ZHC-GW8000 Application Guide

LoRa Concentrator

Version: ZHC-GW8000_Application Guide_V1.0

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Contents

1. Overview of Concentrator

1.1.Product Introduction

ZHC-GW8000 It is a concentrator based on the LoRa private protocol, which realizes the communication between the concentrator and the LoRa node ad hoc network, the concentrator and the server through the ZHC private protocol.

main feature:

● Intelligent self-organizing network, no need to configure nodes, reducing the difficulty of on-site construction

● Time division multiplexing to improve the communication efficiency between the concentrator and the node

● The concentrator supports active collection and active reporting, reducing server-side development

● Distinguish the receiving and sending channels according to the data priority to avoid interference

● Support TCP client

● Support MQTT

● Provide JSON communication protocol

● Provide concentrator data monitoring and parameter configuration software

● Support node management and query node data

1.2.Basic parameters

project		description
3 LoRa channels 1 management channel 2 data channels	Protocol	ZHC private agreement
	Frequency band	471.2MHz~501.8MHz, a total of 32 channels
	aisle	Channel 1 is the management channel, channels 2 and 3 are the data channels
	Transmit power	Maximum transmit power 20dBm
	antenna	Suction cup antenna (470MHz ~ 540MHz)
4G	Support range	4G, compatible with 2G GSM
	SIM card	Standard 6-pin SIM card interface, 3V/1.8V SIM card
	antenna	Full frequency suction cup antenna
button	Reset	Restore factory button
Indicator light	Status Indicator	LoRa transceiver indicator, serial port transceiver indicator
temperature	Operating temperature	-20℃~+70℃
	storage temperature	-40℃~+125℃
humidity	Working humidity	5%~95%RH (no condensation)

	Storage humidity	1%~95%RH (no condensation)
powered by	Supply voltage	DC9~36V
	Power consumption	12V/0.3A 36/0.06A

1.3.Hardware description
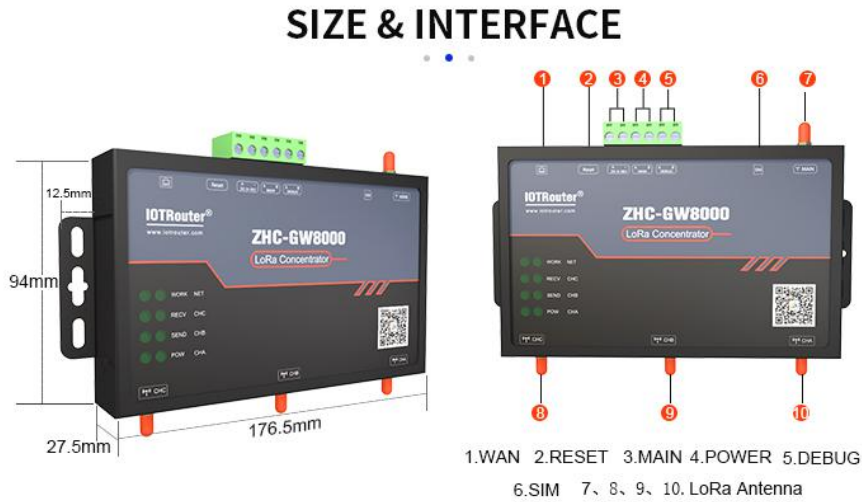
name	Remarks
Network port	Reserved
Reset button	Reset button
power supply	Power supply range DC: 9~36V, terminal size 5.08mm-2
RS485 MAIN	RS485 AB terminal size 5.08mm-24G transparent transmission, management tool interaction
RS485 DEBUG	RS485 AB terminal size 5.08mm-2Output LoRa to send and receive data
SIM card	SIM card interface
4G antenna	Full frequency suction cup antenna
WORK	Equipment operating status indicator
RECV	4G data receiving indicator
SEND	4G data sending indicator
POW	Power Indicator
NET	4G network indicator
CHA/CHB/CHC	LoRaData transceiver indicator
LoRa antenna	470MHz~510MHz Suction Cup Antenna

2. Node overview

2.1.Product Introduction

2.1.1.ZHC0921

ZHC0921 is a data collection terminal based on the LoRa private protocol, which communicates with the concentrator ad hoc network, concentrator and server through the ZHC private protocol.

main feature:

● No software is required to configure the node

● Time division multiplexing to improve communication efficiency

● stand by5Device types

● Type R supports a serial port collection command, which can intercept collection responses; supports transparent transmission

● Type A supports one-way AI acquisition, and can be configured with 3 trigger reporting modes

● Type D supports one-way DI collection, and can be configured with 3 trigger reporting modes

● Type AD supports one-way AI and one-way DI collection, and 6 trigger reporting modes can be configured

● Type E supports collection to meet Multifunctional energy meter with DL/T645 protocol

● Support active detection

2.1.2.ZHC0931

ZHC0931 is a data acquisition terminal based on the LoRa private protocol, which communicates with the concentrator ad hoc network, concentrator and server through the ZHC private protocol.

main feature:

● No software is required to configure the node

● Time division multiplexing to improve communication efficiency

● Support 2 device types

● Type R supports a serial port collection command, which can intercept collection responses; supports transparent transmission

● Type O support Two road DO control, Can control DO relay output through transparent transmission command

- Types of E supports the collection of multifunctional electric energy meters that meet the DL/T645 protocol
- Support active detection

2.2.Basic parameters

project		description
1 LoRa channel	protocol	ZHC private agreement
	Frequency band	471.2MHz~501.8MHz, a total of 32 channels
	aisle	Channel 1 is the management channel, channels 2 and 3 are the data channels
	Transmit power	Maximum transmit power 20dBm
	antenna	Suction cup antenna (470MHz ~ 540MHz)
button	Upgrade	Firmware upgrade
Indicator light	Status Indicator	LoRa transceiver indicator, working status indicator
temperature	Operating temperature	-20℃~+70℃
	storage temperature	-40℃~+125℃
humidity	Working humidity	5%~95%RH (no condensation)
	Storage humidity	1%~95%RH (no condensation)
powered by	Supply voltage	DC9~36V
	Power consumption	12V/0.1A 36/0.02A

