ZB-2000 Modules

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!

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1. Introduction

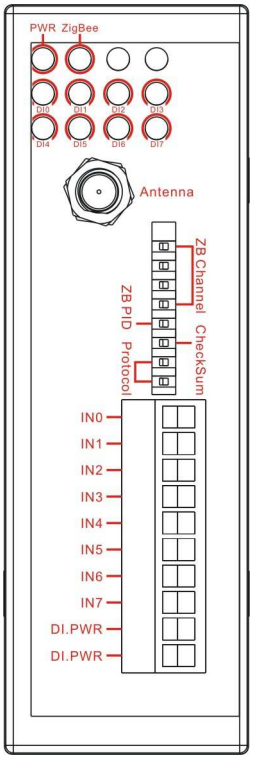
ZB-2000 is a family of wireless(ZigBee) data acqusition and control modules. They provide digital input/output, timer/counter and others functions. These modules can be remote controlled by a set of commands. The DIO modules support TTL signal, photo-isolated digital input, relay contact output, solid-state relay output, PhotoMOS output and open-collector output. Reference *Sec.1.3* for detail information.

1.1 More Information

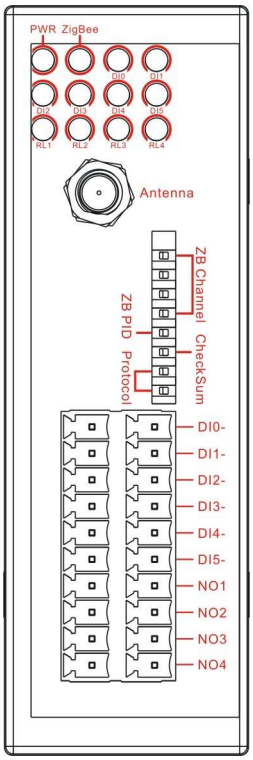
ZB-2000 modules is a wireless data acqusition based client/server system. Accordingly, A Net Server of ZigBee(ZB-2570) is essential in such system. Please refer to " ZigBee converter quick start " for more information as following links:
http://ftp.icpdas.com/pub/cd/usbcd/napdos/zigbee/manual

