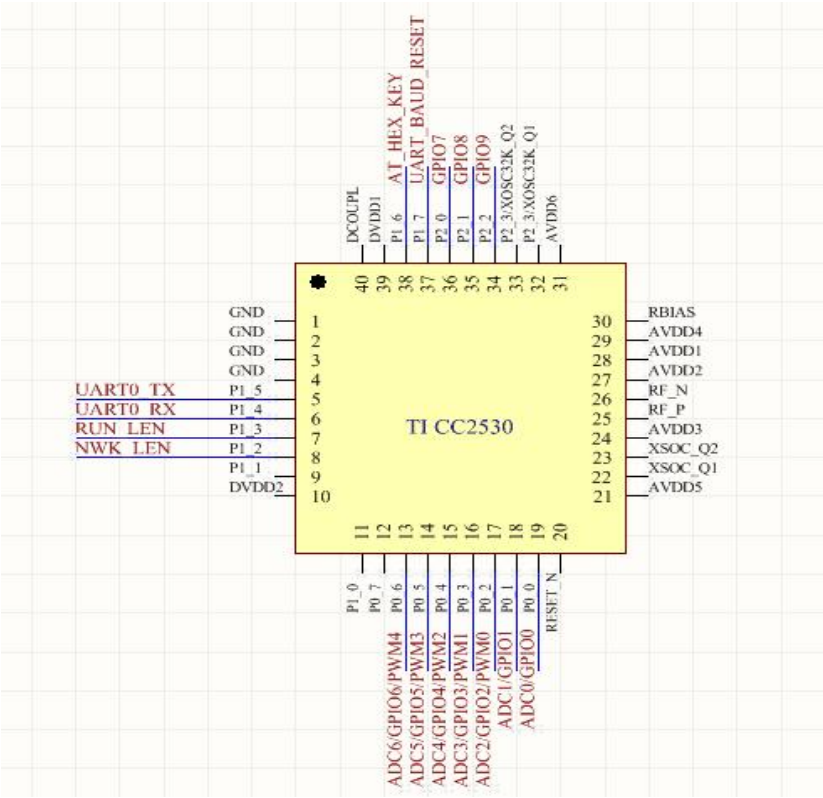
SN	Model	RF chip	frequency (Hz)	Airspeed (bps)	Power (dBm)	Antenna form
1	E18-M S1-PCB	CC2530	2.4G	250K	4	PCB
2	E18-MS1IPX	CC2530	2.4G	250K	4	IPEX
3	E18-M S1PA2-PCB	CC2530	2.4G	250K	20	PCB
4	E18-MS1PA 2-IPX	CC2530	2.4G	250K	20	IPEX

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5	E18-2G4Z27SP	CC2530	2.4G	250K	27	PCB
6	E18-2G4Z27SI	CC2530	2.4G	250K	27	IPEX
The wireless modules of ★ E18 series can be exchanged after software debugging, and can be used with different power★						

2. Introduction of function and command structure

2.1 Functional pin diagram



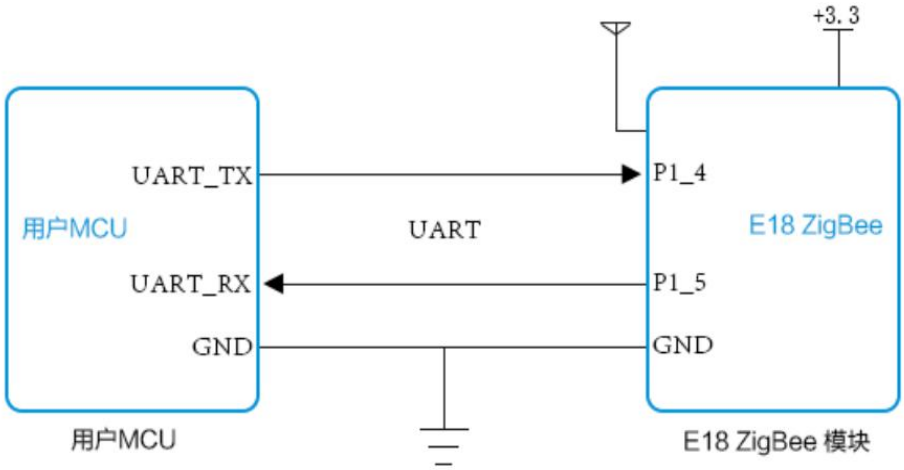
Pin	CC2530 Pin name	module Pin name	Input / output	Pin Usage
1	GND	GND		Ground wire, connected to the power supply reference ground
2	VCC	VCC		The power supply supply, must be between 1.8~3.6V
3	P2.2	GPIO	I/O	DC-Download the program or the Debug clock interface
4	P2.1	GPIO	I/O	DD-Download the program or the Debug data interface
5	P2.0	GPIO	I/O	N/C
6	P1.7	NWK_KEY	I	For manual join, exit, and quick matching keys. No networking: a short press means to join the network or create a network operation; Networking: short press indicates quick matching;

				Long press to leaving the current network; Note: The low level is effective, the 100ms ≤ short press ≤ 3000ms, 5000 ≤ long press.
7	P1.6	GPIO	I/O	N/C
8	NC	NC		N/C
9	NC	NC		N/C
10	P1.5	UART0_TX	I	Serial port TX foot
11	P1.4	UART0_RX	O	Serial port with RX feet
12	P1.3	RUN_LED	O	To indicate the network status of the module, quick flash 256 (10Hz frequency) indicates that the module is joining the network or creating the network, and slow flash 12 times (2Hz frequency) indicates that the module has joined the network or created the network successfully.
13	P1.2	NWK_LED	O	Use to indicate the network status of the module, 256 times of flash flash (10Hz frequency) indicates that the fast matching, and slow flash 12 times (3Hz frequency) means that the module has been added and successfully matched.
14	P1.1	GPIO	I/O	The PA launch control pin is connected inside the module; The E18-MS1-PCB / E18-MS1-IPX is without a PA inside;
15	P1.0	GPIO	I/O	The PA receiving control pin is connected inside the module; The E18-MS1-PCB / E18-MS1-IPX is without a PA inside;
16	P0.7	GPIO	I/O	N/C
17	P0.6	GPIO	I/O	N/C
18	P0.5	GPIO	I/O	N/C
19	P0.4	GPIO	I/O	N/C
20	P0.3	GPIO	I/O	N/C
21	P0.2	GPIO	I/O	N/C
22	P0.1	GPIO	I/O	N/C
23	P0.0	GPIO	I/O	N/C
24	RESET	RESET	I	Reset port

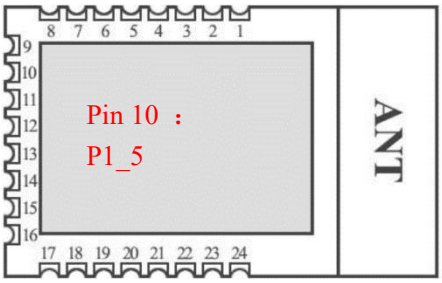
2.2 Pin in connection description

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2.2.1 Serial port connection description



2.2.2 Foot position description



E18-MS1 Series

The E18 ZigBee networking module adopts UART serial port communication mode. Users can connect with any MCU with UART function. The E18 P1_4 and P1_5 pins are RX and TX pins of the internal serial port of E18 respectively. The specific connection mode is shown in the figure above.

E18 series module pin table

1	GND	13	P1.2
2	VCC	14	P1.1
3	P2.2	15	P1.0
4	P2.1	16	P0.7
5	P2.0	17	P0.6
6	P1.7	18	P0.5
7	P1.6	19	P0.4
8	NC	20	P0.3
9	NC	21	P0.2
10	P1.5	22	P0.1
11	P1.4	23	P0.0
12	P1.3	24	RESET

3. Serial port command format and configuration mode

3.1 Serial port instruction format

The serial port of the ZigBee module is a full-duplex serial port. Because there is a large amount of data interaction in actual use, the serial port commands are in the format of command frames regardless of input or output, and have a mechanism to ensure the integrity of the command frame. The command sent by the host computer to the module Must have complete frame structure. At the same

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time, in the actual ZigBee networking environment, the messages received by ZigBee module are randomly and unpredictable, so the serial port of ZigBee module will have a high probability of random output (TX) messages.

Command frame structure:

Name	Frame head	Frame length	Frame load
	SFD	LEN	payload
Byte number	1	1	elongate

Frame header: Start with 0x55 as the command

Frame length: Frame length is the frame load length, with the maximum value of 255.

Frame load: the frame load is the valid data of the serial port frame (including verification). When the module receives the same frame load bytes and the frame length, a complete command frame is received

Command mode:

The ZigBee module has three command modes: Input commands, feedback commands, and asynchronous commands.

Input commands: The command frame entered into the module as a full command frame.

Feedback command: After the module receives the input command, the feedback command is generated for each input command. In principle, it is necessary to continuously input a command and wait for the feedback command to the module, but the module itself is fault-tolerant for the cohesive two consecutive frame commands, so there may be a continuous feedback of multiple commands after the continuous input of multiple commands. The waiting time of the feedback command is the CPU execution time inside the module, up to 10 seconds.

Ascynchronous command: The command randomly sent by the module to the upper computer may be causal or not related to the input command, but more uncertain factors, so the asynchronous command can be treated as a random event.

Frame load structure and serial port commands:

Name	Frame load			
	Payload			
	Command type	command code	Command data	check code
	Cmd type	cmd code	Cmd data	check
Byte number	1	1	0~252	1

Command type: Classification according to the command mode and working mechanism. Command types for the input commands and feedback commands range from 0 x 00 to 0 x 7 F, and the asynchronous commands range from 0 x 80 to 0 x F F.

Command code: the encoding of the command, 1 byte.

Command data: The additional parameters of the command execution, the minimum is 0 bytes, the maximum is 252 bytes

Check code: The check code is an XOR8 check in Payload that does not contain the part of the check code itself

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Frame load size range: Since each command contains the command type, command code, and check code, the frame load is a minimum of 4 bytes and a maximum of 255 bytes.

Treatment of serial adhesive

The TX output port of the ZigBee module may output multiple instructions in a series of times, including serial port feedback commands and asynchronous commands in a very short time period. When the upper computer receives the serial port command, it extracts the complete frame load from the continuous received command according to the continuous "frame head", "frame length" and "frame load", and then processes the frame load. The upper computer can design a timeout mechanism, if a new command is not received within 5 ms, It can receive the command from the new frame header and extract the full frame load.

3.2 Command Type

Command mode	Command type	Descriptor	Command type name
input command / Feedback command	0x00	TYPE_CFG	Local Configuration Command
	0x01	TYPE_ZDO_REQ	Network Management Command
	0x02	TYPE_ZCL_SEND	Device status and control command
An asynchronous command	0x80	TYPE_NOTIFY	System notification command
	0x81	TYPE_ZDO_RSP	Network management returns
	0x82	TYPE_ZCL_IND	Receiving equipment status and control
	0x8F	TYPE_SEND_CNF	Send confirmation

The causal relationship between "input command" and "async command".:

The asynchronous command TYPE_NOTIFY may be causally related to the input command TYPE_CFG;

The asynchronous command TYPE_ZDO_RSP must be caused by the input command TYPE_ZDO_REQ, but the TYPE_ZDO_REQ command does not necessarily produce TYPE_ZDO_RSP;

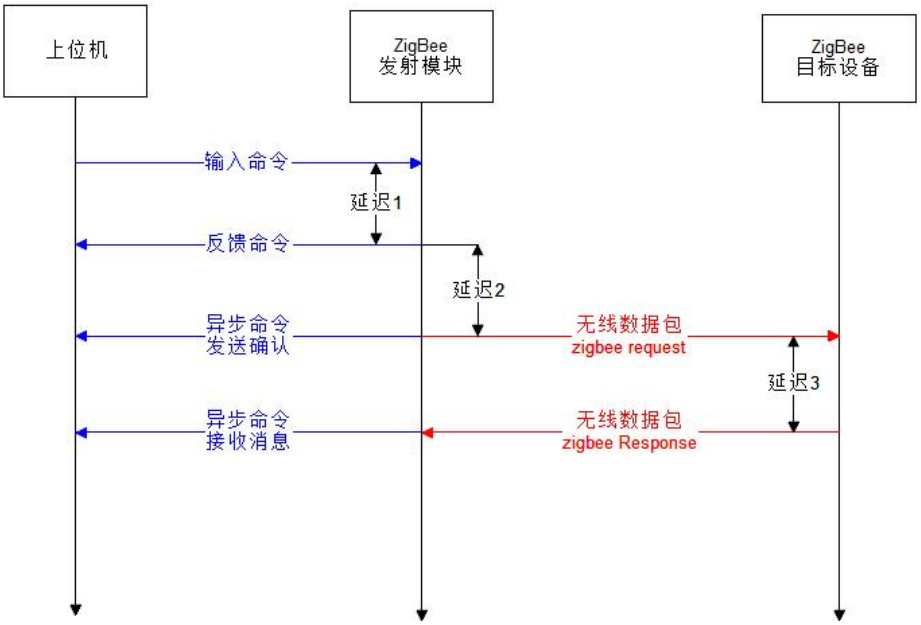
The asynchronous command TYPE_ZCL_IND is a message received from the device that may be related to or may be unrelated to the input command TYPE_ZCL_SEND. The parameter SeqNum in TYPE_ZCL_IND is equal to the SeqNum in TYPE_ZCL_SEND, indicating that the asynchronous command is caused by the input command.

TYPE_SEND_CNF is generated every time a valid TYPE_ZDO_REQ command or TYPE_ZCL_SEND command is entered, so TYPE_SEND_CNF can be used for task blocking or buffer release, especially useful when sending to multiple targets at the same time.

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TYPE_ZDO_REQ and TYPE_ZCL_SEND are both wireless transmission commands, and the wireless transmission itself has the possibility of delay, disorderly order, and the result is reflected in the corresponding asynchronous commands.

