Wireless Data Transmission Module   G-BOX

Operating manual

Catalog

1-1. Summarize

As a wireless data transmission module, G-box adopts Modbus-TCP protocol. It is applied in automatic system with Xinje XC series PLC and other products to implement the wireless connection between automatic system and GPRS network or GSM network. Based on this module, we can do remote programming and diagnoses to the PLC, achieve programme upload and download through the upper computer software XCP pro configuration of XC series PLC. The mobile user can use SMS message service to control the PLC. So G-BOX is suitable for the cases such as remote monitor of the distributed system.

1-2. Compatibility

The wireless data transmit communication system includes upper computer configuration software XCPpro of XC series PLC (3.0i and above editions available), G-BOX, SIM card containing GPRS service (China Mobile SIM card available only), the PLC which supports Modbus-TCP protocol.

China Mobile data services are divided into CMWAP and CMNET. CMWAP is a internal network of China Mobile which is used to download color-ring, so it's a local area network under which G-BOX can't work normally.

1-3. Performance characteristic

G-BOX has below characteristics：

- Open and lucid data transmission
- The data transmission terminal integrates with TCP/IP protocol stack, supports TCP, UDP, DNS, PPP, etc.
- Standard industry port: RS-232 or RS-485
- Supporting persistent online mode, offline re-dial and heartbeat function
- Supporting sending and receiving of message data
- Supporting local configuration
- Supporting GPRS and GSM

1-4. Applied function

The applied function of G-BOX in the whole network is shown as below:
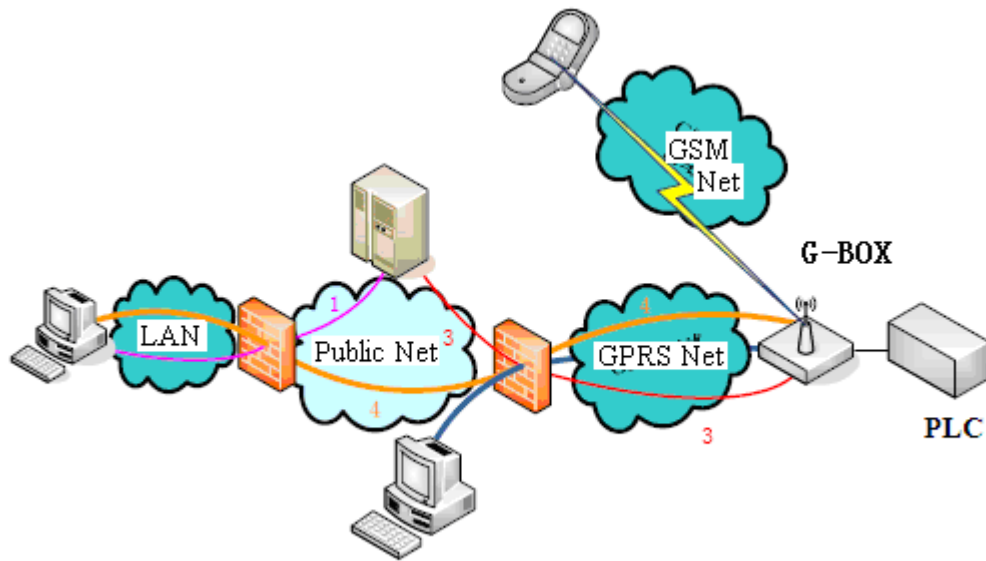
The automatic system based on G-BOX has below functions:

- Wireless upload and download PLC programme and real time monitor

It seems to be difficult to remote monitor or modify PLC programme in remote control system. After equipping with G-BOX, maintainance workers can monitor the PLC even if the control station is far from the local place. It also makes the programme wireless uploading and downloading to be true.

- Message communicate with user's mobile

Although G-BOX has message sending and receiving functions, it can't achieve optimal effect as far as the system control object is concerned. If configure a G-BOX module for PLC, user's mobile can send and receive message with PLC through GSM network and monitor the PLC status anytime. If any problem appears, G-BOX will send fault code message to the user's mobile, then the user send the modify message to the G-BOX, the G-BOX will send the message to the PLC. So user can know the problem and deal with it immediately.

1-5. Applied field

The whole automatic control system could be applied in below fields:

- Industry control, remote sensing, remote measurement
- Monitor nobody-on-duty machine room and storehouse
- Monitor pipe network
- Collect and monitor oil field and coal mine data
- Fault diagnoses of huge equipment
- Any other situations need wireless data transmission