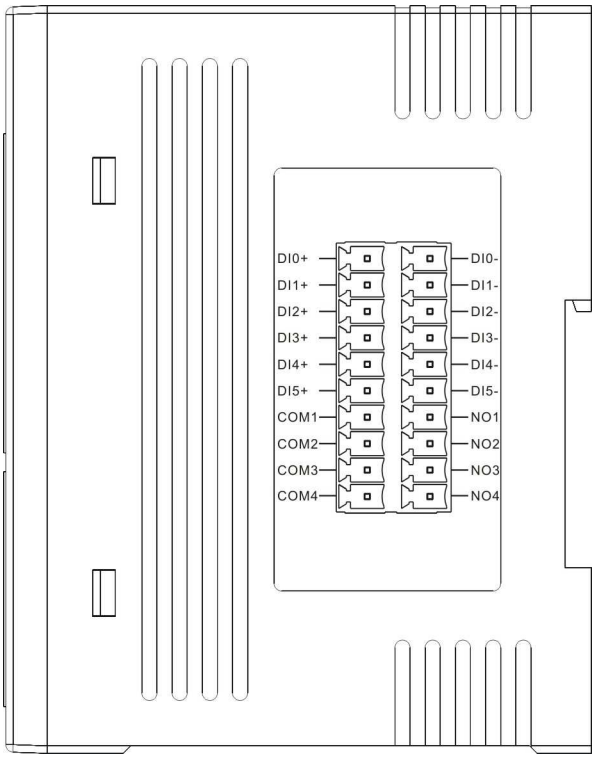
1.2 Pin Assignment

ZB-2053



ZB-2060





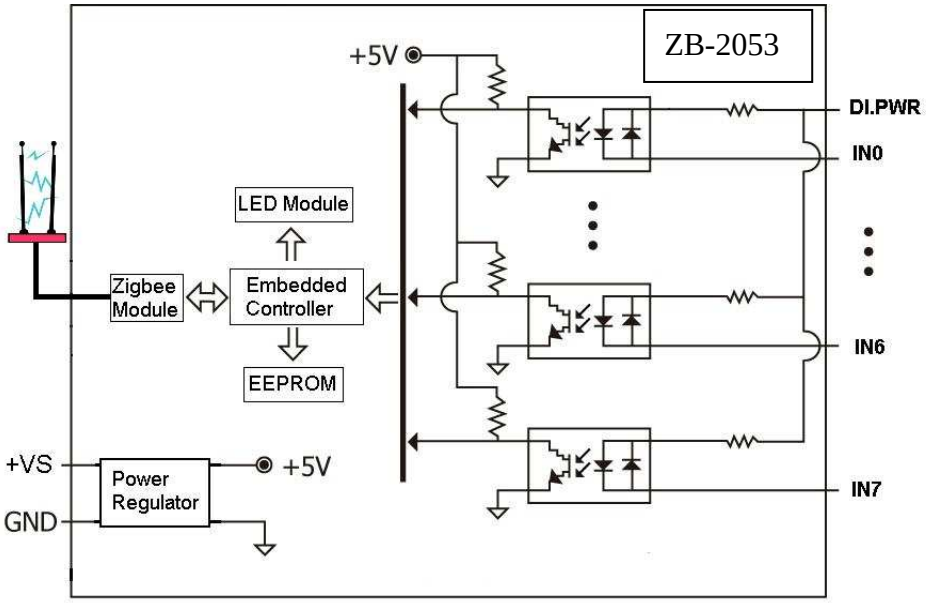
1.3 Specifications

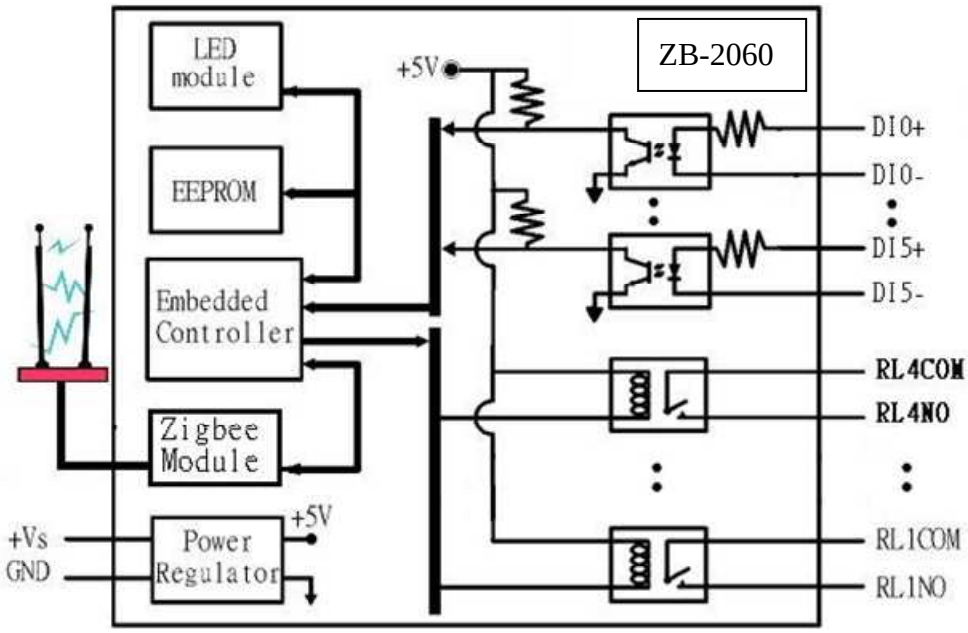
ZB-2053

Digital Input	
Input Channels	8
Input Type	Isolation, Wet contact (Sink/ source)
Input level	On Voltage Level: +3.5V to +30VDC
	Off Voltage Level: +1V Max.
Input Impedance	3KOhm, 0.33W
Counters	Channels: 8
	Max. Counters : 16-bit (65535)
	Max. Input Frequency: 100Hz
	Min. Pulse Width; 5ms
Intra-module Isolation, Field to Logic	3000 VDC
4KV ESD Protection	Yes, contact for each terminal
EFT Protection	+/- 4KV to Power
Surge Protection	+/- 3KV to Power
LED Display	
1 LED as Power Indicator 1 LED as Zigbee Communication Indicator	
8 LEDs as Digital Input Indicators	
Power	
Power Consumption	1W max
Environment	
Operating Temperature	-25 to 75 ℃
Storage Temperature	-30 to 75 ℃
Humidity	5 to 95%, Non-condensing

