

Z-BOX wireless module

User manual

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Preface

As the fast development of wireless technology, the related products are used widely. The wireless products are new source for industry network which can simplify the network distribution, save cost of network configuration and maintenance. With the wireless network, the product can remote-monitor local device state, collect technology parameters, update terminal device program, upload/download recipe of local data.

1 Specification

1-1. Type

Z-BOX series wireless LAN products include Z-BOX module and Z-BOX expansion board:

Туре	Function
Z-BOX module	Connect Modbus master station, such as PC, HMI, PLC. To realize wireless communication. Refer to chapter 2.
XC-ZBOX-BD	Plug and play, connect Xinje PLC to realize wireless communication. Refer to chapter 3.
XP-ZBOX-BD	Plug and play, connect Xinje integrated PLC&HMI controller, to realize wireless communication. Refer to chapter 3.

If the antenna of module and BD board is not long enough, we provide below choices:

Name	Function
2.4GHz terminal antenna	Z-BOX default configuration, suitable for large and not
	complete closed space. Refer to chapter 4-1.
2.4GHz sucker antenna	Suitable for narrow, closed and strong signal shielded space,
	such as metal electrical cabinet. Refer to chapter 4-2.
2.4GHz wall-mounted	Large cover area, strong signal, strong interference immunity
antenna	ability. Suitable for large area factory. The network can cover
	the whole place. Refer to chapter 4-3.
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1-2. Dimension

Z-BOX module dimension: (unit: mm)



Note: ZBOX-BD is plug-and-play expansion board, it can install on Xinje PLC, and integrated PLC&HMI controller directly.

1-3. Features

Coordinator, router and repeater are needed in the wireless LAN. The coordinator is the essential device for the network; router and repeater can extend the network.

Product features:

(1) Strong networking ability, support star, tree and mesh network. ZBOX can auto-select network structure as the actual environment.

(2) Network node has big capacity and fast starting speed, the node quantity can up to 254.

- (3) Use 2.4GHz wave band, strong interference immunity ability.
- (4) Lower power consumption.
- (5) Easy to wiring, network node can move and expand.

(6) Strong self-healing ability. ZBOX will search other network path when communication is error.

Advantage:

- (1) Simplify the network distribution
- (2) Save the cost of structure and maintenance
- (3) Enable to remote monitor, update local devices, upload/download recipe data
- (4) Ensure the reliability and stability of communication

Application:

- (1) Industry control, remote sensing, remote measurement
- (2) Monitor the unattended machine room, store house
- (3) Pipe network monitoring
- (4) Oilfield and coal data collection and monitoring
- (5) Factory remote distribution control

2 z-вох

2-1. Hardware

Part introduction of ZBOX:



Power supply
 Serial port
 SWITCH
 LED indicator

Performance:

Item	Explanation
Working frequency	2.4GHz
Max transmit power	4.5dBm
Working temperature	-10° C ~ 60° C
Protocol	Zigbee, Modbus-RTU
Max data transfer speed	100Kb/s

> Power supply

ZBOX is active module. It needs external power supply.

The power range is: AC 85~264V/47-63Hz or DC 90~375V (L+, N-).

> SWITCH

There are 2 switches on the ZBOX:



Switch	Description		Function		
S1	Device type	ON	Router		
	selection	OFF	Coordinator		
S2	State save selection	ON	Remember the network state, recover the last network after re-power on		
		OFF	Not save network state, re-select the network		

LED indicator

ZBOX indicator diagram:



LED function:

No.	LED		Function		
1	POWER	Power	Z-BOX power supply is normal when LED is ON		
2	СОМ	Serial port	Data exchange when LED is flickering		
3	RF	Wireless signal	The wireless signal send and receive when LED is flickering		
(4)	ACT	Network	Flicker 1 time/s: coordinator is building the network. LED is always ON after networking is successful Flicker 3 time/s: router is adding the network. LED is always ON after succeed Flicker 50 time/s: read the BD serial port signal of PLC. LED is always ON after succeed (PLC mode)		
5	Y	Signal	 : weak signal : medium signal : strong signal 		

> Serial port

Z-BOX module has a RS232 port which can connect PC, HMI, PLC and other devices.



2-2. Software

ZBOX has two working modes: PC mode and PLC mode.

PC mode: connect all the Modbus master devices, such as HMI, PC...

PLC mode: connect the devices which can be Modbus master and slave, such as PLC, integrated PLC&HMI controller.

ZBOX default mode is PC mode. User can change the mode by ZBOX config software.

Z-BOX Config software is used to change the working mode.

(1) Please download the ZBOX config software on <u>www.xinje.com</u>.

(2) Connect ZBOX and PC with TP cable, power on the module.

(3) Open ZBOX config software.

