ZT-2000 DIO SERIES

User Manual

Warranty

All products manufactured by ICP DAS are under warranty regarding defective materials for a period of one year, beginning from the date of delivery to the original purchaser.

Warning

ICP DAS assumes no liability for any damage resulting from the use of this product. ICP DAS reserves the right to change this manual at any time without notice. The information furnished by ICP DAS is believed to be accurate and reliable. However, no responsibility is assumed by ICP DAS for its use, nor for any infringements of patents or other rights of third parties resulting from its use.

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Trademarks

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Technology Support

If you have any problems, please feel free to contact us via email at service@icpdas.com.

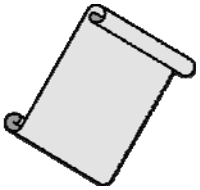
Table of Contents

What's in the Shipping Package?

The shipping package contains the following items:

ZT-2000 DIO Module

ANT-124-05



Quick Start

If any of these items are missing or damaged, please contact your local distributor for more information. Save the shipping materials and cartons in case you need to ship the module in the future.

More Information

- Documentation:

  CD: \Napdos\ZigBee\ZT_Series\Document
  http://ftp.icpdas.com/pub/cd/usbcd/napdos/zigbee/zt_series/document

- Software:

  CD: \Napdos\ZigBee\ZT_Series\Utility
  http://ftp.icpdas.com/pub/cd/usbcd/napdos/zigbee/zt_series/utility

1 Introduction

1.1 Introduction to ZigBee

ZigBee is a specification for a suite of high-level communication protocols using small, low-power digital radios based on the IEEE 802.15.4 standard for personal area networks. ZigBee devices are often used in mesh network form to transmit data over longer distances, passing data through intermediate devices to reach more distant ones. This allows ZigBee networks to be formed ad-hoc, with no centralized control or high-power transmitter/receiver able to reach all of the devices. Any ZigBee device can be tasked with running the network.

ZigBee is targeted at applications that require a low data rate, long battery life, and secure networking. ZigBee has a defined rate of 250 kbit/s, best suited for periodic or intermittent data transmission or a single signal transmission from a sensor or input device. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that requires short-range wireless transfer of data at relatively low rates. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs.

1.2 Introduction to the ZT-2000 DIO Series

ZT-2000 I/O series devices are small wireless ZigBee I/O modules based on the IEEE802.15.4 standard that allow data acqusition and control via personal area ZigBee networks. They provide digital input/output, timer/counter and other functions. These modules can be remotely controlled using a set of DCON or Modbus RTU commands. The DIO modules support TTL signals, photo-isolated digital input, relay contact output, solid-state relay output, PhotoMOS output and open-collector output. See Sec. 2.1 for more detailed information.

ZT-2000 I/O series is a wireless data acquisition-based client/server system. Accordingly, a Net Server for the ZigBee (ZT-2570/ZT-2550) is essential in such systems. So, if there is any configuration issue of ZigBee coordinator, please refer to the “ZT-25XX ZigBee Converter Quick Start“ document for more information, which can be found at the following link:

http://ftp.icpdas.com/pub/cd/usbcd/napdos/zigbee/zt_series/document/

1.3 Introduction to the ZT-2042

The ZT-2042 offers 4 PhotoMOS relay output channels and 4 sink-type digital output channels with short circuit protection. Each channel features photo couple isolation. The ZT-2042 has 8 LED indicators to display the DO channel status. 4kV ESD protection and 3000 V_{DC} intra-module isolation are the standard. Users can easily configure the module address, protocol, checksum, ZB-PID and ZB-channel settings using a combination of rotary and DIP switches.

1.4 Introduction to the ZT-2043

The ZT-2043 offers 14 sink type digital output channels with short circuit protection. All channels feature photo-couple isolation. The ZT-2043 includes 14 LED indicators to display the DO channel status. 4 kV ESD protection and 3750 V_{DC} intra-module isolation are the standard. Users can easily configure the module address, protocol, checksum, ZB-PID and ZB-channel settings using a combination of rotary and DIP switches.

1.5 Introduction to the ZT-2052

The ZT-2052 offers 8 digital input channels, each of which features photocouple isolation. In addition, you can choose either sink-type or sourcetype input via wire connections. All channels are able to be used as 16-bit counters. The ZT-2052 has 8 LED indicators to display the channel status and also includes 4 kV ESD protection and 3000 V_{DC} intra-module isolation. Users can easily configure the module address, protocol, checksum, ZB-PID and ZB-channel settings using a combination of rotary and DIP switches.

1.6 Introduction to the ZT-2053

The ZT-2053 offers 14 digital input channels which can be used for either dry or wet contact. Its effective distance for dry contact is up to 500 meters. All channels are able to be used as 16-bit counters. The ZT-2053 includes 14 LED indicators to display the channel status as well as 4 kV ESD protection and 3750 V_{rms} intra-module isolation. Users can easily to configure the module address, protocol, checksum, ZB-PID and ZB-channel settings using a combination of rotary and DIP switches.

1.7 Introduction to the ZT-2055

The ZT-2055 offers 8 isolated channels for digital input and 8 isolated channels for digital output. Either sink-type or source-type digital input can be selected via wire connections. All digital input channels are also able to be used as 16-bit counters. The ZT-2055 supports source-type output with short circuit protection. There are options to enable both power-on and safe values. The ZT-2055 has 16 LED indicators to display the channel status, and has 4 kV ESD protection and 2500 V_{DC} intra-module isolation. Users can easily confi gure the module address, protocol, checksum, ZB-PID and ZBchannel settings using a combination of rotary and DIP switches.

1.8 Introduction to the ZT-2060

The ZT-2060 offers 4 Form A power relay output channels and 6 digital input channels, each of which features photocouple isolation. In addition, you can choose sink-type or source-type input via wire connections. All channels are able to be used as 16-bit counters. The ZT-2060 has 10 LED indicators to display the channel status, and has 4 kV ESD protection and 3000 V_{DC} intramodule isolation. Users can easily configure the module address, protocol, checksum, ZB-PID and ZB-channel settings using a combination of rotary and DIP switches.

2 Information to the Hardware

2.1 Specifications

➢ Specifications to ZigBee

Wireless	
RF Channels	16
RF Transmit Power	11 dBm
Antenna (2.4 GHz)	5 dBi Omni-directional Antenna
Transmit Range (LOS)	700 m (Typical)
Max. Slaves Supported	255
EMI Certification	CE/FCC, FCC ID

➢ Specifications to ZT-2000 Series Module Board

Gernal	
Protocols	Supports DCON and Modbus RTU Protocols
Hot Swap	Rotary and DIP switch
EMS Protection	
ESD (IEC 61000-4-2)	±4 kV Contact for each Terminal
EFT (IEC 61000-4-4)	±4 kV for Power Line
Surge (IEC 61000-4-5)	±3 kV for Power Line
Mechanical	
Flammability	Fire Retardant Materials (UL94-V0 Level)
Dimensions (W x L x H)	33 mm x 87 mm x 110 mm
Installation	DIN-Rail
Environment	
Operating Temperature	-25 to 75 °C
Storage Temperature	-30 to 80 °C
Relative Humidity	10 ~ 90% RH, Non-condensing

➢ Specifications to the ZT-2042

Relay Output	
Output Channels	4
Output Type	PhotoMOS Relay, Form A
Load Voltage	60 V_{DC} / V_{AC}
Max. Load Current	60 V/1.0 A Operating Temperature: -25 °C ~ +40 °C
	60 V/0.8 A Operating Temperature: +40 °C ~ +60 °C
	60 V/0.7 A Operating Temperature: +60 °C ~ +75 °C
Power-on Time	5.0 ms
Power-off Time	0.5 ms

Digital Output	
Channels	4 (Sink)
Output Type	Isolated Open Collector
Max. Load Current	700 mA/channel
Load Voltage	+5 V_{DC} ~ +50 V_{DC}
External Power Reversed Protection and Short Circuit Protection	Yes
Current Limited Protection	1.1 A

Gernal		
LED Indicator	PWR	1 Red LED, ZigBee Device Power Indicator
	ZigBee	1 Green LED, ZigBee Communication Indicator
	DO0 ~ DO7	8 Red LED, Digital Output Channel Indicators
Power		
Input Voltage Range		+10 V_{DC} ~ +30 V_{DC}
Power consumption		1.32W (Max.)
Intra-module Isolated, Field-to-Logic		3000 V_{DC}

※Please see other specifications to the “Specifications to ZigBee“ and “Specifications to ZT-2000 Series Module Board” topics at the section 2.1.

➢ Specifications to the ZT-2043

Digital Output	
Channels	14 (Sink)
Output Type	Isolated Open Collector
Max. Load Current	700 mA/channel
Load Voltage	+5 V_{DC} ~ +50 V_{DC}
External Power Reversed Protection and Short Circuit Protection	Yes
Current Limited Protection	1.1 A

Gernal		
LED Indicator	PWR	1 Red LED, ZigBee Device Power Indicator
	ZigBee	1 Green LED, ZigBee Communication Indicator
	DO0 ~ DO13	14 Green LED, Digital Output Channel Indicators
Power		
Input Voltage Range		+10 V_{DC} ~ +30 V_{DC}
Power consumption		0.84W (Max.)
Intra-module Isolated, Field-to-Logic		3750 V_{DC}

※Please see other specifications to the "Specifications to ZigBee" and "Specifications to ZT-2000 Series Module Board" topics at the section 2.1.

➢ Specifications to the ZT-2052

Digital Input		
Channels		8
Wet Contact	Type	Sink/Source
	ON Voltage Level	+3.5 V_{DC} ~ +30 V_{DC}
	OFF Voltage Level	+1 V_{DC} Max.
Counters	Max. Count	16-bit (65535)
	Max. Input Frequency	100 Hz
	Min. Pulse Width	5 ms
Input Impedance		3 kΩ, 0.33 W

Gernal		
LED Indicator	PWR	1 Red LED, ZigBee Device Power Indicator
	ZigBee	1 Green LED, ZigBee Communication Indicator
	DI0 ~ DI7	8 Green LED, Digital Input Channel Indicators
Power		
Input Voltage Range		+10 V_{DC} ~ +30 V_{DC}
Power consumption		1 W (Max.)
Intra-module Isolated, Field-to-Logic		3750 V_{rms}

※Please see other specifications to the "Specifications to ZigBee" and "Specifications to ZT-2000 Series Module Board" topics at the section 2.1.

➢ Specifications to the ZT-2053

Digital Input		
Channels		14
Dry Contact	Type	Sink
	ON Voltage Level	Close to GND
	OFF Voltage Level	Open
	Effective Distance for Dry Contact	500 m Max.
Wet Contact	Type	Sink/Source
	ON Voltage Level	+3.5 V_{DC} ~ +30 V_{DC}
	OFF Voltage Level	+1 V_{DC} Max.
Counters	Max. Count	16-bit (65535)
	Max. Input Frequency	100 Hz
	Min. Pulse Width	5 ms
Input Impedance		3 kΩ, 0.33 W

Gernal		
LED Indicator	PWR	1 Red LED, ZigBee Device Power Indicator
	ZigBee	1 Green LED, ZigBee Communication Indicator
	DI0 ~ DI13	14 Green LED, Digital Input Channel Indicators
Power		
Input Voltage Range		+10 V_{DC} ~ +30 V_{DC}
Power consumption		0.72 W (Max.)
Intra-module Isolated, Field-to-Logic		3750 V_{DC}

※Please see other specifications to the “Specifications to ZigBee“ and “Specifications to ZT-2000 Series Module Board” topics at the section 2.1.

➢ Specifications to the ZT-2055

Digital Input		
Channels		8
Dry Contact	Type	Source
	ON Voltage Level	Close to GND
	OFF Voltage Level	Open
	Effective Distance for Dry Contact	500 meters Max.
Wet Contact	Type	Sink/Source
	ON Voltage Level	+10 V_{DC} ~ +50 V_{DC}
	OFF Voltage Level	+4 V_{DC} Max.
Counters	Max. Count	16-bit (65535)
	Max. Input Frequency	100 Hz
	Min. Pulse Width	5 ms
Input Impedance		10 kΩ
Overvoltage Protection		±70 V_{DC}

Digital Output	
Channels	8 (Sink)
Output Type	Isolated Open Collector
Max. Load Current	700 mA/channel
Load Voltage	+3.5 V_{DC} ~ +50 V_{DC}
Overvoltage Protection	60 V_{DC}
Overload Protection	1.4 A (with short-circuit protection)

Gernal		
LED Indicator	PWR	1 Red LED, ZigBee Device Power Indicator
	ZigBee	1 Green LED, ZigBee Communication Indicator
	DO0 ~ DO7	8 Red LED, Digital Output Channel Indicators
	DI0 ~ DI7	8 Green LED, Digital Input Channel Indicators
Power		
Input Voltage Range		+10 V_{DC} ~ +30 V_{DC}
Power consumption		2.5 W (Max.)
Intra-module Isolated, Field-to-Logic		2500 V_{DC}

※Please see other specifications to the "Specifications to ZigBee" and "Specifications to ZT-2000 Series Module Board" topics at the section 2.1.

➢ Specifications to the ZT-2060

Digital Input		
Channels		6
Wet Contact	Type	Sink/Source
	ON Voltage Level	+3.5 V_{DC} ~ +30 V_{DC}
	OFF Voltage Level	+1 V_{DC} Max.
Counters	Max. Count	16-bit (65535)
	Max. Input Frequency	100 Hz
	Min. Pulse Width	5 ms
Input Impedance		3 kΩ, 0.33 W

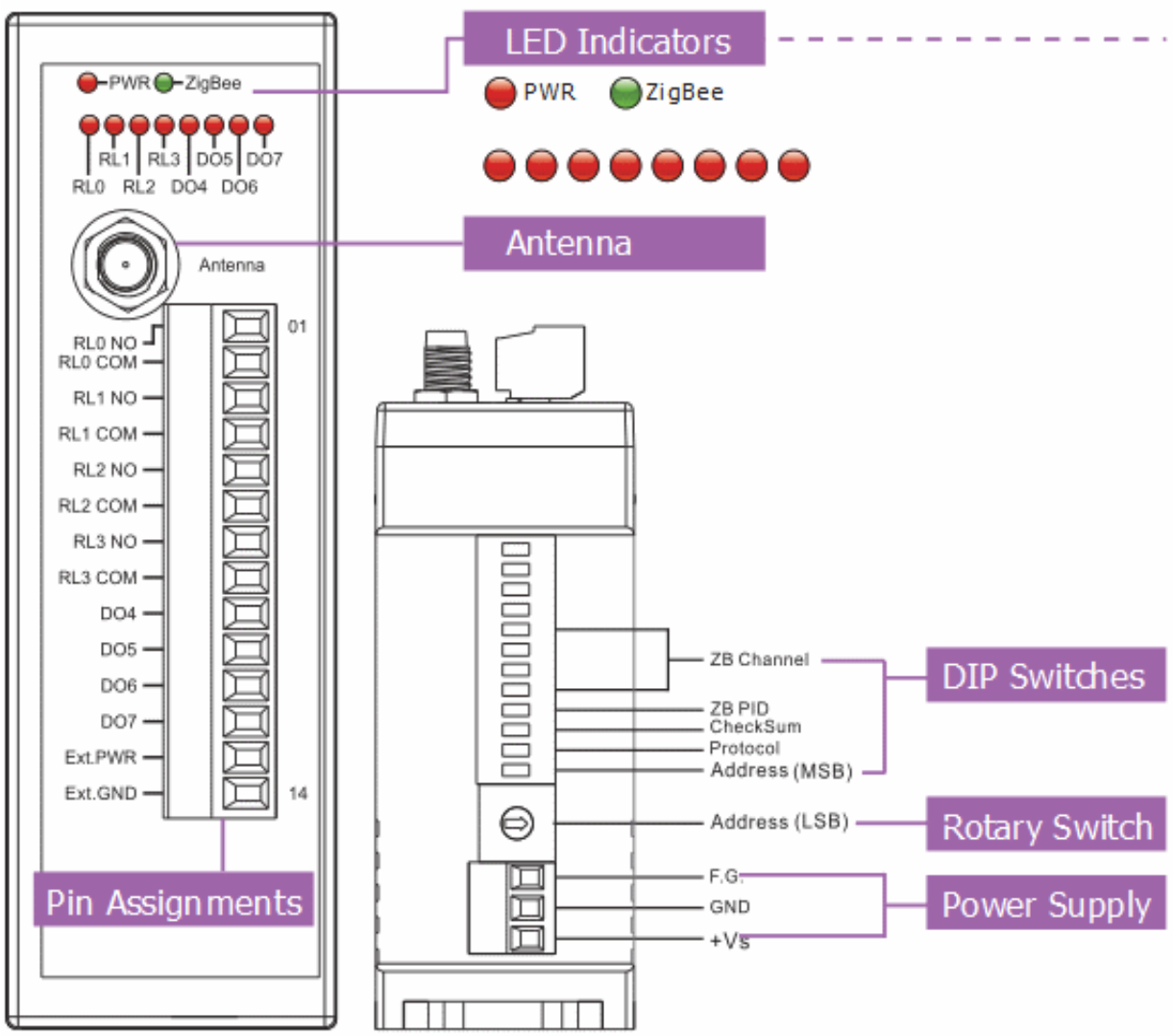
Relay Output		
Output Channels		4
Output Type		Power Relay, Form A
Contact Rating		5A @ (250 V_{AC}/ 30 V_{DC})
Max. Contact voltage		270 V_{AC} / 125 V_{DC}
Operate Time		10 ms Max. at Rated Voltage
Release Time		5 ms Max. at Rated Voltage
Endurance	Electrically	Resistive Load: 100,000ops. Min. (10 ops/minute)
	Mechanically	At no Load: 20,000,000ops. Min. (300 ops/minute)
Dielectric Strength	Between contacts	750 V_{AC} for 1 Minute
	Between coil to contacts	3,000 V_{AC} for 1 minute
Insulation Resistance		Min. 1000 MΩ at 500 V_{DC}
Surge Strength		5,080V (1.2 / 50us)

Gernal		
LED Indicator	PWR	1 Red LED, ZigBee Device Power Indicator
	ZigBee	1 Green LED, ZigBee Communication Indicator
	DI0 ~ DI6	6 Green LED, Digital Input Channel Indicators
	RL0 ~ RL3	4 Red LED, Digital Output Channel Indicators
Power		
Input Voltage Range		+10 V_{DC} ~ +30 V_{DC}
Power consumption		1.4 W (Max.)
Intra-module Isolated, Field-to-Logic		2500 V_{DC}