ZB-2060		
Digital Input		
Input Channels		6
Input Type		Isolation, Wet contact (Sink/ source)
Input level		On Voltage Level: +3.5V to +30VDC
		Off Voltage Level: +1V Max.
Input Impedance		3K Ohms, 0.33W
Counters		Channels: 6
		Max. Counters : 16-bit (65535)
		Max. Input Frequency: 100Hz
		Min. Pulse Width: 5ms
Relay Output		
Output Channels		4
Output Type		Power Relay, From A
Contact Rating		(250VAC/30VDC) @ 5A
Max. Contact voltage		270VAC/ 125VDC
Operate Time		10ms Max. at rated voltage
Release Time		5ms 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	750VAC for 1 minute
	Between coil to contacts	3,000VAC for 1 minute
Insulation Resistance		Min. 1000MΩ at 500VDC
Surge Strength		5,080V (1.2 / 50us)
4KV ESD Protection		Yes, contact for each terminal
EFT Protection		+/- 4KV to Power
Surge Protection		+/- 3KV to Power
LED Display		
1 LED as Power Indicator		1 LED as Zigbee Communication Indicator
10 LEDs as Digital Input and Output Indicators		
Power		
Power Consumption	1.2W	
Environment		
Operating Temperature	-25 to 75 ℃	
Storage Temperature	-30 to 75 ℃	
Humidity	5 to 95%, Non-condensing	

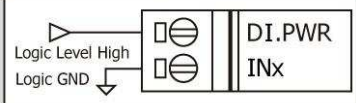
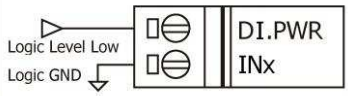
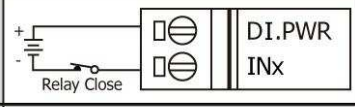
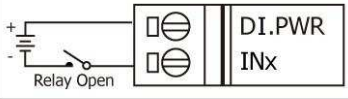
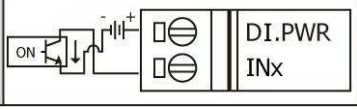
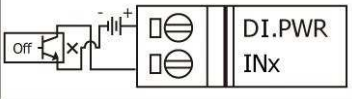
1.4 Block Diagram



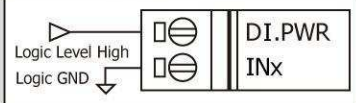
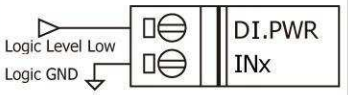
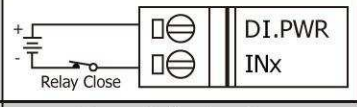
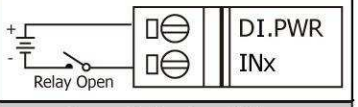
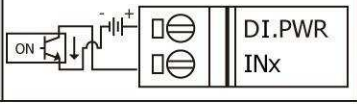
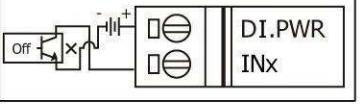


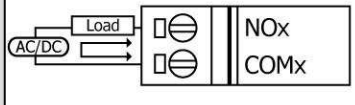
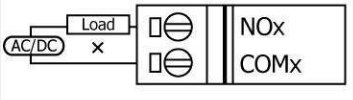
1.5 Wire Connection