2.3.Hardware description

2.3.1.ZHC0921

name	Remarks
9~36V	Power supply range DC: 9~36V, terminal size 5.08mm-2
GND	Signal ground
A.B	RS485*1(A, B)
AI	1×4~20mA analog quantity detection
GND	Signal ground
DI	1×default dry node on-off detection
GND	Signal ground
WORK	Flash:Connecting to the network 4s off/500ms on:Normal work 3s always on:Fixed-point collection
SEND	Flashing means data is being sent
RECV	Flashing means that there is data reception
WORK	Fast flashing: network access for 4s off/500ms on: normal operation 3s on steady: fixed-point acquisition
Reset button	reset
Dial code openturn off	Decide on channel and frequency
LoRa antenna	IPEX base + suction cup antenna (470MHz ~ 540MHz)

2.3.2.ZHC0931

拨码开关　　　　　复位键　　　LoRa天线

name	Remarks
9~36V	Power supply range DC: 9~36V, terminal size 5.08mm-2
GND	Signal ground
A.B	RS485*1(A, B)
NO1	Relay output normally open
COM1	Relay common
NO2	Relay output normally open
COM2	Relay common
WORK	Flash:Connecting to the network 4s off/500ms on:Normal work 3s always on:Fixed-point collection
SEND	Flashing means data is being sent
RECV	Flashing means that there is data reception
WORK	Fast flashing: network access for 4s off/500ms on: normal operation 3s on steady: fixed-point acquisition
Reset button	reset
Dial code openturn off	Decide on channel and frequency
LoRa antenna	IPEX base + suction cup antenna (470MHz ~ 540MHz)

3. Quick start
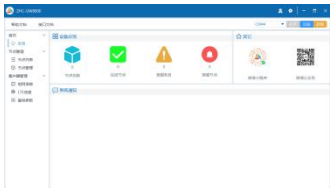
3.1.Concentrator Preparation

- ZHC-GW8000
- DC9~36Vpower supply
- ZHC-GW8000 management tool
- 2/3/4GA set of full frequency antenna
- LoRa Three sets of 470~510MHz antenna
- USB To RS485 tool

ZHC-GW8000	ZHC-GW8000 management tool	DC 12V power adapter
2/3/4G full frequency antenna	470~510MHz antenna	USB to RS485 tool

3.2.Set up the concentrator

3.2.1.Introduction to host computer parameters

3.2.1.1.Get concentrator parameters

Use the USB to RS485 tool to connect the concentrator and the PC.

Open the corresponding port:

Click "Get Device Information"
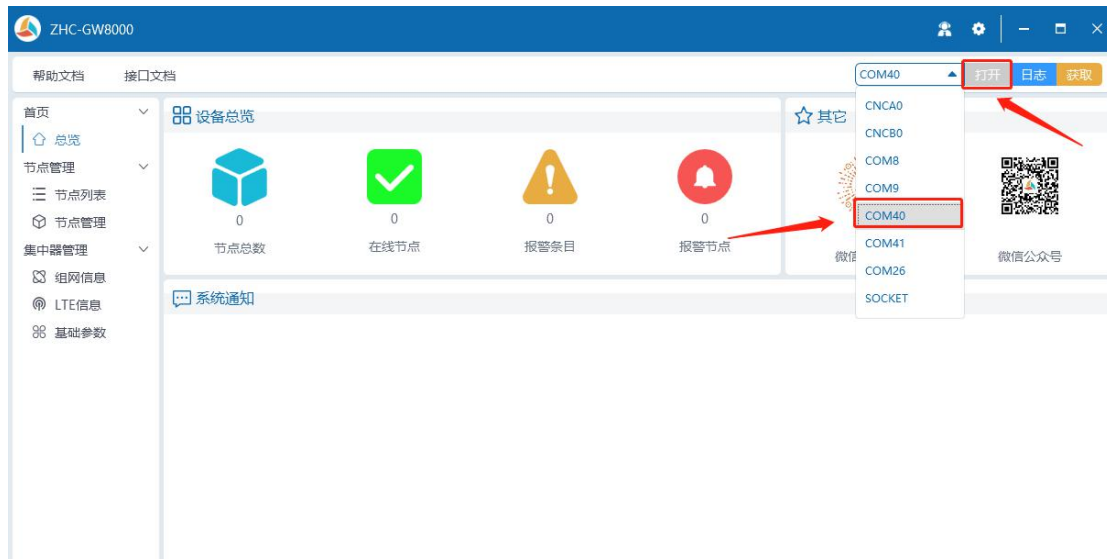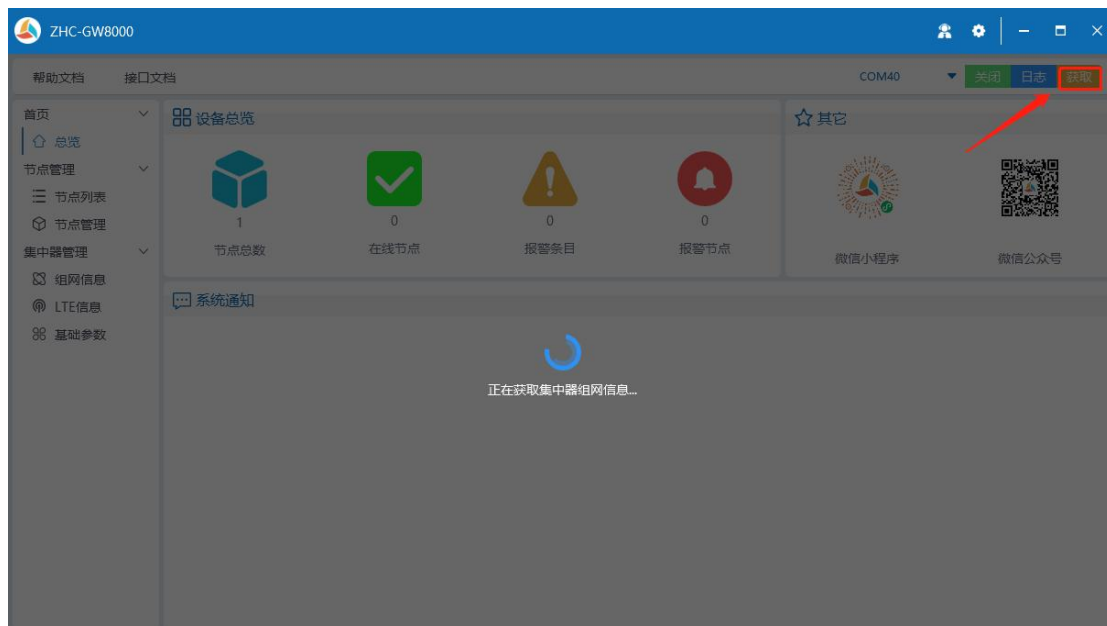

Concentrator returns include "concentrator basic parameters", "node list", "LTE information", "networking information" and other related parameters.