A schematic return of the three layers of the serial port command



- After entering the serial command, the command is processed in the module MCU first. If the module works properly, output the feedback command after delay about 1~2ms. And if there is a feedback command which indicates that the module is running normally. Feedback results are shown in the ***AF Status Table***.
- If the module is running normally, the serial port command is converted to a wireless signal and sent through the RF signal. Due to the slow transmission speed of ZigBee, it needs to wait for delay 2 before the signal is sent out. Whether the signal is sent or not, a confirmation command will generate to diagnose whether the signal is sent or not. Delay 2 has great time randomness, including signal transmission, route forwarding, signal retransmission, in the best case of several milliseconds, and in the worst case of up to 20 seconds. The diagnostic results are shown in ***AF Status Table***
- After the signal is sent to the target, the target returns the message of the processing result. Delay 3 includes the delay in signal transmission of the opposing device, and the delay in signal processing of the opposing device, such as reading and writing FLASH, drive sensor, and other operations for the peripheral. The result of this message, please refer to the ZCL Status Table.

3.3, Command code

Local configuration command:

Command code	descriptor	command name
0x00	CFG_STATUS	The current state of the query module

0x02	CFG_OPEN_NET	Open the network / start the network
0x03	CFG_CLOSE_NET	Turn off the network / Stop the network
0x04	CFG_RESET	Reset / restore the factory
0x05	CFG_NODE_TYPE	Set the module type
0x06	CFG_CHANNEL	Query and Set up the channel
0x07	CFG_GET_PANID	Query PANID
0x08	CFG_SET_PANID	Set up PANID
0x09	CFG_VIEW_GROUP	View module plus groups
0x0A	CFG_ADD_GROUP	Module plus group
0x0B	CFG_REMOVE_GROUP	Module retreat group
0x0D	CFG_SET_POWER	Set the query transmit power
0x0F	CFG_TEST	Test pattern
0x10	CFG_READ_ATTR	Read device properties
0x11	CFG_WRITE_ATTR	Modify device properties
0x14	CFG_FIND_BIND	Automatically build a connection

Network management command:

0x00	ZDO_NWK_ADDR_REQ	Query the node short address
0x01	ZDO_IEEE_ADDR_REQ	Query the node IEEE address

Device status and control command:

Command code	descriptor	command name
0x00	ZCL_READ_ATTR_REQ	Read the device status
0x01	ZCL_WRTIE_ATTR_REQ	Modify the device status
0x0F	ZCL_CMD	Send a control command

System Notification Command:

Command code	Descriptor	command name
0x00	NOTIFY_BOOT	Device startup
0x01	NOTIFY_NET_STATUS	Network status change
0x04	NOTIFY_NODE_ADDR	Modulshort address update
0x06	NOTIFY_LEAVE	Module off-grid notification
0x10	NOTIFY_FIND_BIND	Automatically build a connection

Network Management returns:

Command code	Descriptor	Command name
0x00	ZDO_NWK_ADDR_RSP	Query the node short address
0x01	ZDO_IEEE_ADDR_RSP	Query the node IEEE address

Status and Control of the receiving equipment:

Command code	Descriptor	Command name
0x00	ZCL_READ_ATTR_RSP	Read the device status
0x01	ZCL_WRTIE_ATTR_RSP	Modify the device status
0x0F	ZCL_CMD_IND	Receive control commands

Send confirmation:

Command code	Descriptor	Command name
0x01	ZDO_SEND_CNF	The Network management command sends a confirmation
0x02	ZCL_SEND_CNF	Equipment status control to send the confirmation

3.4 AF Status status Table

The *AF status table* is included in the feedback command and the sending confirmation command, which is used to detect various abnormalities of the ZigBee module. Usually in ZigBee communication applications, it should be ensured that the module works normally. For example, the amount of data written to the serial port is greater than the transmission rate of ZigBee, the ZigBee module works in an environment with dense Bluetooth or WIFI, and the target device is disconnected, which may lead to abnormal communication. The user can judge the cause of the communication failure according to the abnormal state of the returned command.

Error return status table: ACK return and general command feedback, proprietary command feedback all fit into this table.	
State value	State description
0x00	Successful operation
0x01	Operation failed
0x02	parameter error
0x10	memory error
0x11	Memory full
0x12	The mode does not support
0x1A	The MAC layer has insufficient resources
0xC2	The order is void
0xCD	The target device does not exist
0xB7	Target device missed message (with APS ACK on)
0xE1	channel disturbance
0xE9	Confidated by the payment of the MAC ACK
0xF0	Device hibernation caused a send timeout
0xF1	The sending queue is full

3.5 ZCL data type table

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The ZCL datatype table describes the data size of the properties (Attribute) on the Zigbee device side. When the ZCL command is used to manage the status of the target device, the basic operations to "read", "write" and "check" for the attributes (Attribute) of the target device, and to process the corresponding size data value according to the attribute data type of the target device.

The ZCL attribute datatype table					
Class	Data type	ID	Byte number	Invalid value	Report alignment
NULL	nodata	0x00	0		0
Ordinary data	data8	0x08	1		0
	data16	0x09	2		0
	data24	0x0a	3		0
	data32	0x0b	4		0
	data40	0x0c	5		0
	data48	0x0d	6		0
	data56	0x0e	7		0
	data64	0x0f	8		0
Logic data	bool	0x10	1	0xff	0
Binary bit data	bit8	0x18	1		0
	bit16	0x19	2		0
	bit24	0x1a	3		0
	bit32	0x1b	4		0
	bit40	0x1c	5		0
	bit48	0x1d	6		0
	bit56	0x1e	7		0
	bit64	0x1f	8		0
signless integer	uint8	0x20	1		4
	uint16	0x21	2		4
	uint24	0x22	3		4
	uint32	0x23	4		4
	uint40	0x24	5		8
	uint48	0x25	6		8
	uint56	0x26	7		8
	uint64	0x27	8		8
Symbolic integer	int8	0x28	1		4
	int16	0x29	2		4
	int24	0x2a	3		4
	int32	0x2b	4		4

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	int40	0x2c	5		8
	int48	0x2d	6		8
	int56	0x2e	7		8
	int64	0x2f	8		8
Enumeration	enum8	0x30	1	0xff	0
	enum16	0x31	2	0xffff	0
Floating decimal	semi	0x38	2		4
	single	0x39	4		4
	double	0x3a	8		8
Alphabetic string	octstr	0x41	The first byte	The head is 0xff	0
	string	0x42	The first byte	The head is 0xff	0
	octstr16	0x43	The first double byte	Head is 0xffff	0
	string16	0x44	The first double byte	Head is 0xffff	0
Serial type	uint8_array	0x48	2 + Total amount of content length	Head is 0xffff	0
	struct	0x4C	2 + Total amount of content length	Head is 0xffff	0
Time	ToD	0xe0	4	0xffffffff	4
	date	0xe1	4	0xffffffff	4
	UTC	0xe2	4	0xffffffff	4
ID	clusterID	0xe8	2	0xffff	0
	attriID	0xe9	2	0xffff	0
	bacOID	0xea	4	0xffffffff	0
Other data	EUI64	0xf0	8	0xffffffff	0
	key128	0xf1	16		0

3.6 ZCL error status code

The ZCL error code is included in the received return ZCL command. When sending the error code to the target device, the target device has received the control command, but the instruction execution is invalid.

ZCL State table		
Value	description	The Issue

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0x00	Successful operation	All orders
0x01	Operation failed	All orders
0x7E	The operation is not authorized	When reading and writing a Attribute
0x80	The command is not formed correctly	Send proprietary commands
0x81	This ZCL proprietary command is not supported	Send proprietary commands
0x82	This ZCL generic command is not supported	Send a general command
0x83	Vendor-defined ZCL proprietary commands are not supported	Send a proprietary vendor ID
0x84	Vendor-definition ZCL generic command is not supported	Send a band-vendor ID generic command
0x85	Invalid field	Error in the parameter for the proprietary command
0x86	Unsupported Attribute's	General order
0x87	Error input value	All orders
0x88	Attribute Read-only	When writing a Attribute
0x89	Space is insufficient	Private commands (with storage capabilities)
0x8A	There is a repeat term	Private commands (with storage capabilities)
0x8B	Didn't find	Private commands (with storage capabilities)
0x8C	The Attribute does not support active reporting	Configure an active report or read configuration
0x8D	The data type is invalid	Universal command with a datatype
0x8E	The option is invalid	proprietary command
0x8F	The Attribute writes only about it	When reading the Attitude
0x90	Inconsistent startup status	
0x91	Out Of Band	
0x92	Inconsistent error	
0x93	Refuse this operation	
0x94	overtime	
0x95	Abort	OTA time
0x96	Invalid image data	OTA time
0x97	Waiting for data	OTA or any other big data transfer
0x98	No image file is available	OTA time
0x99	More image data is needed	OTA time
0xc0	hardware error	
0xc1	software error	

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0xc2	Calibration error	

3.7 Data structure and data transmission function settings of E18 module

The E18 digital transmission module only has the data transmission function and only one UART input and output port, and has no other peripheral control function, so it only supports one ZigBee port, and its information is as follows.

The ZigBee protocol information	
Endpoint ID	1
Profile ID	0x0104
Device ID	0x0500
In Cluster	0x0000 (Basic) 0x0003(Identify) 0xFC08 (Data transparent Transmission, manuCode=0x2000)
Out Cluster	0x0003 0xFC08 (Data transparent Transmission, manuCode=0x2000)

Transparent transmission related properties:

Cluster = 0xFC08， manucode = 0x2000				
Attribute ID	Descriptor	Name	Data type	Operate
0x0000	Baud	Baud rate	uint32	R
0x0001	targetAddr	destination address	uint16	RW
0x0002	targetEP	target pattern	uint8	RW
0x0003	sendMode	Through transmission mode	bool	RW
0x0004	LP Level	Low power consumption mode	Enum8	RW

Supported control commands:

Order ID	Command direction	Descriptor	Function
0x00	C2S	Send Data	Data sent
0x01	C2S	Set Target	Set the target
0x02	C2S	Set Baud req	Set the Porter rate
0x03	C2S	Set Low Power	Set up the low-power consumption mode

How to set the transtransmission mode:

- The module itself can set the port rate, target address, target mode, transtransmission mode and low power mode through the "set local properties" command.
- If you need to set the transparent transmission remotely, except the transparent transmission mode, which can be set through the ZCL write attribute command, the rest of the attributes must be

written through the ZCL control command. In particular, the baud rate only supports 9600, 19200, 38400, 57600 and 115200, and it is invalid if other values are set.

- Using the Remote Command Control module, the manufacture code in the command must be set to 0xFC08.
- To ensure the correctness of the settings, the module itself can view the setting results and the current serial port status with the Read Local Properties command. The remote device can query the transmission status of the module through the ZCL command.
- Through the local instructions or remote instructions, the attribute corresponding to the transmission mode is set to 1 (TRUE), and the module enters the transmission mode.
- Once the module enters the transmission mode, the serial port command fails, and the module native machine needs to send 3 "+" in line to exit transmission mode. Users can also send a ZCL write attribute instruction to the module on the remote device, and modify the attribute corresponding to the transtransmission mode to be 0 (FALSE).
- The module in command mode can communicate with the module in transmission mode. The command mode module sends the "Data Send" command to the module in transmission mode in ZCL command mode, and the module in transmission mode can output the Payload part data of the command mode module.
- Modes in command mode can receive on-demand, multicast and broadcast data of modules in transtransmission mode, and output data in ZCL receiving command format.

Target address and target mode setting table:

Destination address	Target pattern	Transmission effect
0xFFFF	Not equal to 0	Broadcast to all devices, including dormant terminals
0xFFFD	Not equal to 0	Broadcast to all non-dormant devices
0xFFFC	Not equal to 0	Broadcast to the coordinator and all routing devices
0x0000~0xFFF8	1	Short address on demand through transmission
0x0001~0xFFF8	0	Main Broadcast
0xFFFE	0xFE	Transmission to MAC address lock target (requires coordinator to set target binding)

The effect that setting the low power mode:

Low power consumption mode	Wake up cycle	Upload the heartbeat packet cycle
0	1 Seconds	2 Minutes
1	3.3 Seconds	4 Minutes
2	5 Seconds	6 Minutes
3	∞ second	8 Minutes

IV. User instruction set

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For user convenience, the E18 ZigBee module uses two modes, namely transparent transmission and HEX instruction format.(Default command mode)

In the command mode, users can enter the transtransmission mode by setting the **local attribute instruction "**55 07 00 11 00 03 00 01 13**"**. Sending "+ + +" in the transmission mode can directly enter the command mode;

Note: The text part of the following command parses the command to better understand the meaning of the sending and feedback command. Please use only the HEX part.

4.1 Local configuration command

4.1.1 Query current status of query module

Command code: 0x00

Function: This command is used to query the status and parameters of the module, including the module's MAC address, networking, channel, PANID, short address, what is the key.

Enter the command format:

Name	cmd data
	Command data
	NULL
	empty
Byte number	0

Feedback command format:

Name	cmd data							
	Command data							
	Net status	DevType	IEEE Addr	Channel	PANID	Short Addr	Ext PANID	NWK Key
	network state	device type	MAC address	channel	PANID	short address	expand PANID	Network key
Byte number	1	1	8	1	2	2	8	16

Network status: 0x00 - networked, and 0xFF- not networked

Device type: 0x00 - coordinator, 0x01 - router, 0x02 - terminal node, 0x03 - dormant terminal node

MAC address: Module MAC address, fixed once out of factory,Unique in the world.

Channel: module current channel, No channel when not networked

PANID: module current PANID, No PANID when not networked

Short address: module current short address, No short address when not networked

Extended PANID: Not available without networking

Network key: The network value is 0

Command example: (purple: Load length red: command type + command code blue: check code)

Send command: 55 03 00 00 00

Feedback command:

Unnetworked: 55 0D 00 00 FF Networking Status 00 Device Type 28 EA E2 1A 00 4B 12 00 MAC

address 9C
Networked: 55 2A 00 00 00 networking status 00 device type 28 EA E2 1A 00 4B 12 00 MAC address 19 channel 93 61 PANID 00 00 short address
28 EA E2 1A 00 4B 12 00 Extension ID C6 CD 93 B5 2F 37 9E F6 E9 A6 CE 3A 15 33 CF 55 Key B1

4.1.2 Open the network / start the networking

Command code: 0x02

Function: The coordinator opens the network to allows the device to join the network (The coordinator creates a new network when out of factory), and the routing and terminal nodes join the network. The coordinator creates the network, and the routing and terminal node network is sometimes delayed, and the final result is obtained in the Network Status Change in the System Notification Command. Execute this command after the router is connected to the network, which can prolong the time for the coordinator to open the network. **If you fail to create or join a network, make up to 5 reattempts, and manually try again after 5 failures.**

Enter the command format:

Name	cmd data
	Command data
	NULL
	empty
Byte number	0

Feedback command format:

Name	cmd data
	Command data
	Status
	state
Byte number	1

Status: The 0x00 - operation is valid, and the 0xFF - operation is invalid. This command is valid only after soft start.