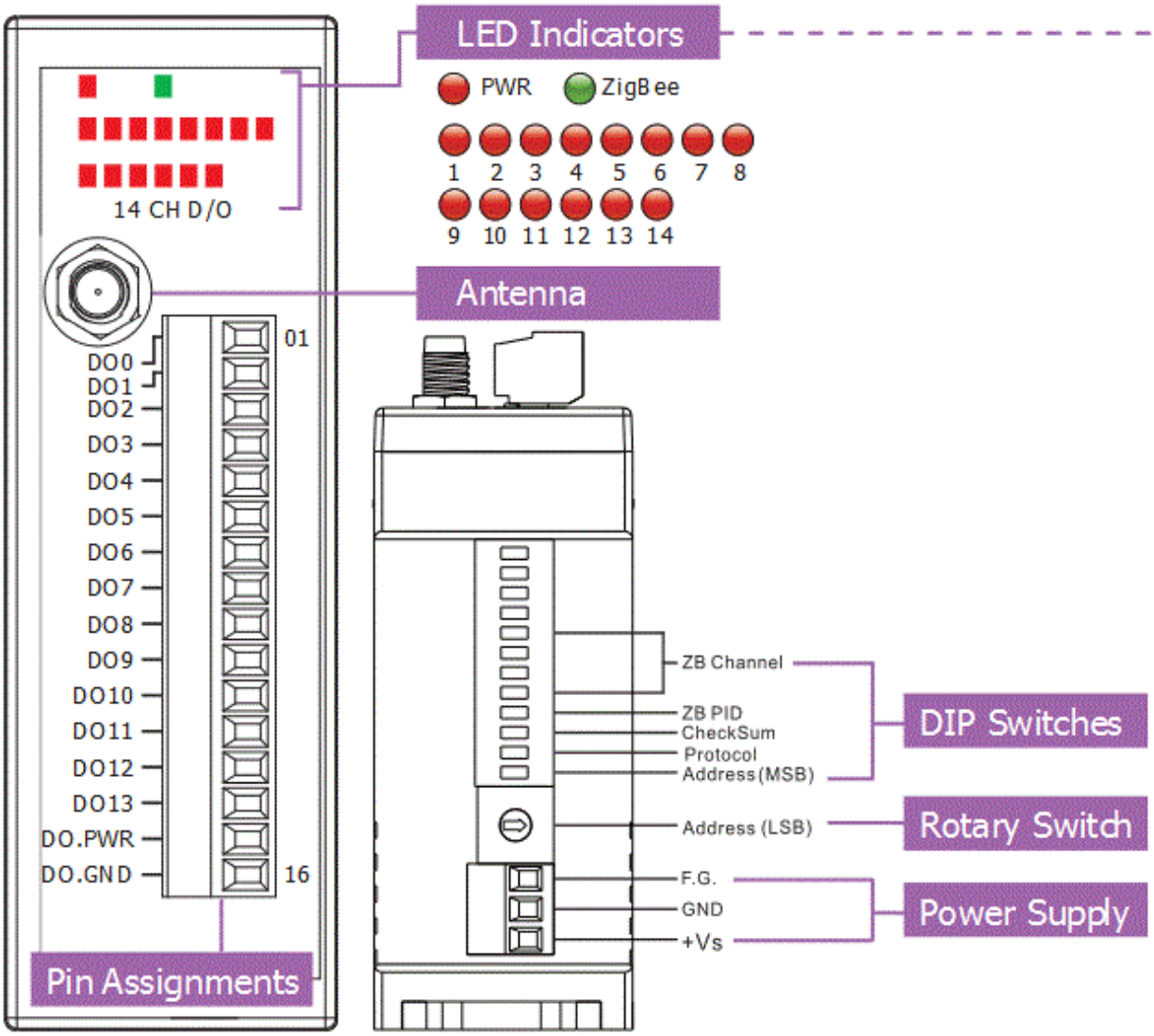
※Please see other specifications to the "Specifications to ZigBee" and "Specifications to ZT-2000 Series Module Board" topics at the section 2.1.

2.2 Pin Assignments

➢ Pin Assignments to the ZT-2042



➢ Pin Assignments to the ZT-2043



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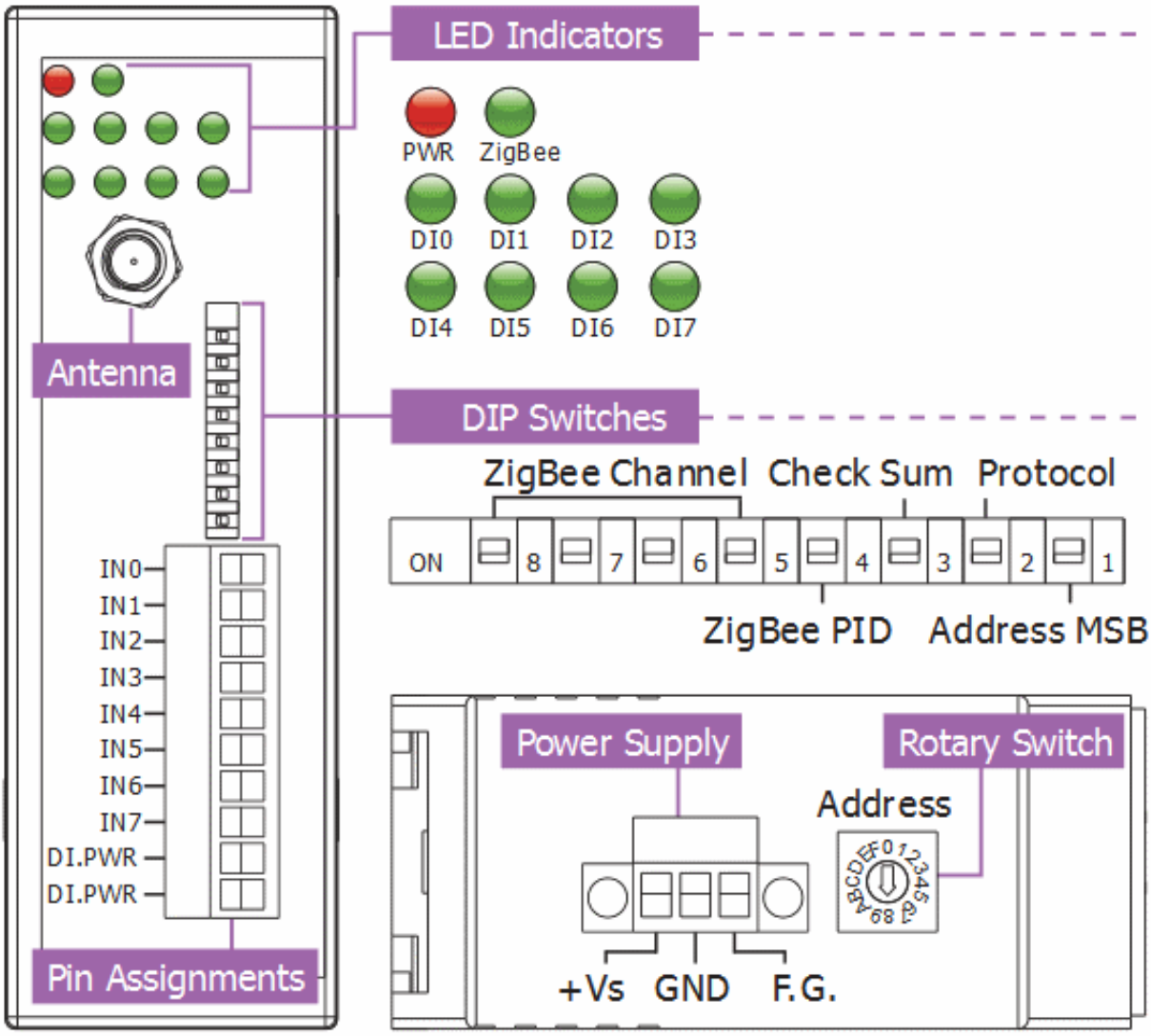

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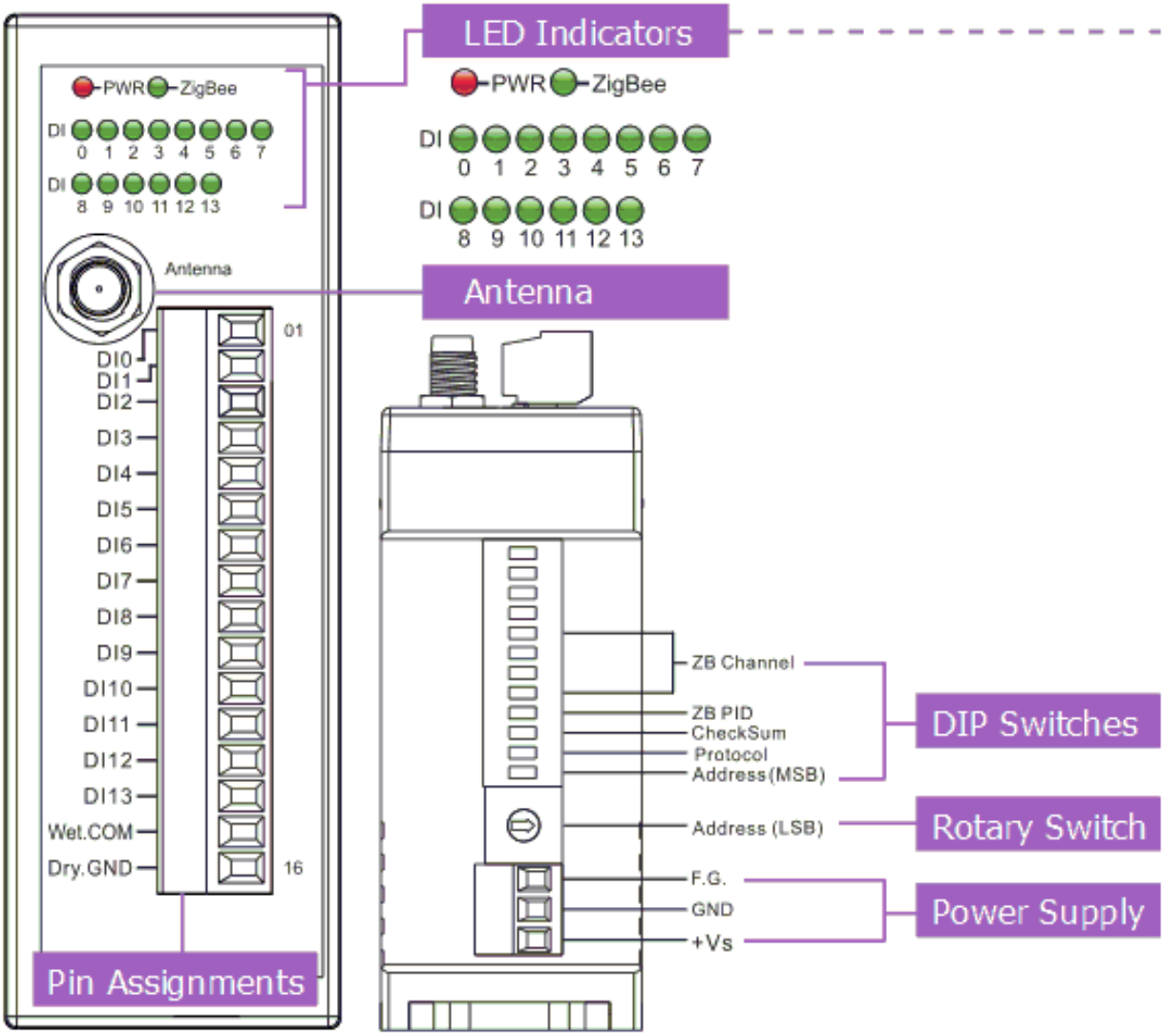

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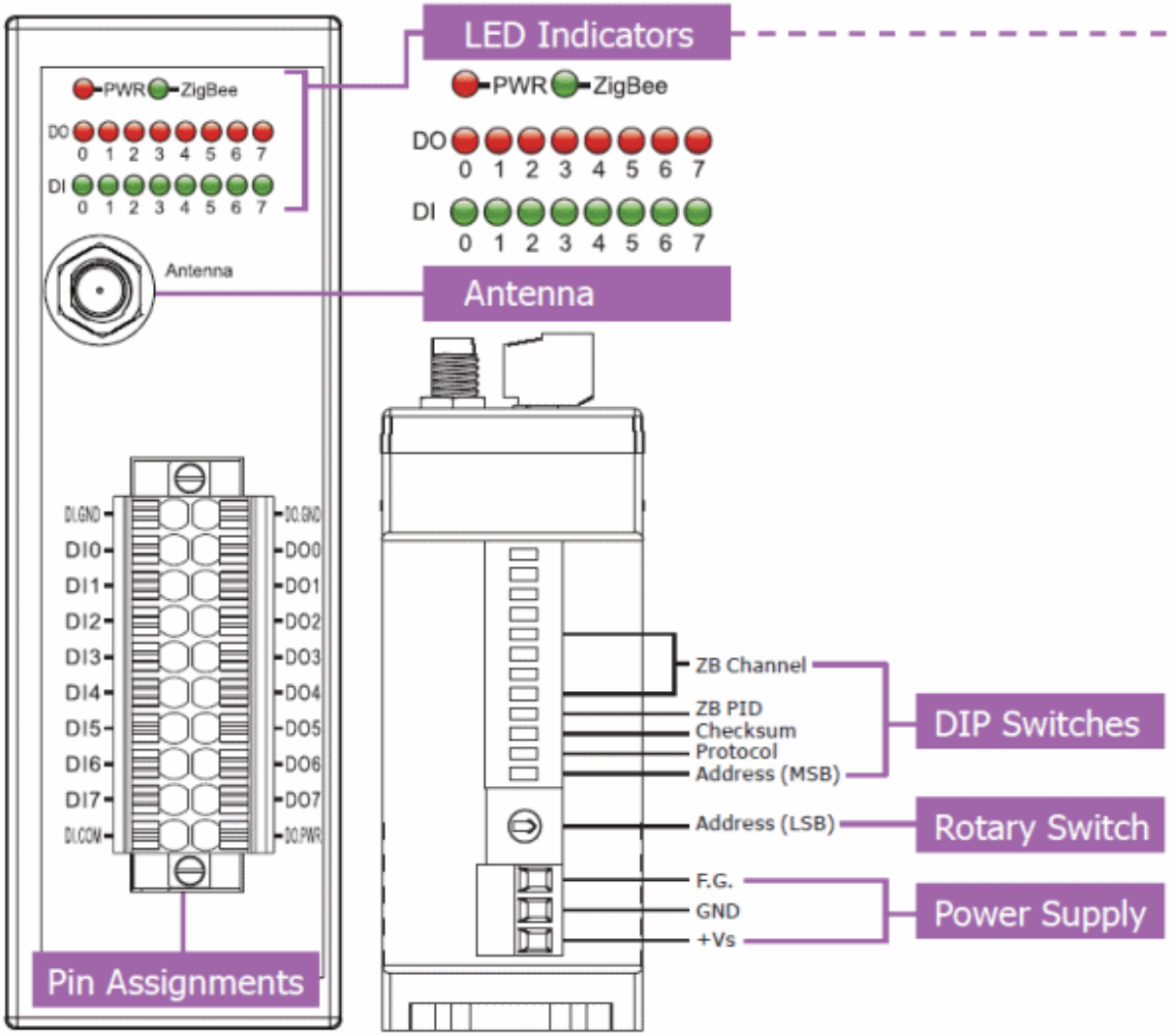

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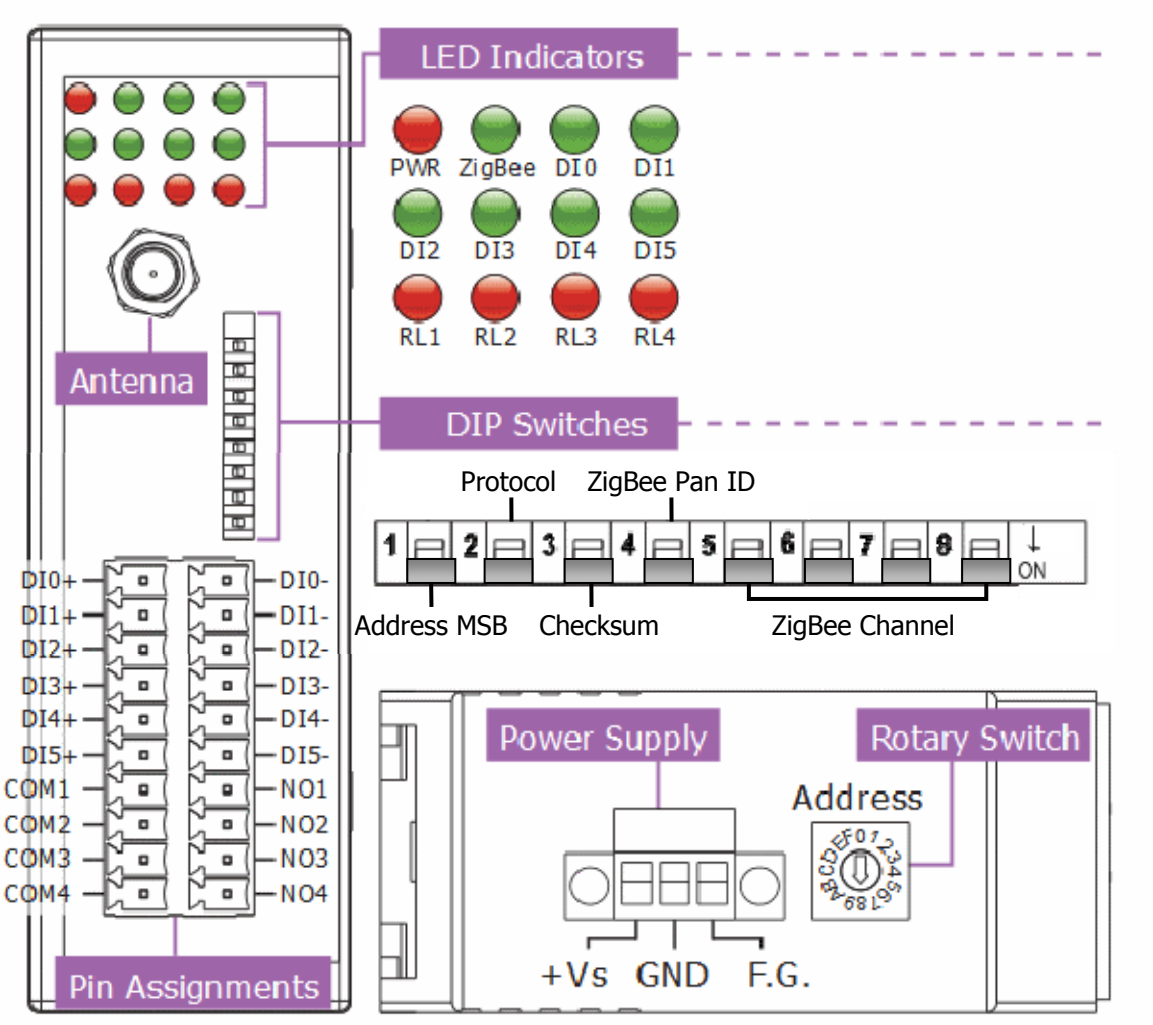
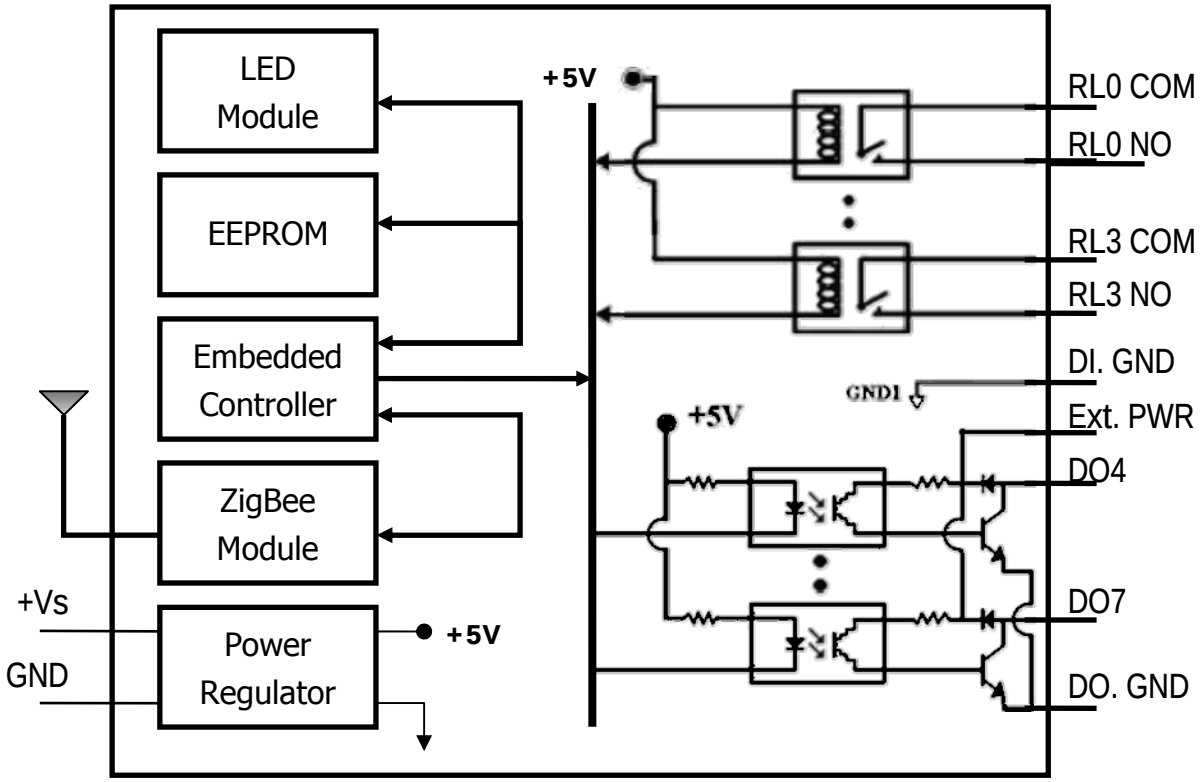