3.2.1.2.Node management
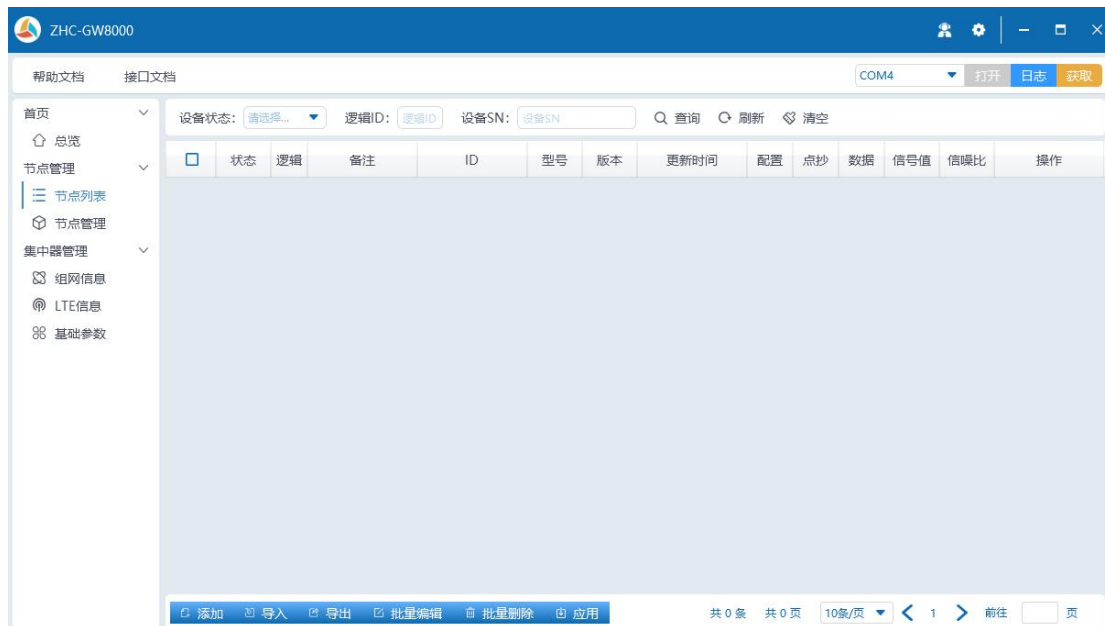
● Add

Click "Add", enter the "device number" of the specified node in the "add page" (the label on the node shell is attached with "device number"), and click save. The concentrator will return a JSON protocol frame to indicate the result of the addition, see《ZHC-GW8000_JSON_Application Guidance.

● Import

The host computer software of the concentrator supports importing a pre-saved node information file, which can be established with the "export" function. After importing the node information file, you need to click "Apply" to download all node information to the concentrator.

● Export

The host computer of the concentrator does not support restarting to save data. After the LoRa network is set up and can run normally, the current node information file can be exported to facilitate later maintenance.

● Batch deletion

Check the specified nodes and click "Batch Delete" to delete multiple nodes on the concentrator. Operate with caution!

● Application

"After importing the node information file, click "Apply" to insert multiple nodes into the concentrator.

● Inquire

The upper computer software of the concentrator can filter the current list according to "node status", "equipment SN", and "logical ID".

● Refresh

Get the latest node information from the concentrator instantly.

● Point copy

After the node is connected to the network, you can click "Copy" to get the node data instantly.

● Local data

Obtain the latest three pieces of data reported by the node from the concentrator.

3.2.1.3.LTE Information management
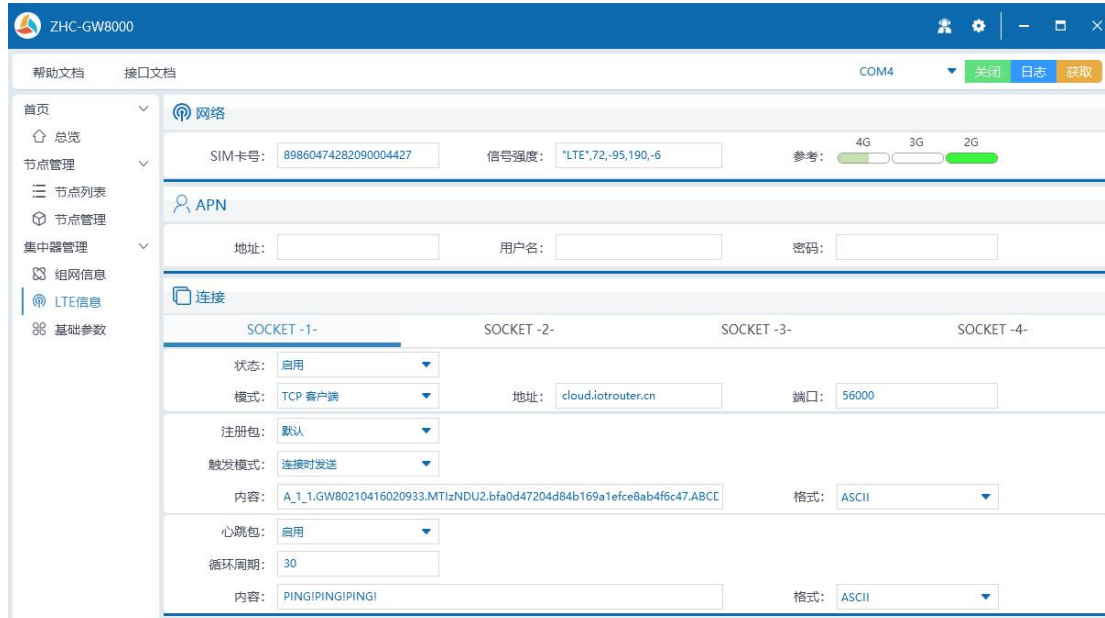
● The internet

Right-click this area to get the current SIM card ID and current signal strength from the concentrator.