2. Performance and parameter
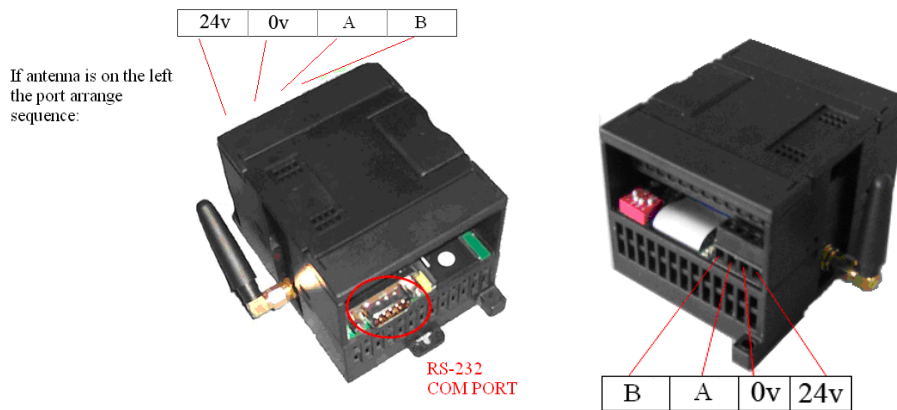
2-1. Port arrangement

If the antenna is on the left, the port arrange sequence is 24V, 0V, A, B

1. The power voltage is DC 24V, allowed range is DC 21.6V~26.4V.
2. G-BOX communicate port is RS-232 or RS-485(port A and B), when use RS-485, port A is "+", port B is "-".

2-2. RS-232 communication port

RS-232 port has nine pinholes, see below picture:
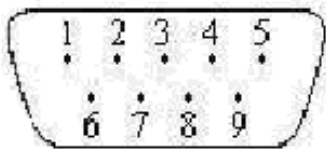
DB 9 pinholes

2	RXD
3	TXD
5	GND

PC and G-BOX cable connection figure:
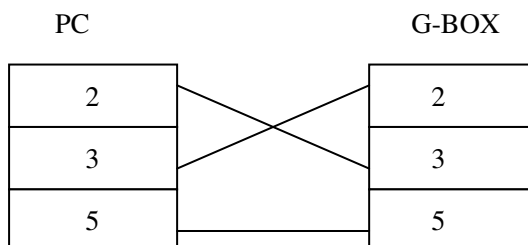
XC series PLC and G-BOX cable connection figure:

XC-PLC   G-BOX

G-BOX communication port can connect one device(PLC or PC), the communication protocol is Modbus-RTU.
If G-BOX communicates with GPRS network, the protocol is Modbus-TCP.

2-3. RS-485 communication port

When use RS-485 port, connect port A ,B with PLC port A,B.
Attention: RS-232 port and RS-485 port can't be used at the same time.

2-4. Outline dimension and installation

The outline dimension is 71mm×100mm×67mm (width×length×high).

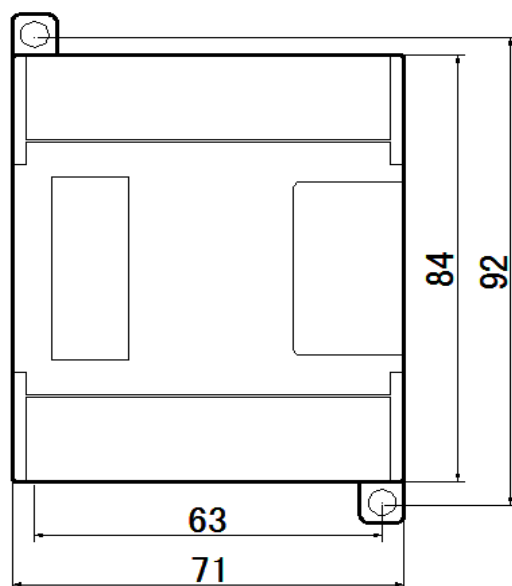Use M3 snail to fix the module or install on the DIN46277 (width 35mm) track.

Attention:

1. Among installation, avoid metal bits or wire bits dropping into the module
2. Before connecting, please make sure the specs of the module and device are correct
3. Make sure the wire connection is firm. If not, some problem will occur such as data incorrect, short, ect.
4. When installing or connecting with the module, make sure the power is cut off.

2-5. SWITCH

There are four switches: S1, S2,S3, S4.

ON

| 1 | 2 | 3 | 4 |

OFF

S1	S2	S3	S4	State	Description
Random	OFF	OFF	ON	Parameter setting	Use PC to set G-BOX original parameters
ON	OFF	OFF	OFF	Permanent online	G-BOX has already logged on the server
OFF	OFF	OFF	OFF	Dormancy	G-BOX is dormant, it will log on the server after phone call activation

Note: When setting the parameter, G-BOX receives data from COM port; after exiting parameter setting and return to working status the parameter become effective.

2-6. LED indicator light

| LED	Indicate	Function
PWR	Power	On available
COM	COM port	Glitter available
ONLINE	Connection	On available
GPRS	Mobile phone part works	Glitter once per second: searching for network Glitter once per three seconds: GSM connected Quickly glitter: GPRS data transmission On: start or abnormal

2-7. Product characteristic parameter

Parameter Name	Description
Working frequency band	Single-frequency: 800MHz, Dual-frequency: 900MHz/1800MHz
Receiving sensitivity	<-106dBm
Maximum transmitting power	2W（900MHz），1W（1800MHz）
Working temperature	0°C～50°C
Power voltage	DC 24.0V
Average stand-by time	<7mA （idle mode）
Fundus current	<2.5mA
Protocol	GSM/GPRS Phase2/2+
GSC RF antenna connector	50ΩE GSC
Message service	MO / MT
	Point to point
	Message mode: TEXT / PDU
GPRS data service	GPRS CLASS 10
	TCP/IP protocol: multilinking, ACK answering, high-capacity cache
Dynamic area	62dB
Maximum data transmitting speed	85.6kb/s

2-8. Network communication project

After original setting by the upper computer, G-BOX has below information: Master server IP, port No., device ID, log on name, etc.