2.3 Block Diagram

➢ Block Diagram to the ZT-2042



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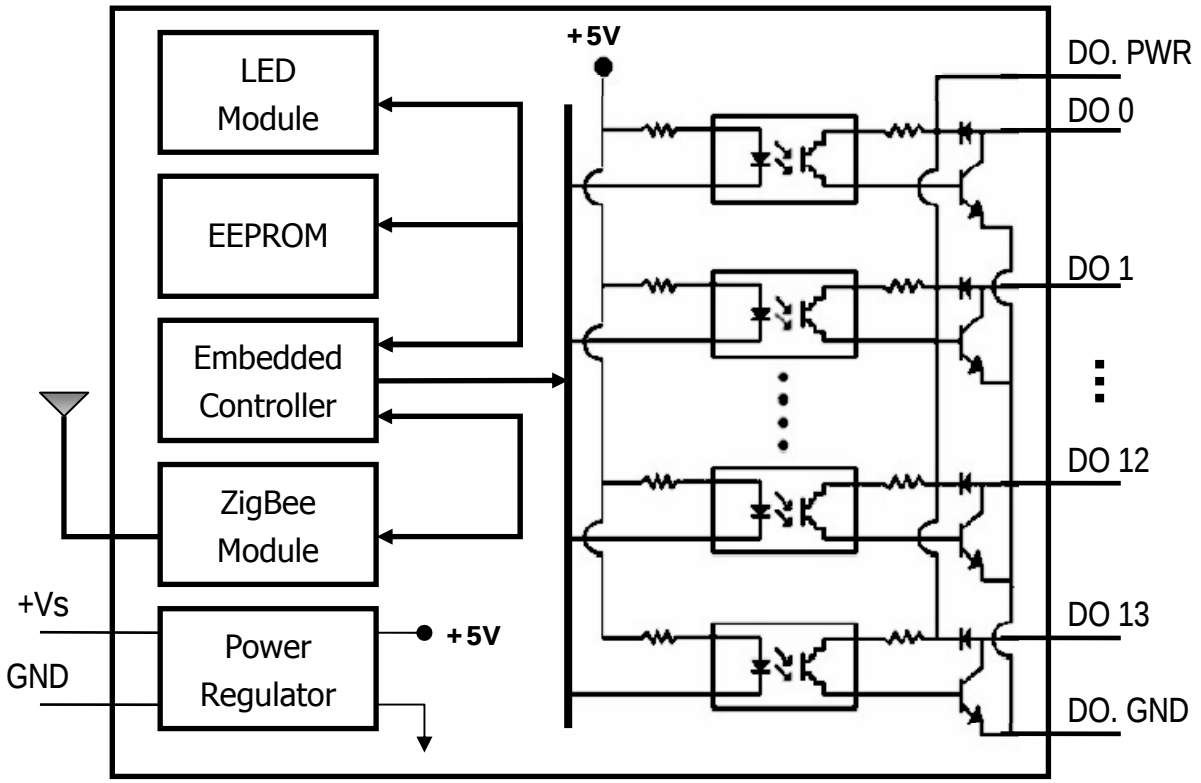

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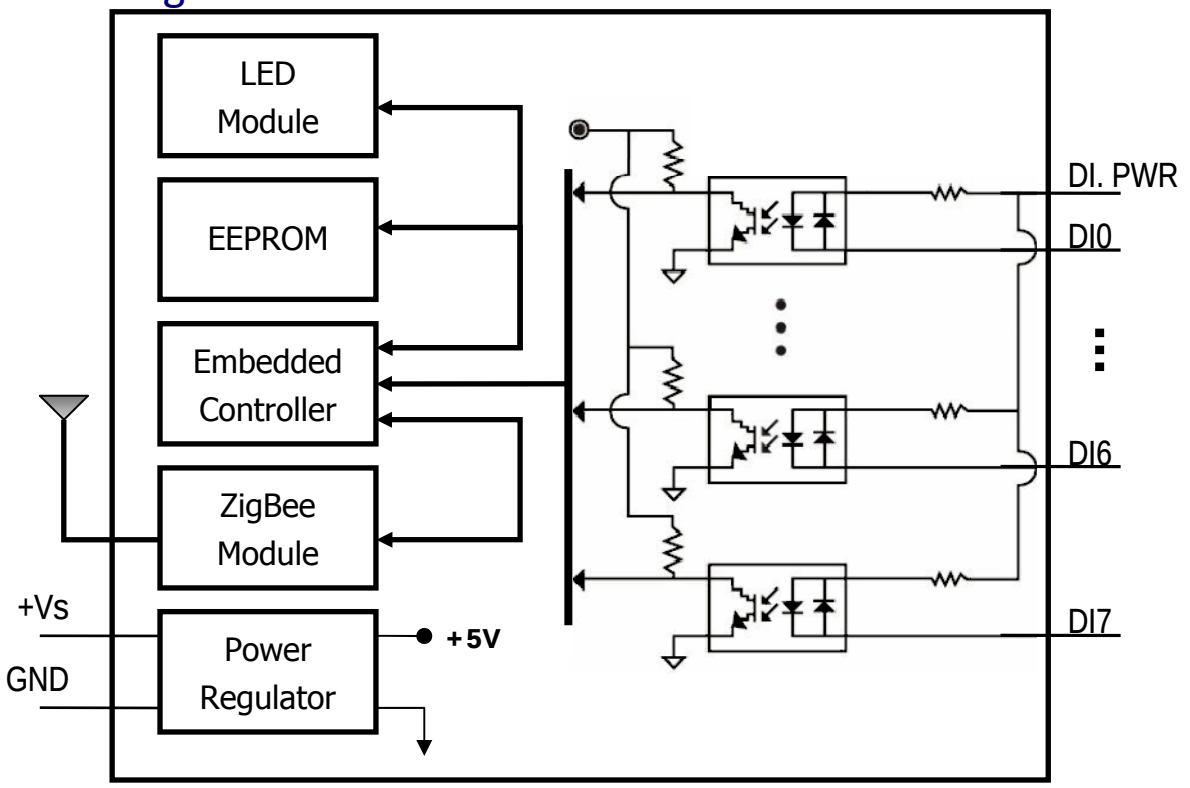

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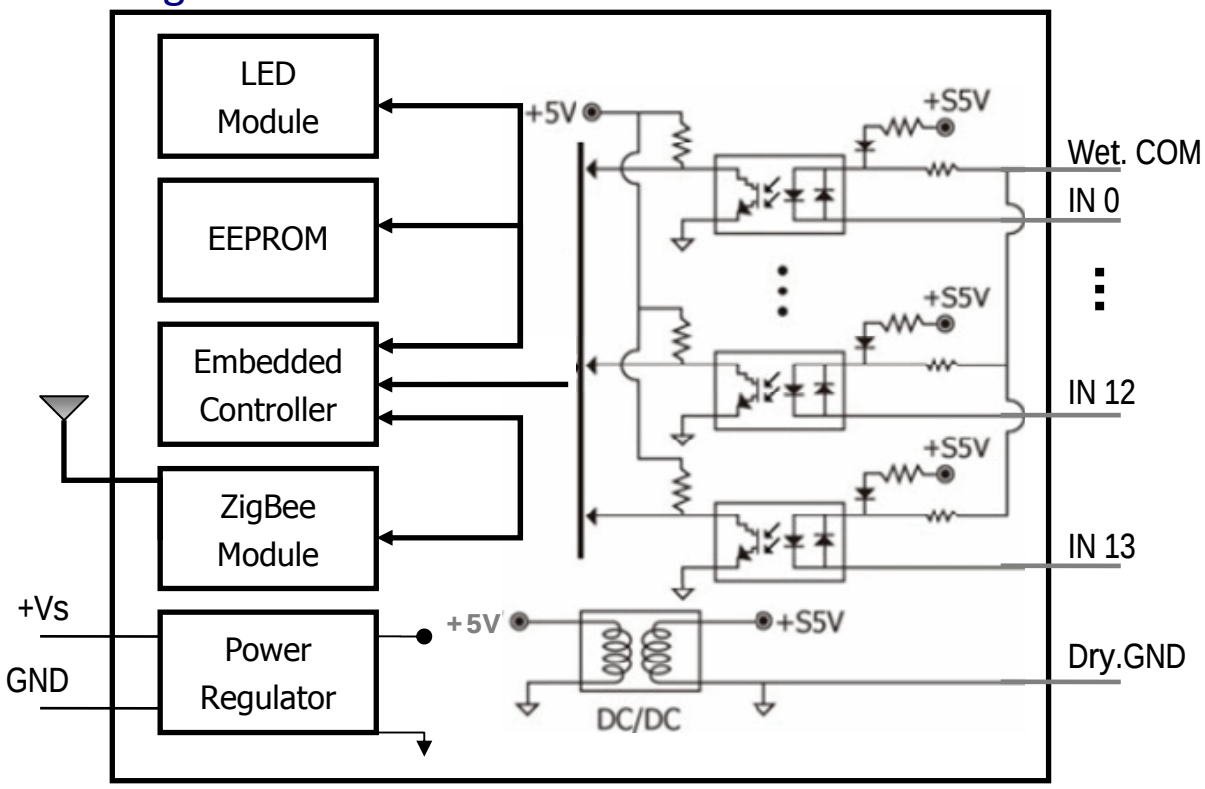

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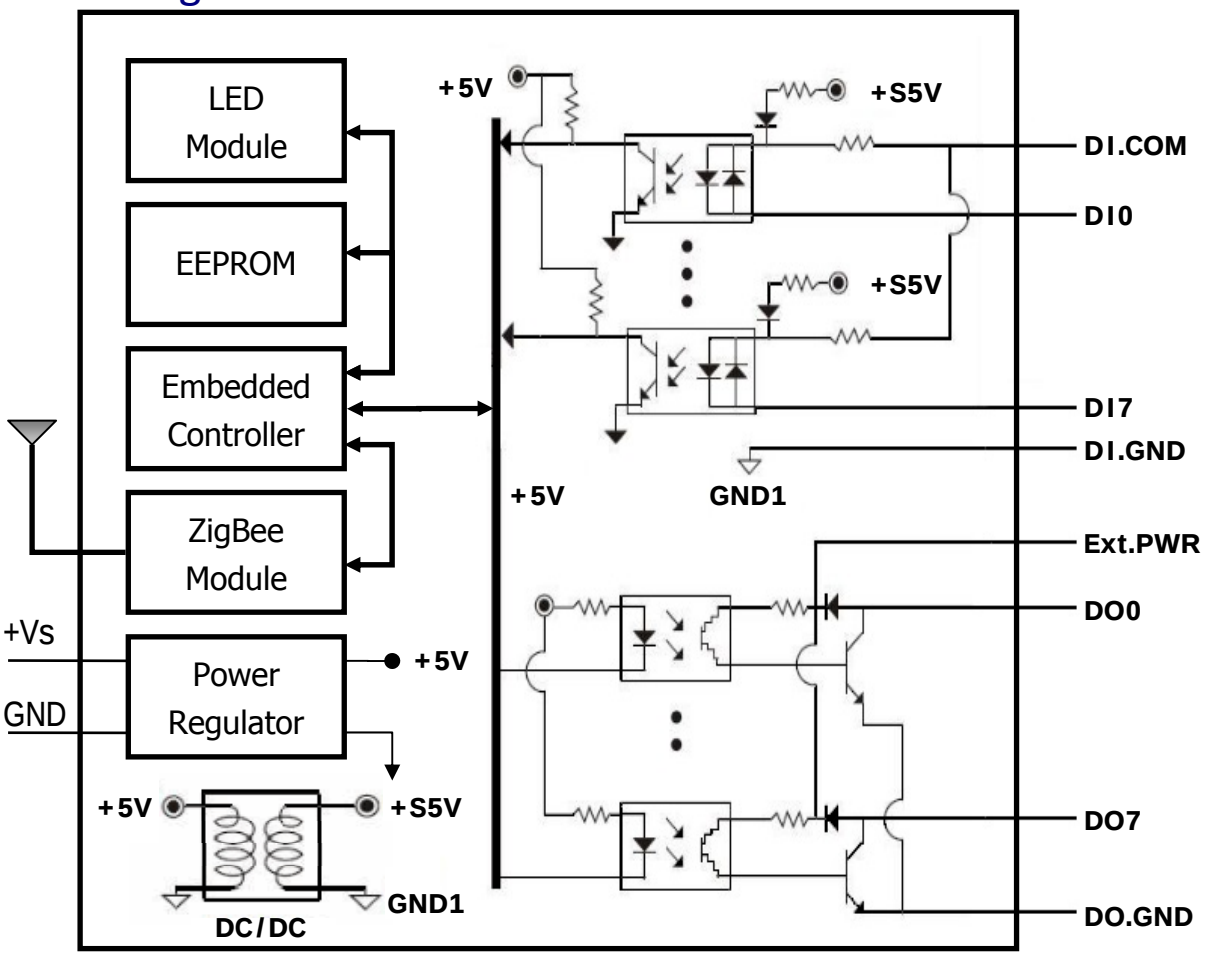

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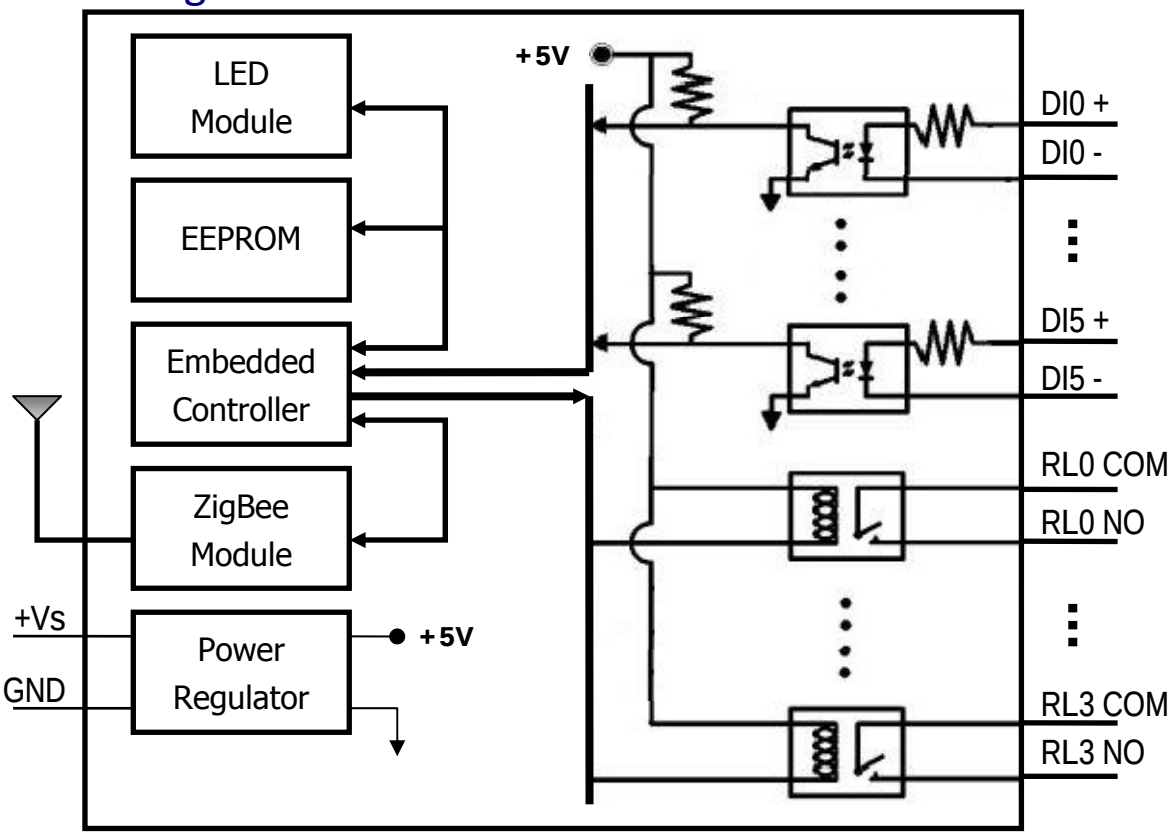
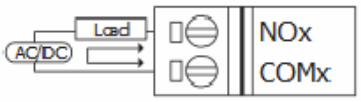
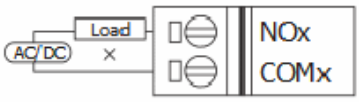
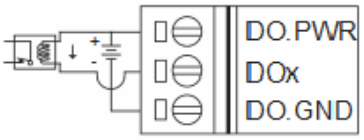
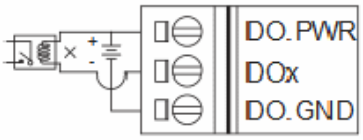
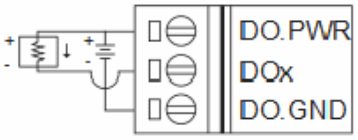
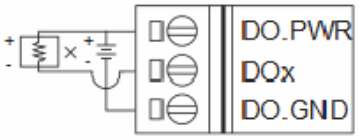