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 03 00 02 02

Feedback command: 55 04 00 02 00 network is successful 02

Aynchronous feedback command: 55 29 80 01 02 Network Open 28 EA E2 1A 00 4B 12 00 MAC address 13 channel C9 45 PANID 00 00 short address 28 EA E2 1A 00 4B 12 00 extension PANID 2A 83 DE 81 59 20 3A 58 92 1A 2C 4B 5E 77 B9 A6 key 28

Asynchronous feedback command: 55 04 80 02 B4 Network window time 36 (B4 default 180s)

Note: After the user uses this instruction, the module network command lamp (P1.3 pin) will act. When the network is not connected, the network indicator light will quick flash to find the network (terminal / router) or form the network (coordinator), and the network indicator will flash slowly after the network formation or query is successfully added. When networked, the network indicator light will slowly flash directly to prompt the user.

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4.1.3 Close the network / stop the networking

Command code: 0x03

Function: Turn off networking permission, and operating the command on routing and terminal nodes may cause subsequent devices to enter the network.

Enter the command format:

Name	cmd data
	Command data
	NULL
	empty
Byte number	0

Feedback instruction format:

Name	cmd data
	Command data
	Status
	state
Byte number	1

Status: The 0x00 – operation is valid, and the 0xFF – operation is invalid.

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 03 00 03 03

Feedback command: 55 04 00 03 00 status 03

Aynchronous feedback command: 55 04 80 02 00 Network window time 82 (close the network, allow the network access window time to clear zero)

4.1.4 Restore the factory settings

Command code: 0x04

Function: module reset, exit the network or restore factory settings. When the factory is restored, all the parameters set by the module are restored to the default values.

Enter the command format:

Name	cmd data		
	Command data		
	mode	PANID	Channel
	The reset mode	Pan ID	channel
Byte number	1	2	1

The mode: 0x00-the module is reset; 0x01 - module is retired; and 0x02 - module is reset from the factory.

PANID: the current PANID of the module, you can fill in 0xFFFF when reset; If you need to withdraw from the network or when the network has been established, you need to restore the factory, and you need to fill in the current PANID of the module.

Channel: the current channel of the module, fill in 0x00 when reset, If you need to withdraw from the network or when the network has been established, you need to restore the factory, and you need to fill in the current PANID of the module.

Feedback command format:

Name	cmd data
	Command data
	Status
	state
Byte number	1

Status: 0 – operation is valid, and the 0xFF – operation is invalid.

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 07 00 04 00 Mode 93 61 PANID 19 channel EF (reset)

55 07 00 04 01 Mode 93 61 PANID 19 Channel EE (Off-Network)

55 07 00 04 02 Mode 93 61 PANID 19 Channel ED (Restore factory settings)

Feedback command: 55 04 00 04 00 status 04

Asynchronous feedback command: 55 05 80 00 00 Device type 10 Software version number 90

4.1.5 Set the device type

Command code: 0x05

Function: Set the module as the coordinator, routing or terminal node (dormant or non-dormant). This setting needs to be set before the device networking, and the module needs to be restarted after setting the device type to ensure that the protocol stack can refresh the device type. If not restarted, the failure to join the network will lead to failure;

Enter the command format:

Name	cmd data
	Command data
	Type
	device type
Byte number	1

Device type: 0x00 - coordinator, 0x01 - router, 0x02- terminal node, 0x03 - dormant terminal node

Feedback command format:

Name	cmd data
	Command data
	Status
	state
Byte number	1

Status: The 0x00 - operation is valid, and the 0xFF - operation is invalid.

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 05 00 05 00 Device Type 05 (coordinator)

55 04 00 05 01 Device Type 04 (router)

55 05 00 05 02 Device Type 07 (Terminal)

55 04 00 05 03 Device Type 06 (Sleeping Terminal)

Feedback command: 55 04 00 05 00 modified successfully 05 (Please query the device type with the query status instruction after successful modification)

Remarks:

1. If the device type is set to dormant terminal, the module will not enter the dormant mode until it joins the network. After the first networking is successful, the module will first enter a 1-second wake-up period, which lasts for 1 minute. During this 1-minute period, it belongs to the information configuration interaction time between the coordinator and the terminal node. The user can remove the dormant terminal through the coordinator (network manager) during this period. After one minute, the module will automatically enter the sleep cycle corresponding to the low power consumption level set by the user (if the coordinator wants to delete the sleep node, the sleep node needs to automatically wake up through commands, buttons, and the sleep terminal to perform off-grid operation);

2. If the dormant node has joined the network, but the dormant node is powered off and then powered on again, the dormant node will have 30 seconds after the network is restored. This time is the information configuration interaction time between the coordinator and the terminal node, which is consistent with the above .

4.1.6 Query and setup channel

Command code: 0x06

Function: enabling or divide module channel, needs to be set before creating network or network, can be set in standby mode. The module by default supports 7 preferred channel values (11,14,15,19,19,20,24,25), the command that enables or divides a plurality of preferred channels, and the feedback command carries the enabled channel.

Enter the command format:

Name	cmd data	
	Command data	
	Set	ChannelList
	set up	List of channels
Byte number	1	elongate N

Settings: 0x00- disable channel, 0x01- enabling channel, 0x02- coverage channel (list cannot be 0)

Channel: Set the list of channels for disable or enabling, valid from 0x0B~0x1A (11-26).

Feedback command format:

Name	cmd data	
	Command data	
	status	ChannelList
	state	List of channels
Byte number	1	elongate N

Status: 0x00 setting is valid, 0xFF-the setting is invalid

Channel list: Current module enabling channel list, up to 16 bytes

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 04 00 06 00 query 06

Feedback command: 55 0B 00 06 00 success 0B 0E 0F 13 14 18 19 channel list 0A

Send command: 55 05 00 06 01 enable 15 channel list 12

Feedback command: 55 0C 00 06 00 successful 0B 0E 0F 13 14 15 18 19 channel list 1F

Send command: 55 06 00 06 00 energy 13 14 channel list 01

Feedback command: 55 09 00 06 00 success 0B 0E 0F 18 19 channel list 0D

Send command: 55 06 00 06 02 override 11 12 channel list 07

Feedback command: 55 06 00 06 00 Success 11 12 channel list 05

4.1.7 Query PANID

Command code: 0x07

Function: Set the PANID for module networking, and the default 0xFFFF is random mode. Setting up the PANID requires either before the coordinator establishes the network or before the node joins the network. It can be set up in standby mode.

Enter the command format:

Name	cmd data
	Command data
	NULL
	empty
Byte number	0

Feedback command format:

Name	c md data	
	Command data	
	status	PANID
	state	P an ID
Byte number	1	2

Status: 0x00 - setting is valid, 0xFF- the setting is invalid

PAN ID:Module PANID, with a default value of 0xFFFF

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 03 00 07 07

Feedback command: 55 06 00 07 00 query successful C1 BE PANID 78

Query feedback PANID: FE FF

4.1.8 Set up the PANID

Command code: 0x08

Function: The module establishes a network in coordinator mode, or joins the network in routing and terminal node mode, and sets a specified PANID before establishing the network or joining the

network.

Enter the command format:

name	cmd data
	Command data
	PANID
	Pan ID
Byte number	2

PANID: Preset the PANID value

Feedback command format:

name	cmd data
	Command data
	status
	state
Byte number	1

Status: 0x00 - setting is valid, 0xFF- the setting is invalid.

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 05 00 08 98 89 PANID 19

Feedback command: 55 04 00 08 00 successful 08

4.1.9 View the module grouping

Command code: 0x09

Function: View the groups joined by the module, which can be operated locally or remotely.

Enter the command format:

name	cmd data
	Command data
	EP_idx
	Port index
Byte number	1

Port index: the endpoint serial number (non-port number) of the corresponding module, the default transmission port is 0x00,1 reserved for the second serial port, 2,3 reserved for PWM, GPIO and ADC.

Feedback command format:

Name	cmd data		
	Command data		
	Status	Group Num	Group List
	state	Number of grouping	Add group list
Byte number	1	1	2*N

Status: 0x00 - query is valid, with subsequent data, and 0xFF - the query is invalid

Number of groups: The total number of groups added by this port on the module

Add group list: Add group list for the port on the module

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 04 00 09 00 port index 09

Feedback command: 55 05 00 09 00 query valid 00 09

No group feedback: 00 Feedback group ID after grouping

4.1.10 Module grouping

Command code: 0x0A

Function: Specify a port grouping on the module

Enter the command format:

Name	cmd data	
	Command data	
	EP_idx	Group ID
	Port index	group ID
Byte number	1	2

Feedback command format:

Name	cmd data
	Command data
	Status
	state
Byte number	1

Status: The 0x00 - operation is valid, and the 0xFF - operation is invalid

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 06 00 0A 00 port Index 00 10 Group ID 1A

Feedback command: 55 04 00 0A 00 successful 0A

Note: If you use multicast communication, you should set the target short address to the added group ID, and set the target port to 0xFF

4.1.11 Module withdrawal group

Command code: 0x0B

Function: Specifies that a port on the module exits the specified grouping

Enter the command format:

Name	cmd data	
	Command data	
	EP_idx	Group ID
	Port index	group ID
Byte number	1	2

Port index: Default value of 0

Group ID: The ID number that need to exit the group

Feedback command format:

Name	cmd data

	Command data
	Status
	state
Byte number	1

Status: 0x00-Operation is valid, 1-The module port is no longer in the group, and 0xFF-The operation is invalid.

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 06 00 0B 00 port Index 00 10 Group ID 1B

Feedback command: 55 04 00 0B 00 successful 0B

4.1.12 Query and Set the transmit power

Command code: 0x0D

Function: Query or set the module transmit power

Enter the command format:

Name	cmd data	
	Command data	
	Mode	Power
	pattern	power
Byte number	1	1

Mode: 0-query, 1-setting

Power range: 0x00~0x14

Feedback command format:

Name	cmd data
	Command data
	Status
	state
Byte number	1

Status: The 0x00 - operation is valid, and the 0xFF - operation is invalid

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 05 00 0D 01 11 power level 1D

Feedback command: 55 05 00 0D 00 effective operation: 11 power level 1C

Send command: 55 04 00 0D 00 0D

Feedback command: 55 05 00 0D 00 14 power level 19

Note: The power level is 0x00~0x14. If the setting exceeds the maximum value, the setting will not take effect and the previous setting power will be maintained. The upper computer configuration range is 0x0E~0x14.

4.1.13 Factory mode

Command code: 0x0F

Function: To test the module transmission power and frequency accuracy

Enter the command format:

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Name	cmd data		
	Command data		
	Chan	Power	Mode
	channel	power	pattern
Byte number	1	1	1

Channel: Module support channel 0x0B~0x1A (11-26)

Power: Power level is 0x00~0x14

Mode: Default value is 0x00

Feedback command format:

Name	cmd data
	Command data
	Status
	state
Byte number	1

Status: The 0x00 - operation is valid, and the 0xFF - operation is invalid

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 06 00 0F 0B channel 14 Power 00 mode 10

Feedback command: 55 04 00 0F 00 operation valid 0F

Note: In the factory mode, the module will always be in the transmitting state, and the module needs to be reset to exit this mode.

4.1.14 Read the local properties

Command code: 0x10

Function: Read the ZCL attribute status parameters on the module

Enter the command format:

Name	cmd data	
	Command data	
	EP_idx	AttrID
	Port index	parameter ID
Byte number	1	2

Port index: port index of the module, default 0

Parameter ID: The ZCL property ID of the module

Feedback command format:

Name	cmd data	
	Command data	
	Status	Data
	executing state	Parameter data

Byte number	1	n

Status: The 0x00 - operation is valid, and the 0xFF - operation is invalid

Example instructions: (purple: load length red: command type + command code blue: check code)

Read the target Short address command: 55 06 00 10 00 port index 01 00 AttrID 11

Feedback command: 55 06 00 10 00 successful FF 00 target short address EF

Note: If the target short address is not set, the factory default value is FF FF

Read the baud rate command: 55 06 00 10 00 port index 00 00 AttrID 10

Feedback command: 55 08 00 10 00 successful 00 C2 01 00 baud rate D3

Read the target Short address command: 55 06 00 10 00 port index 01 00 AttrID 11

Feedback command: 55 06 00 10 00 successful B2 30 target short address 92

Read the target port command: 55 06 00 10 00 port index 02 00 AttrID 12

Feedback command: 55 05 00 10 00 Success 01 target port 11

Note: If the target port number is not set, the factory default value is FF

Read Serial port mode command: 55 06 00 10 00 port index 03 00 AttrID 13

Feedback command: 55 05 00 10 00 successful 00 serial port mode 10

Note: Serial port mode: 0 command mode, 1 Transparent transmission mode

Read the low power level command: 55 06 00 10 00 port index 04 00 AttrID 14

Feedback command: 55 05 00 10 00 Success 01 Low power level 11

Low power level: 0-1 second cycle wake up (2 minute heartbeat packet)

1-3.3 Second cycle wake-up (4-minute heartbeat packet)

2-5 second cycle wake-up (6-minute heartbeat packet)

3- sleep all the time (8 minutes heartbeat bag)

4.1.15 Set the local properties

Command code: 0x11

Function: Set the ZCL status parameters of the module

Enter the command format:

Name	cmd data		
	Command data		
	EP_idx	AttrID	Data
	Port index	parameter ID	Parameter data
Byte number	1	2	n

Port index: the port index number of the module, the default value is 0

Parameter ID: The ZCL property ID of the module

Parameter data: Data for the parameters that you want to modify

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Feedback command format:

Name	cmd data
	Command data
	Status
	executing state
Byte number	1

Status: The 0x00 - operation is valid, and the 0xFF - operation is invalid

Example instructions: (purple: load length red: command type + command code blue: check code)

Set the serial port baud rate: 55 0A 00 11 00 port index 00 00 AttrID 00 C2 01 00 baud rate D2

Return: 55 04 00 11 00 Success 11

Set the target short address command: 55 08 00 11 00 port index 01 00 AttrID B2 30 target short address 92

Return: 55 04 00 11 00 Success 11

Set the target port command: 55 07 00 11 00 port index 02 00 AttrID 01 target port 12

Return: 55 04 00 11 00 Success 11

Set the transmission mode command: 55 07 00 11 00 port index 03 00 AttrID 01 transmission mode 13

Return: 55 04 00 11 00 Success 11

Set the low power level command: 55 07 00 11 00 port index 04 00 AttrID 02 Low power Class 17

Return: 55 04 00 11 00 Success 11

Full Baud rate configuration command table:

Communication Porter rate	Local property configuration command	Command feedback	remarks
9600(0x002580)	55 0A 00 11 00 00 00 80 25 00 00 B4	55 04 00 11 00 11	The port rate inconsistency does not affect the communication and the restart effect after the port rate setting
19200(0x004B00)	55 0A 00 11 00 00 00 00 4B 00 00 5A	55 04 00 11 00 11	
38400(0x009600)	55 0A 00 11 00 00 00 00 96 00 00 87	55 04 00 11 00 11	
57600(0x00E100)	55 0A 00 11 00 00 00 00 E1 00 00 F0	55 04 00 11 00 11	
115200(0x01C200)	55 0A 00 11 00 00 00 00 C2 01 00 D2	55 04 00 11 00 11	

4.1.16 Automatic Connection

Command code: 0x14

Function: the module will automatically establish regular connection, the two modules can operate together to establish regular connection. When the operation times out, the previous constant connection will be deleted. Establish frequently connected results will be notified via asynchronous

commands.