There are two cases for activating G-BOX and connect with GPRS network:

Case one:
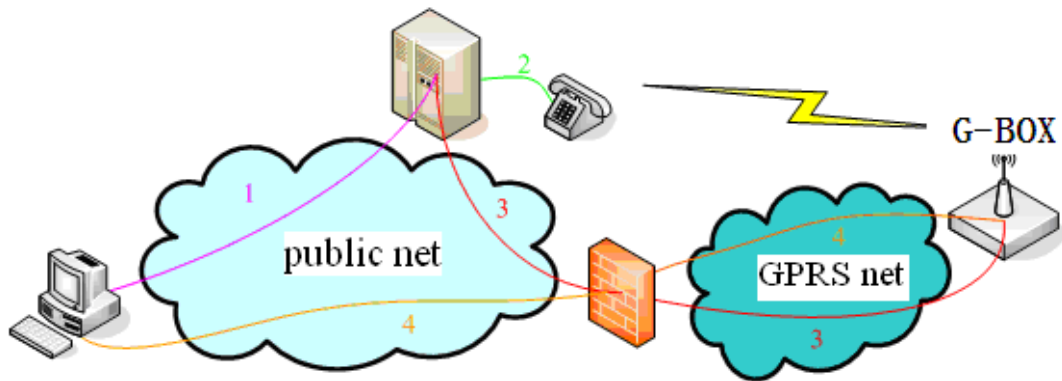
1. The PC on public net which has confirmed IP logs on the server and sends connecting application
2. The server calls the phone number of appointed device, hangs up after ringing twice to activate the G-BOX
3. The activated G-BOX logs on the server to obtain the PC information
4. G-BOX connects with the PC

Case two:
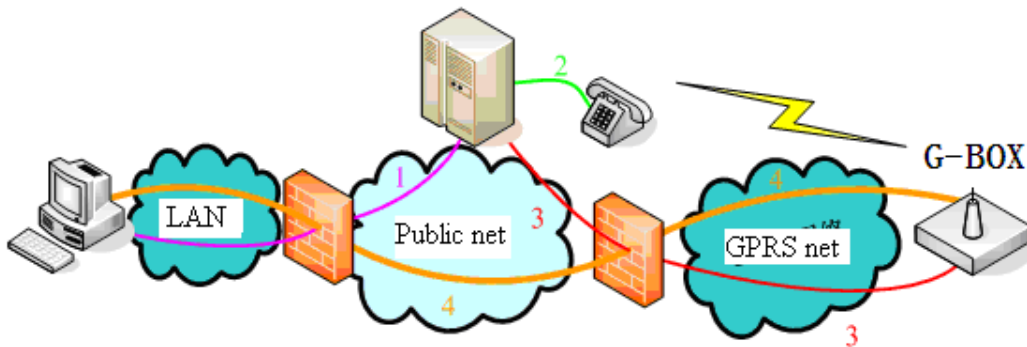
1. The PC on the subnet logs on the server, sends connecting application
2. The server calls the phone number of appointed device, hangs up after ringing thrice to activate the G-BOX
3. The activated G-BOX logs on the server

The activated G-BOX begins connecting with GPRS net, if it doesn't receive the data after receiving the end command for 3 to 5 mintues G-BOX will stop the connection with GPRS net.

3-1. Original setting

The original setting aims to get the corresponding information among upper computer software XCPpro and G-BOX. According to the parameter knowability to user, it is divided into unknown and known situations.

3-1-1 Preparation

- **A SIM card（China Mobile card available only）**

  Choose corresponding services in terms of different control requests
  1. Need remote programme maintainance: open GPRS CMNET service
  2. Need message monitor: open message service
     (call China Mobile service Tel: 10086 for details)

- **One OP/TP download cable ——used to configure GBOX**

- **One XC download cable —— used to connect GBOX and PLC**

- **One PC connected with Internet and installed XCPpro software**
- **Choose a reliable network（do not need confirmed IP, bandwidth, speed, but credible）**
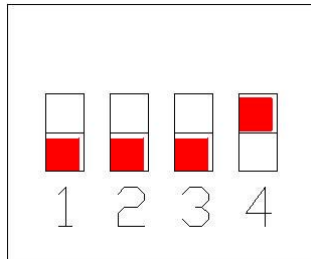
3-1-2 Unknown situation

If the user doesn't know the parameter information in the G-BOX for initial using, please connect the G-BOX and upper computer to read and record the information in the XCPpro software. The user also can modify the parameter of G-BOX and save them in the software.