ZB-2053

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
		

ZB-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
		

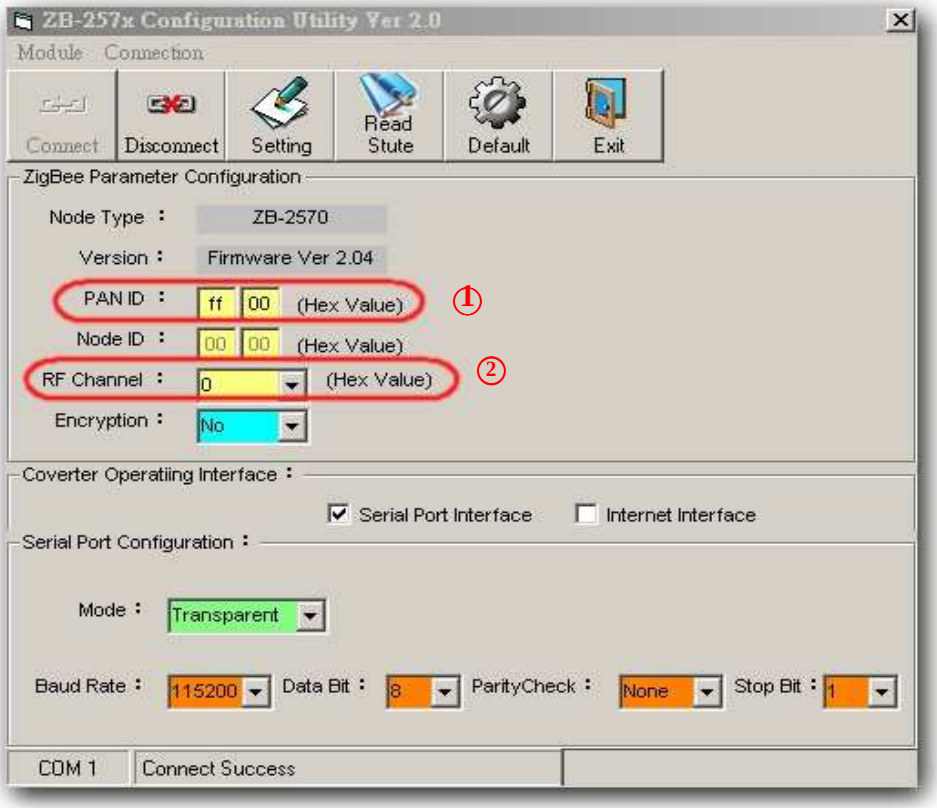
1.6 Quick Start

This Quick Start document describes the methods used to quickly set up and test the ZB-2000 series modules using the ICP DAS DCON Utility. First, you must set the ZB-2570 before using any ZB-2000 modules because the ZB-2570 is a Net Server of ZigBee. For more information about the ZB-2570, please refer to the following links :

(“ ZigBee converter quick start “)

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

If you have installed ZB-257x Utility already, you only need to set *PAN ID* and *ZB Channel* as same as ZB-2570’s setting as following:



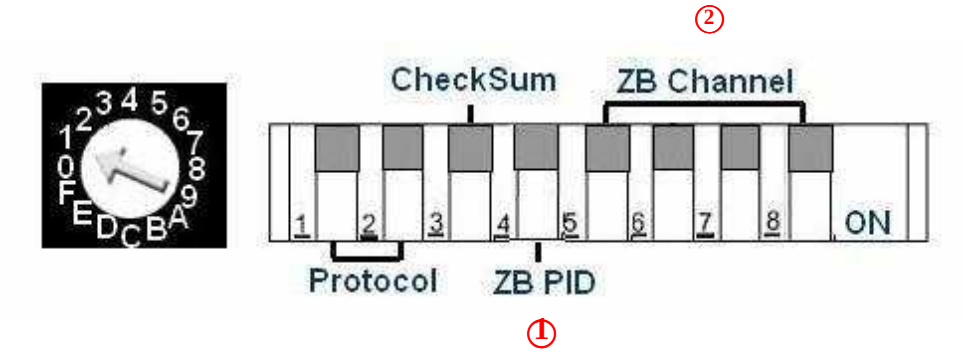
Dip Switch (ZB-2000 Series Modules)

1	2	3	4	5	6	7	8
Protocol		CheckSum	ZB PID	ZB Channel			

Protocol	DCON : (Dip Switch Bit 1 Off, Dip Switch Bit 2 Off) Modbus RTU : (Dip Switch Bit 1 Off, Bit 2 On) Modubs ASCII : (Dip Switch Bit 1 On, Bit 2 On) DIO Mapping : (Dip Switch Bit 1 On, Bit 2 Off)
CheckSum	Disabled : (Dip Switch Bit 3 Off) Enabled : (Dip Switch Bit 4 On)
ZB PID	0xFF01 (Dip Switch Bit 4 On) 0xFF00 (Dip Switch Bit 4 Off)
ZB Channel	0~0x0F (bit 8 is LSB, bit 5 is MSB)

Rotary Switch (ZB-2000 Series Modules)

N	0	1	2	3	4	5	6	7	8	9
Address	FF	01	02	03	04	05	06	07	08	09
N	A	B	C	D	E	F				
Address	0A	0B	0C	0D	0E	0F				



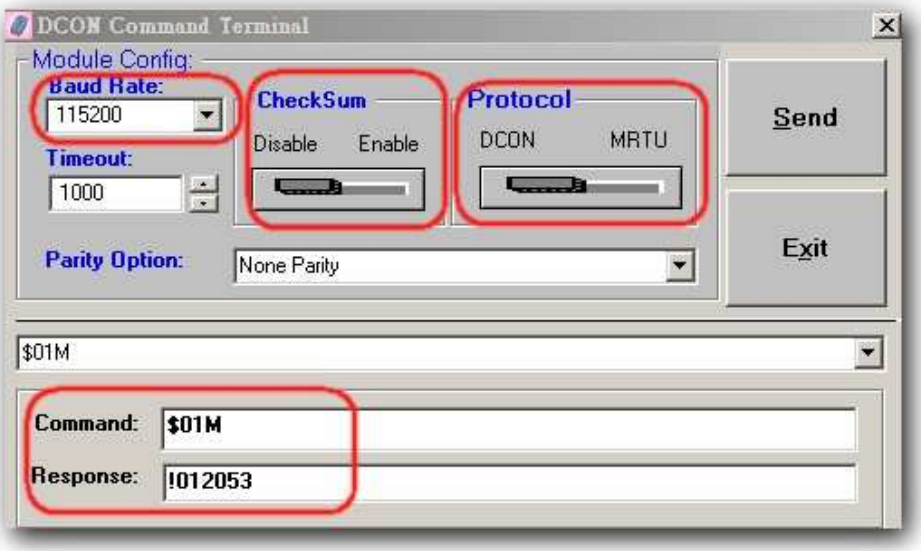
- **Configure the Setting of the ZB-2000 modules**