Enter the command format:

Name	cmd data
	Command data
	EP_idx
	Port index
Byte number	1

Port index: the port index number of the module, the default value is 0

Feedback command format:

Name	cmd data	
	Command data	
	Status	EP_idx
	executing state	Port index
Byte number	1	1

Execution status: 0x00 - execution is valid, and 0xFF - execution is invalid

Port index: the port index number of the module

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 04 00 14 00 port index 14

Feedback command: 55 04 00 14 00 port index 14

Asynchronous feedback command: 55 06 80 10 0C A8 target short address 01 target port 35

Aynchronous feedback command: 55 10 82 0F 00 0C A8 target short address 01 target port 13 command number 01 command direction 08 FC ClusterID 00 20 vendor code FC RSSI 01cmdID 00 status 13

Key trigger:

Asynchronous feedback command: 55 06 80 10 0C A8 01 35

Asynchronous feedback command: 55 10 82 0F 00 0C A8 01 07 01 08 FC 00 20 FC 01 00 07

Remarks:

1. After using the automatic communication connection, the user can directly use the command to make the pairing parties enter the transparent transmission mode, and then the mutual data communication can be started.

2. Indicator light: when the module is searching for automatic pairing, the indicator light flashes quickly (100ms on/off); when the module finds a paired device, the indicator light flashes slowly (333ms on/off); if the device is being found, the indicator light goes out.

4.2 System notification command

4.2.1 Equipment startup notification

Command code: 0x00

Function: The notification message when the module is powered up and contains the MAC address of the module

Aynchronous feedback command:

Name	cmd data

	Command data	
	Device Type	Verson
	device type	Software version number
Byte number	1	1

Device type: 0x00 - coordinator, 1- router, 2 - terminal, 3 - dormant terminal
Software Version No.: Current Version No.10 (V1.0)
Example instructions: (purple: load length red: command type + command code blue: check code)
Asynchronous feedback command: 55 05 80 00 02 Device Type 10 Software version 92

4.2.2 Network status change notification

Command: 0x01
Function: the module network success, the module network failure, This asynchronous command will be generated when the connected module opens the network.

Aynchronous feedback command:

Name	cmd data						
	Command data						
	Net status	IEEE Addr	Channe l	PANI D	Short Addr	Ext PANID	NWK Key
	network state	MAC address	channel	PANI D	short address	expand PANID	Network key
Byte number	1	8	1	2	2	8	16

Network status: 0 - no network, 1 - network, 2 - network open
MAC address: module MAC address, fixed once out of factory, unique in the world
Channel: the module current channel, 0 when networking fails
PANID: The module currently PANID, 0xFFFF when networking fails
Short address: the module current short address, 0xFFFE when the network fails
Extension PANID: All 0 when networking failed
Network key: All 0 for network failure
Example instructions: (purple: load length red: command type + command code blue: check code)
Aynchronous feedback command:
Open network command notification: 55 29 80 01 02 Network open C6 B4 E2 0A 00 4B 12 00 Mac address 14 channel 16 B3 PANID 00 00 short address C6 B4 E2 0A 00 4B 12 00 expand PANID 1B F0 09 64 46 CB 73 77 A7 66 F8 CA 01 B7 80 F6 network key 0E
Restart command notification: 55 29 80 01 01 networked C6 B4 E2 0A 00 4B 12 00 Mac address 14 channel 16 B3 PANID 00 00 short address C6 B4 E2 0A 00 4B 12 00 expansion PANID 1B F0 09 64 46 CB 73 77 A7 66 F8 CA 01 B7 80 F6 network key 0D

4.2.3 Open and close network notifications

Command code: 0x02
Function: After the coordinator opens the network, the asynchronous command notifies the window

time to open the network. If new devices are connected, the new device may add the window time to the coordinator. In addition, the already connected route and the terminal can also use the coordinator instruction to open the network to increase the window time of the coordinator to open the network, but if the coordinator network is closed, the route and the terminal can not be opened. The command is also issued when the coordinator turns off the network, cutting the window time to 0.

Aynchronous feedback command:

Name	cmd data
	Command data
	timeout
	Window time
Byte number	1

Window time: Coordinator network open window time, when "0" means close the network.(Maximum Network Open Time, 0xB4-180s)

Example instructions: (purple: load length red: command type + command code blue: check code)

Asynchronous feedback command: 55 04 80 02 B4 Network window time 36 (B4 default 180s)

4.2.4 Module short address update notification

Command code: 0x04

Function: When a module or node is connected to the network, it reports the MAC address or short address to the coordinator, and when the short address changes during operation, this command will be used as a notification. After receiving the command, the host computer should update the mapping relationship between the MAC address and the short address in time.

Aynchronous feedback command:

Name	cmd data		
	Command data		
	IEEE Addr	Nwk Addr	Node Type
	MAC address	short address	node type
Byte number	8	2	1

MAC address: the MAC address of the target node

Short address: the short address of the target node

Node type: 1-router, 2- non-dormant terminal node, 3-dormant terminal node

Example instructions: (purple: load length red: command type + command code blue: check code)

Aynchronous feedback command: 55 0E 80 04 C6 DE E2 08 00 4B 12 00 MAC address 1A 47 short address 02 node type 70

4.2.6 Module off-grid notification

Command code: 0x06

Function: The device is actively off the grid (using withdrawal instructions or keys), the coordinator will receive the message, and the device may send multiple packets each time off the grid. If the device

is not in the coverage of the coordinator when actively off-grid, the coordinator cannot receive the message, but the transmission module can normally off-grid.

Aynchronous feedback command:

Name	cmd data
	Command data
	IEEE Addr
	MAC address
Byte number	8

MAC address: the MAC address of the off-grid device

Example instructions: (purple: load length red: command type + command code blue: check code)

Asynchronous feedback command: 55 0B 80 06 51 20 9F 0C 00 4B 12 00 MAC address 3D

4.2.7 Automatic establishment of connection notification

Command code: 0x10

Function: The status notification of the constant connection of the data transmission module, the module that initiates the constant connection first is the passive mode, and the one that initiates the last is the active mode.

Aynchronous feedback command:

Name	cmd data	
	Command data	
	Nwk Addr	EP
	Target short address	port
Byte number	1	1

Port index: the port index number of the module

Example instructions: (purple: load length red: command type + command code blue: check code)

Asynchronous feedback command: 55 06 80 10 0C A8 target short address 01 target port 35

Aynchronous feedback command: 55 10 82 0F 00 0C A8 target short address 01 target port 13 command number 01 command direction 08 FC ClusterID 00 20 vendor code FC RSSI 01cmdID 00 status 13

4.3 Network management command

4.3.1 Network command format analyze

Unified command header format:

The network management command sends the input command, the first time the feedback command is received, the second time the asynchronous command "send confirmation" is received, and the third time the asynchronous command "network management return" is received. Each time a command is received, it determines whether the next command will be received.

Enter the send-out command format:

Name	cmd data	
	Command data	
	Nwk Addr	Cmd param

	short address	command parameter
Byte number	2	elongate

Command parameters: The parameters of different commands are different, and the parameters of different commands will be parsed later.

Serial port feedback command format:

Name	cmd data	
	Command data	
	status	handle
	executing state	Command number
Byte number	1	1

Execution status: 0x00 - valid, will send confirmation, other values - Execution is invalid

Command Number: The number assigned by the system to the command, the user can trace the corresponding input command in the confirmation of sending and the return of the network management command.

Send a confirmation command format:

Name	cmd data		
	Command data		
	Nwk Addr	AF status	handle
	short address	Send results	Command number
Byte number	2	1	1

Short address: the short address of the sending target

Send results: wireless send results, see the ***3.4 AF Status table***

aboveabove command Number: The number assigned by the system to trace the corresponding input command in sending the confirmation and network management command return.

Receiving the return command format:

Name	cmd data			
	Command data			
	Nwk Addr	handle	Zdo status	Cmd param
	short address	Command number	Execution results	command parameter
Byte number	2	1	1	elongate

Short address: returns the device short address of the command

Command number: consistent with the system allocation when sending, the terminal returns what the receiver produces

Execution result: The receiving execution result of the command may return “unsupported”

Command parameter: The parameter is valid when the result is 0.

Command sending and receiving instructions:

Network management command is issued by the upper computer to the transmission module or network manager. The function of the feedback command only indicates whether the command is correctly entered and whether the module is in the state of sending messages. Sending confirmation indicates whether the message was sent or even to the target (not on the way). Receiving the return command is the result of the execution by the opposing device.

4.3.2 Query the node short address

Command code: 0x00

Function: Query the short address of the target node according to the IEEE address. This command should enter the 0xFFFD broadcast address in the short address field (Nwk Addr) of the frame header, otherwise the input is invalid.

Enter the send command format: (only for the command parameters)

Name	cmd param
	command parameter
	IEEE Addr
	MAC address
Byte number	8

MAC address: the MAC address of the queried node

Receive return command format: (indicates the command parameter only)

Name	cmd param
	command parameter
	IEEE Addr
	MAC address
Byte number	8

MAC address: the MAC address of the queried node, and the short address of the queried node is in the command header.

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 0D 01 00 FD FF broadcast address 3D 01 70 0F 00 4B 12 00 target device MAC address 19

Feedback command: 55 05 01 00 00 State 05 command number 04

Send confirmation: 55 07 8F 01 FD FF broadcast address 00 successful 05 command number 89

Receive the return command: 55 11 81 00 00 A0 target short address 05 command number 00 successful 3D 01 70 0F 00 4B 12 00 target MAC address B3 00 reserved byte bit 8D

Note: The terminal does not support checking its own short address

4.3.3 Query the node MAC address

Command code: 0x01

Function: Query the MAC address of the target node according to the short address

Enter the send command format: (only for the command parameters)

Name	cmd param
	command parameter

	NULL
	empty
Byte number	0

Receive return command format: (indicates the command parameter only)

Name	cmd param
	command parameter
	IEEE Addr
	MAC address
Byte number	8

MAC address: the MAC address of the queried node

Example instructions: (purple: load length red: command type + command code blue: check code)

Send command: 55 05 01 01 7B 20 target short address 5B

Feedback command: 55 05 01 01 00 Status 1A command number 1A

Send confirmation: 55 07 8F 01 7B 20 Target Short address 00 Status 1A Command Number CF

Return command is received: 55 11 81 01 7B 20 target short address 1A command number 00 success 3D 01 70 0F 00 4B 12 00 target MAC address AB Startidx 00 assocnum 70

Note: The terminal does not support querying their own MacAddr

4.3.4 Query target supported cluster (cluster)

Command code: 0x04

Function: Query the cluster supported by the target device

Enter the send command format: (only for the command parameters)

Name	c md param
	Command content
	Endpoint
	port number
Byte number	1

Port number: The port number of the target device being queried

Receive return command format: (indicates the command parameter only)

Name	c md param							
	Command content							
	Endpoint	P rofileID	deviceID	device version	In Cluster List		Out Cluster List	
	port number	Equipment contour	equipment ID	Device Information Version	Enter the cluster table		Output cluster table	
					quantity	tabulation	quantity	tabulation
Byte number	1	2	2	1	1	2*N	1	2*N

Port number: The device port number being queried
Device profile: profile ID, only need to care the value of 0x0104
Device ID: Device type ID of the port, available to distinguish between the functions supported by the target device.
Device information version: Version number of the device description information, 0 is version v1.0
Input Cluster Table: Input cluster supported by the device
Output cluster table: Device-supported output cluster

Example: Use the E18 module to query a ZigBee module with PWM function. Port 1 of the target module is data transtransmission, and port 2 is PWM output

Query port 1: (purple: load length red: command type + command code blue: check code)
Send command: 55 06 01 04 3B B1 target Short address 01 target port 8E
Feedback command: 55 05 01 04 00 State 04 command number 01
Send confirmation: 55 07 8F 01 3B B1 target short address 00 status 04 command number 00
Return command was received: 55 1D 81 04 3B B1 target short address 04 command number 00 successful 01 target port 04 01 Device Outline 50 00 Device Type 00 Device Version 04 Input Cluster Size 00 00 03 00 07 00 08 FC Input Cluster 03 Output Cluster Size 03 00 06 00 08 00 Output Cluster A5

Data analysis 1:

The target module short address is 0xB13B, port 1 is data transtransmission, device profile is 0x0104, which is ZigBee HA application device, and device type 0x0050 is a data transmission device. There were four input clusters of 0x0000,0x0003,0x0007,0xFC08. The last cluster 0xFC08 indicates that the device is a data transmission device. The output cluster has 0x0003,0x0006, and 0x0008. The 0x0006 and 0x0008 indicate that the device can output control instructions for the light.