Setting step:
1. **Hardware connection and setting**
    (1) reset switch 1,2,3, set switch 4:

    (2) Use COM port to connect G-BOX and upper computer
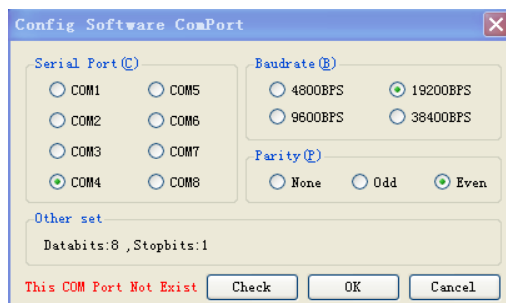   (3) Make sure SIM card inside and GPRS service opened, power on.
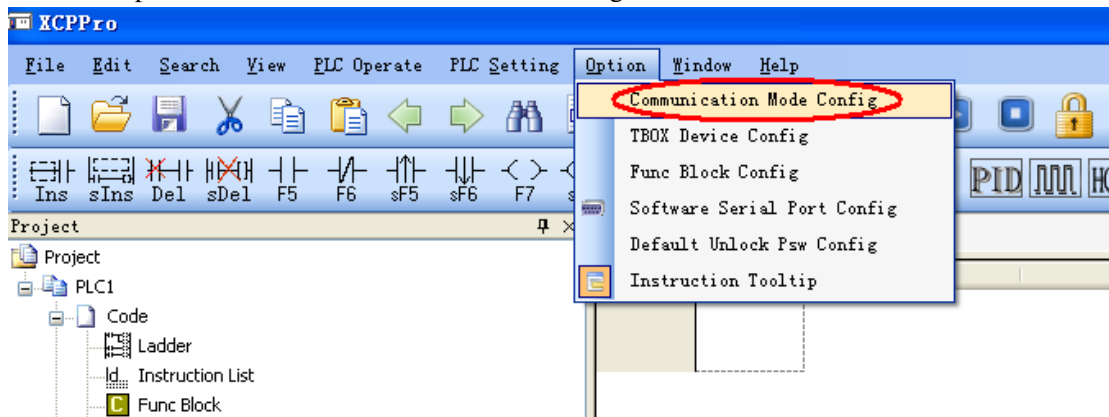   Attention: the message remained in SIM card will be cleared

2. **Software setting**
A. Open software XCPpro to configure software com port, default value: 19200BPS, even. Choose com port manually.
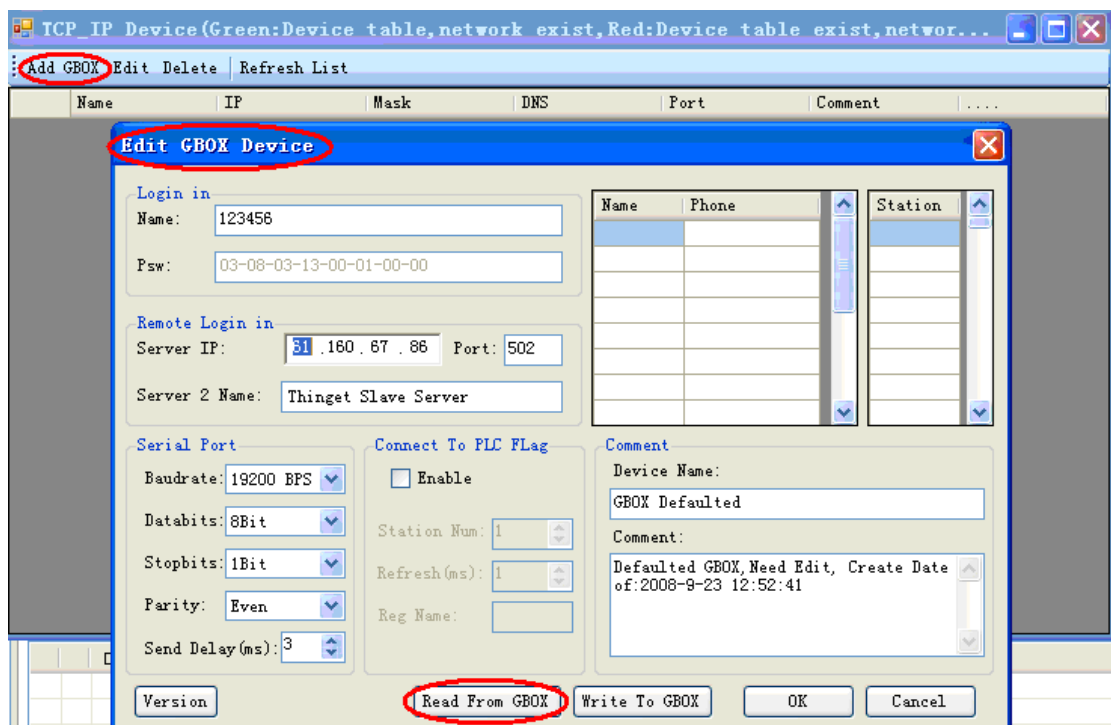