SBOXConfig	
COM:	The PortName cannot be empty Parameter name: PortName
Unknown Mode	
Read	Write

Function:

- 1. COM: PC serial port
- 2. Device type config: select PC mode or PLC mode
- 3. Unknown mode: show the present module working mode
- 4. Read: read the module parameter
- 5. Write: modify the module parameter

Зzвох-вd

3-1. Hardware

> Type and performance

ZBOX-BD has two types: XC-ZBOX-BD and XP3-ZBOX-BD. The performance is as below:

Parameter	XC-ZBOX-BD	XP3-ZBOX-BD
Purpose	For XC series PLC	For integrated PLC&HMI controller
Working frequency	2.4GHz	2.4GHz
Max transmit power	4.5dBm	4.5dBm
Working temperature	-10°C ~ 60°C	-10°C ~ 60°C
Protocol	Zigbee, ModBus-RTU	Zigbee, ModBus-RTU
Max transfer speed	100Kb/s	100Kb/s

> SWITCH

There are 4 switches on the ZBOX-BD.



No.	Description		Function
S 1	Device type	ON	Router
51	selection	OFF	Coordinator
S2	State save selection	ON	Remember the network state, recover
			the last network after re-power on
		OFF	Do not save the network state,
			re-select the network
S3	- Reserved		
S4			

> LED indicator

LED	Function		
СОМ	Serial port	Data exchange when LED is flickering	
RF	Wireless signal	The wireless signal send and receive when LED is flickering	
ACT	Network	Flicker 1 time/s: coordinator is building the network. LED is always ON after networking is successful Flicker 3 time/s: router is adding the network. LED is always ON after succeed Flicker 50 time/s: read the BD serial port signal of PLC. LED is always ON after succeed (PLC mode)	
RSII	Signal	 : weak signal : medium signal : strong signal 	

3-2. Software

ZBOX-BD will install on PLC and integrated PLC&HMI controller. Before using, please configure the com3 of PLC in XCPpro software.

• System requirements:

Hardware: PLC and integrated PLC&HMI hardware v3.1 and above. Software: XCPpro software v3.1 and above.

- Configuration steps
- 1. Install the ZBOX-BD on the PLC or integrated PLC&HMI controller.



2. Connect the PLC or integrated PLC&HMI controller with the PC, open XCPpro software.

3. Configure the COM3 parameter:

Click configure/PLC comm port setting in the menu. Click "read from PLC" in below window. Then select "serial port 3" and Modbus Num 1. Then click "write to PLC". Click "BD" in the left list.

PLC1 - Serial Port Set		×
PLC Config PLC Serial Port BD CAN CAN Save Hold Memory OCC Module I/O M Module M Motion	Serial Port 3 Communication Mode Image: Modbus Num 1 Image: Communication Overtime Set (ms) Char : 3 Reply : 300 Serial Port User Protocol Baudrate: 19200 BPS Databits: 8Bit Stopbits: 1Bit Parity: Even Notice:configuration effective, reboot PLC	
Read From PLC W	Vrite To PLC OK Cancel	

Select "BD serial port"---"OK". Then download empty program to the PLC. At last, re-power on the PLC.

• Download and upload program

1. Open the XCPpro software, click Option/comm Mode setting.

Input the PLC serial port 3(BD serial port) station No. in below window:

Select Communication Mo	de 🛛 🗙
Serial Port	+
Serial Port	Station Num: 1 🛨
O UDP	
network type	
inner network	
C outer network	
	OK Cancel

2. Click configure/BD setting. Select "BD serial port"----"OK".



3. Make the program and download to the PLC or upload from the PLC.

4 Wireless antenna

4-1. Terminal antenna



Terminal antenna has small volume, easy to install. It is suitable for large and not complete closed space.

ltem	Description
Frequency	2400~2483MHZ
Receiving sensitivity	>-106dBm
Standing wave	≤1.8
Gain	3dBi
Max transmit power	50W
Input matched impedance	50Ω
Interface	SMA Male
Communication distance	Up to 150m (open environment)
Antenna dimension	Φ8×84 mm

Note: ZBOX default antenna is terminal antenna.

4-2. Sucker antenna



Sucker antenna is suitable for narrow, closed and strong signal shielded space, such as metal electrical cabinet.