Query port 2: (purple: load length red: command type + command code blue: check code)
Send command: 55 06 01 04 3B B1 target Short address 02 target port 8D
Feedback command: 55 05 01 04 00 State 05 command number 00
Send confirmation: 55 07 8F 01 3B B1 target short address 00 status 05 command number 01
Received return command: 55 1D 81 04 3B B1 target short address 05 command number 00 success 02 target port 04 01 Device Outline 01 01 Device Type 00 Device Version 06 Input Cluster Size 00 00 03 00 04 00 05 00 06 00 08 00 Input Cluster 00 Output Cluster Size 07

Data analysis 2:

The short address of the target module is 0xB13B, the No. 2 port is controlled by PWM, the device outline is also 0x0104, which is a ZigBee HA device, and the device type is 0x0101, which is a dimming light device. There are 6 input clusters respectively 0x0000, 0x0003, 0x0004, 0x0005, 0x0006, 0x0008, this information indicates that the module supports PWM.

4.3.5 Number of query device support ports

Command code: 0x05
Function: Query the cluster supported by the target device

Enter the send command format: (only for the command parameters)

name	c md param
	Command content
	NULL
	empty
Byte number	0

Receive return command format: (indicates the command parameter only)

name	c md param	
	Command content	
	Endpoint Num	Endpoint List
	port number	List of ports
Byte number	1	N

Number of ports: Total number of ports for the target device

Port list: List of ports for the target device

Example: Use E18 module to query a transmission module with 3 PWM output (purple: load length red: command type + command code blue: check code)

Send command: 55 05 01 05 3B B1 target short address 8E

Feedback command: 55 05 01 05 00 State 06 command number 02

Send confirmation: 55 07 8F 01 3B B1 target short address 00 status 06 command number 02

Received return command: 55 0C 81 05 3B B1 target short address 06 command number 00 successful 04 port number 01 02 03 04 port list 08

Data analysis:

The target device is a digital transmission module with PWM output, consisting of 4 ports, 1 for data transtransmission, and 3 for PWM control output.

4.4 Equipment Status Management and Equipment Control (ZCL command)

4.4.1 ZCL command format analyze

Unified command header format:

The ZCL commands are designed to use a limited much number of command formats to combine highly variable control commands for different devices, including access to Attribute s (attributes) in the devices, and to initiate control over these devices.

ZCL commands include input commands, feedback commands, and two asynchronous commands: "send confirmation" and "receive commands". Access to the device is a 24bit virtual address with a short address + port number.

ZCL command supports unicast, multicast, broadcast 3 transmission modes. The multicast and broadcast port is 0xFF.

Enter Command Format: Entering the command produces ZCL wireless commands from the coordinator to the device in the following uniform header format.

Name	cmd data

	Command data								
	EP_Idx	shortAddr	Endpoint	SeqNum	Direction	ClusterID	ManuCode	AckMode	Ext data
	local port Send mode	Target short address	Target port	frame number	Command direction	cluster ID	Manufacturer code	Response mode	Extended data
Byte number	1	2	1	1	1	2	2	1	elongate

Native port: Native port index, low 4-bit valid, the default is 0

Send mode: bit6 -APS encryption, bit7-forced send (no routing, no forwarding)

Target short address: Send target short address, 0xFFFC~0xFFFF is broadcast (0xFFFE is invalid address)

Target port: the port of sending the target, When 0xFF is filled in and the short address is not broadcast, it is sent by multicast.

Frame number: The upper computer generates the frame number. If the frame number and short address of the ZCL frame are received, and the port and transmission are equal, then the message is the reply message of the target device.

Command direction: Refer to ZCL architecture, 0-C2S (attack->bear), 1 S2C (bear->attack)

Cluster ID: The cluster ID that sends the message

Vendor code: the vendor code that sends the message, the target device needs to support the vendor code to be valid, fill in 0x0000 by default.

Response mode: 0 - respond with Default Response, 1-respond with APS Ack.

Extended data: The extended data of different commands is different. The subsequent command parsing is only analyzed for the extended data part

Feedback command format:

Name	cmd data	
	Command data	
	status	handle
	executing state	Command number
Byte number	1	1

Execution status: 0x00 - If the execution is valid, a confirmation of sending will be generated, other values -Execution is invalid.

Command Number: The number assigned to the command by system, so that users can trace the corresponding input command in sending confirmation and network management command return.

Send a confirmation format:

Name	cmd data					
	Command data					
	EP_Idx	shortAddr	Endpoint	handle	Direction	AF status
	Port index	Target short	Target port	Command number	Command	Send results

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	Send mode	address			direction	
Byte number	1	2	1	1	1	1

Native port: Native port index, low 4 bits is valid, same as when sending
Send mode: the same as when sending
Target short address: Send the target short address, the same as when sending
Target port: The port of the target, the same as when sending
Command Number: The number that the system assigns to the command
Command direction: the sending direction of the command, 0-C2S (attack -> received), 1 S2C (received-> attack)

Send results: wireless send results, see the ***3.4 AF Status table***

Aynchronous command "receive ZCL message" : When the coordinator receives a ZCL message, it switches to the following unified header format

Name	cmd data								
	Command data								
	EP_Idx	shortAddr	Endpoint	SeqNum	Direction	ClusterID	ManuCode	Rssi	Ext data
	Receive port Each other mode	Source short address	Source port	Command number	Command direction	cluster ID	Manufacturer code	signal intensity	Extended data
Byte number	1	2	1	1	1	2	2	1	elongate

Receiving port: index of local receiving port, low 4 bits is valid.
Other party mode: bit - 4, received broadcast or group broadcast, bit-5 signal strength is valid
Source short address: the short address of the other party's device
Source port: the port of the other party device
Frame number: the frame number of the message received, if the frame number received is the same as the message sent, and the source address and source port and send
Command direction: refer to ZCL architecture, 0-C2S (attack->receive), 1 S2C (receive->attack)
Cluster ID: The cluster ID that receives the message
Vendor code: The vendor code that received the message needs the support of the source device
Signal strength: the signal intensity of the message received
Extended data: The extended data of different commands is different. The subsequent command parsing is only analyzed for the extended data part.

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4.4.2 ZCL command resolution

ZCL command parsing, parsing only the "extended data" part of the input command and received message. There is a causal relationship between certain commands, so commands with a causal relationship between sending and receiving are parsed uniformly.

In the ZCL protocol, each attribute represents a state parameter or physical quantity of the target device. Related states or physical quantities are usually grouped into the same cluster. Commands to access attributes (read, write, check, report) can carry multiple attribute parameters in the same cluster at the same time.

Multiple identical properties may exist on a single target, usually assigned to different ports. For example, the target device is a multi-hole socket. The opening and closing status and power consumption of each socket have their own independent parameters. They will use the same cluster ID and attribute ID, but the target ports are different. By setting different target ports, obtain the required corresponding The state parameter of the target.

Function	Command code	Transmit by radio	Receive
Read device properties	0x00	ZCL_READ_ATTR_REQ	ZCL_READ_ATTR_RSP
Modify device properties	0x01	ZCL_WRTIE_ATTR_REQ	ZCL_WRTIE_ATTR_RSP
Send a control command	0x0F	ZCL_CMD	not have
Receive control commands	0x0F	not have	ZCL_CMD_IND

4.4.3 Read the device properties

Command code: 0x00

Function: Read ZCL attributes, that is, state parameters, can read multiple state parameters in a specified cluster on a port.

Enter the send command format: (representing the extended data section only)

Name	ext data	
	Extended data	
	AttrNum	AttrID List
	Number of attributes	Attribute ID list
Byte number	1	2*N

Number of attributes: The number of attributes to be read at one time. The actual read attribute can only be less than or equal to this value.

List of attributes: A list of uint16 arrays composed of the attribute ID

Received return command format: (indicates extended data section only)

Name	ext data

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	Extended data				
	AttrNum	Attr List * N			
	Number of attributes	attribute list			
		attribute ID	ZCL state	data type	Data value
Byte number	1	2	1	1	elongate

Number of attributes: The number of attributes read. If the device does not support some attribute IDs contained in the read command, the returned command also does not contain these attributes.

Attribute ID: 16-bit attribute ID read

ZCL status: see **3.6 ZCL error status code**, Only after the "operation is successful", there is the following data.

Data Type: Data type, see the **3.5 ZCL Data Type Table**

Data value: The state value corresponding to this property. The size is determined by the "bytes" item in the data type.

Example instructions: (purple: load length red: command type + command code blue: check code)

Read all of the properties under the Cluster ID 0xFC08:

Send command: 55 19 02 00 00 port index + send mode 7B 20 target short address 01 target port A2 command number 00 command direction 08 FC ClusterID 00 20 vendor code 00 answer mode 05 read Attribute number 00 00 01 00 02 00 03 00 04 00 attribute ID list 2F

Feedback command: 55 05 02 00 00 Status A2 command number A0

Send confirmation command: 55 0A 8F 02 00 port index + send mode 7B 20 target short address 01 target port A2 command number 00 command direction 00 state 75

Aynchronous command feedback: 55 2C 82 00 00 port index + send mode 7B 20 target short address 01 target port A2 command number 01 Command direction 08 FC ClusterID 00 20 vendor code FF RSSI 05 attribute number 00 00 attribute ID 00 state 23 data type 00 C2 01 00 baud rate 01 00 attribute ID 00 state 21 Data type FF FF target short address 02 00 attribute ID 00 state 20 data type FF Target port 03 00 attribute ID 00 Status 10 Datatype 00 Mode 04 00 attribute ID 00 Status 30 Datatype 00 Low power Level 6F

Read all of the properties under the Cluster ID 0x0000:

Send command: 55 1F 02 00 00 port index + send mode 00 00 target short address 01 target port A1 command number 00 command direction 00 00 ClusterID 00 00 vendor code 00 answer mode 08 attribute number 00 00 0100 0200 0300 0400 0500 0600 0700 Property list AA

Feedback command: 55 05 02 00 00 Status A1 command number A3

Send confirmation command: 55 0A 8F 02 00 port index + send mode 00 00 target short address 01 target port A1 command number 00 command direction 00 state 2D

Aynchronous command feedback: 55 5F 82 00 00 port index + send mode 00 00 target short address 01 target port A 1 command number 01 command direction 00 00 ClusterID 00 00 vendor codeFF RSSI 08 attribute format 00 00 attribute ID 00 state 20 data type 01 ZigBee version 01 00 property ID 00 state 20 Data type 10 Software version 02 00 property ID 00 state 20 Data type 16 protocol version 03 00 attribute ID 00 state 20 Data type 01 Hardware version 04 00 attribute ID 00 state 42 Data type 10 77 77 77 2E 45 62 79 74 65 2E 63 6F 6D 20 20 20 vendor name 05 00 attribute ID 00 state 42 Data

type 10 46 57 43 4F 44 45 3D 37 34 30 36 2D 30 2D 31 30 Product Model 06 00 Attribute ID 00 Status 42 Datatypes 08 32 30 32 32 30 35 31 33 Compilation Date 07 00 Attribute ID 00 Status 30 Data Type 01 Power Supply Mode C0

Vendor Name: 10 (data length) 77 77 77 2E 45 62 79 74 65 2E 63 6F 6D 20 20 20 converted to ASIIC www.Ebyte.com

Product model: 10 (data length) 46 57 43 4F 44 45 3D 37 34 30 36 2D 30 2D 31 30 converted to ASIIC FWCODE=7406-0-10

Compilation date: 08 (data length) 32 30 32 32 30 34 32 34 converted to ASIIC 20220513

Remarks:

1. If the target short address is read in FD FF broadcast mode, all devices in the network except the coordinator will give feedback. It is not recommended to use broadcast mode to query and modify device information;

2. When remotely reading multiple attributes at one time, the port index + sending mode in the sending command needs to be sent using "0x40", otherwise the sending of the read command will fail;

3. The attributes under Cluster ID 0x0000 do not support the terminal device to read its own attributes, but the terminal device can read other devices;

4. Port index + sending mode: If you use ZCL command for data communication transmission, users need to use port index + sending mode: 0x40 mode to send.

4.4.4 Modify the device properties

Command code: 0x01

Function: To modify the specified attribute, multiple attributes can be modified at one time, but the attribute must exist and be writable in the target device, and the data type must be the same as that in the target device. If the modification is invalid, which attributes will be invalidated in the returned command.

Enter the send command format: (representing the extended data section only)

Name	ext data			
	Extended data			
	AttrNum	Attr List * N		
	Number of attributes	attribute list		
		attribute ID	data type	Data value
Byte number	1	2	1	elongate

Number of attributes: Number of attributes to be modified

Property ID: Property ID to be modified

Data Type: Data type, see the **3.5 ZCL Data Type Table**

Data value: The status value is determined by the "number of bytes" in the data type.

Received return command format: (indicates extended data section only)

Name	ext data		
	Extended data		
	AttrNum	Attr List * N	
	Number of attributes	attribute list	
		attribute ID	ZCL state
Byte number	1	2	1

Number of attributes:Modify the number of invalid properties. Returns only attributes with invalid modification, if the value is 0, all is OK.

Attribute ID: Modified attribute ID

ZCL status: error cause, see **3.6 ZCL error status code**

Example instructions: (purple: load length red: command type + command code blue: check code)

Modify Device Status: Modify the target device Baud rate in the Cluster ID 0xFC08

Send command: 55 13 02 01 00 port index + Send mode 78 B8 target short address 01 target port A2 command number 00 command direction 08 FC ClusterID 00 20 vendor code 00 state 01 property 000 number 00 00 attribute ID 23 data type 80 25 00 00 Baud Rate B4

Feedback command: 55 05 02 01 00 state A2 Frame serial number A1

Send confirmation command: 55 0A 8F 02 00 port index + send mode 78 B8 target short address 01 target port A2 command number 00 command direction 00 state EE

Aasynchronous ZCL command feedback: 55 12 82 01 00 port index + send mode 78 B8 target short address 01 target port A2 command number 01 command direction 08 FC ClusterID 00 20 vendor Code FF RSSI 01 attribute number 00 00 attribute ID 88 read only 43

Note: Changing the device baud rate needs to be modified using the send control command.

