

ZBlinx-Z series

User Guide

Version 0.0.1

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User Guide for the ZBlinx-Z series

Version 0.0.1

Firmware version 1.0.X

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Notice to Users

When a system failure may cause serious consequences, protecting life and property against such consequences with a backup system or safety device is essential. The user agrees that protection against consequences resulting from system failure is the user's responsibility.

This device is not approved for life-support or medical systems.

Changes or modifications to this device not explicitly approved by SENA Technologies will void the user's authority to operate this device.

Precautions and Safety

Electricity

Use only the supplied AC adapter. Use of unauthorized power adapter is not recommended. Electrical shock may result.

Do not kink or crease the power cable or place heavy objects on the power cable. Fire can result from damaged power cables.

Do not handle power plug and adapter with wet hands. Electrical shock may result.

Immediately power off the product and unplug the AC adapter if smoke or odors emit from the product and adapter. Fire can result from improper use.

Immediately power off the product and unplug the AC adapter if water or other liquids are present. Fire can result from improper use.

Product

ZBlinx-Z meets the RS-232 standards. Do not wire with non-standard products. Damage to your products may result from improper use.

Do not drop or subject the device to impact. Damage to your products may result from improper use.

Keep away from harsh environments including humid, dusty, and smoky areas. Damage to your products may result from improper use.

Do not use excessive force on the buttons or attempt to disassemble the device. Damage to your products may result from improper use.

Do not place heavy objects on the product. Damage to your products may result from improper use.

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1. Introduction

1.1. Overview

ZBlinx Z series are a module device for "wireless personal-area networks," or WPANs using ZigBee technology that is an IEEE 802.15.4 standard for data communications with business and consumer devices. ZBlinx Z series combine IEEE 802.15.4, which defines the physical and MAC protocol layers, with network, security and application software layers as specified by the ZigBee Alliance, a consortium of technology companies. ZBlinx Z series run in the 2.4-GHz unlicensed frequency band, and both use small form factors and low power. ZBlinx Z series can communicate with other ZigBee devices that support the ZigBee2007 Pro stack profile. ZBlinx Z series has a compact design and can be placed conveniently into devices or equipment. Its detachable antenna optimizes the quality and distance for wireless communications. ZBlinx Z series lineup has several models with different communication type as below.

- **ZBlinx-ZE10:** ZigBee embedded OEM module, long distance
- **ZBlinx-ZS10:** ZigBee-RS232 adapter, long distance
- **ZBlinx-ZU10:** ZigBee-USB adapter, long distance
- **ZBlinx-ZE10SK:** ZigBee embedded OEM module starter kit, ZE10 included.

ZBlinx-Z series support DSSS (Direct Sequence Spread Spectrum), which divides the 2.410 - 2.475 GHz spectrum into 14 channels. ZBlinx-Z series also supports authentication and 128 bit ZigBee AES encryption algorithms. ZBlinx Z series can be configured and controlled by typical AT commands. Users can easily configure ZBlinx-Z series by using a terminal program such as HyperTerminal and can use ZigBee wireless communication without modifying user's existing serial communication program. In addition to the basic AT commands, ZBlinx-Z series provides some expanded AT commands for various functions.

1.2. Product Specification

	ZBlinx-Z series		
	ZE10	ZS10	ZU10
Product type	Embedded module	Serial Adapter	USB Adapter
Interface	2.00mm, pin header 14x2	D-SUB9, Female	USB 'A', Male
ZigBee Stack	ZigBee 2007 Pro	ZigBee 2007 Pro	ZigBee 2007 Pro
Frequency range	2.410~2.475GHz	2.410~2.475GHz	2.410~2.475GHz
Channel space	5MHz	5MHz	5MHz
Channel number	14ch	14ch	14ch
TX Power	+13dBm	+13dBm	+10dBm
RX Sensitivity	-100dBm at 1% BER	-100dBm at 1% BER	-100dBm at 1% BER
RF connector	RPSMA, COAX, CHIP, WHIP	RPSMA	RPSMA
Antenna type	Dipole 5.37 dBi	Dipole 5.37 dBi	Dipole 5.37 dBi
	Dipole 3.27 dBi	Dipole 3.27 dBi	Dipole 3.27 dBi
	Dipole 1.40dBi	Dipole 1.40dBi	Dipole 1.40dBi
	Whip ANT 2.1 dBi		
	Chip ANT 0.5dBi		
Power	+3.3V	+5~12V	+5V USB power
Battery pack	None	Lithium polymer +3.7V	None
Environmental	-30 ~ 80°C, 95%	-30 ~ 80°C, 95%	-30 ~ 80°C, 95%
Configuration	AT command set	AT command set	AT command set
Dimension	23 x 37 x 11.15mm	68 x 31 x 16mm	68 x 22 x 10mm
Weight	10g	24g	12g
Approvals	FCC, CE,TELEC, KCC	FCC, CE,TELEC, KCC	FCC, CE,TELEC, KCC
Warranty	1-year limited warranty	1-year limited warranty	1-year limited warranty

2. Approval Information

2.1. FCC

2.1.1. FCC Information to User

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution

Modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

2.1.2. FCC Compliance Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received,

Including interference that may cause undesired operation

2.1.3. RF Exposure Statement

The equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This device and its antenna must not be co-located or operation in conjunction with any other antenna or transmitter.