You have to set the switch configuration of ZB-2000 modules as same as ZB-2570 module's configuration setting. Please refer to "1.8 Configuration Tables " for more switch pin (or see chart above) configuration.

For instance, take the pin of ZB-2000 module's dip switch to put into "off "(see chart above), Indicate module's protocol is DCON , Checksum is disabled now, and you can communicate with the setting of ZB-2570 below.

- PAN ID : FF00
- ZB Channel : 00

Take the pin of ZB-2000 module's Rotary switch to put into "1", Indicate module's address(ID) is 01, you can use the "DCON Utility" through ZB-2570 to command to ZB-2000 modules and receive the value of response, as shown in the following figure. (Command $01M and receive the value of response, !012053)



ICP DAS ZB-2000 modules are command based. A series of commands are provided to allow the configuration and DI/O functions to be set. The basic DI/O and configuration commands are listed below. Refer to the following links for more information.
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7000/manual/modbusdio.pdf

The Configuration command structure of the Modbus RTU is as follows:

Field ❶	Field ❷	Field ❸	Field ❹ ~ Field *n	Field (❹+*n)
Module Address	Function code	Sub function	Configuration field	CRC16

*n: This value depends on the Sub-function code. Please refer to the "Modbus DIO User's Manual" for more details.

Ex: To modify the power-on value of the module from 01, the following command should be sent:

01 46 27 0F BB F9

The supported DI/O commands are as follows:

Function code	Description
0x01	Read coils
0x02	Read discrete inputs
0x03	Read multiple registers
0x04	Read multiple input registers
0x05	Write single coils
0x0F	Write multiple coils

Ex: 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

Ex: 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

Ex: 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

The Configuration command structure of the Modbus ASCII is as follows:

Command Format:

Leading Character	Module Address	Command	[LRC]	CR	LF

Response Format:

Leading Character	Module Address	Data	[LRC]	CR	LF

Using Modbus ASCII Protocol, all command are coded in hexadecimal values, represented with readable ASCII characters. Only the characters 0...9 and A...F are used for coding.

Using Modbus ASCII Protocol, characters are used to start and end a frame. The Leading Character ':' is used to flag the start of a command and each command is ended with a CR•LF combination. The LRC characters are appended to the command preceding the CR•LF characters.

LRC Calculation:

All characters except for Leading Character (:) and delimiter (CR•LF) are added with a carry being discarded. Total value is converted to binary notation, is converted to 2's complements, then to hexadecimal figures, that is, LRC.

Example :

Modbus RTU => 01 46 00 [12 60]

Modbus ASCII => :014600B9(CR•LF)

(1.) hexadecimal = 01h+46h+00h = 47h

(2.) 2's complement: = B9h (LRC)

- ## Technical Support

If you have problems about using the ZB-2000 series modules, please contact ICP DAS Product Support.

Email: Service@icpdas.com

1.7 Default Settings

Default settings for the ZB DIO modules are as follows：

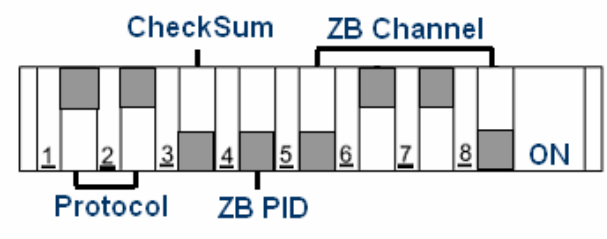
- Protocol：DCON
- Module Address：01
- Checksum：Disabled
- ZB PID：0xFF00
- ZB Channel：00

1.8 Configuration Tables

Dip Switch

1	2	3	4	5	6	7	8
Protocol		CheckSum	ZB PID	ZB Channel			

Protocol	DCON : (Dip Switch Bit 1 Off, Dip Switch Bit 2 Off) Modbus RTU : (Dip Switch Bit 1 Off, Bit 2 On) Modubs ASCII : (Dip Switch Bit 1 On, Bit 2 On) DIO Mapping : (Dip Switch Bit 1 On, Bit 2 Off)
CheckSum	Disabled : (Dip Switch Bit 3 Off) Enabled : (Dip Switch Bit 4 On)
ZB PID	0xFF01 (Dip Switch Bit 4 On) 0xFF00 (Dip Switch Bit 4 Off)
ZB Channel	0~0x0F (bit 8 is LSB, bit 5 is MSB)



ZB PID : (Range : 0xFF00、0xFF01)

The PID value make by ZB-DIO modules. The ZB-2570 which have same ZB PID are in the same ZB-DIO. This number is a part of Zigbee network.