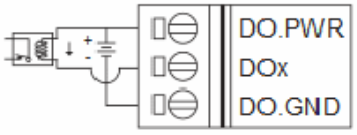
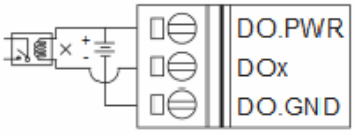
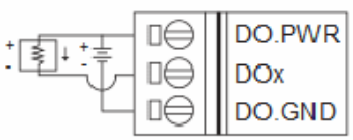
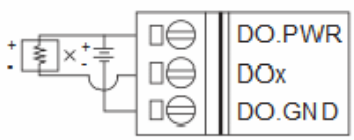
2.4 Wire Connections

➢ Wire Connections to the ZT-2042

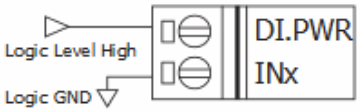
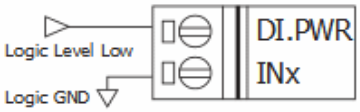
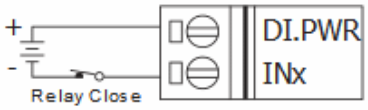
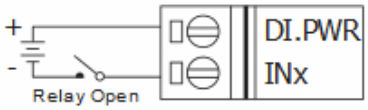
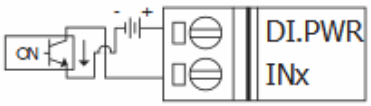
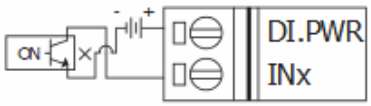
Relay Output	ON State LED ON Readback as 1	OFF State LED OFF Readback as 0
From A Relay Contact	Relay ON	Relay OFF
		

Digital Output	ON State LED ON Readback as 1	OFF State LED OFF Readback as 0
Drive Relay	Relay ON	Relay OFF
		
Resistance Load	Relay ON	Relay OFF
		

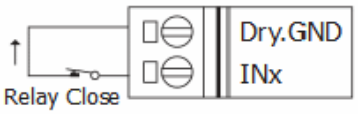
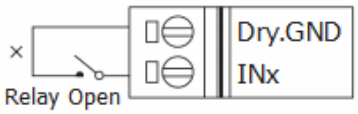
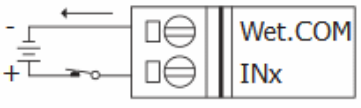
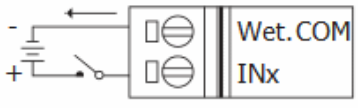
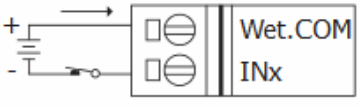
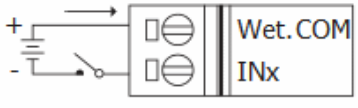
➢ Wire Connections to the ZT-2043

Digital Output	ON State LED ON Readback as 1	OFF State LED OFF Readback as 0
Drive Relay	Relay ON	Relay OFF
		
Resistance Load	Relay ON	Relay OFF
		

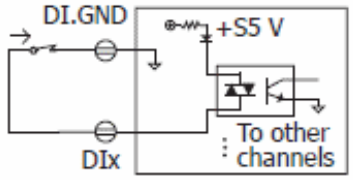
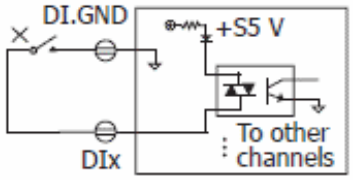
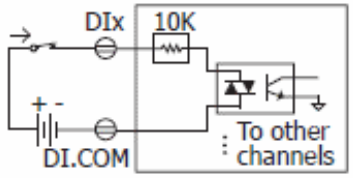
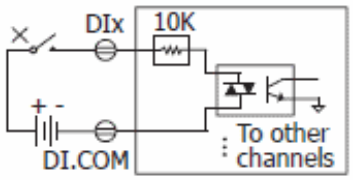
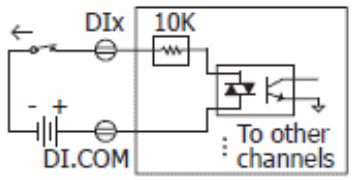
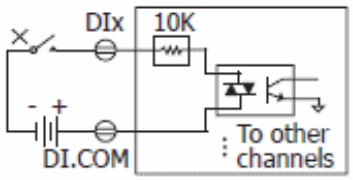
➢ Wire Connections to the ZT-2052

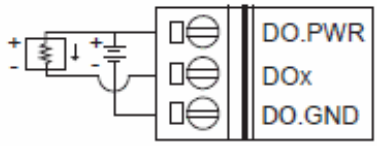
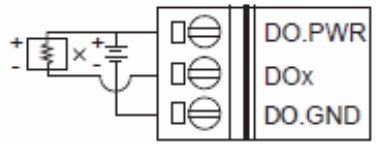
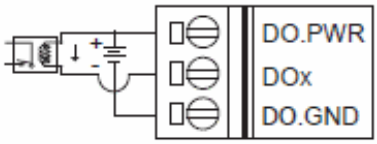
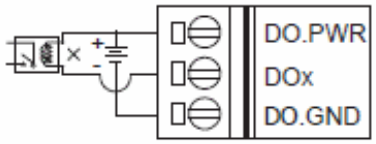
Input Type	ON State LED ON Readback as 1	OFF State LED OFF Readback as 0
TTL/ CMOS Logic	Voltage > 3.5V	Voltage < 1V
		
Relay Contact	Relay ON	Relay OFF
		
Open Collector	Open Collector ON	Open Collector OFF
		

➢ Wire Connections to the ZT-2053

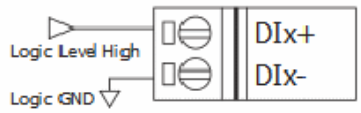
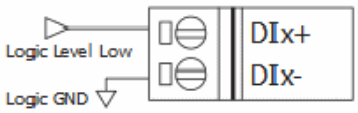
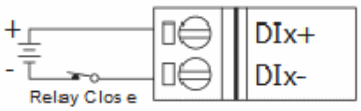
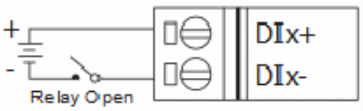
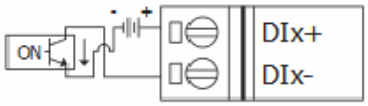
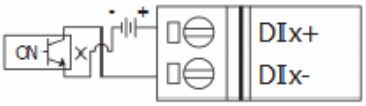
Input Type	ON State LED ON Readback as 1	OFF State LED OFF Readback as 0
Dry Contact	Relay ON	Relay OFF
		
Wet Contact (Source)	Voltage > 3.5V	Voltage < 1V
		
Wet Contact (Sink)	Open Collector ON	Open Collector OFF
		

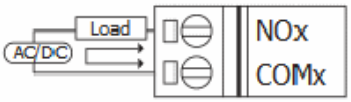
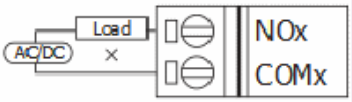
➢ Wire Connections to the ZT-2055

Input Type	ON State Readback as 1	OFF State Readback as 0
Dry Contact	Close to GND	Open
		
Wet Contact (Sink)	+10 ~ +50 VDC	+4 VDC Max.
		
Wet Contact (Source)	+10 ~ +50 VDC	+4 VDC Max.
		

Output Type	ON State Readback as 1	OFF State Readback as 0
Digital Output (Resistance Load)		
Digital Output (Inductive Load)		

➢ Wire Connections to the ZT-2060

Input Type	ON State LED ON Readback as 1	OFF State LED OFF Readback as 0
TTL/ CMOS Logic	Voltage > 3.5V	Voltage < 1V
		
Relay Contact	Relay ON	Relay OFF
		
Open Collector	Open Collector ON	Open Collector OFF
		

Output Type	ON State LED ON Readback as 1	OFF State LED OFF Readback as 0
Relay Contact	Relay ON	Relay OFF
		

3 Setting up the ZT-2000 DIO Device

3.1 Introduction to the Configuration Parameters

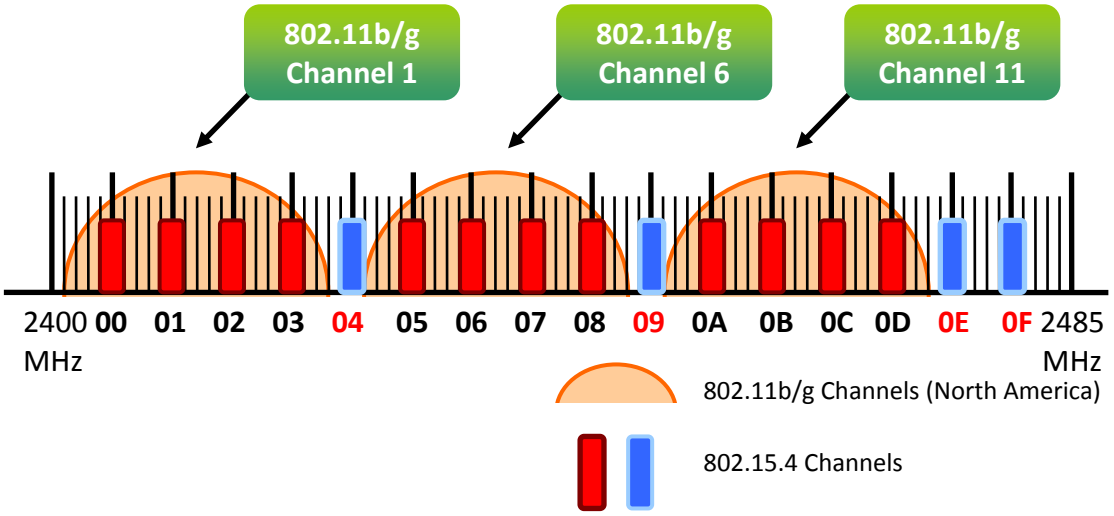
A. "Pan ID" parameter is the group identity for a ZigBee network, and must the same for all devices in the same ZigBee network.

B. "Node ID / Address" parameter is the individed identity of a specific the ZigBee module, and must be unique for each device connected the same ZigBee network.

C. "RF Channel" parameter indicates the radio frequency channel, and must be set to the same value as other modules on the same ZigBee network.

Channel	0x00	0x01	……	0x0F
Frequency (MHz)	2405	2410	……	2480

※ *RF channels 0x04, 0x09, 0x0E or 0x0F are recommended because they do not overlap with the Wi-Fi frequencies based.*



D. Protocol/Application Mode :

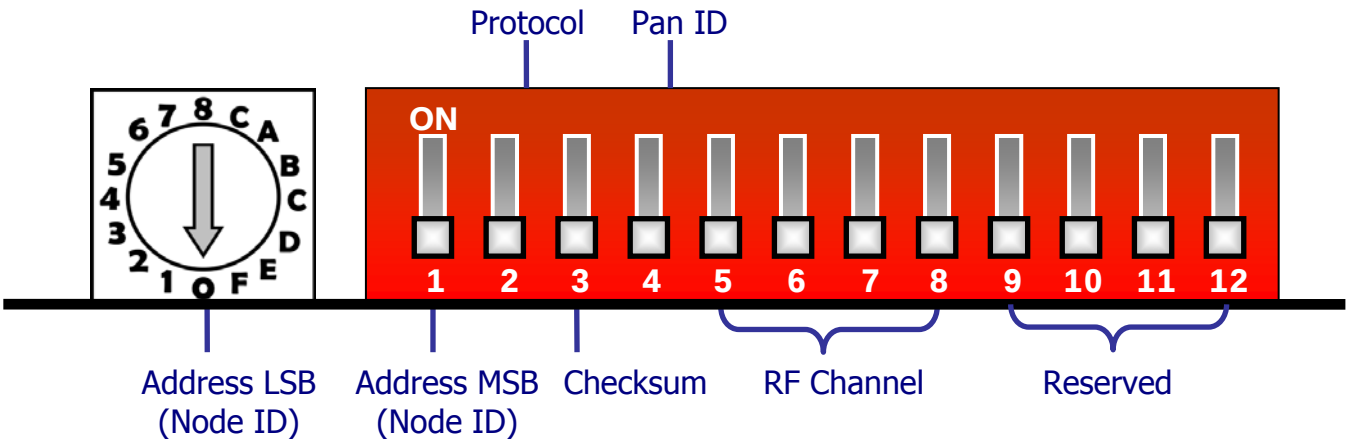
When implementing custom programs based on different protocols, the following application modes are recommended in order to ensure communicatible

User Program Protocol	ZT-2000 I/O	ZT-2550	ZT-2570
DCON	DCON	Transparent	Transparent
Modbus RTU	Modbus RTU	Transparent Modbus Gateway	Transparent Modbus Gateway
Modbus TCP	Modbus RTU	------	Modbus Gateway

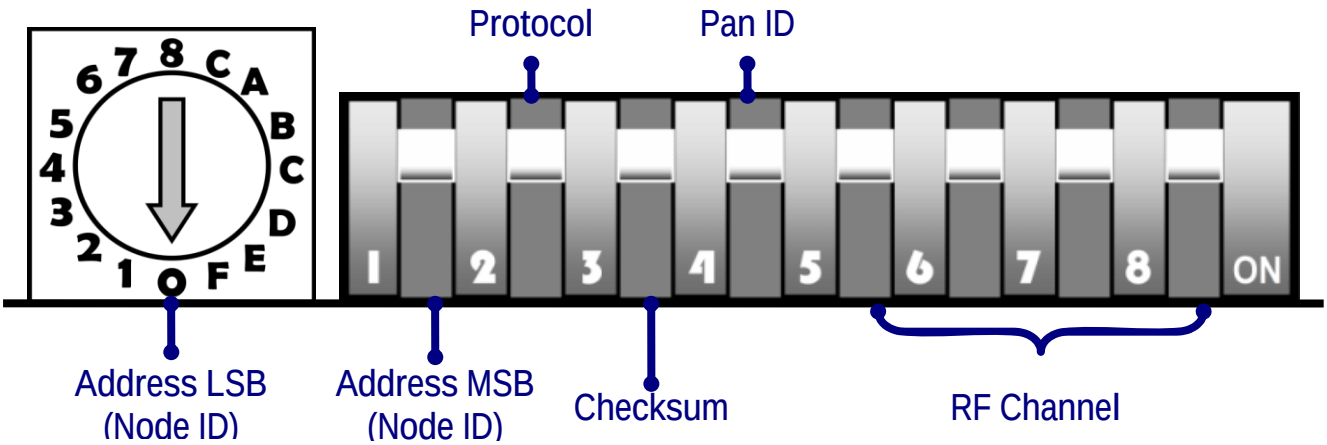
3.2 Introduction to the Rotation and DIP Switch

The configuration of ZT-2000 series can be adjusted by using the external rotary switch and the DIP switches. The ZT-2000 device should only be rebooted once the configuration is complete.

➢ DIP Switch to the ZT-2042/ZT-2043/ZT-2053/ZT-2055



➢ DIP Switch to the ZT-2052/ZT-2060



➢ Rotary Switch

	0	1	2	3	……	F	Note
Address	SW	01	02	03	……	0F	MSB = 0
Node ID	SW	0x0001	0x0002	0x003	……	0x000F	
	0	1	2	3	……	F	
Address	10	11	12	13	……	1F	MSB = 1
Node ID	0x0010	0x0011	0x0012	0x013	……	0x001F	

※ *Once the address of hardware switch is set to 0x00, it mens the address is using software configurations. Refer Sec. 6.6 for more detailed information.*

➢ DIP Switch

Number	Item	Status	Comments
1	Address MSB	OFF	Valid Address (Node ID) from 0x00 to 0x0F
		ON	Valid Address (Node ID) from 0x10 to 0x1F
2	Protocol	OFF	DCON Protocol
		ON	Modbus RTUProtocol
3	Checksum	OFF	Disabled
		ON	Enabled
4	ZigBee Pan ID	OFF	Pan ID = 0x0000
		ON	Pan ID = 0x0001
5	ZigBee RF Channel	OFF	------
		ON	0x08
6		OFF	------
		ON	0x04
7		OFF	------
		ON	0x02
8		OFF	------
		ON	0x01

3.3 Starting the ZT-2000 I/O Device

As the ZigBee network is controlled by the ZigBee coordinator, the ZT-2550/ZT-2570 (ZigBee coordinator) must be configured first. Please refert to documents shown below for full details of how to configure these devices.

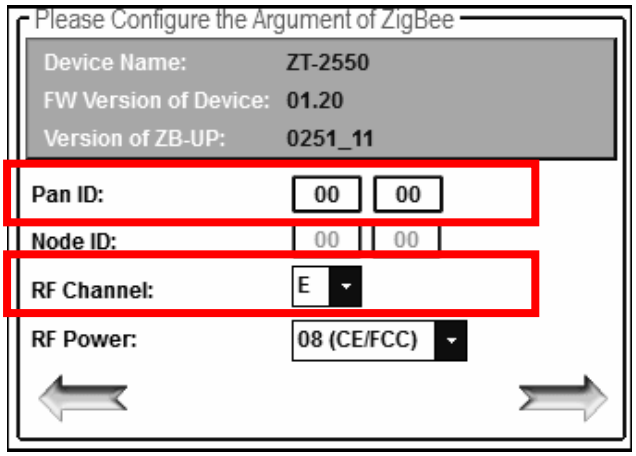
Once configuration of the ZigBee coordinator has been completed. Set the ”Pan ID” and the “RF Channel” values for the ZT-2000 I/O device to the same values as the network, and then reboot the device. The module will automatically start to function on the ZigBee network using the default protocol.