2.1.4. Do not

Any changes or modifications to the equipment not expressly approved by the party responsible for compliance could void user's authority to operate the equipment.

2.2. CE

2.2.1. EC-R&TTE Directive

2.3. TELECOM

2.4. KCC

3. RF Information

3.1. Radio Frequency Range

2410~2475MHz

3.2. Number of Frequency Channel

14 channels

3.3. Transmission Method

DSSS (Direct Sequence Spread Spectrum)

3.4. Modulation Method

O-QPSK (Offset Quadrature Phase Shift Keying)

3.5. Radio Output Power

+13dBm

3.6. Receiving Sensitivity

-100dBm

4. AT Command

4.1. Overview

This document contains a description of the AT commands supported in the ZBlinx-Z Series. It also contains information on how to use the AT commands to create Zigbee applications.

4.2. Command Line Format

Each command line sent to ZBlinx-Z Series is composed of a prefix, body and terminator. Only “AT” can be used for the prefix. The body is a string of characters. The terminator is <CR> or <NL>. A command can be one of following:

- Read a configuration parameter:

```
AT<Command>?<CR>
```

- Do something:

```
AT<Command><CR>
```

- Write a configuration parameter:

```
AT<Command>=<Parameter 1>,<Parameter 2>,<Parameter 3>,...<CR>
```

Commands denoted with a “+” character are extended AT commands.

S-registers are not supported. Multiple commands in the same command line are not supported.

4.3. Standard AT Commands

4.3.1. AT

Description	Check the state of the connection between host and ZBlinx-Z device.
Response	OK<CR>

4.3.2. ATA

Description	Answer incoming call.
Response	CONNECT<CR>

4.3.3. ATD<node ID or IEEE address>

Description	Dial the node ID or IEEE address.
Response	CONNECT<CR>, BUSY<CR>, NO CARRIER<CR> or ERROR<CR>

4.3.4. ATE<0 or 1>

Description	Echo or No Echo.
Response	OK<CR>

4.3.5. ATH

Description	Hang up the current call.
Response	NO CARRIER<CR>

4.3.6. ATO

Description	Return to data mode.
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Response	
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4.3.7. AT<0 or 40>

Description	Get/Set the S-registers. (S0: number of rings before auto-answer (under 10), S40: determine throughput (This is the same with the value of data transport mode))
Example	ATS0=3<CR> OK<CR> ATS40?<CR> 1<CR> OK<CR>

4.3.8. ATZ

Description	Reset the node. (initialize current network status)
Response	OK<CR>

4.3.9. AT&F

Description	Factory reset. (initialize cookies)
Response	OK<CR>

4.3.10. +++

Description	Interrupt data mode.
Response	OK<CR>

4.4. Extended AT Commands

4.4.1. AT+EUI?

Description	Get the 64-bit EUI address. (IEEE address, long address)
Response	000D6F0000488434<CR> OK<CR>

4.4.2. AT+DESTEUI

Description	Get/Set the 64-bit destination EUI address for data transmission. (pairing, point-to-point and send GPIO values)
Example	AT+DESTEUI=000D6F000048842F<CR> OK<CR> AT+DESTEUI?<CR> 000D6F000048842F<CR> OK<CR>

4.4.3. AT+NODEID?

Description	Get the 16-bit node ID. (network address, short address) The only coordinator has a fixed value (0x0000) and other device types are assigned at random.
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Response	1E9C<CR> OK<CR>
-----------------	--------------------

4.4.4. AT+CH

Description	Get/Set the channel mask to use. Bits set as 1 indicate that this particular channel can be used. Bits set as 0 indicate that this particular channel should not be used. For example, a channel mask value of 0x00000001 indicates that only channel 0 should be used. Valid channels range from 11 to 26 inclusive. This translates to a channel mask value of 0x07FFF800.
Example	AT+CH=7FFF800<CR> OK<CR> AT+CH?<CR> 07FFF800<CR> OK<CR>

4.4.5. AT+PANID

Description	Get/Set the 16-bit PAN ID.
Example	AT+PANID=ABCD<CR> OK<CR> AT+PANID?<CR> ABCD<CR> OK<CR>

4.4.6. AT+EPID

Description	Get/Set the 64-bit extended PAN ID.
Example	AT+EPID=0123456789ABCDEF<CR> OK<CR> AT+EPID?<CR> 0123456789ABCDEF<CR> OK<CR>