Item	Description
Frequency	2400~2483MHZ
Receiving sensitivity	>-106dBm
Standing wave	≤1.8
Gain	3dBi
Max transmit power	50W
Input matched impedance	50Ω
Interface	SMA Male
Communication distance	Up to 150m (open environment)

4-3. Wall-mounted antenna



Wall-mounted antenna has large cover area, strong signal, and strong interference immunity ability. It is suitable for large area factory.

ltem	Description
Frequency	2400~2483MHZ
Receiving sensitivity	>-106dBm
Standing wave	≤1.8
Gain	3dBi
Max transmit power	50W
Input matched impedance	50Ω
Interface	SMA Male

Wall-mounted antenna is mounted on the wall in order to expand the network cover area. Please refer to below mounting steps:





Mounting notes:

- 1. Mounting height
- Suggest height: H= h (relative height of Z-BOX module or ZBOX-BD) + 2m
- 2. Mounting angle

Put the antenna at suitable angle to cover the whole area.



4-4. Antenna layout

The antenna type is decided by actual environment and device distribution. The following are some common mounting layout.

• Environment:

Factory area is more than 2000 m² Signal needs to pass through many walls

- Layout
 - 1. Same floor, same room



Diagram 1



Diagram 2



Diagram 3

Diagram 1 covers larger area than diagram 2 for the same device distribution on the same floor. Although the diagram 2 can cover all the devices, the signal is weak for the device far from the antenna. Diagram 3 is suitable for the concentrated device distribution.

2. Same floor, same factory, with mezzanine



Diagram 4

Diagram 4 is suitable for large mechanical factory which has office on the second floor. Mount the antenna at the height of second floor to cover all the devices.

3. Same floor, different room







Diagram 6

Diagram 5 and 6 adopt different way for the same place. Diagram 5 uses TBOX, ZBOX and ZBOX-BD. Diagram 6 uses ZBOX, ZBOX-BD and repeater.

4. Different floor



The office and workshop is in the different floor. There are up to two floors between the two antennas to ensure the normal communication.

5 Application

5-1. One HMI with multi-PLC

1. Purpose

Monitor three PLCs state via the simple SCADA in the control room.

2. Device

ltem	Quantity	Function	
Xinje PLC 3		Terminal equipment	
Z-BOX	1 Coordinator, build the network		
XC-ZBOX-BD 3		Router, add the network	
PC	1	To run the simple SCADA, monitor the terminal equipment	

3. Network



4. Steps

(1) Connect PLC master with PC, open the XCPpro software

(2) Click configure/PLC comm port setting in the menu. Click "read from PLC" in below window. Then select "serial port 3" and Modbus Num 1. Then click "write to PLC". Click "BD" in the left list.

PLC1 - Serial Port Set	×
PLC 1 - Serial Port Set	Serial Port 3 Communication Mode • Modbus Num 1 • C User Protocol Overtime Set (ms) Char: 3 Reply: 300 Serial Port User Protocol Baudrate: 19200 BPS Databits: 8Bit Stopbits: 1Bit Parity: Even Notice:configuration effective, reboot PLC
Read From PLC	Write To PLC OK Cancel

Select "BD serial port"---"OK". Then download empty program to the PLC. At last, re-power on the PLC.

PLC1 - BD Set		×
PLC Config Password PLC Serial Port BD CAN An CAN Module Ifo I/O COL MA Module M Motion	BD Config(write to PLC when downloading) BD © No Config © BD Serial Port © Other BD BD-2AD2PT-P BD-2AD2PT1DA-P BD-2AD2PT1DA-P BD-2AD2PT1DA-P BD-2AD2PT-P-BD2 XP-3AD3PT-P-BD2 XP-3AD2DA-P-BD2 XP-3ATC-P-BD2 XP-3TC-P-BD2	
	Read From PLC	OK Cancel

The steps are the same for setting PLC slave 1 and 2. But please note PLC slave 1 Modbus Num is 2. PLC slave 2 Modbus Num is 3.

PLC1 - Serial Port Set	×
PLC Config Password PLC Serial Port BD CAN CAN CAN Module TO I/O MA Module M Motion	Serial Port 3 Communication Mode 2 for PLC slave 1 Modbus Num C User Protocol 3 for PLC slave 2 Overtime Set (ms) Char : 3 Reply : 300 Serial Port User Protocol 3 Baudrate: 19200 BPS Image: Complex in the set i
Read From PLC	Write To PLC OK Cancel

(3) Configure the ZBOX module

Connect ZBOX with PC, set the switch as below:



Z-BOX is the coordinator in PC mode. If the signal is too weak, the communication will not have packet error rate but delay. If signal LED doesn't light, please adjust the antenna position.

Z-BOX application in different mode:

Working mode	Switch setting	Function	ACT state from power on to succeed
PC mode	OFF ON 1 2	Coordinator	ACT flickers 1time/s → ACT always lights after networking succeed
	OFF ON 1 2	Router	ACT flickers 3time/s → ACT always lights after adding network succeed
PLC mode	OFF ON 1 2	Coordinator	ACT flickers 1time/s → ACT always lights after networking succeed. Then ACT flickers 50time/s after 5s → read PLC BD serial port station no., ACT always lights after succeed.
	OFF ON 1 2	Router	ACT flickers 3 time/s \rightarrow ACT always lights after adding network succeed. Then ACT flickers 50 time/s after $5s \rightarrow$ read PLC BD serial port station no., ACT always lights after succeed.