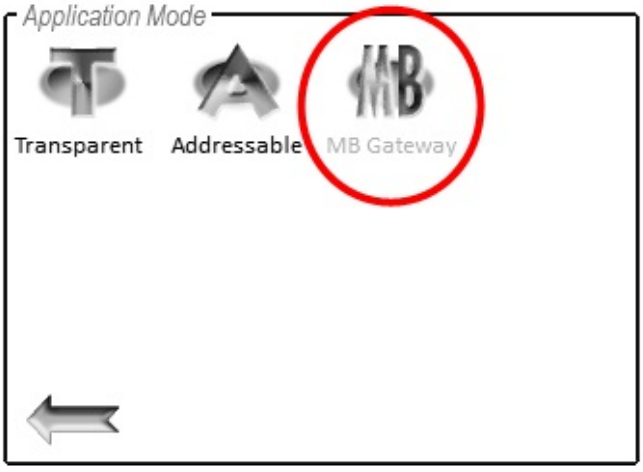
※ **Documents**
http://ftp.icpdas.com.tw/pub/cd/usbcd/napdos/zigbee/zt_series/document/zt-255x/
http://ftp.icpdas.com.tw/pub/cd/usbcd/napdos/zigbee/zt_series/document/zt-257x/

※ **Configuration Utility** (Used to configure ZT-2000 I/O device Coordinator)
http://ftp.icpdas.com.tw/pub/cd/usbcd/napdos/zigbee/zt_series/utility/

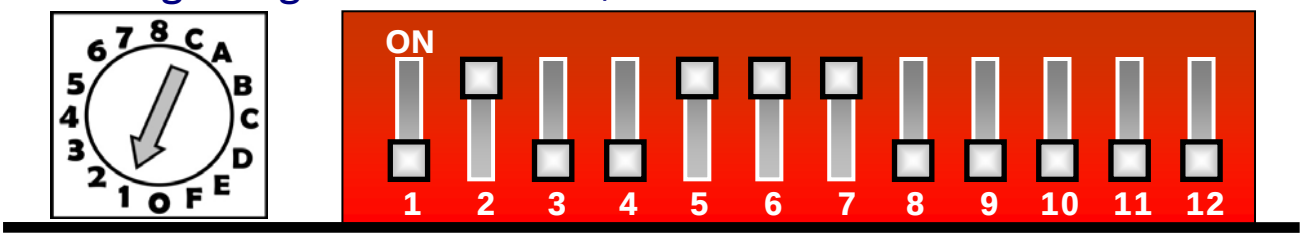
3.4 Examples

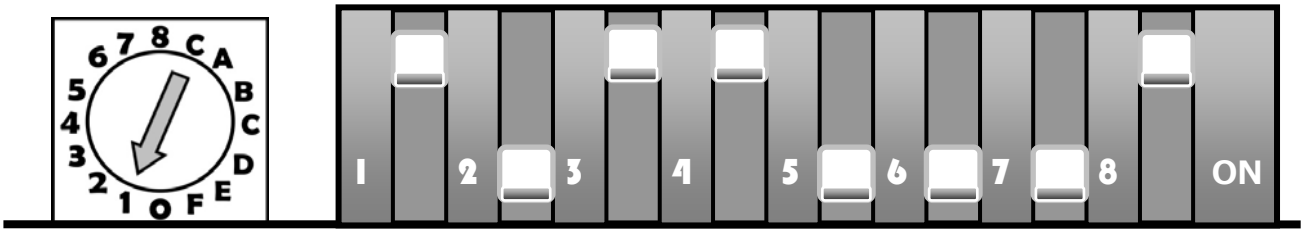
➢ Configurations of ZT-2550/ZT-2570





➢ Configuring the ZT-2000 I/O Device





Number	Item	Status	Explain	
1	Address MSB	OFF	Address/Node ID is **01** (Rotation Switch=1)	
2	Protocol	ON	Use **Modbus RTU** Protocol	
3	Checksum	OFF	Disabled	
4	ZigBee Pan ID	OFF	Pan ID=**0x0000**	
5	ZigBee RF Channel	ON	0x08	ZigBee RF Channel = **0x0E**
6		ON	0x04	
7		ON	0x02	
8		OFF	------	

3.5 Communications Testing

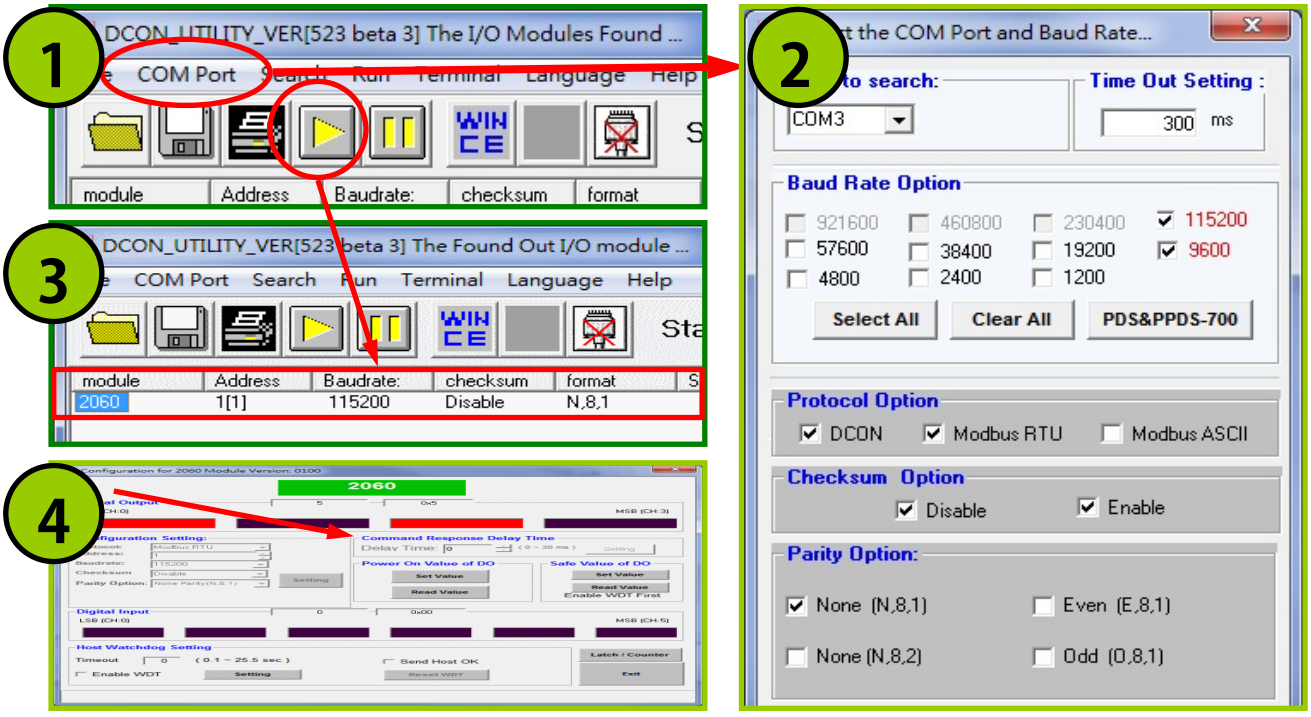
Once the ZT-2000 I/O device has joined the ZigBee network, the signal quality can be comfirmed by monitoring the status of the ZigBee Net LED indicators. If the LED indicator shows a steady light, communication with the ZT-2000 I/O device has been successfully established for data acquisition and control.

ICP DAS also provides the “DCON Utility”, which can be used to simulate DCON/Modbus communication. This software can also be used to verify the device settings and ZigBee I/O functions.

※ The **DCON Utility** can be dowmload from:
http://ftp.icpdas.com/pub/cd/8000cd/napdos/driver/dcon_utility/

➢ Simulating I/O channel operation via the DCON Utility

1. Launch the DCON Utility and select the appropriate COM Port settings to connect to the ZigBee Coordinator (ZT-2550/ZT-2570).
2. Click the “Search” button to start searching for ZT-2000 I/O device connected to the same ZigBee network.
3. If any ZT-2000 I/O devices are found, they will be displayed in the device list window. Double-click the list of the module name to start the platform to operate the I/O channels.



4 DCON/Modbus RTU Command Set

4.1 How to communicate with ZT-2000 I/O Device

ICP DAS ZT-2000 I/O devices can operate using both the DCON and the Modbus RTU protocol, and the I/O channel can be easily controlled and monitored via wireless transmission. The document available at the following link gives details of the DCON and Modbus RTU protocol command sets.

http://ftp.icpdas.com/pub/cd/8000cd/napdos/7000/manual/modbusdio.pdf

4.2 DCON Protocol Command Set

All ZT-2000 I/O series devices are controlled via wireless broadcast commands, so each device must have a unique address that is saved in the EEPROM of the device to denote the difference.

Consequently, all command and response formats contain the destination address of the module. When an I/O device receives a command, it will determine whether or not to respond based on the address contained in the command. However, there are two exceptions, the #** and ~** commands.

- DCON Request Command Format

Delimiter Character	Module Address	Command	[Checksum]	CR

- DCON Response Command Format

Delimiter Character	Module Address	Data	[Checksum]	CR

※ Note: 'CR' (Carriage Return) is the character used to end a frame.

4.2.1 Checksum

- Calulate the Checksum:

  Sum the ASCII code of all the characters contained in the command in addition to the 'CR' terminator. The Checksum is the sum value expressed in Hexadecimal format.

- Example: Request Command "$012(CR)"

  Sum = '$' + '0' + '1' + '2' = 24h + 30h + 31h + 32h = B7h
  Checksum = "B7"
  DCON Request Command with Checksum = "$012B7(CR)"

- Example: Response Command "!01200600(CR)"

  Sum = '!' + '0' + '1' + '2' + '0' + '0' + '6' + '0' + '0'
  = 21h+30h+31h+32h+30h+30h+36h+30h+30h
  = 1AAh
  Checksum = "AA"
  DCON Response Command with Checksum = "!01200600AA(CR)"

※ Note: Checksum is the sum value expressed in capital letters.

4.2.2 Overview the DCON Command Sets

General Command Sets			
Command	Response	Description	Section
%AANNTTCCFF	!AA	Sets the Module Configuration	4.2.3
#**	No Response	Synchronized Sampling	4.2.4
#AA00(Data)	>	Sets the Multiple Digital Output (DO0-DO7)	4.2.5
#AA0A(Data)	>	Sets the Multiple Digital Output (DO0-DO31)	4.2.6
#AA1c(Data)	>	Sets the Single Digital Output (DO0-DO7)	4.2.7
#AAAc(Data)	>	Sets the Single Digital Output (DO0-DO31)	4.2.8
#AAN	!AA(Data)	Reads the Digital Input Counter	4.2.9
$AA2	!AANNTTCCFF	Reads the Module Configuration	4.2.10
$AA4	!S(Data)	Reads the Synchronized Data	4.2.11
$AA5	!AAS	Reads the Reset Status	4.2.12
$AA6	!(Data)	Reads the Status of the Digital I/O	4.2.13
$AAC	!AA	Clears the Latched Digital Input Status	4.2.14
$AACN	!AA	Clears the Digital InputCounter	4.2.15
$AAF	!AA(Data)	Reads the firmware Version	4.2.16
$AALS	!(Data)	Reads the Latched Digital Input Status	4.2.17
$AAM	!AA(Data)	Reads the Module Name	4.2.18
$AAP	!AASC	Reads the Communication Protocol	4.2.19
@AA	>(Data)	Reads the Status of the Digital I/O	4.2.20
@AA(Data)	>	Sets the Digital Output Channels	4.2.21
~AAD	!AAF	Reads the Active Status of the Digital I/O	4.2.22
~AADVV	!AA	Sets the Active Status of the Digital I/O	4.2.23
Host Watchdog Command Sets			
Command	Response	Description	Section
~**	No Response	Host OK Command	4.2.24
~AA0	!AASS	Reads the Status of the Watchdog	4.2.25
~AA1	!AA	Resets the Timeout Status of the Watchdog	4.2.26
~AA2	!AAVV	Reads the Timeout Value and Watchdog Setting	4.2.27
~AA3EVV	!AA	Sets the Timeout Value and Watchdog Setting	4.2.28
~AA4V	!AA(Data)	Reads the Power-on/Safe Value	4.2.29
~AA5V	!AA	Sets the PowerOn/Safe Value	4.2.30
~AARDvv	!AA	Sets the Response Delay Time	4.2.31
~AARD	!AA(Data)	Reads the Response Delay Time	4.2.32

4.2.3 %AANNTTCCFF

Description
This command is used to set the configuration of a module

Syntax	
%AANNTTCCFF[CHECKSUM](CR)	
%	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
NN	The new address of the module in hexadecimal format(00 to FF)
TT	The new type code，DIO devices are always 0x40
CC	The new baud rate, ZigBee I/O devices are always 0x0A
FF	The command is used to update direction of the DI counter. 00: Falling Edge，Checksum Disabled 40: Falling Edge，Checksum Enabled 80: Rising Edge，Checksum Disabled C0: Rising Edge，Checksum Enabled

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	%0101400A80
Response	!01
Sets the update directional of the counter for the module 01 to rising edge, and returns a response indicating a valid command.	

Example	
Command	%0101400A00
Response	!01
Sets the update directional of the counter for the module 01 to rising edge, and returns a response indicating a valid command.	

※Related Commands: $AA2, ~AAI, ~AATnn

4.2.4 #**

Description
When this command is received, it will allow all modules to read data and will store the data for later retrieval.

Syntax	
#**[CHECKSUM](CR)	
#	Delimiter character
**	The synchronization sampling command

Response
There is no response to this command. To access the stored sychronzed data, another command, $AA4, must be sent.

Example	
Command	#**
Response	No response
Sends the synchronization sampling command.	

Example	
Command	$014
Response	!1FF0000
Sends a command to read the synchronized data. For module 01, the status byte of the response is 1, which means that it is the first time the synchronized data has been read since the previous #** command was recevied (FF is the status of DI channels).	

Example	
Command	$014
Response	!0FF0000
Sends a command to read the synchronized data. For module 01, the status byte of the response is 0, which means that it is **NOT** the first time the synchronized data has been read since the previous #** command was received (FF is the status of DI channels).	

※Related Commands: $AA4

4.2.5 #AA00(Data)

Description
This command is used to set the digital output value of the lower eight channels (DO0-DO7) of a specificed module.

Syntax	
#AA00(Data)[CHECKSUM](CR)	
#	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
00	The command to set the digital output value of the lower eight channels (DO0-DO7).
(Data)	A two-digit hexadecimal value, where bit 0 corresponds to DO0, bit 1 corresponds to DO1, etc. When the bit is '0', it denotes that the digital output channel is OFF, and '1' denotes that the digital output channel is ON.

Response	
Valid Command	>[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
Ignored Command	! [CHECKSUM](CR)
>	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
!	Delimiter character to indicate the command was ignored
	This will be related if a host watchdog timeout has occurred. The digital output channels are set to the safe value, and the digital output value that was sent is ignored.

Example	
Command	#020006
Response	>
Sets the DO0 and DO3 channels of module 02 to OFF and the DO1 and DO2 channels of module 02 to ON, and returns a response indicating that the command was valid.	

Example	
Command	#020016
Response	?02
Attempts to set the DO1, DO2 and DO5 channels of module 02 to ON, and the DO0, DO3, DO6, DO7 and DO8 channels of module 02 to OFF. A response indicating that the command was invalid is returned because the ZT-2060 only supports DO0 to DO3.	

Example	
Command	#020005
Response	!
Attempts to set the DO0 and DO2 channels of module 02 to ON, and the DO1, DO3, DO5, DO6, DO7 and DO8 channels of module 02 to OFF, but returns a response indicating that a Host watchdog timeout has occurred. The digital output channel is set to the safe value and the command that was sent is ignored.	

※Related Commands: #AA0A(Data), #AA1cDD, AAAc(Data), $AA6, @AA, @AA(Data)

4.2.6 #AA0A(Data)

Description
This command is used to set the value of digital output channels (DO0-DO31) to a specificed module.

Syntax	
#AA0A(Data)[CHECKSUM](CR)	
#	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
00	The command to set the digital output value
	#AA0A(Data): DO0-DO7 #AA0B(Data): DO8-DO15 #AA0C(Data): DO16-DO23 #AA0D(Data): DO24-DO31
(Data)	A two-digit hexadecimal value, where bit 0 corresponds to DO0, bit 1 corresponds to DO1, etc. When the bit is 0, it denotes that the digital output channel is OFF, and 1 denotes that the digital output channel is ON.

Response	
Valid Command	>[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
Ignored Command	! [CHECKSUM](CR)
>	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
!	Delimiter character to indicate the command was ignored
	This will be related if a host watchdog timeout has occurred. The digital output channels are set to the safe value, and the digital output value that was sent is ignored.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	#020A0E
Response	>
Sets the DO0 channel of module 02 to OFF and the DO0, DO1 and DO2 channels of module 02 to ON, and returns a response indicating that the command was valid.	

Example	
Command	#020A06
Response	!
Attempts to set the DO1 and DO2 channels of module 02 to ON, and the DO0 and DO3 channels of module 02 to OFF, but returns a response indicating that a Host watchdog timeout has occurred. The digital output channel is set to the safe value and the command that was sent is ignored.	

Example	
Command	#020A0F
Response	>
Sets the DO0, DO1, DO2 and DO3 channels of module 02 to ON, and returns a response indicating that the command was valid.	

Example	
Command	#020A00
Response	>
Sets the DO0, DO1, DO2 and DO3 channels of module 02 to OFF, and returns a response indicating that the command was valid.	

※Related Commands : #AA00(Data), #AA1c(Data), AAAc(Data), $AA6, @AA, @AA(Data)

4.2.7 #AA1c(Data)

Description
This command is used to set a single digital output channel of the lower eight channels (DO0 ~ DO7) to a specificed module.

Syntax	
#AA1c(Data)[CHECKSUM](CR)	
#	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
1	The command to set a single digital output channel from the lower eight channels.
c	The command to specify the digital output channel to be set (0 to 7).
(Data)	00 : set the digital output channel to OFF 01 : set the digital output channel to ON

Response	
Valid Command	>[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
Ignored Command	! [CHECKSUM](CR)
>	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
!	Delimiter character to indicate the command was ignored.
	This will be related if a host watchdog timeout has occurred. The digital output channels are set to the safe value, and the digital output value that was sent is ignored.

Example	
Command	#021001
Response	>
Sets the DO0 channel of module 02 to ON, and returns a response indicating that the command was valid.	

Example	
Command	#021401
Response	?02
Attempts to set the DO4 channel of module 02 to ON. A response indicating that the command was invalid is returned because the ZT-2060 only supports DO0 to DO3.	

※Related Commands : #AA00(Data)、#AA0A(Data)、AAAc(Data)、$AA6、@AA、
@AA(Data)

4.2.8 #AAAc(Data)

Description
This command is used to set a single digital output channel (DO0-DO31) of a specificed module

Syntax	
#AAAc(Data)[CHECKSUM](CR)	
#	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
A	The command to set a single digital output channel. (DO0-DO31)
	#AAAc(Data): DO0-DO7 #AABc(Data): DO8-DO15 #AACc(Data): DO16-DO23 #AADc(Data): DO24-DO31
c	The command to specify the digital output channel to be set (0-7)
(Data)	00: Sets the digital output channel to OFF 01: Sets the digital output channel to ON

Response	
Valid Command	>[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
Ignored Command	! [CHECKSUM](CR)
>	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
!	Delimiter character to indicate the command was ignored.
	This will be related if a host watchdog timeout has occurred. The digital output channels are set to the safe value, and the digital output value that was sent is ignored.

Example	
Command	#02A201
Response	>
Sets the DO2 channel of module 02 to ON, and returns a response indicating that the command was valid.	

※Related Commands : #AA00(Data)、#AA0ADD(Data)、AA1cDD、$AA6、@AA、@AA(Data)

4.2.9 #AAN

Description
This command is used to read the digital input counter of channel N of a specified module.

Syntax	
#AAN[CHECKSUM](CR)	
#	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
N	The channel to be read (DI0 to DIF)

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
(Data)	A five-digital decimal value representing the digital input counter data for the specified channel (00000 to 65535).
AA	The address of the module responding in hexadecimal format (00 to FF)
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	#011
Response	!0100005
Reads data from channel 1 of module 01 and returns a response indicating that the command was valid and that the counter value is 00005.	

Example	
Command	#015
Response	!0100005
Reads data from channel 5 of module 01 and returns a response indicating that the command was valid, and that the counter value is 00005.	

※Related Commands: #AACN

4.2.10 $AA2

Description
This command is used to read the configuration of the module

Syntax	
$AA2[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
2	The command to read the configuration of the module

Response	
Valid Command	!AATTCCFF[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the module responding in hexadecimal format (00 to FF)
TT	The Type Code of the module and should be 0x40 for DIO module.
CC	The Baud Rate of the module and should be 0x0A for ZigBee DIO module.
FF	Checksum and counter update direction settings for the module. 00: Falling Edge, Checksum Disabled 40: Falling Edge, Checksum Enabled 80: Rising Edge, Checksum Disabled C0: Rising Edge, Checksum Enabled
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	$012
Response	!01400A80
Reads the configuration of module 01, and returns a reponse indicating that the command was valid, with a value 0x80 indicating the direction of the counter update is rising edge and the checksum disabled.	