● APN

Use dedicated network card, right click this area to read and write APN information.

● Connection

The concentrator supports 4 LTE SOCKET connections and connects to cloud.iotrouter.cn by default.

Among them, only the first channel can be set to MQTT client mode.

When the concentrator is connected to cloud.iotrouter.cn, the upper computer software of the concentrator can interact with the concentrator remotely through SOCKET.

3.2.1.4.Networking information
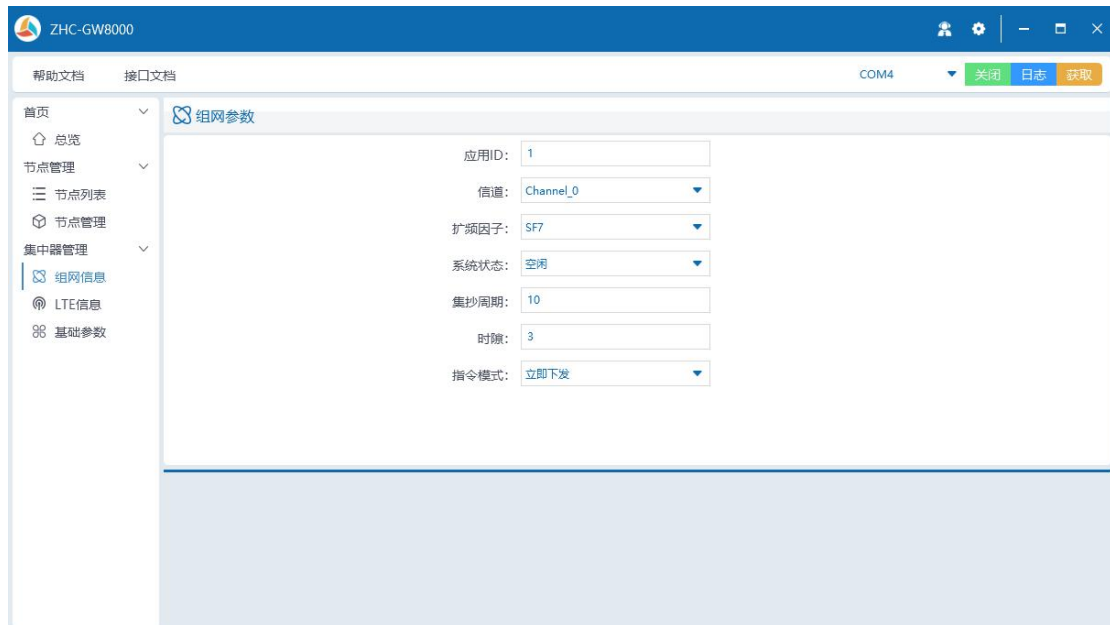
To establish a LoRa network, it is necessary to ensure that the "channel" and "spreading factor" of the concentrator and the node are consistent.

3.2.1.5.Basic parameters

● Concentrator information

Contains basic parameters of the concentrator.

● Timed action

The concentrator operates according to the set time point.

● Module communication

Enable this option to directly communicate with the 4G module.

● Location information

Reserved.

● Firmware upgrade

Provide an upgrade interface, select the corresponding firmware to upgrade the firmware of the concentrator and nodes.