ZB Channel : (Range : 0 ~ 0x0F)

The channel value make by ZB-DIO modules. The ZB-2570 which have same ZB Channel are in the same ZB-DIO. This number is a part of Zigbee network.

Rotary Switch

N	0	1	2	3	4	5	6	7	8	9
Address	FF	01	02	03	04	05	06	07	08	09
N	A	B	C	D	E	F				
Address	0A	0B	0C	0D	0E	0F				

INIT Operation :

Each ZB DIO module has a build-in EEPROM to store configuration information such as address, ZBPID, ZB Channel and other information. User may forget the configuration of module. Therefore, the ZB DIO have a special mode named “INIT mode”. The “INIT mode” is setting as Address = 0xFF, ZB PID = 0xFF00, ZB Channel = 0, Protocol = DCON, Checksum disabled.

Note :

Changes to the rotary switch and the dip switch take effect on the next power-on reset.

Data Format Setting (FF)

7	6	5	4	3	2	1	0
CU	CS	reserved			reserved		

Key	Description
CS	Checksum Setting 0: Disable 1: Enable
CU	Count Update 0: The counter is updated when there is a falling edge in the input signal. 1: The counter is updated when there is a rising edge in the input signal.

Note: The reserved bits should be zero.

1.9 DI/O Data Format Table

The data format of the response of the **$AA4**, **$AA6** and **$AALS** commands is:
(the First Data)(the Second Data)00.
The data format of the response of the **@AA** commands is:
(the First Data)(the Second Data).
Note: both the First Data and the Second Data are in two hexadecimal digits format.

Module	The First Data		The Second Data	
ZB-2060	DO0-DO3	00~0F	DI0-DI5	00~3F
ZB-2053	DI0-DI7	00~FF		00

Data Format Setting (FF)

7	6	5	4	3	2	1	0
CU	CS	reserved			reserved		

Key	Description
CS	Checksum Setting 0: Disable 1: Enable
CU	Count Update 0: The counter is updated when there is a falling edge in the input signal. 1: The counter is updated when there is a rising edge in the input signal.

Note: The reserved bits should be zero.

1.10 DI/O Data Format Table

The data format of the response of the **$AA4**, **$AA6** and **$AALS** commands is:
(the First Data)(the Second Data)00.
The data format of the response of the **@AA** commands is:
(the First Data)(the Second Data).
Note: both the First Data and the Second Data are in two hexadecimal digits format.

Module	The First Data		The Second Data	
ZB-2060	DO0-DO3	00~0F	DI0-DI5	00~3F
ZB-2053	DI0-DI7	00~FF		00

2. DCON Protocol

All communication with ZB DIO modules consists of commands generated by the host and responses transmitted by the ZB DIO modules. Each module has a unique ID number that is used for addressing purposes and is stored in non-volatile memory. The ID is 01 by default and can be changed using a user command. All commands to the modules contain the ID address, meaning that only the addressed module will respond. The only exception to this is commands #**(Section 2.2) and ~** (Section 2.26), which are sent to all modules, but in both of these cases, the modules do not reply to the command.

Command Format:

Leading Character	Module Address	Command	[CHKSUM]	CR

Response Format:

Leading Character	Module Address	Data	[CHKSUM]	CR

CHKSUM 2-character checksum which is present when the checksum setting is enabled.See Sections 1.1 (Data Format Setting) for details.

CR End of command character, carriage return (0x0D)

Checksum Calculation:

1. Calculate the ASCII code sum of all the characters in the command/response string except for the carriage return character (CR).
2. The checksum is equal to the sum masked by 0FFh.

Example:

Command string: $012(CR)

1. Sum of the string = “$”+”0”+”1”+”2” =

24h+30h+31h+32h = B7h

2. Therefore the checksum is B7h, and so

CHKSUM = “B7”

3. The command string with the checksum = $012B7(CR)

Response string: !01200600(CR)

1. Sum of the string =

“!”+”0”+”1”+”2”+”0”+”0”+”6”+”0”+”0” =

21h+30h+31h+32h+30h+30h+36h+30h+30h = 1AAh

2. Therefore the checksum is AAh, and so

CHKSUM = “AA”

3. The response string with the checksum

= !01200600AA(CR)

Note:

All characters should be in upper case.