4.4.7. AT+POWER

Description	Get/Set the TX power. (-43~3)
Example	AT+POWER=3<CR> OK<CR> AT+POWER?<CR> 3<CR> OK<CR>

4.4.8. AT+GROUPID

Description	Get/Set the 16-bit Group ID.
--------------------	------------------------------

Example	AT+GROUPID=ABCD<CR> OK<CR> AT+GROUPID?<CR> ABCD<CR> OK<CR>
----------------	--

4.4.9. AT+DESTGROUPID

Description	Get/Set the 16-bit destination Group ID for data transmission. (group network)
Example	AT+DESTGROUPID=ABCD<CR> OK<CR> AT+DESTGROUPID?<CR> ABCD<CR> OK<CR>

4.4.10. AT+INFO

Description	Show the current information of this node.
Response	<i>Information of this node</i> ... OK<CR>

4.4.11. AT+SCAN

Description	Perform a scanning for joinable network.
Response	<i>List of the joinable networks</i> ... OK<CR>

4.4.12. AT+ASCAN

Description	Perform a scanning for existing network.
Response	<i>List of the existing networks</i> ... OK<CR>

4.4.13. AT+ESCAN

Description	Perform a scanning for energy level of each channel.
Response	<i>List of the RSSI for each channel</i> ... OK<CR>

4.4.14. AT+FORM

Description	Form a network. If there's no specified channel mask or PAN ID, it does an energy scan on the indicated channel mask and randomly chooses one from amongst those with the least average energy. Then picks a short PAN id that does not appear during an active scan on the chosen channel. At this time extended PAN ID is alternated for
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	EUI address if it isn't designated before.
Response	OK<CR>

4.4.15. AT+PERMIT

Description	Permit other nodes to join the network. (0~254s, 255=continuance)
Response	OK<CR>

4.4.16. AT+JOIN

Description	Join a network using the specified network parameters.
Response	OK<CR>

4.4.17. AT+LEAVE

Description	Leave the current network.
Response	OK<CR>

4.4.18. AT+SLEEP

Description	Sleep mode only for end-device. (0: none-sleep, 1: sleep and wake up periodically and possible to transmit data, 2: similar to mode 1 but can deep-sleep if there's no data transmission quite a while, 3: deep-sleep)
Response	<i>Information of this node</i> ... OK<CR>

4.4.19. AT+NODETYPE

Description	Get/Set the node type. (0: none, 1: coordinator, 2: router, 3: end-device) It's applied after resetting the node.
Example	AT+NODETYPE=1<CR> OK<CR> AT+NODETYPE?<CR> 1<CR> OK<CR>

4.4.20. AT+LISTEN

Description	Get/Set the listen mode to receive a message or GPIO value from the network. It is presented by a form of "+(or ++ when GPIO) <i>EUI address of sender message</i> ".
Example	AT+LISTEN=1<CR> OK<CR> AT+LISTEN?<CR> 1<CR> OK<CR>

4.4.21. AT+OPMODE

Description	Get/Set the operation mode. (0: none, 1: pairing, 2: unicast, 3: multicast, 4:
--------------------	--

	broadcast) It's applied after resetting the node.
Example	AT+OPMODE=1<CR> OK<CR> AT+OPMODE=?<CR> 1<CR> OK<CR>

4.4.22. AT+DATAMODE

Description	Get/Set the data transport mode. (0: no data loss, 1~3: optimized for thruput, 4: maximized thruput)
Example	AT+DATAMODE=1<CR> OK<CR> AT+DATAMODE?<CR> 1<CR> OK<CR>

4.4.23. AT+UNICAST

Description	Send unicast message to specific node using EUI address or node ID.
Example	AT+UNICAST=000D6F000048842F,send_unicast_MSG<CR> OK<CR>

4.4.24. AT+MULTICAST

Description	Send multicast message to specific group. Every node belongs to a group after being booted up if it is designated a group ID. (default: 0x0000)
Example	AT+MULTICAST=ABCD,send_multicast_MSG<CR> OK<CR>

4.4.25. AT+BROADCAST

Description	Send broadcast message to the all nodes joining the network.
Example	AT+BROADCAST=send_broadcast_MSG<CR> OK<CR>

4.4.26. AT+REMOTECONFIG

Description	Remote control the configuration of specific node by sending unicast command message. It is possible to get or set the configuration status of the node joined current network.
Example	AT+REMOTECONFIG<CR> <i>Possible command list</i> ... OK<CR> AT+REMOTECONFIG=000D6F000048842F,AT command<CR> OK<CR>

4.4.27. AT+TIMEOUT

Description	Get/Set the time out for data transmission. (ms)
Example	AT+TIMEOUT=100<CR> OK<CR> AT+TIMEOUT?<CR> 100<CR> OK<CR>