3.2.2.Setup steps

1) Read concentrator parameters
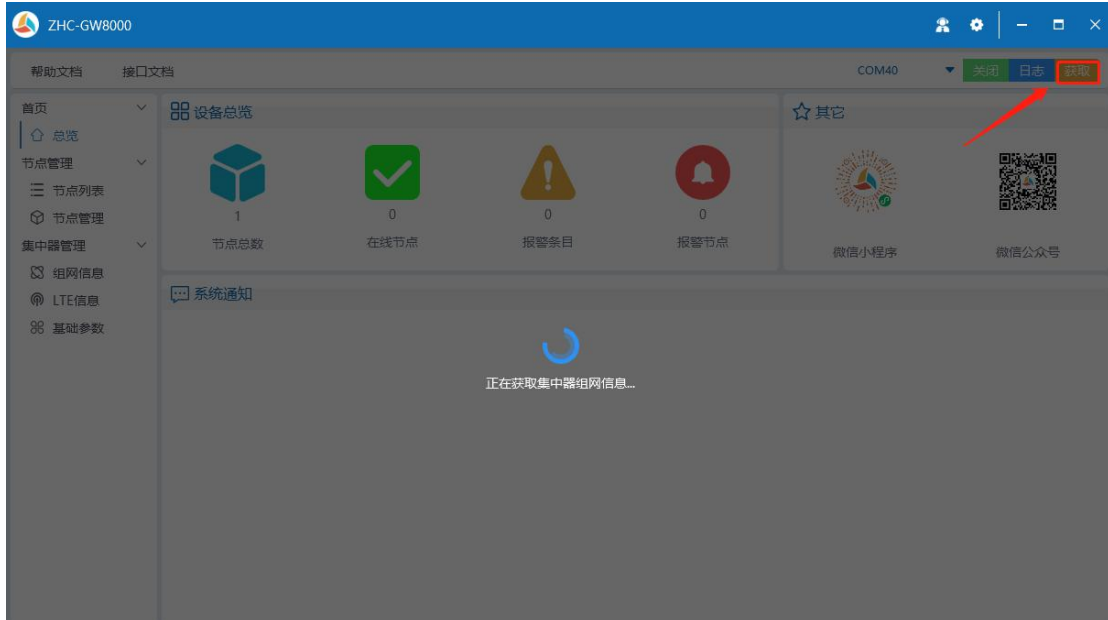
2) Set networking parameters, Please make sure that the application ID is not 0. After modifying the application ID, you need to manually reset the node
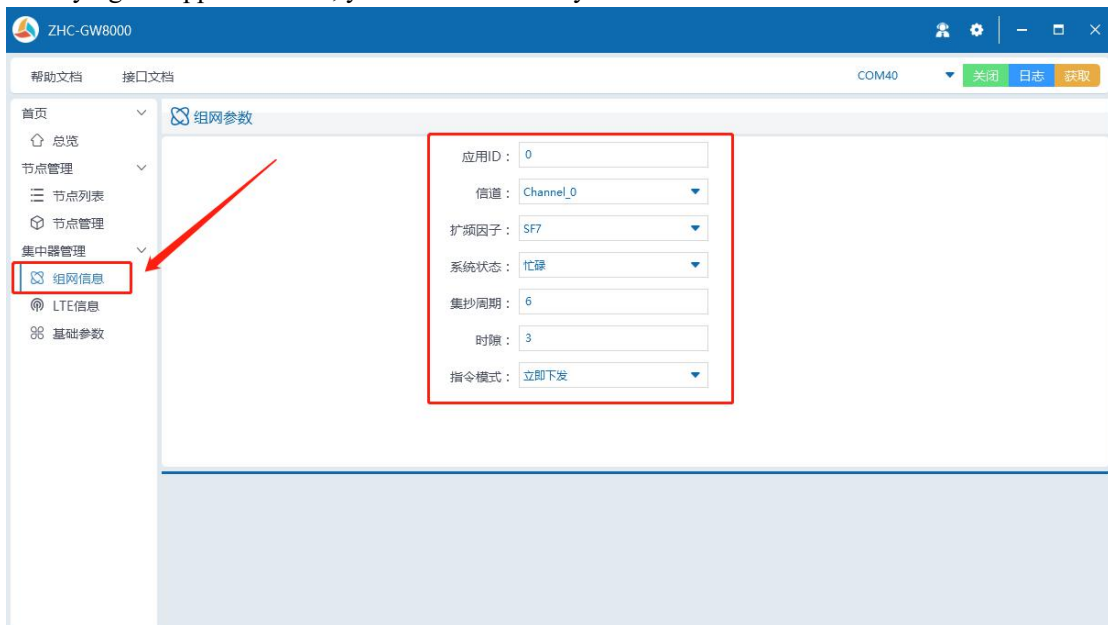
3) Add nodes one by one. The device number is the node ID, which is required. The device model is determined according to the actual application, a mandatory option
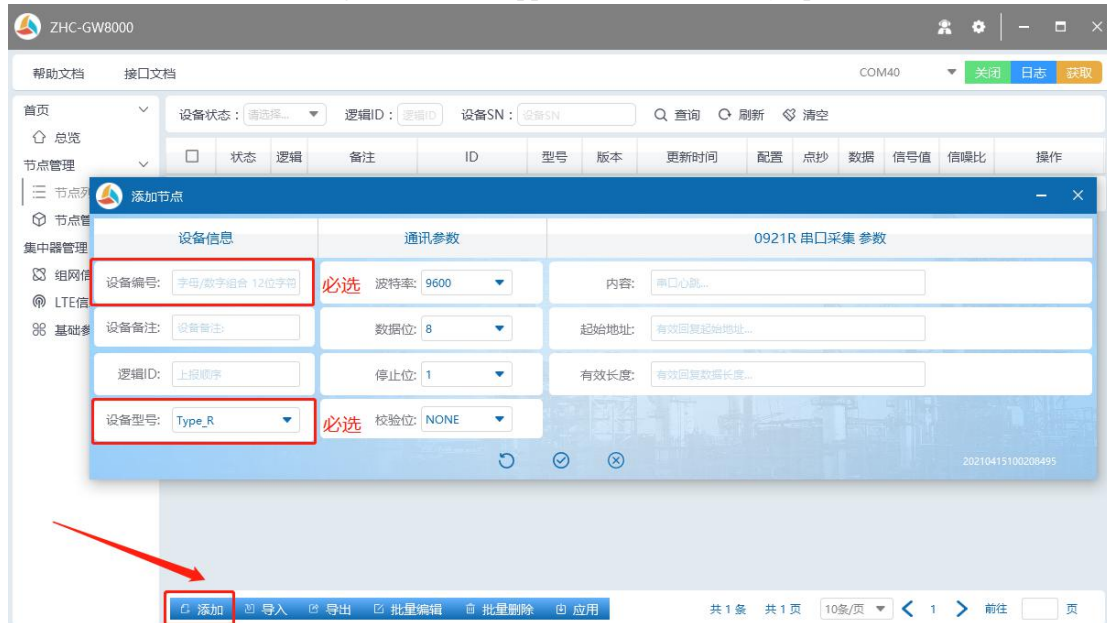
4) Set the server parameters to be connected by the concentrator (Optional)
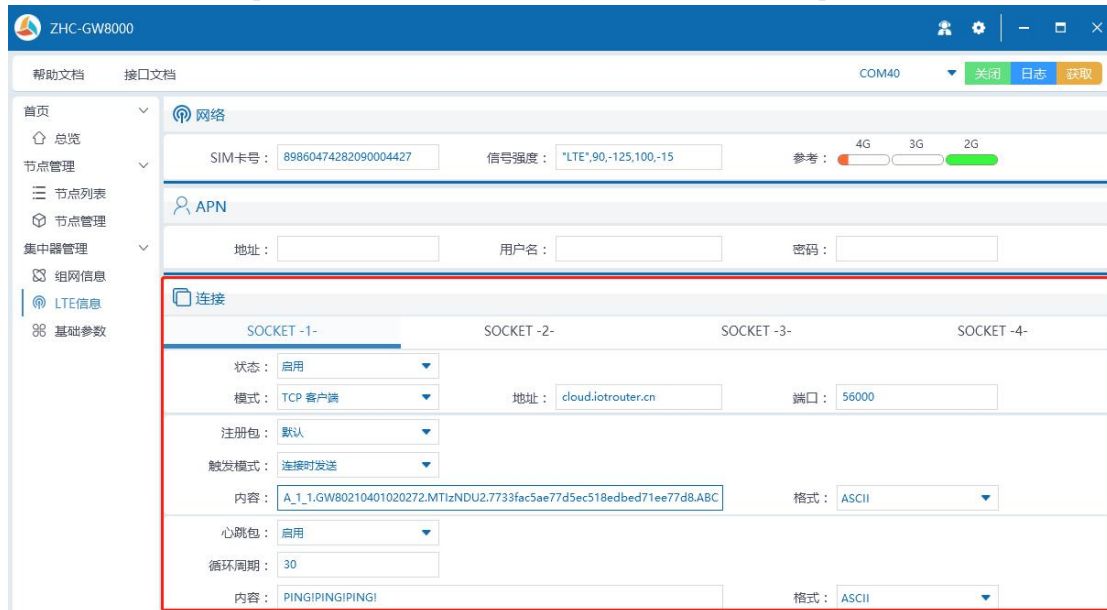
5) In "Basic Parameters", restart the concentrator
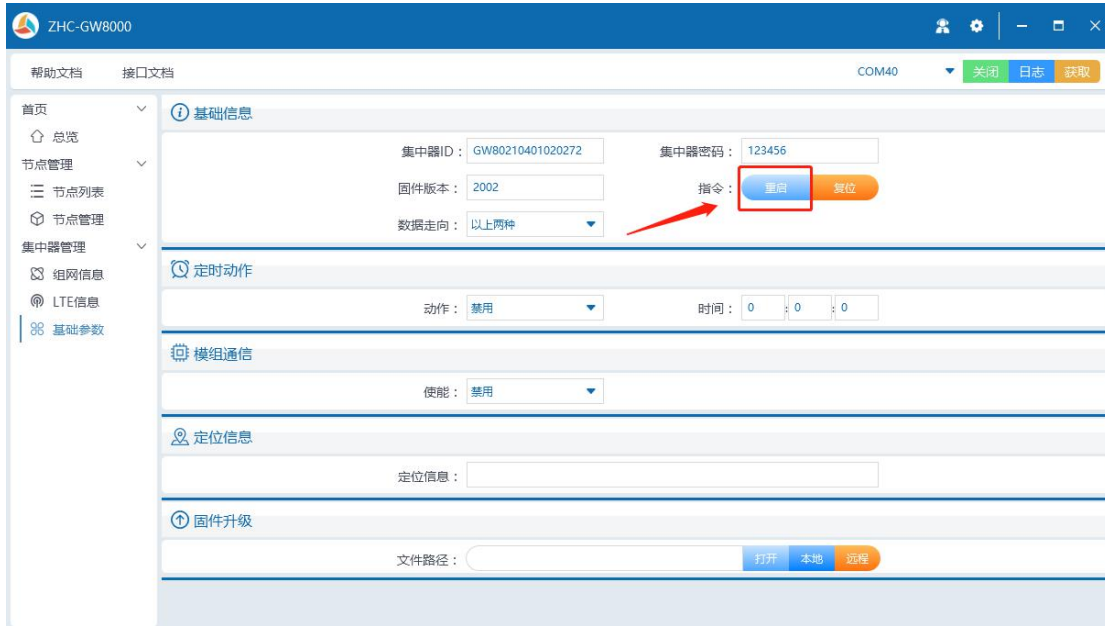
After the restart is complete, it is recommended to read the concentrator information once and confirm that the parameters are correct before proceeding.