Modify Device Status: Modify the target short address in the Cluster ID 0xFC08

Send command: 55 13 02 01 00 port index + Send mode 78 B8 target short address 01 target port A2 command number 00 command direction 08 FC ClusterID 00 20 vendor code 00 state 01 property 000 number 00 00 attribute ID 23 data type FD FF target short address 97

Feedback command: 55 05 02 01 00 state A2 command number A1

Send confirmation command: 55 0A 8F 02 00 port index + send mode 78 B8 target short address 01 target port A2 command number 00 command direction 00 state EE

Aynchronous ZCL command feedback: 55 0F 82 01 00 port index + send mode 78 B8 target short address 01 target port A2 command number 01 command direction 08 FC ClusterID 00 20 vendor Code FF RSSI 00 state CA

Modify device status: Modify the target port in Cluster ID 0xFC08

Send command: 55 13 02 01 00 port index + Send mode 78 B8 target short address 01 target port A2 command number 00 command direction 08 FC ClusterID 00 20 vendor code 00 state 01 property number 00 00 attribute ID 23 data type 11 port number 86

Feedback command: 55 05 02 01 00 state A2 command number A1

Send confirmation command: 55 0A 8F 02 00 port index + send mode 78 B8 target short address 01 target port A2 command number 00 command direction 00 state EE

Aynchronous ZCL command feedback: 55 0F 82 01 00 port index + send mode 78 B8 target short address 01 target port A2 command number 01 command direction 08 FC ClusterID 00 20 vendor Code FF RSSI 00 state CA

Modify device status: Modify the Transparent mode in Cluster ID 0xFC08
Send command: 55 13 02 01 00 port index + Send mode 78 B8 target short address 01 target port A2 frame number 00 command direction 08 FC ClusterID 00 20 vendor code 00 state 01 property number 03 00 attribute ID 10 Data type 01 transmission mode A7
Feedback command: 55 05 02 01 00 state A2 command number A1
Send confirmation command: 55 0A 8F 02 00 port index + send mode 78 B8 target short address 01 target port A2 command number 00 command direction 00 state EE
Aynchronous ZCL command feedback: 55 0F 82 01 00 port index + send mode 78 B8 target short address 01 target port A2 command number 01 command direction 08 FC ClusterID 00 20 vendor Code FF RSSI 00 state CA

Modify device status: Modify low power levels in Cluster ID 0xFC08
Send command: 55 13 02 01 00 port index + Send mode 2B DC target short address 01 target port A2 command number 00 command direction 08 FC ClusterID 00 20 vendor code 00 state 01 property number 04 00 property ID 30 data type 01 power level B7
Feedback command: 55 05 02 01 00 state A2 command number A1
Send confirmation command: 55 0A 8F 02 00 port index + send mode 2B DC target short address 01 target port A2 command number 00 command direction 00 state D9
Aynchronous ZCL Command Feedback: 55 12 82 01 00 port index + send mode 2B DC target short address 01 target port A2 command number 08 FC ClusterID 00 20 vendor Code FF RSSI 01 Property Number 04 00 Property ID 88 Read-Only 70
Note: The low power level of the equipment needs to be modified using the sending control command.

4.4.5 Send a control command

Command code: 0x0F
Function: When sending device control commands, each command can carry variable-length command parameters. Command parameters are relatively complex relative attribute states, which can be multiple variables, arrays, or data streams. Send the wrong control command to the wrong device, or set the "reply mode" in the input command to 0, will receive the default return frame. The user can detect whether it corresponds to the sent control command by defaulting the cmd ID and frame serial number in the returned frame.
Send a control command format:

Name	ext data	
	Extended data	
	Cmd ID	Cmd param
	order ID	command parameter
Byte	1	elongate

number		

Command ID: The command ID of the control command

Command parameter: Parameters carried by the control command. The content of the command parameters is determined by the cluster, cmd ID, and manufacturing Code.

Receiving the control command format:

Name	ext data	
	Extended data	
	Cmd ID	Cmd param
	order ID	command parameter
Byte number	1	elongate

Command ID: Command ID of the control command received

Command parameter: Parameters carried by the received control command. The content of the command parameters is determined by the cluster, cmd ID, and manufacturing Code.

Example instructions: (purple: load length red: command type + command code blue: check code)

Send a control command to modify the port rate:

Send command: 55 10 02 0F 00 port index + send mode CB A6 target short address 01 target port AB frame serial number 00 command direction 08 FC ClusterID 00 20 vendor code 00 answer 02 cmdID 80 25 00 00 baud rate B9

Feedback command: 55 05 02 0F 00 Status AB command number A6

Send confirmation command: 55 0A 8F 02 00 port index + send mode CB A6 target short address 01 target port AB command number 00 command direction 00 state 4A

Aasynchronous ZCL command feedback: 55 14 82 0F 20 port index + Send mode CB A6 target short address 01 target port AB command number 01 command direction 08 FC Cluster ID 00 20 vendor code FC RSSI 02 cmdID 00 success 80 25 00 00 baud rate E4

Send control instructions to modify low power levels:

Send command: 55 10 02 0F 00 port index + send mode 2B DC target short address 01 target port AA command number 00 command direction 08 FC ClusterID 00 20 vendor code 00 answer 03 cmdID 03 power level 85

Feedback command: 55 05 02 0F 00 Status AB command number A7

Send a confirmation command: 55 0A 8F 02 00 port index + send mode 2B DC target short address 01 target port AA command number 00 command direction 00 state D1

Aasynchronous ZCL command feedback: 55 10 8F 02 00 port index + send mode 2B DC target short address 01 target port AA command number 00 command direction 08 FC Cluster ID 00 20 vendor code FC RSSI 03 cmdID 00 status DB

Note: It is not recommended to modify the baud rate remotely (it may cause problems if the modification is not successful). After setting the low power consumption level 3 remotely (the remote can no longer operate it).

Send the control instructions to mark the devices:

Send command: 55 11 02 0F 00 port index + send mode FD FF target short address (full mark on the network device) FF target port A1 command number 00 command direction 03 00 ClusterID 00 00 vendor code 00 answer 00 cmdID 00 00 Duration 53

Feedback command: 55 05 02 0F 00 status A1 command number AC

Send confirmation command: 55 0A 8F 02 00 port index + Send mode FD FF target short address FF A1 command number 00 command direction 00 state D1

Note: The IDENTIFY cluster is used to mark the device. When the device is in the marked state, the module indicator light will flash (P1.2 pin), and it can also be discovered by other ZigBee devices and establish a constant connection with it.

4.4.6 ZCL Properties and Control

List the attributes and control commands under each cluster by cluster (ClusterID) classification

4.4.6.1 Cluster=0x0000

Function: This cluster defines the factory information of the device, and almost all devices must support the cluster (BASIC cluster)

Attribute list:

Cluster = 0000， Server				
AttrID	Descriptor	Name	Data type	Operate
0x0000	ZCL Version	ZigBee edition	uint8	read only
0x0001	Application Version	Software release	uint8	read only
0x0002	Stack Version	Protocol version	uint8	read only
0x0003	Hardware Version	Hardware version	uint8	read only
0x0004	Manufacturer Name	Trade name	string	read only
0x0005	Modle Identifier	product model	string	read only
0x0006	Date Code	Compilation date	string	read only
0x0007	Power Source	Power supply mode	enum8	read only

4.4.6.1 Cluster=0x0003

Function: It is used to mark the device. In the marked state, the device can be found by human flesh, and can also be found by other ZigBee devices and establish a constant connection with it (IDENTIFY cluster).

Attribute list:

Cluster = 0003， Server				
AttrID	Descriptor	Name	Data type	Operate
0x0000	Identify Time	Tagged time	Uint16	read-write

Send a control command:

Cluster = 0003， Client->Server			
cmdI	descriptor	name	parameter

D			
0x00	Identify	marking equipment	uint16 IdentifyTime: Marking the pattern duration

Receiving the control command:

Cluster = 0003，Sever->Client			
cmdID	descriptor	name	parameter
0x00	IdentifyQueryresponse	Returns and query the marked device	uint16 timeout: Mark time remaining

4.4.6.1 Cluster=0xFC08

Function: Ebyte data transparent transmission dedicated

Attribute list:

Cluster = 0xFC08，manuCode=0x2000, Server				
AttrID	descriptor	name	data type	operate
0x0000	Baud	Baud rate	uint32	read only
0x0001	targetAddr	Default target short address	uint16	read-write
0x0002	targetEP	Default destination port	uint8	read-write
0x0003	sendMode	Through transmission mode	bool	read-write
0x0004	LP Level	Low power consumption mode	enum8	read only

The Baud rate support 9600, 19200, 38400, 57600, 115200.

Transmission mode: 0-command mode, 1-Transparent mode

Low power mode: 0-1 second wake up (heartbeat for 2 minutes), 1-3.33 second wake up (heartbeat for 4 minutes), 2-5 second wake up (heartbeat for 6 minutes),

3-Always stay dormant (with an 8-minute heartbeat pack)

Send a control command:

Cluster = 0xFC08，manuCode=0x2000, Client->Server			
cmdID	descriptor	name	parameter
0x00	UartSend	Transmission send	uint8 data []: transmission data
0x01	SetDstAddr	Set the default target	uint16 dstAddr: Target short address uint8 endpoint: Target port
0x02	SetBaud	Set the Porter rate	uint32 baud: Set the newbaud rate, and the

			restart takes effect
0x03	SetLP_Level	Set up the low-power consumption mode	uint8 LP_level: Low-power level
0x04	Reset	Module restart	uint8 extAddr[8]: The MAC address of the module

The baud rate needs to set the correct value, so the attribute cannot be modified directly.
Low-power mode needs to set the correct value, so the attribute cannot be modified directly.
The module cannot be broadcasted after restarting. It needs to fill in the correct MAC address. Even if it is broadcast, only one can be restarted.

Receiving the control command:

Cluster = 0xFC08， manuCode=0x2000, Sever->Client			
cmdID	descriptor	name	parameter
0x00	UartNotify	Transparent transmission	uint8 data []: transmission data
0x01	SetDstAddrRsp	Set the default target to return	uint8 status: The ZCL status
0x02	SetBaudRsp	Set the baud rate to return	uint8 status: The ZCL status
0x03	SetLP_LevelRsp	Set low power return	uint8 status: The ZCL status

5. User instructions

5.1 ZigBee network roles and considerations

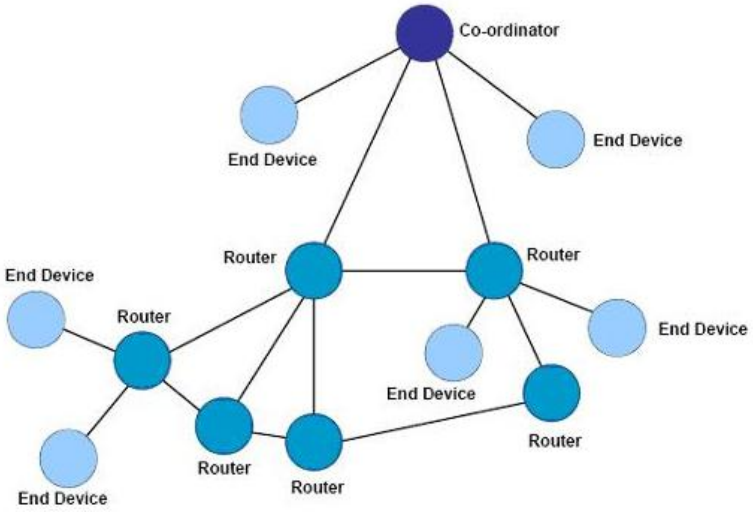
SN.	Description
1	This module uses ZigBee network networking, which consists of one coordinator and any other device (router and terminal).
2	With self-organization, self-routing, network multi-hop function. (The default supported network depth is 5, the total number of child nodes is 20, and the number of child routing nodes is 6)
3	The parent node device (coordinator and router) can save data for the dormant terminal for 7 seconds.
4	Only the dormant terminal has the dormancy function, and the dormancy level is divided into 4 levels. Please refer to section 4.1.14 for details. Users can set it by themselves, and the factory default is 0 (1 second wake-up cycle). Note: It is recommended that the hibernation time must be less than the parent node data save time, otherwise it will affect the data reception.

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5	The coordinator is unique in the network, with a fixed short address of 0000.
6	If the on-demand address is FFFF, FFFD, FFFC, there are three broadcast modes respectively.
7	Automatic assigned when the network parameter PANID is FFFF. If the device PANID is different, it cannot network.
8	All transparent transmission mode devices in the network have the broadcast function turned on. Simultaneous broadcast by multiple devices or higher frequency broadcast by a single device may cause serious network congestion. Please try to avoid this situation.
9	After sleep mode, it can be woken up through the serial port. Note: In the sleep state, the first frame data of the serial port wake-up is invalid (the wake-up frame is less than or equal to 2 bytes). The wake-up time lasts 500ms, within 500ms the device will no longer need to use the wake-up frame.
10	Communication in the ZigBee network, the single-packet data transmission cycle can not be too fast (generally recommended in more than 1 second), too fast may cause data loss.(In particular, there are too many nodes in the network, and too fast broadcast cycle may cause network instability.)
11	The maximum allowable byte of communication single package in device transmission mode: 77Byte. If exceeds 77Bytet, the data communication fails. If you use ZCL to send control commands in command mode for data transmission, more than 77Bytes need to be sent in APS encryption mode (port index + sending mode: 0x40). For specific instructions, see chapter 4.4.
12	The wake-up period of the first minute after the dormant terminal enters the network for the first time is 1 second. During this time, the coordinator must complete the basic setting and query of the network-connected device to prevent the device from being uncontrollable after entering low power consumption.
13	In the broadcast communication, if the network has a dormant terminal, and the dormant terminal wants to receive the broadcast data. It is recommended that the time interval for users to broadcast data is twice the sleep period;
14	The E18 module is used as the coordinator for a centralized collective network. It is recommended that users have no more than 10 one-time network access devices. Too many one-time collective network access devices will lead to a long network access time and the risk of network access failure. If there are more than 10 devices accessing the network at one time, it is recommended that the user use the networking manager as the coordinator.
15	The E18 module acts as the coordinator and supports 7 sub-devices to send on-demand data to the coordinator simultaneously (the measured data for each device is 30Byte). If the scenario requires more devices concurrent, use Networking Manager as the coordinator.
16	Using the quick pairing function, it is not recommended to operate more than two devices at the same time. Try to ensure that only two devices are paired, otherwise it will be connected to unpredictable pairing objects. (After the pairing is completed, you can use the host computer to check whether the target port and short address are successfully modified).