4.4.28. AT+PERIOD

Description	Get/Set the period to send GPIO values. (250*t ms) Every node sends GPIO values to the destination EUI address periodically and it can be read listen mode.
Example	AT+PERIOD=10<CR> OK<CR> AT+PERIOD?<CR> 10<CR> OK<CR>

4.4.29. AT+GPIO

Description	Get/Set the configuration status of GPIO individually or all at once. It's applied after resetting the node.
Example	AT+GPIO0=1<CR> OK<CR> AT+GPIO?<CR> 11000440002200 <CR> OK<CR>

4.4.30. AT+DIO

Description	Get/Set the digital IO value individually or all at once. All GPIO pins can be used as digital IO and it is only possible to set 0 or 1. If there are some pins used analog input, they are displayed by "*".
Example	AT+DIO0=1<CR> OK<CR> AT+DIO?<CR> 00011**0101111 <CR> OK<CR>

4.4.31. AT+ADC

Description	Get the analog input value individually or all at once. GPIO3~6 are possible to set ADC and it's read only.
Response	<i>The analog input value of the ADC</i>

	OK<CR>
--	--------

4.4.32. AT+BAUD

Description	Get/Set the serial port speed.
Example	AT+BAUD=115200<CR> OK<CR> AT+BAUD?<CR> 115200<CR> OK<CR>

4.4.33. AT+DATABIT

Description	Get/Set the data bit of serial port.
Example	AT+DATABIT=8<CR> OK<CR> AT+DATABIT?<CR> 8<CR> OK<CR>

4.4.34. AT+PARITY

Description	Get/Set the parity of serial port.
Example	AT+DATABIT=8<CR> OK<CR> AT+DATABIT?<CR> 8<CR> OK<CR>

4.4.35. AT+STOPBIT

Description	Get/Set the stop bit of serial port.
Example	AT+STOPBIT=1<CR> OK<CR> AT+STOPBIT?<CR> 1<CR> OK<CR>

4.4.36. AT+FLOWCTRL

Description	Get/Set flow control status. (0: none, 1: software, 2: hardware flow control)
Example	AT+FLOWCTRL=0<CR> OK<CR> AT+FLOWCTRL?<CR> 0<CR>

	OK<CR>
--	--------

4.4.37. AT+SECURITY

Description	Get/Set the security status. (0: turning security off, 5: on) Every node must be under the same security level in the network and it's applied after resetting the node.
Example	AT+SECURITY=5<CR> OK<CR> AT+SECURITY?<CR> 5<CR> OK<CR>

4.4.38. AT+NWKEY

Description	Get/Set the 128-bit encryption key. (possible to set only for coordinator, 0: generate random 128-bit number)
Example	AT+NWKEY=0123456789ABCDEF0123456789ABCDEF<CR> OK<CR> AT+NWKEY?<CR> 0123456789ABCDEF0123456789ABCDEF <CR> OK<CR>

4.4.39. AT+SWITCHKEY

Description	Switch the encryption key for current network only for coordinator.
Response	OK<CR>

4.4.40. AT+BOOTLOAD

Description	Start bootloader to perform firmware upgrade.
Response	EM250 Bootloader v20 b09 1. upload ebl 2. run 3. ebl info BL >

4.4.41. AT+HELP

Description	Show all the available commands
Response	<i>Available AT Commands</i> ... OK<CR>

5. GPIO Configuration

5.1. GPIO Configuration

Module		Configuration		
GPIO	Pin number	Configured GPIO	Specific functionality	ADC enable
0	4	-	Factory reset (SW0)	X
1	6	0	ZC or ZR: Permit joining ZED: Wake-up (SW1)	X
2	5	1	ZB status: ZC/ZR/ZED (LED0)	X
3	3	2	ZB status: data transmission (LED1)	X
4	11	3		O (ADC0)
5	10	4		O (ADC1)
6	8	5	Set baud rate 1 (DIPSW0)	O (ADC2)
7	7	6	Set baud rate 2 (DIPSW1)	O (ADC3)
8	? <i>(unconnected)</i>	7	Set baud rate 3 (DIPSW2)	X
9	22	-	UART_TXD (LED2)	X
10	23	-	UART_RXD (LED2)	X
11	21	8	UART_CTS	X
12	20	9	UART_RTS	X
13	24	10	UART_DTR	X
14	25	11	UART_DSR	X
15	26	12		X
16	19	13	Set baud rate 4 (DIPSW3)	X

5.2. GPIO Setting

- 0 disabled (unmonitored digital input)
- 1 Digital input, monitored
- 2 Digital output, default low
- 3 Digital output, default high
- 4 Analog input, single ended (A/D pins only)
- 5 Reserved for pin-specific alternate functionalities