3.3.Node preparation

● One ZHC0921
● DC9~36V power supply
● Three sets of LoRa 470~510MHz antenna

ZHC0921	470~510MHz antenna	DC 12V power adapter
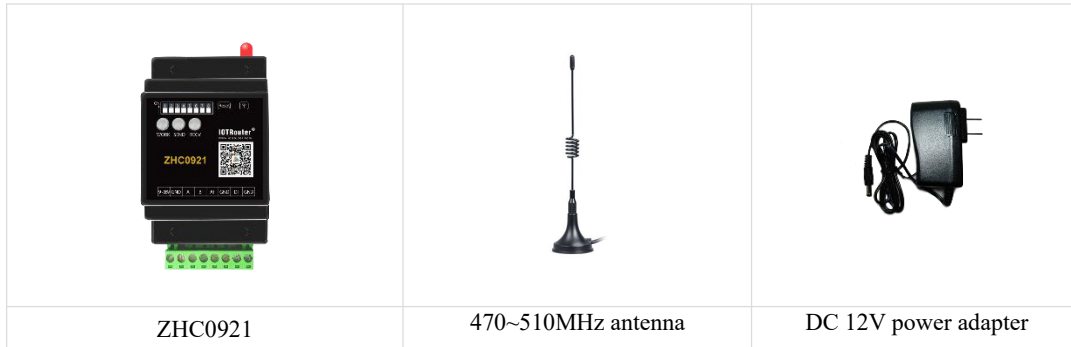
3.4.Set node

Make sure that the channel and spreading factor of the node and the concentrator are the same, otherwise the communication will not be possible.

Node needs to modify spreading factor or channel **reset** (Press and hold the reset button for more than 3 seconds, until the WORK light flashes quickly).

● Set spreading factor

DIP switches 1~3 form a binary variable. 3 is the lowest bit and 1 is the highest bit. It can be expressed as 2^3, corresponding to SF7~SF12 in turn(I.e. DIP switch = 0, corresponding to SF7). SF12 is the limit value.

● Set up channel

DIP switches 4~8 form a binary variable. 8 is the lowest bit and 4 is the highest bit. It can be expressed as 2^5, which corresponds to channel 0 to channel 31 in turn.

Setting example:The picture below isSF9 channel 20
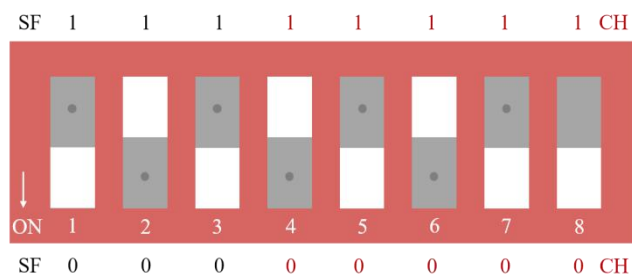
3.5.Data test

Follow the above steps to set the concentrator, and restart the concentrator after setting.

After the spreading factor and channel confirmation of the node and the concentrator are consistent, restart the node.