General Command Sets			
Command	**Response**	**Description**	**Section**
%AANNTTCCFF	!AA	Sets the Module Configuration	2.1
#**	No Response	Synchronized Sampling	2.2
#AA00(Data)	>	Sets the Digital Output	2.3
#AA0A(Data)	>	Sets the Digital Output	2.4
#AA1cDD	>	Sets the Digital Output	2.5
#AAAcDD	>	Sets the Digital Output	2.6
#AAN	!AA(Data)	Reads the Digital Input Counter	2.7
$AA2	!AANNTTCCFF	Reads the Module Configuration	2.8
$AA4	!S(Data)	Reads the Synchronized Data	2.9
$AA5	!AAS	Reads the Reset Status	2.10
$AA6	!(Data)	Reads the Digital I/O Status	2.11
$AAC	!AA	Clears the Latched DI Status	2.12
$AACN	!AA	Clears the Digital InputCounter	2.13
$AAF	!AA(Data)	Reads the firmware Version	2.14
$AALS	!(Data)	Reads the Latched DI Status	2.15
$AAM	!AA(Data)	Reads the Module Name	2.16
$AAP	!AASC	Reads the communication protocol	2.17
$AAPN	!AA	Sets the communication protocol	2.18
@AA	>(Data)	Reads the Digital I/O Status	2.19
@AA(Data)	>	Sets the Digital Output Channels	2.20
~AAO(Name)	!AA	Sets the Module Name	2.21
~AAD	!AAF	Reads the DI/O active status.	2.22
~AADVV	!AA	Sets the DI/O active status.	2.23
~AAI	!AA	Sets the soft INIT	2.24
~AATnn	!AA	Set the soft INIT timeout value	2.25

Host Watchdog Command Sets			
Command	**Response**	**Description**	**Section**
~**	No Response	Host OK	2.26
~AA0	!AASS	Reads the Status	2.27
~AA1	!AA	Resets the Status	2.28
~AA2	!AAVV	Reads the Timeout Settings	2.29
~AA3EVV	!AA	Sets the Timeout Settings	2.30
~AA4V	!AA(Data)	Reads the PowerOn/Safe Value	2.31
~AA5V	!AA	Sets the PowerOn/Safe Value	2.32
~AARDvv	!AA	Sets the Response Delay Time	2.33
~AARD	!AA(Data)	Reads the Response Delay Time	2.34
ZigBee Command Sets			
Command	**Response**	**Description**	**Section**
~AAZBWnn	!AA	Sets the Parent Alive Time	2.35
~AAZBW	!AA(Data)	Reads the Parent Alive Time	2.36

2.1 %AANNTTCCFF

Description:

Sets the configuration of a module.

Syntax:

%AANNTTCCFF[CHKSUM](CR)

%	Delimiter character
AA	Address of the module to be configured in hexadecimal format (00 to FF)
NN	New address of the module in hexadecimal format (00 to FF)
TT	Type code, should be 40 for DIO module.
CC	(Baud Rate code, should be 0A for ZB DIO)
FF	Used to set the counter update direction and checksum (Section 1.1).

Response:

Valid Command: **!AA[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the 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.

Examples:

Command:%0101400A80

Response:!01

Sets the counter update (Rising Edge)

FF (Sets the counter update)

80 : Sets the counter update (Rising Edge)

00 : Sets the counter update (Falling Edge)

Command:%0101400A00

Response:!01

Sets the counter update (Falling Edge)

FF (Sets the counter update)

80 : Sets the counter update (Rising Edge)

00 : Sets the counter update (Falling Edge)

Related Commands:

Section 2.8 $AA2、2.24 ~AAI、2.25 ~AATnn

Related Topics:

Section 1.1 Configuration Tables

2.2 #**

Description:

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

Syntax:

#[CHKSUM](CR)**

#	Delimiter character
**	Synchronized sampling command

Response:

There is no response with this command. To access the data, another command, $AA4, must be sent, see Section 2.11 for details.

Examples:

Command:#**

Response: No response

Sends the synchronized sampling command.

Command:$014

Response:!1FF0000

Sends a command to read the synchronized data. The status byte of the response is 1, which means that it is the first time the synchronized data has been read after the previous #** command.
Digital Input : FF (ZB-2053)

Command:$014
Response:!0FF0000

Sends a command to read the synchronized data. The status byte of the response is 0, which means that it is NOT the first time the synchronized data has been read after the previous #** command.
Digital Input : FF (ZB-2053)

Related Commands:

Section 2.9 $AA4

2.3 #AA00(Data)

Description:

Sets the digital output value of the lower eight channels. (DO0-DO7)

Syntax:

#AA00(Data)[CHKSUM](CR)

#	Delimiter character
AA	Address of the module to be set (00 to FF)
00	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 1, it denotes that the digital output channel is on, and 0 denotes that the digital output channel is off.