※Related Commands: %AANNTTCCFF

4.2.11 $AA4

Description
This command is used to read the synchronization data that was retrieved from a specificed module the last time the #** command was used.

Syntax	
$AA4[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
4	The command to read the synchronized data that was retrieved from a specificed module the last time the #** command was used.

Response	
Valid Command	!S(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the module responding in hexadecimal format (00 to FF)
S	The status of the synchronized data
	0: This is **NOT** the first time to read the synchronized data
	1 : This is the first time to read the synchronized data
(Data)	Synchronized data.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	#**
Response	No response
Sends the synchronized sampling command.	

Command	$014
Response	!10F0000
Sends a command to read the synchronized data from module 01. The module returns a reponse indicating that the command was valid, containing the synchronized data and sets the status byte to 1 to indicate that this is the first time the synchronized data has been read. (Digital Input : 0F)	

Command	$024
Response	!00053F00
Sends a command to read the synchronized data from module 01. The module returns a reponse indicating that the command was valid, containing the synchronized data and sets the status byte to 0 to indicate that the synchronized data has been read previously. (Digital Output: 05; Digital Input: 3F)	

※Related Commands : #**

4.2.12 $AA5

Description
This command is used to read the reset status of a specified module.

Syntax	
$AA5[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
5	The command to read the reset status of the module

Response	
Valid Command	!AAS(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
S	The reset status of the module
	1: This is the first time the command has been sent since the module was powered on. 0: This is **NOT** the first time the command has been sent since the module was powered on, which denotes that there has been no module reset since the last $AA5 command was sent.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	$015
Response	!011
Reads the reset status of module 01. The module returns a response showing that the command was valid and it is the first time the $AA5 command has been sent since the module was powered-on.	

Example	
Command	$015
Response	!010
Reads the reset status of module 01. The module returns a response showing that the command was valid and it is **NOT** the first time the $AA5 command has been sent since the module was powered-on.	

4.2.13 $AA6

Description
This command is used to read the status of the digital input/output channels of a specified module

Syntax	
$AA6[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
6	The command to read the status of the digital input/output channels.

Response	
Valid Command	!(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
(Data)	A six-digit hexadecimal value indicating the status of the digital input/output channels.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	$016
Response	!FF0000
Reads the status of the digital input/output channel of module 01 and returns a reponse indicating that the command was valid. (Digital Input: FF)	

Example	
Command	$026
Response	!070F00
Read the status of the digital input/output channel of module 02 and returns a reponse indicating that the command was valid. (Digital Output: 07; Digital Input: 0F)	

※Related Commands: #AA00(Data), #AA0A(Data), AA1c(Data), #AAAc(Data), @AA, @AA(Data)

4.2.14 $AAC

Description
This command is used to clear the status of the latched digital input channels of a specificed module.

Syntax	
$AAC[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be cleared in hexadecimal format (00 to FF)
C	Clear the status of the latched digital input channels

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	@016
Response	>
Sets the DO1 and DO2 channel of module 01 to ON, and the DO0, DO3 channel to OFF, and returns a response indicating that the command was valid.	
Command	$01C
Response	!01
Clears the status of the latched digital input channels of module 01, and returns a response indicating that the command was valid.	
Command	$01L0
Response	!093F00
Sends the command to read the status of the low latched digital input channels of module 01, and returns a response indicating that the command was valid. (Low Latched DI: 3F; Low Latched DO: 09)	

※Related Commands : $AALS

4.2.15 $AACN

Description
This command is used to clear the digital input counter for channel N of a specificed module.

Syntax	
$AACN[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be cleared in hexadecimal format (00 to FF)
C	The command to clear the digital input counter of channel N
N	The command to clear the digital input counter of channel N

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responsding module in hexadecimal format (00 to FF)
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	#011
Response	!0100009
Reads the counter data from channel 1 of module 01 and returns a response indicating that the command was valid and that the counter value is 00009.	

Command	$01C1
Response	!01
Clears the counter value for channel 1 of module 01, and returns a response indicating that the command was valid.	

Command	#011
Response	!0100000
Reads the counter value for channel 1 of module 01 and returns a response indicating that the command was valid and that the counter value is 00000.	

※Related Commands : #AAN

4.2.16 $AAF

Description
This command is used to read the firmware version of a specificed module.

Syntax	
$AAF[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
F	The command to read the firmware version of the module.

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The firmware version of the module as a string value
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	$01F
Response	!0102.00
Reads the firmware version of module 01, and returns a response indicating that the command was valid and showing that the firmware version is 02.00.	

4.2.17 $AALS

Description
This command is used to read the status of the latched digital input channels.

Syntax	
$AALS[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
L	Read the status of the latched digital input channels.
S	The command to read the status of the latched digital input channels 0: Low latched channels 1: High lathched channels

Response	
Valid Command	!(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The status of the latched digital input channels. A four-digit hexadecimal value followed by 00.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	@016
Response	>
Sets the DO1 and DO2 channel of module 01 to ON, and the DO0, DO3 channel to OFF, and returns a response indicating that the command was valid.	

Command	$01C
Response	!01
Clears the status of the latched digital input channels of module 01, and returns a response indicating that the command was valid.	

Command	$01L0
Response	!093F00
Sends the command to read the status of the low latched digital input channels of module 01, and returns a response indicating that the command was valid. (Low Latched DI: 3F; Low Latched DO: 09)	

Command	$01L1
Response	!060000
Sends the command to read the status of the high latched digital input channels of module 01, and returns a response indicating that the command was valid. (High Latched DI : 00; High Latched DO : 06)	

※Related Commands : $AAC

4.2.18 $AAM

Description
This command is used to read the name of a module.

Syntax	
$AAM[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
M	The command to read the name of the module.

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The name of the module as a string value.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	$01M
Response	!01ZT-2060
Reads the name of module 01, and returns a response indicating that the command was valid, and that the name of the module is “ZT-2060”.	

4.2.19 $AAP

Description
This command is used to read the communication protocol information for a specificed module.

Syntax	
$AAP[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
P	The command to read the communication protocol information

Response	
Valid Command	!AASC[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
S	The protocol(s) supported by the module 0 : DCON 1 : DCON and Modbus RTU 3 : DCON and Modbus RTU/ASCII
C	The protocol is current used 0 : DCON 1 : Modbus RTU 3 : Modbus ASCII
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	$01P
Response	!0110
Reads the communication protocol information for module 01 and returns a response indicating that the command was valid with a value of 10, meaning that the module supports the DCON and Modbus RTU protocols and that the protocol which will be used at the next power-on reset is DCON.	

4.2.20 @AA

Description
This command is used to read the status of the digital input/output ports of a specificed module.

Syntax	
@AA[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)

Response	
Valid Command	>(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
>	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	A four-digital hexadecimal value representing the status of the digital input/output ports.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	@02
Response	>0F0F
Reads the status of the digital input/output port of module 02, a response indicating that the command was valid, with a value of 0F0F, which denotes that channels RL0, RL1, RL2 and RL3 are ON and channels IN0, IN1, IN2 and IN3 are also ON.	

※Related Commands : #AA00(Data)、#AA0A(Data)、#AA1c(Data)、#AAAc(Data)、$AA6 @AA(Data)

4.2.21 @AA(Data)

Description
This command is used to enable the digital output channels of a specificed module.

Syntax	
@AA(Data)[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be enabled in hexadecimal format (00 to FF)
(Data)	The data to be written to the digital output channels: Bit 0 of the value corresponds to DO0, and bit 1 corresponds to DO1, etc. When the bit is 1, it denotes that the digital output channel is ON, and 0 denotes that the digital output channel is OFF.

Response	
Valid Command	>[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
Ignored Command	! [CHECKSUM](CR)
>	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
!	Delimiter character to indicate the command was ignored.
	This will be returned if a Host Watchdog timeout has occurred. The digital output channels are set to the safe value, and the digital output value that was sent is ignored.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	@02F
Response	>
Sets the DO0, DO1, DO2 and DO3 channel of module 01 to ON, and returns a response indicating that the command was valid.	

※Related Commands : #AA00(Data)、#AA0A(Data)、#AA1c(Data)、#AAAc(Data)、$AA6 @AA

4.2.22 ~AAD

Description
This command is used to read the Active Status of the Digital I/O of a specificed module.

Syntax	
~AAD[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
D	The command to read the active status of digital I/O

Response	
Valid Command	!AAVV[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
VV	A two-digit hexadecimal value indicating the active status of the digital I/O.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Bit	7	6	5	4	3	2	1	0
Reserved							OAS	IAS
OAS	Active Status – DO							
	0: An output value of 0 indicates that the relay is inactive An output value of 1 indicates that the relay is active 1: An output value of 0 indicates that the relay is active An output value of 1 indicates that the relay is inactive							
IAS	Active Status – DI							
	0: Input value 1 for no-signal or low voltage Input value 0 for high voltage 1: Input value 0 for no-signal or low voltage Input value 1 for high voltage							

※Related Commands: ~AADVV

4.2.23 ~AADVV

Description
This command is used to set the Active Status of Digital I/O of a specificed module

Syntax	
~AADVV[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
D	The command to set the active status of the digital I/O.
VV	A two-digit hexadecimal value indicating the active status of the digital I/O.

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	~02D03
Response	!02
Sets the active status of digital I/O of module 02 and returns a response indicating that the command was valid..	

Command	~02D
Response	!0203
Reads the active status of digital I/O of module 02 and returns a response indicating that the command was valid with the value to the active status is 03.	

※Related Commands : ~AAD

4.2.24 ~**

Description
This command is used to inform all modules that the host is OK.

Syntax	
~**[CHECKSUM](CR)	
~	Delimiter character
**	The “Host OK” command

Response
There is no response to this command

※Related Commands : ~AA0, ~AA1, ~AA2, ~AA3EVV, ~AA4V, ~AA5V

4.2.25 ~AA0

Description
This command is used to read the status of the Host Watchdog for a specoficed module.

Syntax	
~AA0[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
0	The command to read the status of the Host Watchdog

Response	
Valid Command	!AASS[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
SS	Two hexadecimal digits that represent the status of the Host Watchdog, where: Bit 7: 0 indicates that the Host Watchdog is disabled, and 1 indicates that the Host Watchdog is enabled Bit 2: 0 indicates that no Host Watchdog timeout has occurred, and 1 indicates that a Host Watchdog timeout has occurred
	The host watchdog status is stored in EEPROM and can only be reset by using the ~AA1 command.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	~030
Response	!0304
Reads the status of the Host Watchdog for module 03 and returns a response indicating that the command was valid and the that the Host Watchdog timeout has occurred.	

Example	
Command	~030
Response	!0300
Reads the status of the Host Watchdog for module 03 and returns a response indicating that the command was valid, with a value of 00, meaning that the Host Watchdog is disabled and no Host Watchdog timeout has occurred.	

Example	
Command	~030
Response	!0380
Reads the status of the Host Watchdog for module 03 and returns a response indicating that the command was valid, with a value of 08, meaning that the Host Watchdog is enabled. Send the ~AA1 command to reset the status of the Host Watchdog.	

※Related Commands: ~**, ~AA1, ~AA2, ~AA3EVV, ~AA4V, ~AA5V

4.2.26 ~AA1

Description
This command is used to reset the status of the Host Watchdog timeout for a specificed module

Syntax	
~AA1[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be reset in hexadecimal format (00 to FF)
1	The command to reset the status of the Host Watchdog timeout

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address	

Example	
Command	~030
Response	!0304
Reads the status of the Host Watchdog for module 03 and returns a response indicating that the command was valid and the that the Host Watchdog timeout has occurred.	
Command	~031
Response	!03
Resets the status of the Host Watchdog timeout for module 03 and returns a response indicating that the command was valid.	

※Related Commands: ~**, ~AA0, ~AA2, ~AA3EVV, ~AA4V, ~AA5V

4.2.27 ~AA2

Description
This command is used to read the Host Watchdog timeout value for a specificed module

Syntax	
~AA2[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
2	The command to read the Host Watchdog timeout value

Response	
Valid Command	!AAEVV[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
E	0: The status of the Host Watchdog is disabled 1: The status of the Host Watchdog is enabled
VV	Two hexadecimal digits to represent the timeout value in tenths of a second. Eg, 01 denotes 0.1 seconds and FF denotes 25.5 seconds.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	~032
Response	!03190
Reads the status of the Host Watchdog timeout value for module 03 and returns a response indicating that the command was valid, with a value of 0x90, which denotes that the Host Watchdog is enabled and that the Host Watchdog timeout value is 14.4 seconds.	

※Related Commands: ~**, ~AA0, ~AA1, ~AA3EVV, ~AA4V, ~AA5V

4.2.28 ~AA3EVV

Description
This command is used to enable/disable the Host Watchdog for a specidiced module and sets the Host Watchdog timeout value.

Syntax	
~AA3EVV[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be configured in hexadecimal format (00 to FF)
3	The command to enable or disable the Host Watchdog
E	0: Disables the Host Watchdog 1: Enables the Host Watchdog
VV	Two hexadecimal digits to represent the Host Watchdog timeout value in tenths of a second. Eg: 01 denotes 0.1 seconds and FF denotes 25.5 seconds

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address	

Example	
Command	~013164
Response	!01
Enables the Host Watchdog for module 01 and sets the Host Watchdog timeout value to 10.0 seconds. The module returns a response indicating that the command was valid.	
Command	~012
Response	!01164
Reads the Host Watchdog timeout value for module 01. The module returns a response indicating that the command was valid, with a value of 164, which denotes that the Host Watchdog is enabled and the that the Host Watchdog timeout value is 10.0 seconds.	

※Related Commands: ~**, ~AA0, ~AA1, ~AA2, ~AA4V, ~AA5V

4.2.29 ~AA4V

Description
This command is used to read the power-on DO value or the safe DO value for a specificed module

Syntax	
~AA4V[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
4	The command to read the power-on DO value or the safe DO value
V	P: Power-on Value S: Safe Value

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	Power-on or Safe Value
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	~034P
Response	!030700
Reads the power-on DO value for module 03 and returns a response indicating that the command was valid, with a value of 0700, which denotes that the DO0, DO1 and DO2 channels of module 03 will be enabled if rebooting.	

Example	
Command	~034S
Response	!030F00
Reads the safe DO value for module 03 and returns a response indicating that the command was valid, with a value of 0F00, with a value of 0F00, which denotes that the DO0, DO1, DO2 and DO3 channels of module 03 will be enabled if watchdog enabled.	

※Related Commands: ~AA5V

4.2.30 ~AA5V

Description
This command is used to set the current DO value for a specificed module as either the power-on DO value or the safe DO value.

Syntax	
~AA5V[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
5	The command to set the power-on DO value or the safe DO value
V	P: Power-on Value S: Safe Value

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate that the command was valid
?	Delimiter character to indicate that the command was invalid
AA	The address of the responding module in hexadecimal format (00 to FF)
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address	

Example	
Command	@037
Response	>
Sets the DO0, DO1 and DO2 channels of module 01 to ON, and the DO3 channel to OFF, and returns a response indicating that the command was valid.	
Command	~035P
Response	!03
Sets the power-on DO value for module 03 and the module returns a response indicating that the command was valid.	

Example	
Command	@03F
Response	>
Sets the DO0, DO1, DO2 and DO3 channels of module 01 to ON, and returns a response indicating that the command was valid.	
Command	~035S
Response	!03
Sets the safe DO value for module 03 and the module returns a response indicating that the command was valid.	

※Related Commands: ~AA4V

4.3 The Modbus RTU Protocol Command Set

The Modbus Protocol was developed by Modicon Inc., and was originally designed for Modicon controllers. Detailed information regarding the Modbus RTU Protocol can be found at:
http://www.modicon.com and http://www.modbus.org

- Modbus RTU Command Format

Field 1	Field 2	Field 3	Field 4~n	Field n+1~n+2
Module Address	Function Code	Sub Function	Configuration Field	CRC16

Function Code	Description
0x01	Reads the coils
0x02	Reads the discrete inputs
0x03	Reads multiple registers
0x04	Reads multiple input registers
0x05	Writes to a single coil
0x0F	Writes to multiple coils

Examples:

A. To modify the power-on value for module 01, the following command should be sent
   01 46 27 0F BB F9
B. To read the current DI value of channels 0 to 5, the following command should be sent:
   01 02 00 00 00 05 B8 09
C. To write the DO value 0x0F from channels 0 to 4, the following command should be sent:
   01 0F 00 00 00 04 01 FF 7E D6
D. To only set the DO value of channel 2 to 1, the following command should be sent:
   01 05 00 02 FF 00 2D FA

4.3.1 Modbus Address Mapping

Address Mapping		
Address	Description	Attribute
00001	The Digital Output Channel	R/W
00033	The Digital Input Channel	R
10001	The Digital Input Channel	R
00065	The High Latched DI/O Channels	R
00097	The Low Latched DI/O Channels	R
00129	The Safe Value	R/W
00161	The Power-on Value	R/W
40485	The Module Address. Valid Range is 1~247	R/W
40486	(1) Bits 5:0 (Baud Rate) Valid Range: 0x03-0x0A (2) Bits 7:6 (Data Format) 00: No Parity, 1 Stop Bit 10: Even Parity, 1 Stop Bit 11: Odd Parity, 1 Stop Bit	R/W
00264	Used to Clear the Latched DI/O	W
00513	Used to Clear the DI Count	W
40481	The Firmware Version (Low Word)	R
40482	The Firmware Version (High Word)	R
40483	The Module Name (Low Word)	R
40484	The Module Name (High Word)	R
30001	The DI Count Value	R
00260	The Modbus Host Watchdog Mode: 0: The same as I-7000 series modules 1: The AO and DO commands can be used to clear the status of Host Watchdog timeout	R/W
00261	Enables or disables the Host Watchdog. Write 0 to disable and 1 to enable.	R/W
00270	The Host Watchdog Timeout Status. (Write 1 to clear the Host Watchdog timeout status)	R/W
40492	The Host Watchdog Timeout Count (Write 0 to clear the Host Watchdog timeout count)	R/W
40489	The Host Watchdog Timeout Value.	R/W

	Valid Range is 0~255 in 0.1/s intervals	
00257	The Current Protocol, 0: DCON, 1: Modbus	R/W
10273	The Reset Status 1: This is the first time the module has been read after being powered on 0: This is **NOT** the first time the module has been read after being powered on	R
312345 412345	Informs all modules that the Host is OK	R

4.3.2 PLC Address Mapping

Function Code	Description	Section
0x01	Reads the Coils	4.3.3
0x02	Reads the Discrete Inputs	4.3.4
0x03	Reads Multiple Registers	4.3.5
0x04	Reads Multiple Input Registers	4.3.6
0x05	Writes a Single Coil	4.3.7
0x06	Writes Multiple Registers	4.3.8
0x0F	Writes Multiple Coils	4.3.9
0x46	Reads/Writes the Module Settings	4.3.10

If the function specified in the message is not supported, then the module will respond as below. Note that the Address mapping of the Protocol is base 0.

Error Response

Number	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	Function Code + 0x80
02	Exception Code	1	01

Note: If a CRC mismatch occurs, the module will not respond.

4.3.3 01 (0x01) Read the Coils

Description
This function code is used to read the current digital output readback value of the ZT-2000 I/O module.