Open the log window.
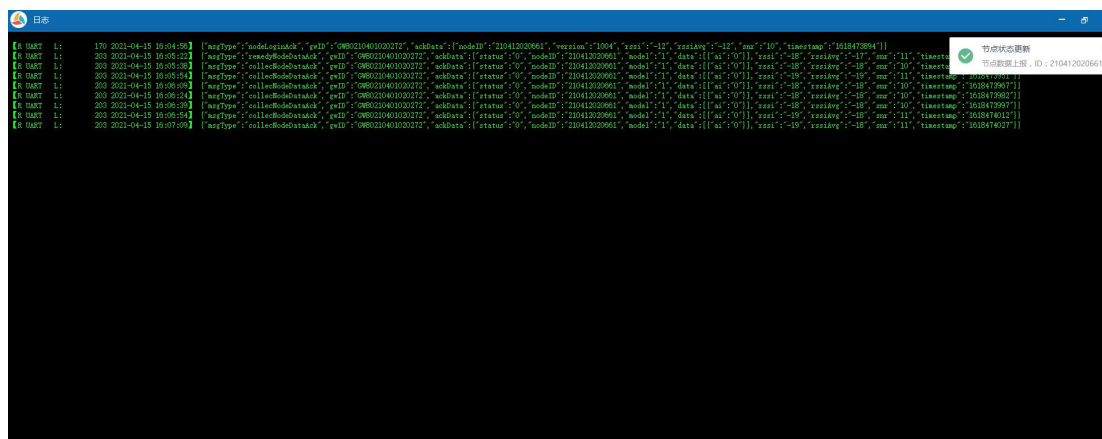
4. Concentrator function description

4.1.LoRa Networking related functions

4.1.1.Networking parameters

Project	Description
App ID	Used to distinguish different application scenarios/concentrators
channel	LoRa communication frequency
Spreading factor	SF7~12. Under the same conditions, SF12 has the longest transmission distance and the lowest speed
system status	Whether the current concentrator is in the time period of collective copying or supplementary copying.
Collection cycle	The interval between two collections. ≥(number of nodes+3)*Time slot
Time slot	The time interval between the two nodes to report the collective copy data. Set in combination with data length and spreading factor.
Command mode	0: Idle issued, that is, when the "system status" of the concentrator is idle, it responds to the issued command, otherwise the issued command is temporarily stored; 1: Immediately issue, as long as the concentrator receives the instruction, it will be issued to the node immediately

4.1.2.Work process

● Access to the network

The concentrator receives the network access request of the node, and decides whether to allow the node to access the network according to the currently mounted node list. After the concentrator receives the network access request, it immediately sends the LTE/RS485MAIN sends the JSON message of the node's network access.

● Offline

When the concentrator judges that the node status changes from online to offline, it will send the node offline JSON message to LTE/RS485MAIN.

1. Determine whether the node is offline according to whether the supplementary copy is replies;

2、Judging whether it is offline according to the two time intervals of the node reporting data.

● Collected copy

When the collective copy cycle arrives, the concentrator sends a collective copy command; the node responds to the collective copy command according to the transmission time coordinate; the concentrator immediately sends the LTE/RS485MAIN sends a collective copy response JSON message; the concentrator waits for the collective copy to complete, and then makes a supplementary copy for the nodes that have not responded.

● Make up

Send a supplementary copy instruction to the designated node. After waiting for a time slot, if the node does not respond, it will immediately put the node offline, and send the node offline JSON message to LTE/RS485MAIN.

● Point copy

The concentrator sends a point copy instruction to the designated node according to the server instruction, without waiting, and the server performs the node data return judgment. Whenever the concentrator receives a point copy response from a node, it will send a point copy JSON message to LTE/RS485MAIN.

● Trigger escalation

The node judges the trigger condition according to different device types, and reports it immediately after the condition is triggered; after the concentrator receives the node-triggered report, it immediately packs the node-triggered JSON message and sends it to LTE/MAIN.

● The latest 3 data of the node

The concentrator will keep the latest 3 pieces of data and related parameters reported by the node.

4.2.LTE

4.2.1.Network parameters

project	Description
SIM card number	SIM card global unique identification
Signal strength	The signal strength of the environment where the current device is located

4.2.1.APN

Except the APN dedicated network card, other ordinary cards do not need to set APN.

project	Description
address	APN address, provided by the operator
username	APN username, provided by the operator
password	APN password, provided by the operator

4.2.3.Connection

● Private Cloud

Users can set the SOCKET parameters to enable the concentrator to access the private cloud using TCP/MQTT, and complete the interaction with the concentrator according to the JSON data protocol.

● Vertical and horizontal clouds

The concentrator is connected to Zongkong Cloud by default. The user can build a TCP client locally to connect to the cloud based on the API provided by the cloud to complete the remote data transmission with the concentrator.

project	Description
status	Whether to enable this connection
mode	TCP/MQTT client (only connection-1-supports MQTT)
address	Destination server address
port	Destination server port
Registration package mode	The server can distinguish the concentrator according to the registration package
Register packet trigger mode	Send when connected: send a registration package when establishing a TCP/MQTT connection Data Carrying: Carry a registration package before each report data The above two types: send a registration package when establishing a TCP/MQTT connection, and carry a registration package before each report data
Register package content	Custom registration package mode is valid

Heartbeat packet mode	To maintain the TCP connection, the server can judge whether the concentrator is offline according to the heartbeat packet
Heartbeat packet cycle	Period of sending fixed data packets to the destination server
Heartbeat packet content	Send the contents of a fixed data packet to the destination server regularly
MQTT	Standard MQTT parameters, support QoS 0/QoS 1

4.3.Basic parameters

4.3.1.Basic information

project	Description
Concentrator ID	Concentrator factory unique serial number
Concentrator password	Effectively connect to the cloud
Firmware version	Current concentrator firmware version
Data trend	When the node actively reports, the concentrator sends JSON data packets in the set direction
instruction	Resetting and restarting the concentrator

4.3.3.Module communication

project	Description
Enable	Directly interact with 4G module through RS485 MAIN

4.3.2.Timed action

project	Description
action	Execute the set action when the set time is reached
time	Beijing time

4.3.4.Location information

project	Description
Location information	Currently does not support obtaining GNSS, the user can write any value (within 100 bytes)

4.4.Serial port

The serial port MAIN is mainly used to communicate with management software, and can also output transparent transmission information.

The serial port DEBUG is mainly used to output the sending and receiving data of each LoRa channel of the concentrator.

5. Node function description

Nodes distinguish functions according to hardware.