B. Click "option", select "communication mode config".

C. Click "+" to set the communication mode

D. Click "Add GBOX", pop up "Edit GBOX device" window.
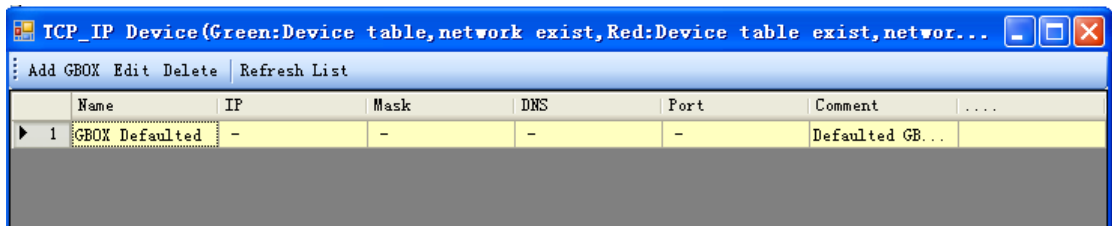
(1) Click "Read From GBOX", the parameters will be shown as upper:
    i.   Login in

       Name: Be able to modify, become effective after writing to GBOX

       Psw: Manufacturer set value, can not change

   ii.   Remote login in

       Server IP, Port, Server 2 Name: can not change

  iii.   Using Authority

       Name, Phone: all users can use if no list; the user on the list can use if there is a list, become effective after writing to GBOX.

   iv.   Serial Port

       Default value, do not need to modify

   v.   Comment

       Be able to modify

Attention: Turn off the power then turn on the power again to make the parameters become effective.

(2) When finish editing click OK, the TCP_IP device list has been added to a GBOX device:

E. Close the window, choose "UDP" and "outer net" then click "GBOX Defaulted", "Station Num1", then click OK to complete the setting.
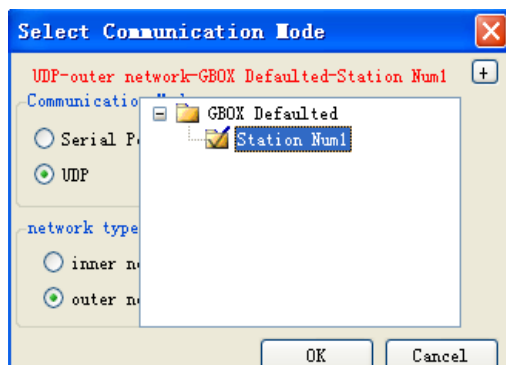
Attention: If there are many G-BOX devices, choose the right one you want to use.
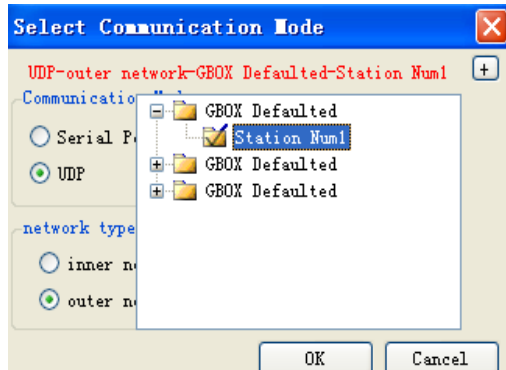
3-1-3. Known situation

If user knows the inforamtion in G-BOX, it is not necessary to connect the G-BOX with upper computer. Open the XCPpro software then click "option"-"Select Communication Mode".Operating step refer to section 3.1.1. The difference is the "Edit GBOX Device" part. The parameters in "Login in" and "Remote Login in" should be consist with the parameters in G-BOX.
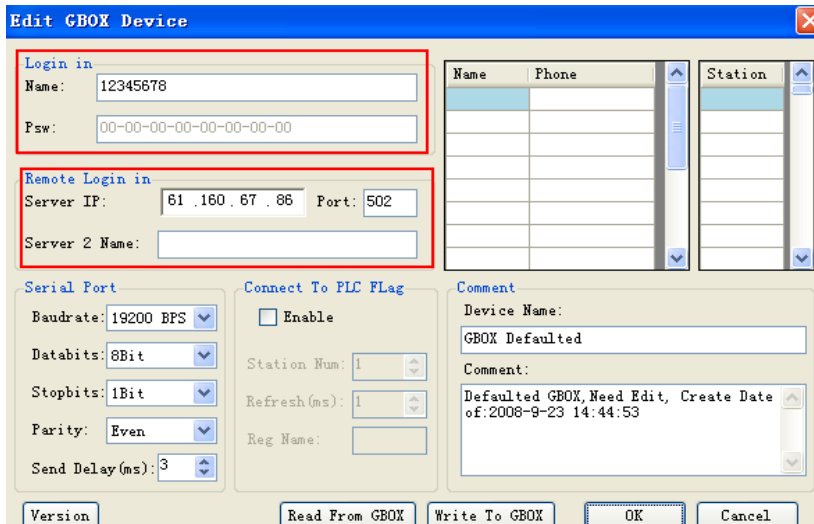
3-2. Working status

After original setting, G-BOX enters working status. Please connect G-BOX with PLC.
There are two working status: permanent online and dormancy.