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5.2 Network Structure

The network structure of this module is a mesh network structure (MESH)
The network of MESH mesh network topology has powerful functions, and the network can communicate through "multi-level hop"; this topology can also form a very complex network; the network also has self-organization and self-healing functions;
Network structure diagram 

5.3 Getting Started with Device Communication

This tutorial uses E18 series modules as the terminal node, and the networking manager is used as the coordinator. The tutorial will introduce the usage method and command analysis of the upper computer in detail, so that the user can get started quickly.

5.3.1 Getting Started with Host Computer (On Demand)

I. Introduction to the upper computer computer

The configuration upper bits computer is mainly divided into three control and configuration panels: **local instruction, network command, device control command**.

Local instructions: network parameters, module local attributes (baud rate, low power level, target port, power, target short address), channel, group information reading and configuration;

Network instruction: node address query, set the regular connection (through the network manager to specify a pair of terminal nodes to match each other with MAC address communication);

Device control instruction: network node network status display (supported by network manager), all kinds of ClusterID attribute management control.

II. Use of the upper computer (local instruction)

1. After opening the host computer, select the serial port number, baud rate, and module model of the device in turn;

2. Execute "Enter parameter configuration" (you can also enter the command mode by sending the serial command "+++"), the status box on the right will prompt that the configuration mode is successfully entered;

3. Implement the "Read parameters" (also by sending the serial port command "55 03 00 00 00" query module current status command), the right state box will prompt the successful read parameters;

4. Execute "query" (also by sending serial command "55 06 00 10 00 00 00 10", read baud rate "55 06 00 10 00 01 00 11" read target short address, "55 06 00 10 00 02 00 12" read target port, "55 04 00 0D 00 0D" read power, "55 06 00 10 00 04 00 14" read low power wake-up cycle);

5. Configure the "Module type" according to the requirements: coordinator, router, terminal node, and dormant node;

6. After selecting the module type, execute write parameters (Users can also send serial commands "55 05 00 05 00 05" coordinator, "55 04 00 05 01 04" router, "55 05 00 05 02 07" terminal, "55 04 00 05 03 06" dormant terminal). See Figure 1-1 and Figure 1-2 below

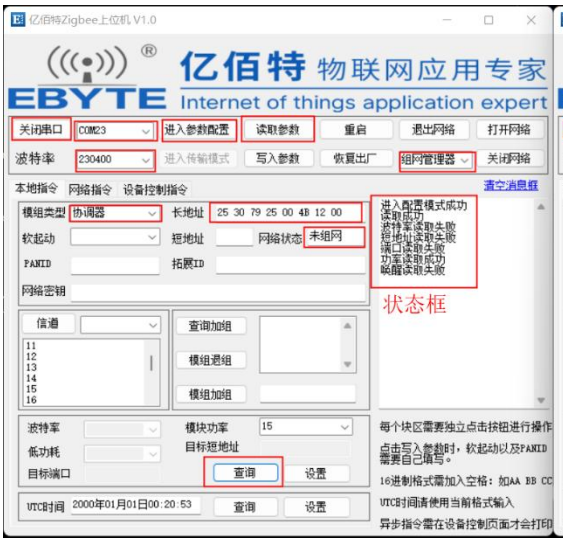


Figure 1-1 Networking Manager

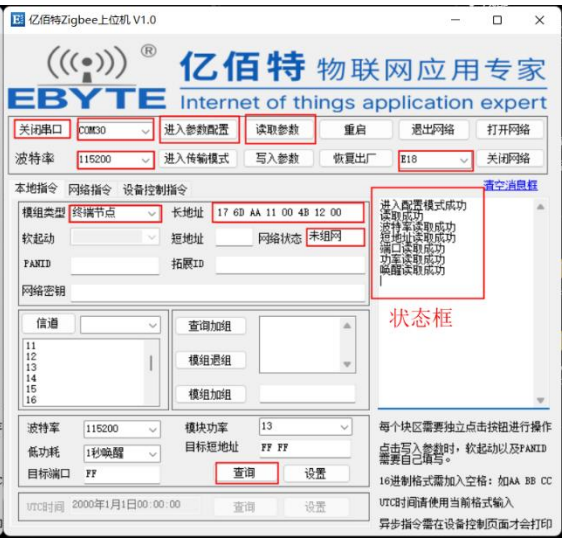


Figure 1-2 E18 series modules

III. Upper unit network operation (local instruction)

Coordinator and terminal set up network steps:

1. Select the corresponding serial port;

2. Select the baud rate (the factory default baud rate of E18 series modules is 115200), the network manager only supports 230400;

3. Select the current module model (supporting E18 and network manager), and then open the serial port;

4. The module enters the configuration mode (command mode);

5. Read the current module parameters;

6. Select the type of device to be set (currently we choose the coordinator);

7. Write parameters (write the set device type into the module), please refer to the description above for the serial port command format;

8. After the device type setting is completed, the module restarts ("55 07 00 04 00 FF FF 19 1D"

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restarts and refreshes the protocol stack);

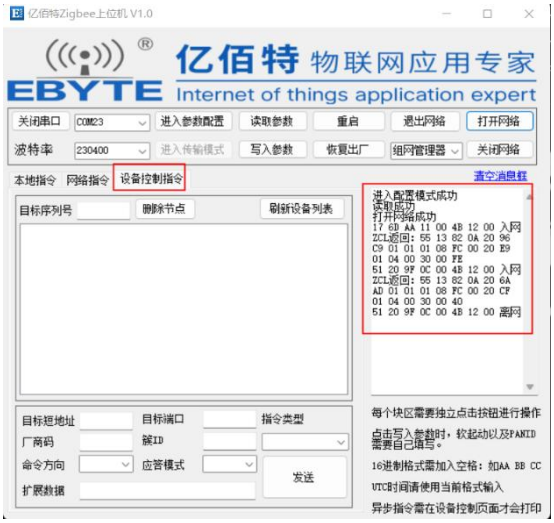
9. Open the network (the coordinator starts to set up the network, and the terminal starts to query and join the network). After the execution is completed, the upper computer will prompt that the network is successfully opened. The specific configuration method of the upper computer is shown in Figure 1-3.

10. Execute "read parameters" (users can also query the current status of the module by sending the serial command "55 03 00 00 00", which can query the current network status, PANID, short address, MAC address, extended ID, network key of the module), The operation result is shown in Figure 1-3 below. The network is successfully established. Under the same network, the PANID and network key are the same.



Graph 1-3

11、The network manager provides notification of device network access and network exit, which is convenient for users to manage the module; **Note: This function needs to be displayed under the "Device Control Command" panel.**



Remarks:

1、The configuration method of the terminal node is the same as that of the coordinator, but note that when the coordinator and the terminal are networked, the network opening time after the

coordinator successfully forms a network is 180 seconds, so the terminal node needs to pay attention to the time limit when joining the coordinator network. , if the terminal node opens the network 180 seconds after the coordinator establishes the network, please open the network on the coordinator first (you can refresh the coordinator's allowed network access time), and then open the network on the terminal device;

2、If you need to set a fixed PANID and channel networking, please set the PANID and channel before setting up the network;

Channel configuration can be configured through the host computer (before accessing the network), first select disable, enable, and override channel functions in the channel function drop-down box, then select the desired channel number in the channel list below, and then click "Channel" (or Send the command "55 05 00 06 01 15 12" through the serial port to enable the channel, please refer to the official website software user manual for details).

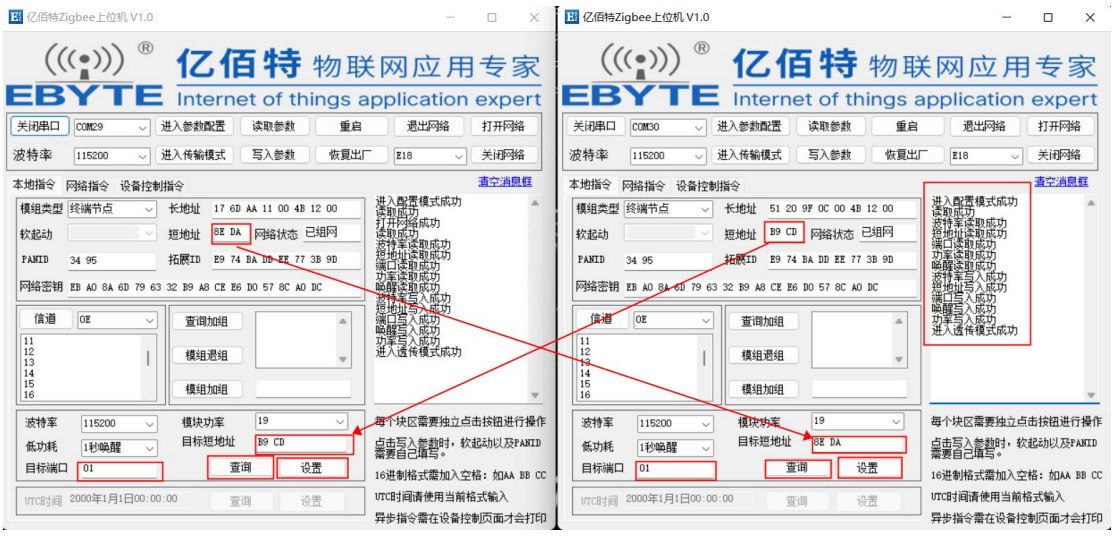
Terminal-to-terminal on-demand communication network parameter configuration:

1. After the device networking is successful, the coordinator and the terminal all click "Query" (Query the local properties of the module. For details, please refer to the description of the serial port command above.);

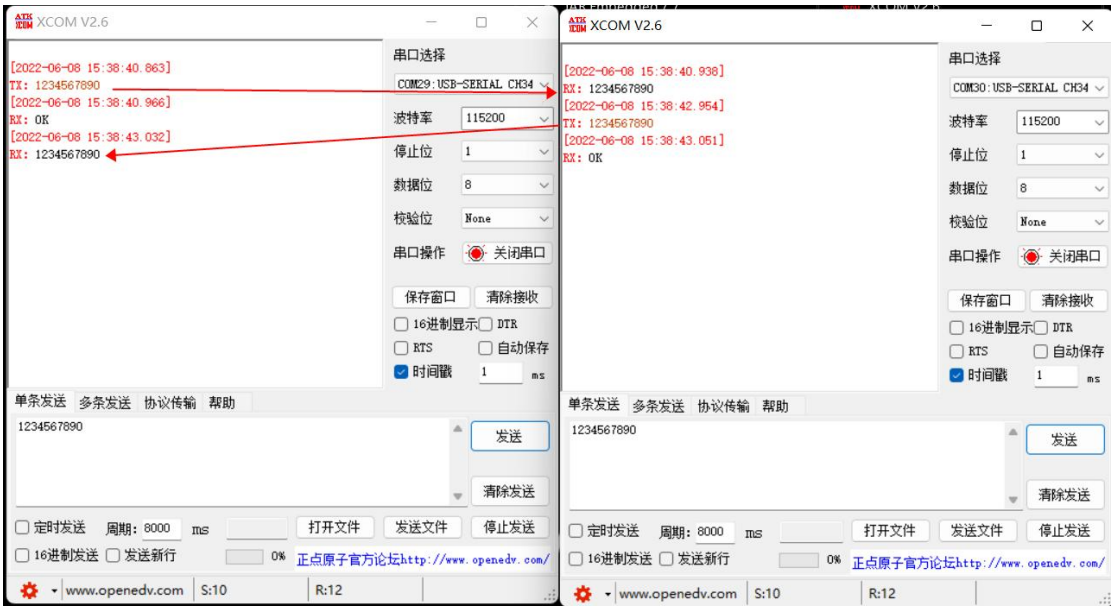
2. Device target short address: terminal 1 target short address is set to "B9 CD" (You can also use the serial port command "55 08 00 11 00 01 00 B9 CD 64"), terminal 2 target short address is set to "8E DA" (also through serial command "55 08 00 11 00 01 00 8E DA 44");

3. Set the target port: uniformly set to "01";

4. Both terminal nodes execute "enter the transmission mode" (they can also enter the transmission mode instruction through the serial port instruction "55 07 00 11 00 03 00 01 13");



Graph 1-4



Graph 1-5

Remarks:

1、When setting the target short address, a space needs to be used to separate the two bytes of the short address (only for the host computer);

2、Set the target port, both parties must ensure the same "01" port;

5.3.2 Multicast communication tutorial

Terminal and terminal multicast communication steps:

1、Fill in the group ID that needs to be added in the module add group filling box, user-defined two-byte HEX, need to be separated by spaces;