5.1.LoRa Networking related functions

● Access to the network

After the node is powered on, it sends a network access request immediately, and if it does not receive the network access permission for a certain period of time, it randomly waits for 1-20s and then initiates the network access again. In this state, the WORK indicator is on for 500ms/off for 500ms.

● Response Collection

After receiving the collective copy instruction, it will immediately synchronize the timeline and wait for the report according to its own logical ID.

● Respond to other commands

Return response data immediately

● Offline judgment

Restart without receiving instructions from the concentrator for a certain period of time.

5.2.ZHC0921

5.2.1.Serial port collection

Provides a serial port acquisition command, the maximum support is 8 bytes.

The user can configure the start byte and length of the collected reply data through the management software.

5.2.2.DI Dry node detection

Provide one-way DI dry node on-off detection.

State refresh rate: 20Hz.

Support DI status change reporting.

5.2.3.AI Analog detection

Provide one AI (4~20mA) analog quantity detection.

State refresh rate: 20Hz.

Support AI status change reporting.

5.3.ZHC0931

5.3.1.Serial port collection

Provides a serial port acquisition command, the maximum support is 8 bytes.

The user can configure the start byte and length of the collected reply data through the management software.

5.3.2.DO Relay output

Provide one DO relay output.The control protocol is detailed in "ZHC-GW8000_JSON_Application Guidance.

5.4.DL/T645 Electric meter collection

ZHC09XXThe series nodes support the collection of multi-function electric energy meters that meet the DL/T645 protocol.

6. Firmware upgrade

Before upgrading, you need to select the corresponding upgrade firmware on the management software and open the corresponding serial port.
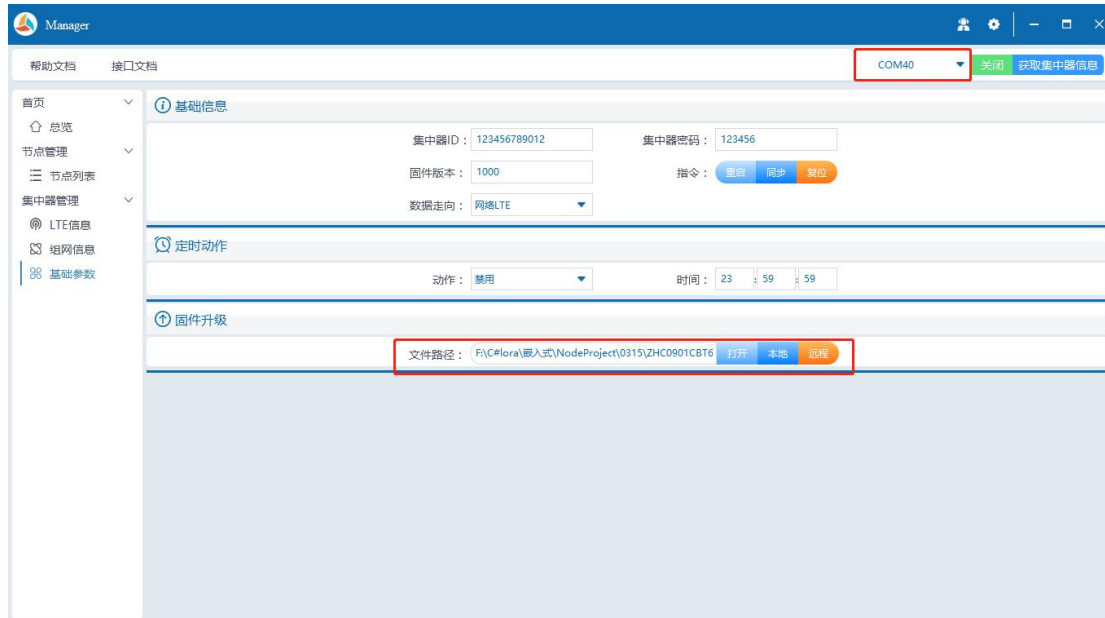
When the management software receives the upgrade request from the concentrator/node, it will automatically start responding to the upgrade package.

Concentrator

The concentrator can enter the upgrade mode by issuing instructions.

After the concentrator enters the upgrade mode, if the upgrade package information is not received, the indicator light flashes; if the upgrade package has been received, the indicator light shows the upgrade progress.

Node

Before the node is powered on, press and hold the reset button, wait for the management software to receive the upgrade request and release the reset button.

7. Common problems

7.1. The node cannot be connected to the network

- ● Check whether the concentrator is powered on
- ● Check whether the concentrator has added this node
- ● Check LoRa Whether the antenna is available
- ● Check whether the communication parameters (spreading factor, channel) of the node and the concentrator are consistent

7.2. Abnormal data

1) The node does not respond. The node indicator status is "Connected to the network" and "RECV The indicator light can flash.
- ● Check the concentrator application ID Whether to modify

2) The node continues to trigger "trigger report"
- ● Check whether the node model is a type R, And the serial port is always receiving data

3) The data reported by the node does not match the actual situation of the node
- ● Node transmission data time coordinate (logical ID) Does not match the current concentrator node, reset the node and reconnect to the network
- ● The model of the node is modified on the concentrator, but the node itself is not modified to the specified model, resulting in data parsing errors, reset the node and reconnect to the network.

7.3. The server cannot receive data

- ● Check the "connection" configuration. Server address, port, MQTT Parameters etc.
- ● Check LTE parameter.SIM Whether the card is available, signal strength,APN

8.Precautions

● The installation location of the concentrator must be at least 20 degrees from the edge of the building with a depression angle of at least 50 cm away from the wall of the building

● Keep the LoRa omnidirectional antenna as far away as possible from other antennas, and the antenna is lower than the highest point of the building to prevent lightning strikes

● The antenna should be installed perpendicular to the ground, so that the antenna performance can reach the best

● The antenna on the concentrator equipment and the concentrator should be protected against lightning (surge arrester/lightning arrester), and the antenna and feeder should be grounded

9.Update history

version	update content	Update time
V1.0.0	First edition	2021-3-20

10.Contact details

Company: Chengdu Zongheng Intelligent Control Technology Co., Ltd.

Address: No.599, Huafu Avenue, Shuangliu District, Chengdu City, Sichuan Province

Website: www.iot-router.com

Phone: 028-83268936

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