3-2-1. Permanent online status

Setting:
1. Set switch 1, reset switch 2,3,4.
2. Make sure SIM card inside, GPRS service opened, power on.(China Mobile card available only)
3. LED signal "ONLINE" on, G-BOX has log on the server. XCPpro software has connected with GPRS net.
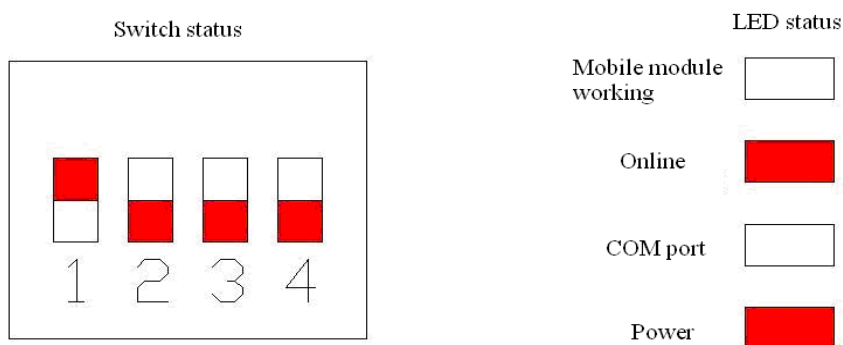
3-2-2. Dormancy status

This mode can save online costs. User can activate the G-BOX by making a phone call, then G-BOX will relog on the server and connect XCPpro with GPRS net.
Setting:
1. Reset switch 1,2,3,4

2. Make sure SIM card inside, GPRS service opened, power on.(China Mobile card available only)
3. If user call the SIM phone number, G-BOX will be activated.
4. If there is no operating to G-BOX for five minutes after calling, G-BOX will enter dormancy status again.

Under the two status, XCPpro tries to connect with G-BOX by P2P. If connecting failure, the server will transmit the message. If connecting success, user can wireless upload, download and monitor the PLC programme. The monitor will be delayed for three senconds.

4. Message Function

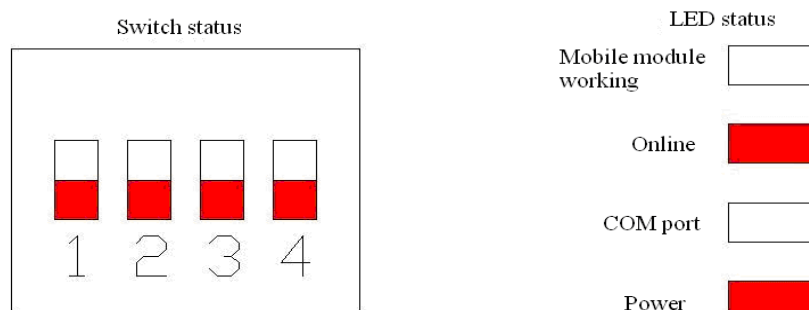When G-BOX switch 4 is set on, it is under message mode. Message function is available even the G-BOX is not activated. There are some notes for user:

1. During the first 50 seconds after power on, the G-BOX is initializing, it will not give correct answer for any requests.
2. If the data is transmitting in GPRS net, the communication from PLC to mobile will be affected(message alarming function), but the communication from mobile to PLC will not be affected.

There are two modes in terms of data transmitting direction:

4-1. PLC => G-BOX => Mobile (Message alarming function)

Under this mode, PLC is master, G-BOX is slaver, the slaver station number is FF(HEX).
The PLC software XCPpro edition should be greater than 3.0i.
There are two modes to realize message alarming function:
1. Via toolbar shortcut:
Click MSG Config
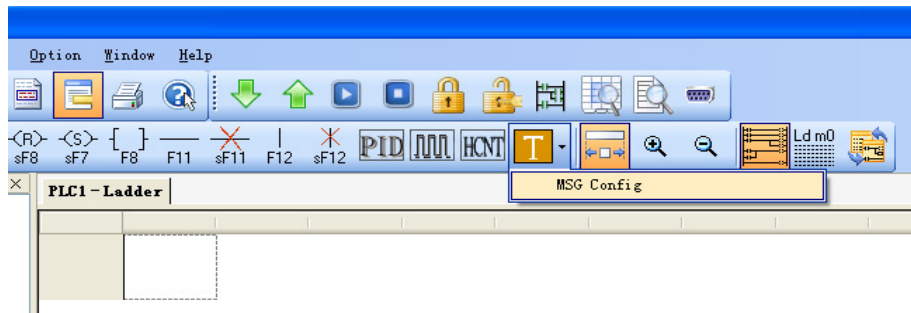
MSG Instruction Config setting
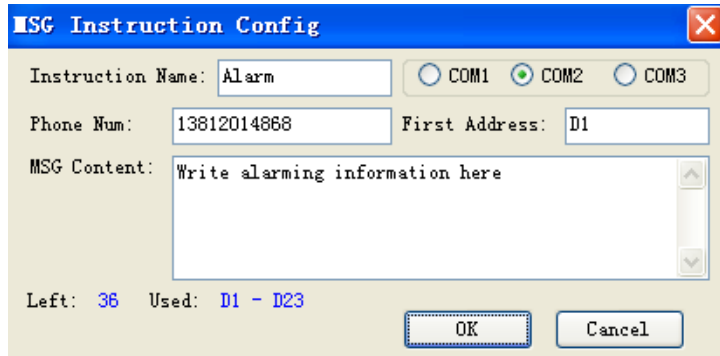
Click OK to build below ladder chart instruction.
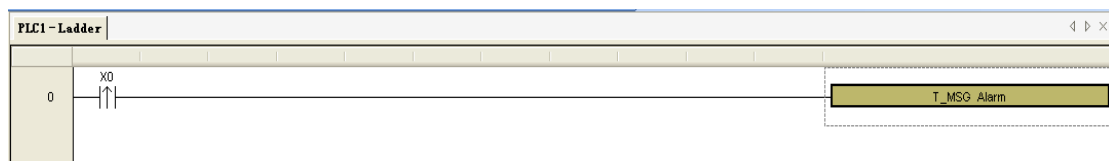
2. Via PLC programme instruction "MRGW". G-BOX slaver station No. is H FF, head address is 50000 (decimal), 50000 can be insteaded by -15536 (decimal) or C350 (HEX).