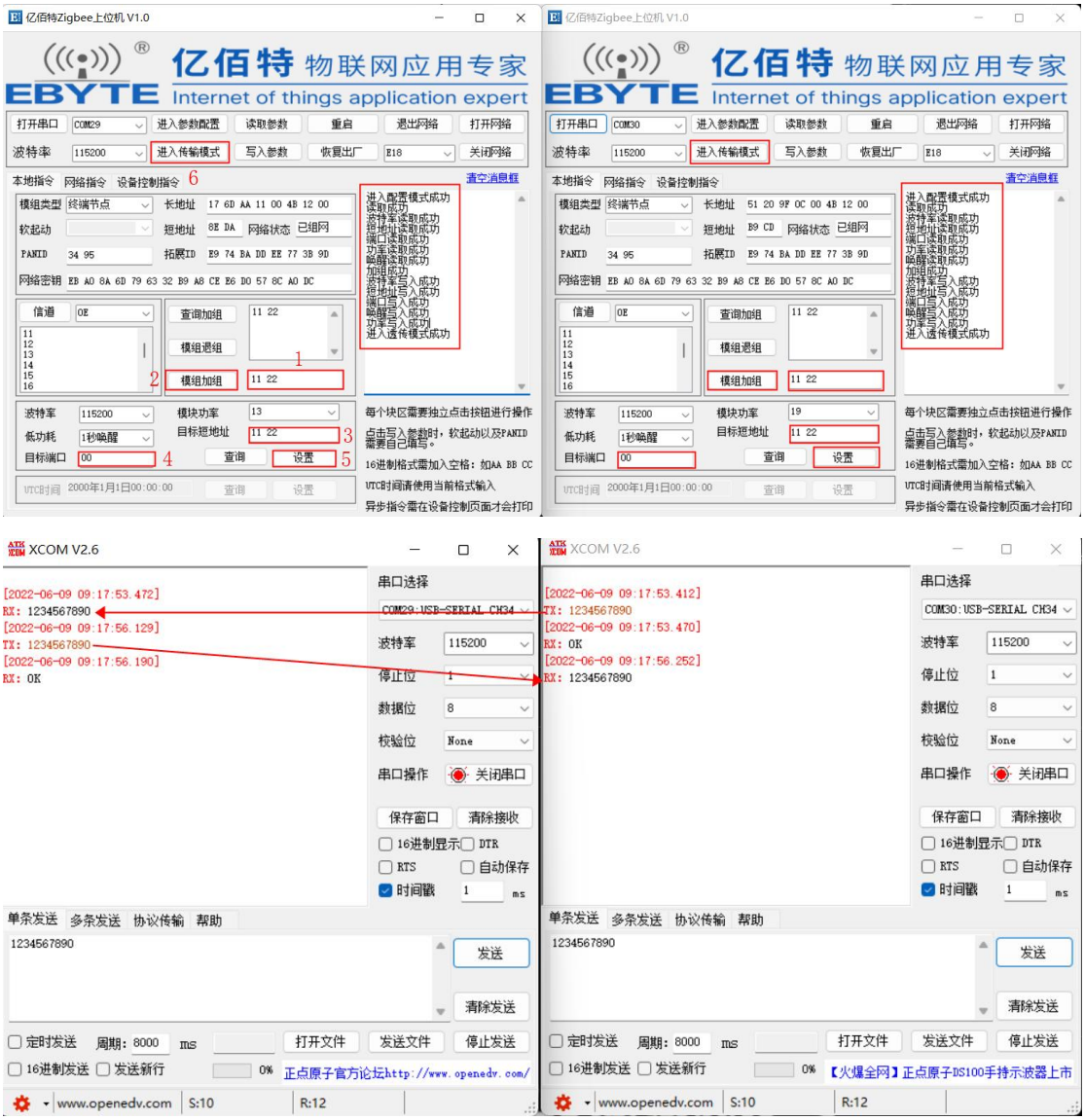
2、After filling in, execute "Add module group", the status box will indicate that the group addition is successful (you can also send the command "55 06 00 0A 00 11 22 1A" through the serial port to add the module to the group);

3、Set the target short address: write the group ID in the fill box as the target short address;

4、Set the target port: write "00" or "FF" as the target short address in the filling box (**the multicast only supports these two port numbers**);

5、After filling in, execute "Set up" (After filling in, execute "Settings" (the prompt bar on the right will prompt you to successfully write various parameters), the serial port command has been described in detail above;

6、Both sides of the module execute "enter the transmission mode", the serial port command: 55 07 00 11 00 03 00 01 13, the operation demonstration is shown in **Figure 1-6**.



Graph 1-6

Remarks:

1、The above operations of the terminal are consistent. After completing the above operations, both parties can conduct "enter transmission mode" operation, and can use serial port debugging assistant for multicast communication;

Multicast communication allows multiple modules to join the same group to form multi-module multicast communication.

5.3.3 Broadcast mode

Differential table of data received by various types of equipment in three broadcast modes:

Broadcast mode	Device type		
	Route	Terminal	Sleeping terminal
0xFFFF	Yes	Yes	Yes
0xFFFD	Yes	Yes	No
Group broadcast	Yes	Yes	No

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0xFFFC	Yes	No	No

Note: Communication steps for users to use broadcast mode

1、Set the target short address: 0xFFFF (received by all devices in the entire network), 0xFFFD (received by all devices except dormant terminals), 0xFFFC (received by all devices except dormant terminals and terminal devices);

2、Set the target port: The target port is set to "FF" by default;

3、After entering the transmission mode, data broadcasting can start (factory data transmission mode default "0xFFFF" mode broadcast);

5.3.4 Upper Computer Network Instructions

1. Network command

1. Node address query function, fill in the short address or MAC address to be queried module in the first filling box;

2. Implement the "Node Address query", in the rear display box will directly display the query short address or MAC address, serial port command: "55 0D 01 00 FD FF 51 20 9F 0C 00 4B 12 00 B8" query node short address, "55 05 01 01 B9 CD 74" query node MAC address.



Graph 1-7

Note: The node address query function does not support the terminal node to query itself for the node address information.

II. The network manager sets up the constant connection function

This function is used by the network manager to assign other nodes in the network for communication binding.

1、Target short address, source target SN, source target SN is formed by adding "01" port number before the MAC address of the target short address module;

2、Cluster ID: Fill in "08 FC" uniformly, and the target virtual SN is formed by adding "01" port number before the MAC address of the target short address module. Note that the target virtual SN here is the module MAC address that the target short address module needs to bind to.

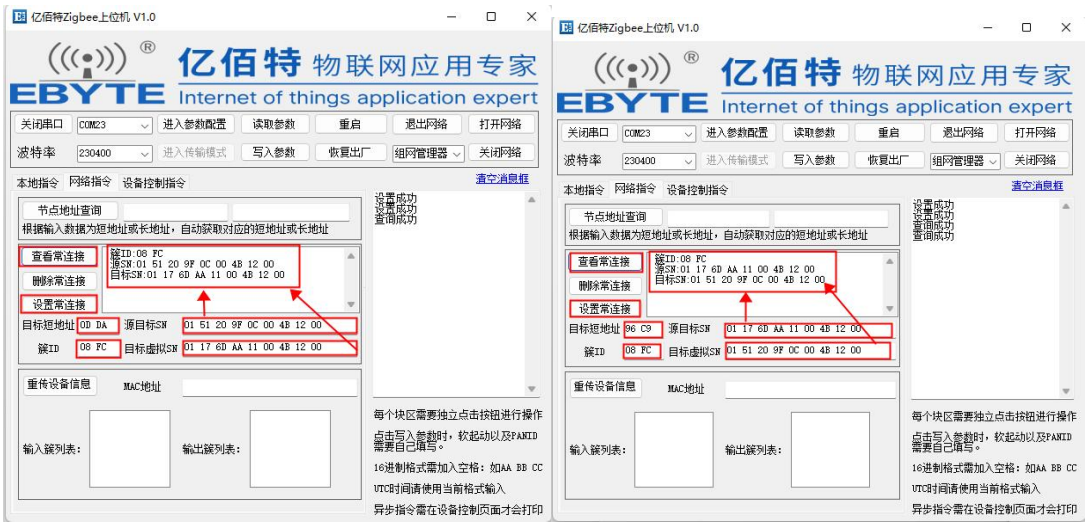
3、After completing the filling, execute the "Set up constant connection" operation. After the setting is successful, you can view the parameters of the binding module through "View constant connection". See Figure 1-8;

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4、After the assignment of the network manager is completed, the target short address and target port in the local properties of the mutual binding module need to be configured as "FE FF" and "FE". See Figure 1-9;

5、Serial port command parsing: "55 19 01 21 0D DA 01 51 20 9F 0C 00 4B 12 00 08 FC 01 17 6D AA 11 00 4B 12 00 20" and "55 19 01 21 96 C9 01 17 6D AA 11 00 4B 12 00 08 FC 01 51 20 9F 0C 00 4B 12 00 A8"can set the often connected to bind each other.

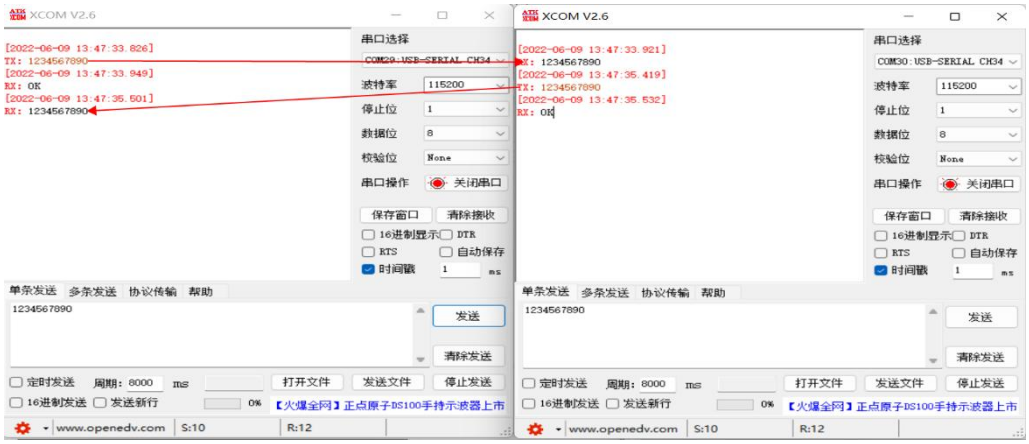
"55 06 01 33 0D DA 00 86" and "55 06 01 33 96 C9 00 86" can view the frequently connected bound devices under the target short address.



Graph 1-8



Graph 1-9



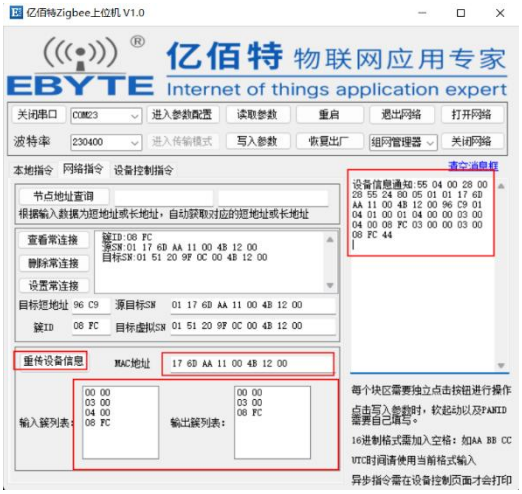
Graph 1-10

II. Device information retransmission function

The device information notification will only be available when the node accesses the network for the first time. If you miss this message, you can re-apply for the device to report it again. It is necessary to ensure that the node is working normally, and you can use this function to view the list of input and output clusters.

1. MAC address: fill in the MAC address of the module to be queried.

2. After filling in, execute "Retransmit Device Information". You can also send serial commands: "55 0B 00 28 17 6D AA 11 00 4B 12 00 B0". See **Figure 1-11**



Graph 1-11

5.3.5 Host computer equipment control command

I. Networking Manager-Network equipment list

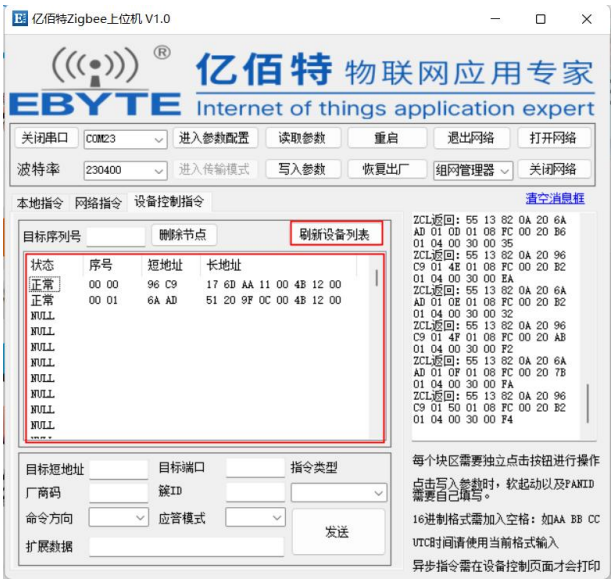
Note:

1、After the operation to refresh the list, you need to wait for the device to scan all network devices, which takes a long time.

2、The network manager can delete the node through the target serial number, and the network access information of the device and the ZCL layer network return notification information will be prompted in the status box on the right (users can view the user manual of the official website

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software).



Graph 1-12

II. Device control command usage

Data Transfer-Cluster ID: 0xFC08

1、The networking manager on-demand data to terminal nodes through device control instructions. See Figure 1-13.

2、Target short address "6A AD" on-demand object, broadcast target short address "FD FF", "FF FF" (for specific broadcast type, please refer to the above - broadcast mode).

Serial port command parsing: "55 10 02 0F 00 6A AD 01 AB 00 08 FC 00 20 00 01 01 02 03 04 05 06 07 B5" The network manager performs data transmission through this "send control command" (for specific analysis, please refer to the instruction description in the software user manual).

4. Different sending control commands can be selected according to "CMD ID": 00-data transparent transmission, 01-set target short address and port, 02-set baud rate, 03-set low power consumption level, 04-module restart.



Graph 1-13

Identify Device tag-Cluster ID: 0x0003

Through the device control command, the device tag query can be realized, which is convenient for the user to physically locate the module, and the P1.2 pin indicator will flash within the time set by the user.

1、Target short address "6A AD" on-demand object, broadcast target short address "FD FF", "FF FF" (for the specific broadcast type, please refer to the above - broadcast mode);

2、Except 0xFC08, the manufacturer code is 0x2000. The rest default to be 0x0000;

3、Extended data is composed of CMD ID + user parameters. For details, please refer to Figure 1-14 and the manual instructions for details;

4、Serial port command parsing: "55 11 02 0F 00 port index + send mode FD FF target short address (full tag in network equipment) FF target port A1 command number 00 command direction 03 00 ClusterID 00 00 vendor code 00 answer 00 cmdID 00 00 duration 53" target short address is selected according to user customization;



Graph 1-14

Note: In the continuous marking time "05 00", "05" is the lower 16 bits, and "00" is the upper 16 bits. This parameter is that the P1.2 pin indicator flashes for 5 seconds.

6. Custom cooperation

★ If corporate customers need to customize products, please contact our company.
★ Ebyte has reached in-depth cooperation with a number of well-known companies.

7. About us



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◆ Wireless transparent transmission, WiFi, Bluetooth, Zigbee, PKE, digital radio... and many other series of wireless products;
◆ With nearly 100 employees, tens of thousands of customers, and has sold millions of products;
◆ Business covers more than 30 countries and regions around the world;
◆ Passed ISO 9001 quality management system, ISO 14001 environmental system certification;
◆ With a number of patents and software copyrights, and has passed international FCC/CE/ROHS and other authoritative certifications.

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