Request				
Byte	Description	Length	Value	
00	Address	1	0x01 to 0xF7	
01	Function Code	1	0x01	
02-03	Starting Channel Numbers or Address Mapping	2	DO	0x0000 ~ 0x001F
			DI	0x0020 ~ 0x003F
			DI/O Latch High	0x0040 ~ 0x005F
			DI/O Latch Low	0x0060 ~ 0x007F
			Safe Value	0x0080 ~ 0x009F
			Power-on Value	0x00A0 ~ 0x00BF
			Reads the WDT Mode	0x0103
			Reads the WDT Enable	0x0104
			Read WDT Status	0x010D
			Read Protocol	0x0100
			Read Reset Status	0x0110
04-05	Output Channel Number or Bit Count	2	0x0001-0x0020 (Bit Count)	

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x01
02	Byte Count	1	Byte Count of the Response [B = (Bit Count + 7)/8]
03	Bit Values	B	(Bit Values)
Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x81
02	Exception Code	1	Refer to the Modbus standard for more details

Example		
Command	05 01 00 00 00 04 [3C 4D]	
	Byte 1	01 (Function Code)
	Bytes 2~3	00 00 (Starting Channel Number)
	Bytes 4~5	00 04 (Output Channel Number)
	Bytes 6~7	3C 4D (CRC)
Response	05 01 01 06 [D0 BA]	
	Byte 1	01 (Function Code)
	Byte 2	01 (Byte Count of the Response)
	Byte 3	06 (DO0~DO3 Value)
	Bytes 4~5	D0 BA (CRC)
Reads the digital output value of the DO to DO3 channels for module 05.		

Example	
Command	05 01 00 40 00 04 [3D 99]
Response	05 01 01 07 [11 7A]
Reads the digital input high latch value of the DI0 to DI3 channels for module 05.	

Examples	
Command	05 01 01 03 00 01 [0D B2]
Response	05 01 01 00 [50 B8]
Reads the Modbus Host Watchdog mode.	

Examples	
Command	05 01 01 10 00 01 [FC 77]
Response	05 01 01 01 [91 78]
Reads the reset status of the modules	

Examples	
Command	05 01 01 04 00 01 [BC 73]
Response	05 01 01 00 [50 B8]
Reads whether the Host Watchdog is enabled or not	

Examples	
Command	05 01 01 0D 00 01 [6C 71]
Response	05 01 01 00 [50 B8]
Resets the Host Watchdog timeout status for a specificed module	

➢ Supported Modules – ZT-2060

Items	Valid Starting Channel
DO	0x0000 ~ 0x0003
DI	0x0020 ~ 0x0025
High Latched DI Channel	0x0040 ~ 0x0045
High Latched DO Channel	0x0046 ~ 0x0049
Low Latched DI Channel	0x0060 ~ 0x0065
Low Latched DO Channel	0x0066 ~ 0x0069
Safe Value	0x0080 ~ 0x0083
Power-on Value	0x00A0 ~ 0x00A3

4.3.4 02 (0x02) Read Discrete Inputs

Description
This function code is used to read the current digital input values of the ZT-2000 I/O module.

Request				
Byte	Description	Length	Value	
00	Address	1	0x01 to 0xF7	
01	Function Code	1	0x02	
02-03	Starting Channel Numbers or Address Mapping	2	DI	0x0000 ~ 0x001F
04-05	Output Channel Number or Bit Count	2	0x0001-0x0020 (Bit Count)	

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x02
02	Byte Count	1	Byte Count of the Response [B = (Bit Count + 7)/8]
03	Bit Values	B	(Bit values)

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x82
02	Exception Code	1	Refer to the Modbus standard for more details

Example		
Command	01 02 00 00 00 08 [79 CC]	
	Byte 1	02 (Function Code)
	Bytes 2~3	00 00 (Starting Channel Numbers)
	Bytes 4~5	00 08 (Output Channel Number)
	Bytes 6~7	79 CC (CRC)
Response	01 02 01 FF [E1 C8]	
	Byte 1	02 (Function Code)
	Byte 2	01 (Byte count of the Response)
	Byte 3	FF (DI0 ~ DI7 Value)
	Bytes 4~5	E1 C8 (CRC)
Reads the digital output of module 01, and returns a reponse indicating that the command was valid, with a value of 0xFF, meaning that the DO0 to DO7 channels which are enabled.		

➢ Supported modules – ZT-2060

Item	Valid Starting Channel
DI	0x0020 ~ 0x0025

4.3.5 03 (0x03) Read Multiple Registers

Description
This function code is used to read the current digital input counter values for the ZT-2000 I/O module.

Request				
Byte	Description	Length	Value	
00	Address	1	0x01 to 0xF7	
01	Function Code	1	0x03	
02-03	Starting Channel Numbers or Address Mapping	2	DI Count	0x0000 ~ 0x001F
			Module Address	0x01E4
			Firmware Version	0x01E0
			Module Name	0x01E2
			Timeout Count	0x01EB
			Timeout Value	0x01E8
			Host OK	0x3038
04-05	Output Channel Number or Bit Count	2	0x0001-0x0020 (Bit count)	

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x03
02	Byte Count	1	Byte Count of the Response (B=2 * Word Count)
03~	Bit Values	B*2	Register Values

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x83
02	Exception Code	1	Refer to the Modbus standard for more details

Example		
Command	01 03 01 E2 00 02 [65 C1]	
	Byte 1	03 (Function Code)
	Bytes 2~3	01 E2 (Starting Channel Number)
	Bytes 4~5	00 02 (Output Channel Number)
	Bytes 6~7	65 C1 (CRC)
Response	01 03 04 20 60 00 54 [F0 12]	
	Byte 1	03 (Function Code)
	Byte 2	04 (Byte count of the Response)
	Byte 3	20 60 00 54 (Module Name)
	Bytes 4~5	F0 12 (CRC)
Reads the name of the module.		

Example	
Command	05 03 01 E4 00 01 [C4 45]
Response	05 03 02 00 05 [89 87]
Reads the software address of the module.	

Example	
Command	01 03 00 00 00 08 [44 0C]
Response	01 03 10 00 15 00 15 00 15 00 15 00 15 00 15 00 15 00 15 [2D 56]
Reads the DI count of the module.	

Example	
Command	05 03 01 EB 00 01 [F4 46]
Response	05 03 02 00 00 49 84
Reads the Host Watchdog timeout value for a module.	

Example	
Command	00 03 30 38 00 01 [0B 16]
Response	There is no response to this command
Informs all modules that the Host is OK	

➢ Supported Modules – ZT-2060

Item	Valid Starting Channel
DI Count Value	0x0000 ~ 0x0005

4.3.6 04 (0x04) Read Multiple Input Registers

Description
This function code is used to read the current digital input counter values of the ZT-2000 I/O module

Request				
Byte	Description	Length	Value	
00	Address	1	0x01 to 0xF7	
01	Function Code	1	0x04	
02-03	Starting Channel Numbers or Address Mapping	2	DI Count	0x0000 ~ 0x001F
			Software Module Address	0x01E4
			Firmware Version	0x01E0
			Module Name	0x01E2
			Timeout Count	0x01EB
			Timeout Value	0x01E8
			Host OK	0x3038
04-05	Output Channel Number or Bit Count	2	0x0001-0x0020 (Bit Count)	

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x04
02	Byte Count	1	Byte Count of the Response (B=2 * Word Count)
03~	Bit Values	B*2	Register Values

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function code	1	0x84
02	Exception code	1	Refer to the Modbus standard for more details

Example	
Command	05 04 01 E2 00 02 [B 85]
Response	05 04 04 20 60 00 54 [B4 65]
Reads the name of the module.	

Example	
Command	01 04 01 E4 00 01 [70 01]
Response	01 04 02 00 20 [B8 E8]
Read the software address of the module.	

Example	
Command	01 04 00 00 00 06 [70 01]
Response	01 04 0C 00 00 00 00 00 00 00 00 00 00 00 00 [95 B7]
Read the DI count of the module	

Example	
Command	00 04 30 38 00 01 [BE D6]
Response	There is no response to this command
Informs all modules that the host is OK	

➢ Supported modules – ZT-2060

Item	Valid Starting Channel
DI Count Value	0x0000 ~ 0x0005

4.3.7 05 (0x05) Write a Single Coil

Description
This function code is used to write the digital output value of the ZT-2000 I/O module.

Request				
Byte	Description	Length	Value	
00	Address	1	0x01 to 0xF7	
01	Function Code	1	0x05	
02-03	Starting Channel Numbers	2	DO	0x0000 ~ 0x001F
			DI Counter Value	0x0200 ~ 0x021F
			Safe Value	0x0080 ~ 0x009F
			Power-on Value	0x00A0 ~ 0x00BF
			Clears the Digital Latched	0x0107
			Sets the WDT Mode	0x0103
			Sets the WDT to Enabled	0x0104
			Clears the WDT Status	0x010D
04-05	Output Value	2	A value of 0xFF00 sets the output to ON A value of 0x0000 sets the output to OFF	

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x05
02-03	Address	2	This value is the same as byte 02 and 03 of the Request
04-05	Output Channel Numbers	2	This value is the same as byte 04 and 05 of the Request

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x85
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	05 05 00 83 FF 00 [7C 56]
Response	05 05 00 83 FF 00 [7C 56]
Sets the power-on value for DO3 to ON.	

Example	
Command	05 05 02 00 FF 00 [8C 06]
Response	05 05 02 00 FF 00 [8C 06]
Clears the digital input counter for a module 05.	

Example	
Command	05 05 00 02 FF 00 [2C 7E]
Response	05 05 00 02 FF 00 [2C 7E]
Sets channel DO2 to ON.	

Example	
Command	05 05 01 07 FF 00 [3D 83]
Response	05 05 01 07 FF 00 [3D 83]
Clears the digital latch for the modules 05.	

Example	
Command	05 05 01 03 FF 00 [7C 42]
Response	05 05 01 03 FF 00 [7C 42]
Sets the Host Watchdog mode to Mode 1.	

Example	
Command	05 05 01 03 00 00 [3D B2]
Response	05 05 01 03 00 00 [3D B2]
Sets the Host Watchdog mode to Mode 0.	

Example	
Command	05 05 01 04 FF 00 [CD 83]
Response	05 05 01 04 FF 00 [CD 83]
Sets the Host Watchdog to enable.	

Examples	
Command	05 05 01 0D FF 00 [1D 81]
Response	05 05 01 0D FF 00 [1D 81]
Clears the status of the Host Watchdog.	

➢ Supported modules – ZT-2060

Item	Valid Starting Channel
DO	0x0000 ~ 0x0003
Clears the DI Count Value	0x0200 ~ 0x0205
Safe Value	0x0080 ~ 0x0083
Power-on Value	0x00A0 ~ 0x00A3

4.3.8 06 (0x06) Write Multiple Registers

Description
This function code is used to configure the settings of the ZT-2000 I/O module.

Request				
Byte	Description	Length	Value	
00	Address	1	0x01 to 0xF7	
01	Function Code	1	0x06	
02-03	Address Mapping	2	Software Module Address	0x01E4
			Clears the Host Watchdog Timeout Count	0x01EB
			Sets the Host Watchdog Timeout Value	0x01E8
04-05	Register Value	2	Sets the Host Watchdog Timeout Value	

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x06
02-03	Address Mapping	2	The value is the same as bytes 02 and 03 of the Request
04-05	Register Value	2	Register Value

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x86
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	05 06 01 E8 00 C8 [08 10]
Response	05 06 01 E8 00 C8 [08 10]
Sets the Host Watchdog Timeout Value (0~255 in 0.1s intervals).	

Example	
Command	09 06 01 EB 00 00 [F9 4A]
Response	09 06 01 EB 00 00 [F9 4A]
Clears the Host Watchdog Timeout Count	

4.3.9 15(0x0F)Write multiple coils

Description
This function code is used to write the digital output value of the ZT-2000 I/O module.

Request				
Byte	Description	Length	Value	
00	Address	1	0x01 to 0xF7	
01	Function Code	1	0x0F	
02-03	Starting Channel Numbers	2	DO	0x0000 ~ 0x001F
			Clears the DI Count Value	0x0200 ~ 0x021F
			Safe Value	0x0080 ~ 0x009F
			Power-on Value	0x00A0 ~ 0x00BF
04-05	Output Channel Number	2	0x0001 ~ 0x0020 (Bit Count)	
06	Byte Count	1	B=(Bit Count + 7)/8	
07	Output Value	2	A bit corresponds to a channel. When the bit is '1', it denotes that the value of the channel that was set is ON. If the bit is '0', it denotes that the value of the channel that was set is OFF.	

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x0F
02-03	Starting Channel Number	2	The value is the same as bytes 02 and 03 of the Request
04-05	Input Channel Number	2	0x0001 ~ 0x0020

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x8F
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	05 0F 00 A1 00 03 01 07 [72 BF]
Response	05 0F 00 A1 00 03 [45 AC]
Sets the Safe value for channels DO1 to DO3 of a module.	

Example	
Command	05 0F 00 00 00 03 01 FF [CE E4]
Response	05 0F 00 00 00 03 14 4E
Sets the DO value for channels DO0 to DO3 of a module.	

Example	
Command	01 0F 02 00 00 08 01 FF [BF 37]
Response	01 0F 02 00 00 08 55 B5
Clears the DI count for channels DI0 to DI7 of a module.	

➢ Supported modules – ZT-2060

Item	Valid Starting Channel
DO	0x0000 ~ 0x0003
Clears the DI Count Value	0x0200 ~ 0x0205
Safe Value	0x0080 ~ 0x0083
Power-on Value	0x00A0 ~ 0x00A3

4.3.10 70 (0x46) Read/Write the Module Settings

Description		
This function code is used to read the settings of the ZT-2000 I/O module, or to change the settings of the ZT-2000 I/O module. The following sub-function codes are supported.		
Sub-function Code	**Description**	**Section**
00 (0x00)	Reads the Name of the Module	A.1
04 (0x04)	Read Software Address of the Module	A.2
05 (0x05)	Reads the Communication Settings	A.3
32 (0x20)	Read the Firmware Version Information	A.4
33 (0x21)	Sets the DI Counter Edge Value	A.5
34 (0x22)	Reads the DI Counter Edge Value	A.6
39 (0x27)	Sets the DO Power-on Value	A.7
40 (0x28)	Reads the DO Power-on Value	A.8
41 (0x29)	Sets the DI/O Active Status	A.9
42 (0x2A)	Reads the DI/O Active Status	A.10

A.1 00 (0x00) Read the Name of the Module

Description
This sub-function code is used to read the name of the ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-Function Code	1	0x00

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-Function Code	1	0x00
03-06	Module Name	4	0x54 0x20 0x60 0x00 for ZT-2060

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	01 46 00 [12 60]
Response	01 46 00 54 20 60 00 [3C 9C]

A.2 04 (0x04) Set the Software Address of the Module

Description
This sub-function code is used to read the name of the ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x04
03	New Address	1	0x01 to 0xF7
04-06	Reserved	1	0x00 0x00 0x00

Response			
Byte	Description	Length	Value
00	New Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x04
03	New Address	4	0x00: OK; Others: Error
04-06	Reserved	1	0x00 0x00 0x00

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	01 46 04 20 00 00 00 [FF 66]
Response	20 46 04 00 00 00 00 [C5 A4]

A.3 05 (0x05) Read Communication Protocol

Description
This sub-function code is used to read the current communication protocol settings for ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x05
03	Reserved	1	0x00

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x05
03	Protocol Support	1	1: DCON and Modbus RTU Protocols supported
04	Baud Rate	1	0x0A
05	Reserved	1	0x00
06	Data Format	1	0=N81; 2=N82; 3=E81; 4=O81
07	Reserved	1	0x00
08	Curent Protocol	1	0=DCON; 1=Modbus RTU
09-10	Reserved	2	0x00 0x00

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0xC6
02	Exception Code	1	Refer to Modbus standard for more details

Example	
Command	05 46 05 00 [E2 6D]
Response	05 46 05 01 0A 00 00 00 01 00 00 [F0 BF]
Reads the current communication protocol settings and returns a response indicating that the command was valid.	

A.4 32 (0x20) Read Firmware Version Information

Description
This sub-function code is used to read the firmware version information of the ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x20

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-Function Code	1	0x20
03	Major Version	1	0x00 ~ 0xFF
04	Minor Version	1	0x00 ~ 0xFF
05	Minor Version	1	0x00 ~ 0xFF

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	01 46 20 [13 B8]
Response	01 46 20 01 00 00 [D2 05]

A.5 33 (0x21) Set the Digital Input Counter Edge Value

Description
This sub-function code is used to set the digital input counter trigger edge value of the ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-Function Code	1	0x21
03	Edge Setting Value	1	0x00 ~ 0xFF (DI0 ~ DI7)
04	Edge Setting Value	1	0x00 ~ 0xFF (DI8 ~ DI15)
05	Edge Setting Value	1	0x00 ~ 0xFF (DI16 ~ DI23)
06	Edge Setting Value	1	0x00 ~ 0xFF (DI24 ~ DI31)

(1 = Rising Edge; 0 = Falling Edge)

Eg, 0x03 denotes that channels 0~1 are set to Rising Edge and channels 2~3 are set to Falling Edge.

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x21
03	Edge Setting Value	1	0x00: OK; Others: Error

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	01 46 21 FF [B8 1D]
Response	01 46 21 00 [F8 5D]

Example	
Command	01 46 22 [92 79]
Response	01 46 22 FF [B8 ED]

A.6 34 (0x22) Read the Digital Input Counter Edge Value

Description
This sub-function code is used to read the digital input counter trigger edge value of the ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x22

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x22
03	Edge Setting Value	1	0x00 ~ 0xFF (DI0 ~ DI7)
04	Edge Setting Value	1	0x00 ~ 0xFF (DI8 ~ DI15)
05	Edge Setting Value	1	0x00 ~ 0xFF (DI16 ~ DI23)
06	Edge Setting Value	1	0x00 ~ 0xFF (DI24 ~ DI31)

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Examples	
Command	05 46 21 3F [B9 7D]
Response	05 46 21 00 [F9 6D]
Sets the counter edge for channels DI0-DI5 count edge to Rising Edge.	

Examples	
Command	05 46 22 [D3 B8]
Response	05 46 22 3F [B9 8D]
Reads the channels DI0 to DI5 of module 05 and returns a response indicating that the command was valid with the value of 3F, meaning that the count edge is Rising Edge.	

A.7 39 (0x27) Set the Digital Output Power-on Value

Description
This sub-function code is used to set the power-on value of the ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x27
03	Power-on Value	1	0x00 ~ 0xFF (DO0 ~ DO7)
04	Power-on Value	1	0x00 ~ 0xFF (DO8 ~ DO15)
05	Power-on Value	1	0x00 ~ 0xFF (DO16 ~ DO23)
06	Power-on Value	1	0x00 ~ 0xFF (DO24 ~ DO31)

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x27
03	Power-on Value	1	0x00=OK; Others=Error

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Examples	
Command	05 46 27 0F [BA C9]
Response	05 46 27 00 [FA CD]
Set the power-on value for channels DO0 to DO3.	

Examples	
Command	05 46 28 [53 BF]
Response	05 46 28 0F [BF 39]
Reads the channels DO0 to DO3 of module 05 and returns a response indicating that the command was valid with the value of 0F.	