Transmitting format: Station No. + Function code + Head address + Register quantities + Byte quantities + Register value + CRC check code

Answering format: Station No. + Function code + Register quantities + CRC check code

Transmitting Format		Answering Format	
Name	HEX	Name	HEX
Station No.	FF	Station No.	FF
Function code	10	Function code	10
High byte of head address	C3	High byte of head address	C3
Low byte of head address	50	Low byte of head address	50
High byte of register quantities	00	High byte of register quantities	00

Low byte of register quantities	01—78	Low byte of register quantities	01—78
Byte quantities	Register quantitiesN×2	Low byte of CRC check code	....
High byte of register value	00—FF	High byte of CRC check code	....
Low byte of register value	00—FF		
High byte of register value	00—FF		
Low byte of register value	00—FF		
....	....		
....	....		
Low byte of CRC check code	....		
High byte of CRC check code	....		

The register value is: the register quantities telephone No. buffer occupying + filled with zero + Telephone number list + filled with zero + the message information

In order to be compatible with the data display of TouchWin series touch screen, exchange the high and low byte of upper register value and change the telephone number list and message information into ASCII code.

The "Multi-register write in" instruction should not greater than 128 bytes (message + register quantities telephone number occupied should not larger than 64 bytes).

For example:

Transmit ABCD to mobile number 13012345678, the data in communication buffer is:

      0x00 0x06   0x33 0x31   0x31 0x30   0x33 0x32   0x35 0x34

      0x37 0x36   0x00 0x38   0x42 0x41   0x44 0x43

Occupied nine registers.

If error occurs, the answer format will be:

Error code	0x90
Other code	01 or 02 or 03 or 04

4-2. Mobile => GBOX   =>   PLC (Control Function)

Under this mode, G-BOX is master, PLC is slaver, the slaver station No. is 1.

The message instruction format:

Instruction	Operating object			Data
Coil read&write	Bit	M	M0~M7999	0 or 1
			M8000~M8511	
		X	X0~X511	
		Y	Y0~Y511	
		S	S0~S1023	
		T	T0~T618	
		C	C0~C634	
Register read&write	Word	D	D0~D7999	K-32,768~K32,767 H0~HFFFF
			D8000~D8511	
		TD	TD0~TD618	
		CD	CD0~CD634	
		FD	FD0~FD5000	
			FD8000~FD8511	
	Double words	DD	D0~D7998	K-2,147,483,648~K2,147,483,647 H0-HFFFFFFFF
			D8000~D8510	
		DTD	TD0~TD616	
		DCD	CD0~CD632	
		DFD	FD0~FD4998	
			FD8000~FD8510	

Note:

1. All the letters in the message should be capital letter.

2. Leave a space among instruction, register and operand, the message should not over 99 letters.

3. If sending a character string message, use English quotation mark ".

4. Chinese character is supported.

Character string read&write command format:

Read command	R	D	(D0~D7999)	Sn(n is the character string length you want to read)
Write command	W	D	(D0~D7999)	Character string information

For example:

Read soft component value

Sending message: R M0   Answering message: M0=0

Sending message: R D5   Answering message: D5=K1234

Sending message: R DD0   Answering message: DD0=K654321

Read character

Sending message: R D0 S20   Answering message: Thinget Made

Write soft component value

Sending message: W M0 1   // Set M0

Sending message: W Y23 0   // Reset Y23

Sending message: W Y35 1   // Set Y35

Sending message: W D5 K1234   // write 1234 to register D5

Sending message: W DD0 H654321   // write 654321(HEX) to register DD0 (occupy D0 and D1)

Write character

Sending message: W D0 "Thinget Made"   // write Thinget Made to register group D0-Dn

The answering message of write command:

OK   // communication succeed

MODBUS ERROR   // Modbus communication has error

UNKNOWN ERROR   // communication error between G-BOX and PLC

TIMEOUT   // communication timeout between G-BOX and PLC

If no answering, the communication between G-BOX and PLC is failure

5. PLC and G-BOX Connection Mark Bit Setting

At real engineering control spot, as the chronic period of the control system and the complexity of the environment, operators need to have a good command of the situation about the equipment such as the connection situation between PLC and G-BOX. In order to satisfy user's demand, we developed the function of PLC and G-BOX connection mark bit setting. User can observe the mark bit to monitor the connection situation between PLC and G-BOX. Mark bit ON means connected, OFF means unconnected.