(4) Configure ZBOX-BD

A. Turn on switch 1 of the 3 ZBOX-BD



B. Install the 3 ZBOX-BDs on the 3 PLCs, power on them.

(5) Run the simple SCADA, the screen is as the following:







PLC slave 2

Note: the SCADA function please refer to TH series HMI manual.

5-2. Distributed control system

Distributed control system remote-monitors the equipment by wireless network. It has simple network distribution, easy management and cost-saving.

1. Purpose

Remote-monitor the PLC state, upload/download program, deal with the alarm and backup the data.

2.	Device

Item	Quantity	Function
Xinje PLC	6	Terminal device
Z-BOX module	6	Coordinator, build the network
XC-ZBOX-BD	6	Router, add the network
T-BOX module	3	Transfer the data of ZBOX
PC	4	Run SCADA to monitor the terminal device

3. Network



4. Steps

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- Workshop 1 configuration
- (1) Connect PLC1 of workshop 1 with PC, open XCPpro software.

(2) Configure ZBOX-BD, please refer to chapter 3-2.

The modbus station no. is 1 for PLC1, 2 for PLC2.

(3) Configure ZBOX 1

Connect ZBOX1 of office 1 with PC, set DIP switch as below: working mode is PC



(4) Configure ZBOX 2

Connect ZBOX2 of office 1 with TBOX, set DIP switch as below: working mode is PC



- (5) Configure ZBOX-BD in workshop1
- A. set DIP switch of the 2 XC-ZBOX-BDs as below:



- B. Install the 2 XC-ZBOX-BDs on PLC1 and PLC2, power on the PLCs.
- (6) Configure the TBOX in office1

Connect TBOX with PC, open XCPpro software. Click option/Ethernet module settings in the menu.

	TCP_IP Device(Green:Device table,network exist <mark>Click this</mark> e table exist,network not exist,					
A	Add TBOX Add GBOX Edit Delete Refresh List Import Export					
		Name	IP	Mask	DNS	Port
۰.	1	TBOX1	192.168.0.9	255.255.255.0	192.168.0.1	502
	double click this					

Edit TBOX Device			2
Communication Master/Client TBOX Comment			
Master Mode		Client Mode]
Protocol: UDP		Send Delay(ms): 0	
Station-IP Table	Shield Table	Station Table	
tatio IP	Station Num	Station Num	
	2	2	

Note: the details please refer to TBOX manual.

(7) Office1 SCADA screen:

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The steps of workshop2 and 3 please refer to workshop1. The final SCADA is as below:



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6Q&A

Q1: what's the difference between coordinator and router?

- A1: the main task of coordinator is to build a virtual personal network. ZBOX and ZBOX-BD can set to coordinator or router by DIP switch. The router can expand the network. It needs to exist in LAN. One LAN can have only one coordinator but many routers. If ZBOX is set to coordinator, ACT will flicker 1time/s when networking and always light after succeed. If ZBOX is set to router, ACT will flicker 3time/s when add the network and always light after succeed.
- Q2: ACT always flickers 1time/s when ZBOX is set to coordinator. Does it mean the network cannot be built?
- A2: (1) the interference is serious, such as wireless router, microwave (2) DIP switch 1 is broken
- Q3: Router cannot be added to the network node.
- A3: (1) Each network node has depth (the default value is 6, cannot be modified). That's mean each node can add 6 sub-nodes. If sub-node cannot be added, the node depth is full. The solution is re-power on the node to lost the node information.
 - (2) the node is not in the network coverage area. Please adjust the node position.

Q4: XC-ZBOX –BD, XP3-ZBOX-BD, Z-BOX (PLC mode) cannot read the station no.

- A4: (1) PLC serial port and BD are not configured. Please refer to chapter 3-2.
 - (2) the serial port program of PLC has short communication period, the port is occupied frequently, cannot communicate with XC-ZBOX-BD, XP3-ZBOX-BD or Z-BOX.
- Q5: Use two coordinators in the place, the node cannot communicate with each other.
- A5: (1) Confirm the ZBOX or ZBOX-BD start normally. Refer to chapter 2-1 and 3-1.(2) Confirm the nodes are in the same network. The nodes in different network cannot communicate with each other.
- Q6: the two nodes are in different floors, the communication is overtime or breakdown.
- A6: (1) one of the node is in the weak signal area, please add repeater between them.
 - (2) the object in the space will block the signal, please use wall-mount antenna. Refer to chapter 4-3, 4-4.



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