A.8 40(0x28) Read the Digital Output Power-on Value

Description
This sub-function code is used to read the power-on value of the ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x28

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x27
03	Power-on Value	1	0x00 ~ 0xFF (DO0 ~ DO7)
04	Power-on Value	1	0x00 ~ 0xFF (DO8 ~ DO15)
05	Power-on Value	1	0x00 ~ 0xFF (DO16 ~ DO23)
03	Power-on Value	1	0x00 ~ 0xFF (DO24 ~ DO31)

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function code	1	0xC6
02	Exception code	1	Refer to the Modbus standard for more details

Examples	
Command	05 46 27 0F [BA C9]
Response	05 46 27 00 [FA CD]
Set the power-on value for channels DO0 to DO3.	

Examples	
Command	05 46 28 [53 BF]
Response	05 46 28 0F [BF 39]
Reads the channels DO0 to DO3 of module 05 and returns a response indicating that the command was valid with the value of 0F.	

A.9 41(0x29) Set DI/O Active Status

Description
This sub-function code is used to set the DI/O active states of the ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x29
03	DI/O Active Status	1	0x00 ~ 0x03

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x29
03	DI/O Active Status	1	0x00 = OK; Others = Error

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Examples	
Command	01 46 29 02 [7E 5C]
Response	01 46 29 00 [FF 9D]
Sets the active status for digital inputs and outputs.	

Examples	
Command	01 46 2A [93 BF]
Response	01 46 2A 02 [7E AC]
Reads the active status for digital inputs and outputs.	

Bit	7	6	5	4	3	2	1	0
Reserved							OAS	IAS
OAS	Active Status – DO							
	0: An output value of 0 indicates that the relay is inactive An output value of 1 indicates that the relay is active 1: An output value of 0 indicates that the relay is active An output value of 1 indicates that the relay is inactive							
IAS	Active Status – DI							
	0: Input value 1 for no-signal or low voltage Input value 0 for high voltage 1: Input value 0 for no-signal or low voltage Input value 1 for high voltage							

A.10 42(0x2A) Read DI/O Active Status

Description
This sub-function code is used to read the DI/O active states of a module

Request			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-function Code	1	0x2A

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0x46
02	Sub-Function Code	1	0x2A
03	DI/O Active Status	1	0x00 ~ 0x03

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7
01	Function Code	1	0xC6
02	Exception Code	1	Refer to Modbus standard for more details

Examples	
Command	01 46 29 02 [7E 5C]
Response	01 46 29 00 [FF 9D]
Sets the active status for digital inputs and outputs.	

Examples	
Command	01 46 2A [93 BF]
Response	01 46 2A 02 [7E AC]
Reads the active status for digital inputs and outputs.	

Bit	7	6	5	4	3	2	1	0
Reserved							OAS	IAS
OAS	Active Status – DO							
	2: An output value of 0 indicates that the relay is inactive An output value of 1 indicates that the relay is active 3: An output value of 0 indicates that the relay is active An output value of 1 indicates that the relay is inactive							
IAS	Active Status – DI							
	2: Input value 1 for no-signal or low voltage Input value 0 for high voltage 3: Input value 0 for no-signal or low voltage Input value 1 for high voltage							

5 Troubleshooting

(1) Technical Support.

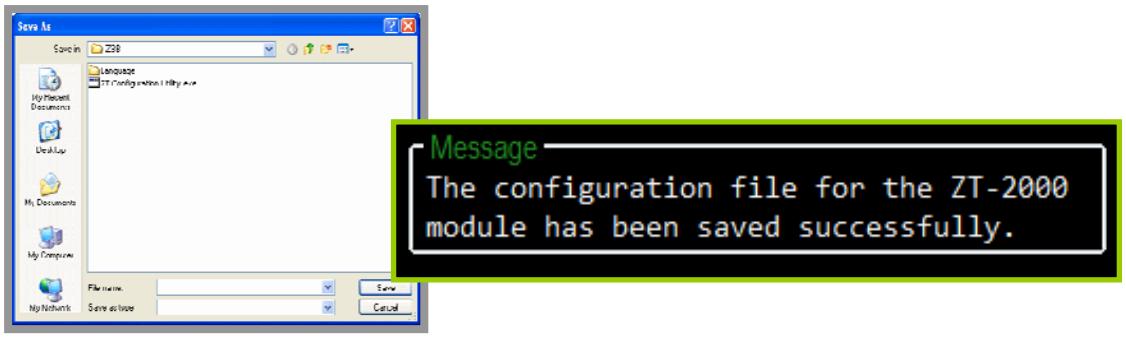
If you have any difficulties using your ZT-2000 series I/O device, please send a description of the problem to service@icpdas.com

Include the following items in your email:

- *A description or diagram of the current DIP switch positions.*
- *A copy of the configuration file for the ZT-2000 coordinator. This file can be obtained using the procedure outlined below and should be attached to your email.*

a. Set the DIP switch of the ZT-255x device to the [ZBSET] position then reboot the device. Launch the ZT Configuration Utility and select [Save Log] icon to save the configuration of the ZT-255x as a file.

b. After clicking the [Save Log] icon, enter the “File Name” and the “File Path” in the Windows “Save” dialog box. Once the configuration has been successfully saved, the following message will be displayed.



6 Appendix

6.1 Dual Watchdog Operation

Dual Watchdog = Module Watchdog + Host Watchdog

The Module Watchdog is a hardware reset circuit that monitors the operating status of the module. While working in harsh or noisy environments, the module may be shut down by external signals. The Watchdog circuit allows the module to operate continuously without disruption.

The Host Watchdog is a software function that monitors the operating status of the host. Its purpose is to prevent problems due to network/communication errors or host malfunctions. When a Host Watchdog timeout occurs, the module will reset all outputs to a safe state in order to prevent any erroneous operations of the controlled target.

ZT-2000 series devices include an internal Dual Watchdog, making the control system more reliable and stable.

6.2 Reset Status

The reset status of a module is set when the module is powered-on or when the module is reset by the Module Watchdog, and is cleared after responding to the first $AA5 command. This can be used to check whether the module had been previously reset. When the response $AA5 to the command indicates that the reset status has been cleared, it means that the module has not been reset since the last $AA5 command was sent. When the response $AA5 to the command indicates that the reset status has been set, and it is not the first time the $AA5 command has been sent, it means that the module has been reset and the digital output value has been changed to the power-on value.

6.3 Digital Output

In addition to configuring the module using digital output commands, the digital output channels can be configured under two other conditions.

Safe Value

When the Host Watchdog is enabled and a Host Watchdog timeout occurs, the “safe value” is loaded to the digital output channels. Any digital output commands have no effect on the digital output ports until the Host Watchdog timeout status is cleared. The Host Watchdog timeout status is saved in the EEPROM, and the status will not be changed, even after a power-on reset. The timeout status can only be cleared by sending the Reset Host Watchdog timeout status command, ~AA1. See Section 6.1 for deltailed information regarding the Host Watchdog.

Power-on Value

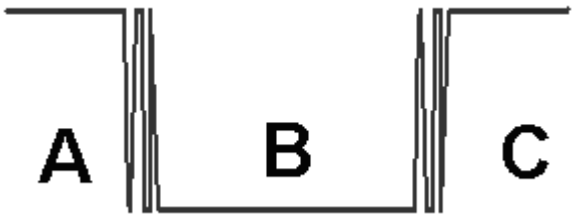
When the module is powered on and the Host Watchdog timeout status is cleared, the “power-on value” will be loaded to the digital output channels after a power-on reset. If the Host Watchdog timeout status has not been cleared during the power-on process, then the safe value will be loaded to the digital output channels.

Both the safe value and power-on value can be set using the ~AA5V command. Refer to Section 4.2.30 for details.

6.4 Latched Digital Input

ZT-2000 series I/O module allows commands to be used to read the status of both the latched high digital input channels and latched low digital input channels. The following is an example that shows the usefulness of latched digital input.

If we read the input of a key switch that is connected to the digital input channel of a module, the input signal is a pulse signal, as shown in the following figure.



In this diagram, it can be seen that during periods A and C, the signal is active, but during period B, the signal is inactive for some unknown reason.

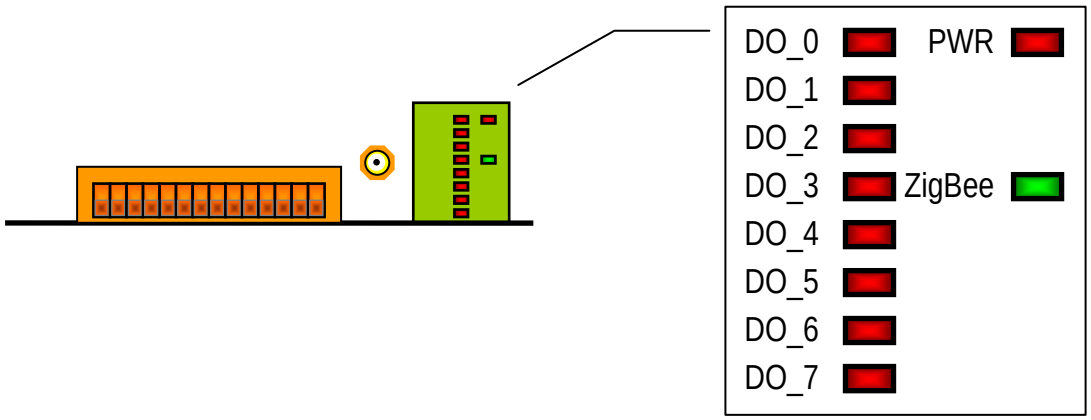
If we attempt to use the Read Digital Input Status command (@AA) to read the signal, but we cannot send the command during period B because of an unknow reason, then the input information will be lost. However, by using the Read Latched Digital Input command ($AALS), we can still retrieve the input information, even if we are not able to send a command during period B. For details related to the Read Latched Digital Input command, refer to Section 4.2.17.

6.5 LED Display Status

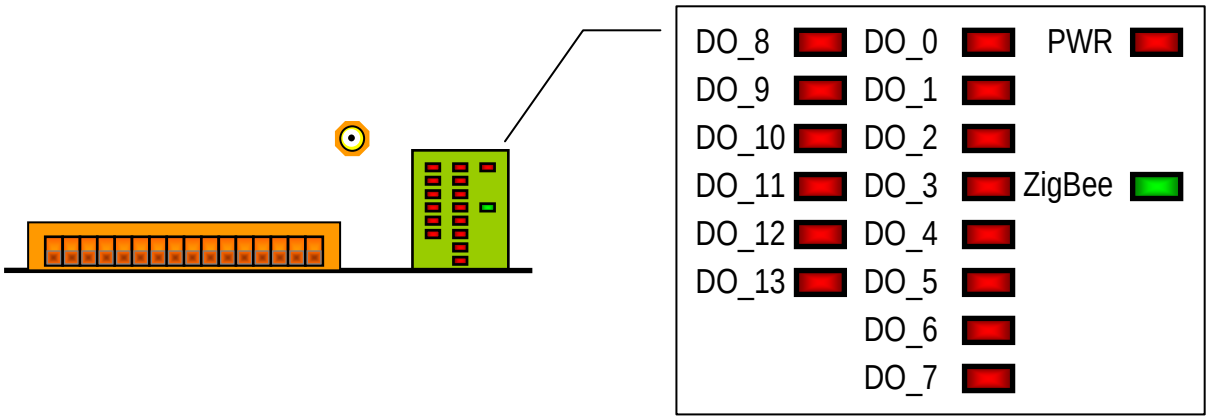
An LED indicator is used to display the status of the power (PWR), the ZigBee network, and individual light for each DI or DO channels.

LED Indicator	Status	Introduction
ZigBee Net (Green LED)	ZigBee Coordinator (Host)	
	Steady Lit	ZigBee network is Establish
	Blink to Steady Lit	Rejoin ZigBee Network or It has Occupied
	ZigBee Router (Slave)	
	Steady Lit	The Signal is Strong
	Blinking (500 ms)	The Signal is Available
	Blinking (1s)	The Signal is Weak
	Blinking (2s)	The Signal is Unstable or There is no Available
ZigBee PWR (Red LED)	The status of module board	
	Steady Lit	The Power is ON and the Module Initialization is Correct
	Blinking (200ms)	Module Initialization Failure
	Blinking (1s)	Watchdog is Enabled and the status of the I/O channel has been changed to the Safe Value. Reset the module via the power switch or configuration commands.
	Steady Unlit	The Power is OFF
ZigBee DI/DO	The status of DI/DO channels	
	Steady Lit	The DI/DO channel is Enabled
	Steady Unlit	The DI/DO channel is Disabled

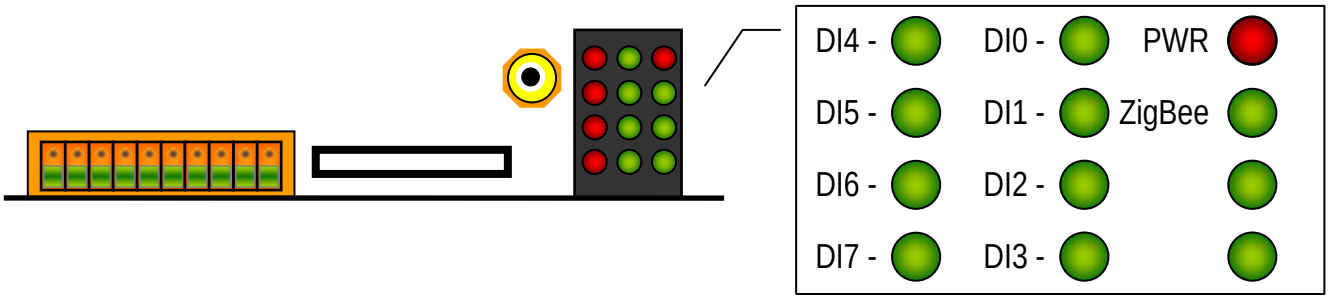
➢ ZT-2042



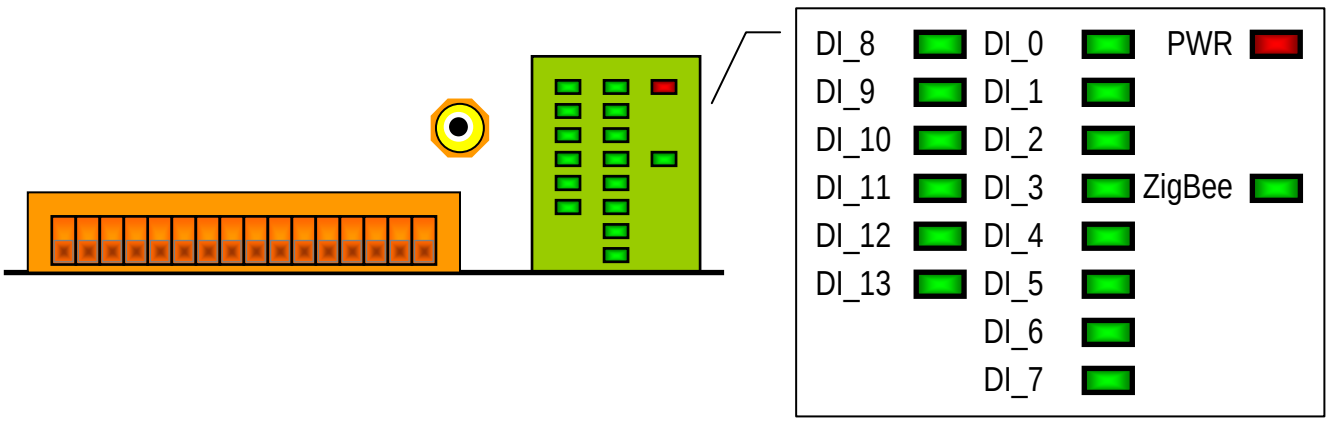
➢ ZT-2043



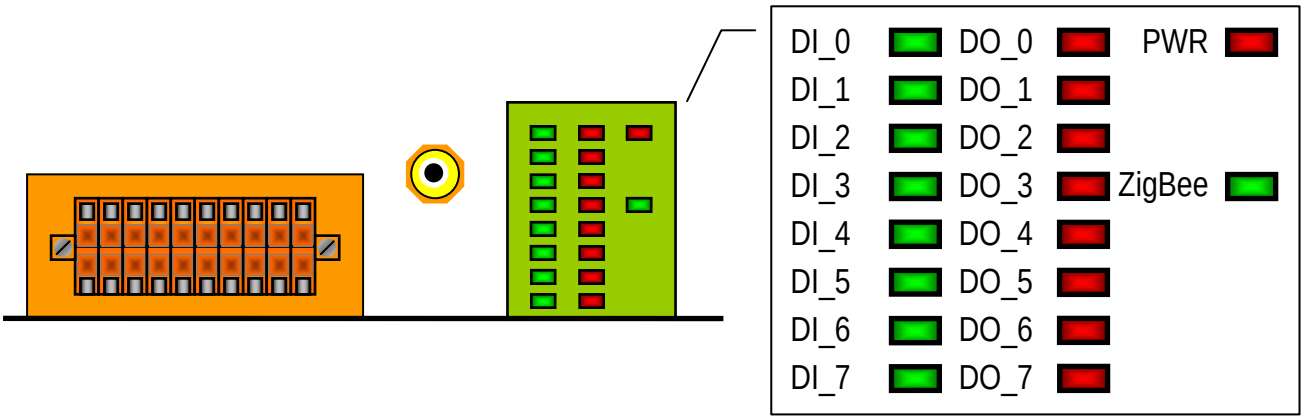
➢ ZT-2052



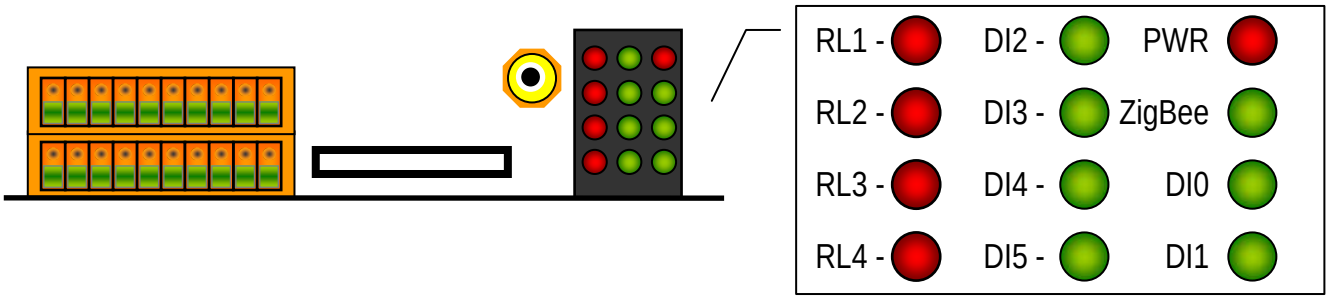
➢ ZT-2053



➢ ZT-2055



➢ ZT-2060



6.6 The Extension to the Software Address

There are only 31 adjustable addresses available to the DIP and rotary switches for the ZT-2000 series I/O modules. If there are any requirments for more range of addresses, there is a software configuration feature for the Address parameter.

If we attempt to configure the Address parameter, there are DCON and Modbus RTU command set provided. Please refer the details at the section 4.2.3 for DCON commands or the section 4.3.6 and 4.3.8 for Modbus RTU commands. In addition, we also can use DCON Utility to set the Address parameter for the more values of 0x00 to 0xFF.

Finally, we only turn the Address of DIP and rotary switches to address 0 and reboot module, the software address will be enabled.