Please pay attention to the software edition: PLC should greater than v1.10, XCPpro should greater than v3.1a.

Setting method:

1. The preparation step please refer to paragraph 3-1-1. Connect the G-BOX and computer with OP/TP download cable.
2. Set on switch 4, open XCPpro to add a G-BOX device. Please refer to paragraph 3-1-2 point 2 software setting for adding step.
3. Please see below edit GBOX device window:

◆ Login in, Remote login in, Serial port, Name, Phone are the same as Paragraph 3-1-2 point2.

◆ Station: one G-BOX can connect with many PLC, select the target PLC station No. here (this function is being developed)

◆ Connect to PLC Flag: including "Enable, Station Num, Refresh, Reg Name", these parameters become effective after writing to G-BOX.

    Enable: choose this item to set on the function of connect PLC flag coil setting

    Station: the connected PLC station

    Refresh: the time G-BOX refresh the connection with PLC flag coil (unit: ms)

    Reg name: The flag coil, can be defined by user

Attention:

1. Refresh time will have 1% error

2. Repower on to make the flag coil effective, initial time may last 20 to 50 seconds which depends on the condition of SIM card.

3. Sending and receiving message, downloading and uploading programme, monitor operating may delay the refresh time.

Whether the G-BOX connected with PLC is affected by refresh time and power on time. To reduce the misjudgement and misoperation brought by these factors, we can via below methods to solve the problem.

Suppose the refresh time is 5 seconds.

● Use a timer to set 30 seconds after PLC power on (50 seconds is better due to PLC power on time), the next operation is permitted only after 30 or 50 seconds.

● Use the mark bit coil pulse as a triggering condition and PLC instruction INC to make PLC register (e.g. D0) value plus one.

● Users can write the PLC programme by themselves. Set off the PLC and G-BOX connection mark bit and set a 15-seconds timer to judge the value changing in D0.

    If value changes in D0, it means PLC and G-BOX are connected, clear the value in D0.

    If value doesn't change in D0, it means PLC and G-BOX are unconnected, at this time user

can take special operation such as close PLC.

However, users can choose other appropriate methods to reduce the influence caused by time delay considering your own operating conditions to obtain the optimal control results.
Welcome to visit Xinje forum to give some advice.
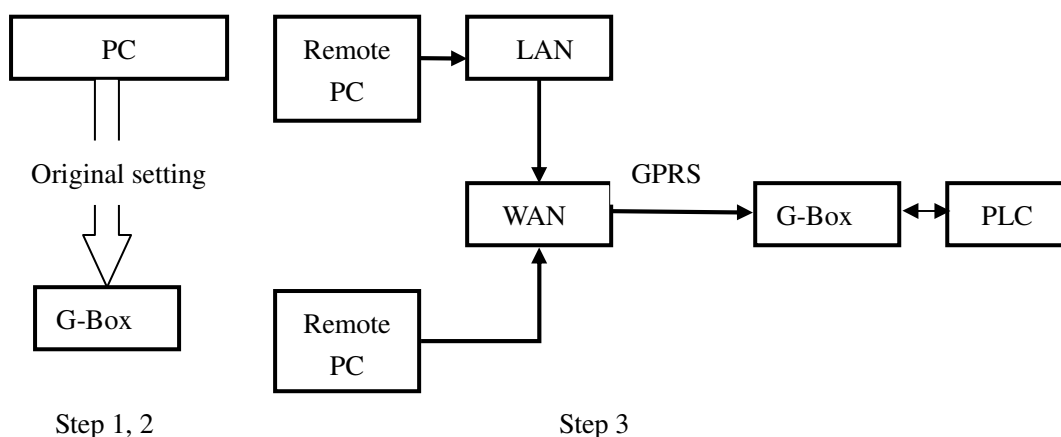
6. Examples

In industry control system, the surrounding condition of control object will affect the results of the whole control system we expected. This brought forward higher requests to the operator. How to make use of communication technology to optimize the resource configuration and improve efficiency has become a new thinking direction.

G-BOX can solve the remote control problem and improve the control system efficiency.

6-1. Example 1

Monitor the nobody on duty machine room and storehouse, modify the PLC programme.

1. For initial using, configure G-BOX parameters in XCPpro, refer to paragraph 3-1. Then record the configure information you have written into G-BOX.
2. There are two work modes: permanent online and dormancy. Choose one kind of mode by setting the switch 1 to 4. Connecting G-BOX with PLC in control system.
3. Engineers can use software XCPpro to download, upload and monitor the programme in remote PLC, you also have to know the G-BOX original setting information.

Step 1, 2   Step 3

6-2. Example 2

In nobody-on-duty control system, if the system has some problems such as over standard temperature, the PLC will via G-BOX send alarming message to operator.

The steps as below:

1. For initial using, set original parameters of G-BOX, refer to paragraph 3-1.
2. Make sure there is alarming instruction in PLC programme. Connect G-BOX with PLC, user can send and receive message by mobile to know the PLC information.