Response:

Valid Command: **>[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

Ignored Command: **![CHKSUM](CR)**

>	Delimiter for a valid command.
?	Delimiter for an invalid command.
!	Ignored Delimiter character.

A host watchdog timeout has occurred, the digital output channel s are set to 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.

Examples:

Command:#020006

Response:>

Sets DO0、DO3 to off，DO1、DO2 to on, and the module returns a valid response. (ZB-2060)

Command:#020016

Response:?02

Sets DO0、DO3 to off，DO1、DO2 to on
DO6、DO7、DO8 to off，DO5 to on
Invalid Command. (ZB-2060 only DO0-DO3)

Command:#020005

Response:!

Host Watchdog Timeout.

Related Commands:

Section 2.4 #AA0A(Data)、2.5 #AA1cDD
2.6#AAAcDD、2.11 $AA6、2.19 @AA
2.20 @AA(Data)

2.4 #AA0A(Data)

Description:

Sets the digital output value.(DO0-DO31)

Syntax:

#AA0A(Data)[CHKSUM](CR)

#	Delimiter character
AA	Address of the module to be set (00 to FF)
0A	Command to set the digital output value. (DO0-DO31) #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 1, it denotes that the digital output channel is on, and 0 denotes that the digital output channel is off.

Response:

Valid Command: **>[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

Ignored Command: **![CHKSUM](CR)**

> Delimiter for a valid command.

? Delimiter for an invalid command.

! Ignored Delimiter character
watchdog timeout has occurred, the digital output channel s are set to 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.

Examples:

Command:#020A0E

Response:>

Sets DO0 to off，DO1、DO2、DO3 to on. (ZB-2060)

Command:#020A06

Response:!

Host Watchdog Timeout.

Command:#020A0F

Response:>

Sets DO0、DO1、DO2、DO3 to on. (ZB-2060)

Command:#020A00

Response:>

Sets DO0、DO1、DO2、DO3 to off. (ZB-2060)

Related Commands:

Section 2.3 #AA00(Data)、2.5 #AA1cDD
2.6#AAAcDD、2.11 $AA6、2.19 @AA
2.20 @AA(Data)

2.5 #AA1cDD

Description:

Sets a single digital output channel of the lower eight channels.

Syntax:

#AA1cDD [CHKSUM](CR)

#	Delimiter character
AA	Address of the module to be set (00 to FF)
1	Command to set a single digital output channel of the lower eight channels.
c	Specifies the digital output channel to be set (0 to 7).
DD	00 : set the digital output channel to off. 01 : set the digital output channel to on.

Response:

Valid Command: **>[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

Ignored Command: **![CHKSUM](CR)**

>	Delimiter for a valid command.
?	Delimiter for an invalid command.
!	Ignored Delimiter character

watchdog timeout has occurred, the digital output channel s are set to 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.

Examples:

Command:#021001
Response:>
Sets DO0 to on.

Command:#021401
Response:?02

Command:#021301
Response:>
Sets DO3 to on.(ZB-2060)

Related Commands:

Section 2.3 #AA00(Data)、2.4 #AA0A(Data)
2.6#AAAcDD、2.11 $AA6、2.19 @AA
2.20 @AA(Data)

2.6 #AAAcDD

Description:

Sets a single digital output channel. (DO0-DO31)

Syntax:

#AAAcDD [CHKSUM](CR)

#	Delimiter character
AA	Address of the module to be set (00 to FF)
A	Command to set a single digital output channel. (DO0-DO31) #AAAcDD : DO0-DO7 #AABcDD : DO8-DO15 #AACcDD : DO16-DO23 #AADcDD : DO24-DO31
c	Specifies the digital output channel to be set. (0-7)
DD	00 : set the digital output channel to off. 01 : set the digital output channel to on.

Response:

Valid Command: **>[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

Ignored Command: **![CHKSUM](CR)**

>	Delimiter for a valid command.
?	Delimiter for an invalid command.
!	Ignored Delimiter character watchdog timeout has occurred, the digital output channel s are set to 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.

Examples:

Command:#02A201

Response:>

Sets DO2 to on (ZB-2060)

Related Commands:

Section 2.3 #AA00(Data)、2.4 #AA0A(Data)
2.5 #AA1cDD、2.11 $AA6、2.19 @AA
2.20 @AA(Data)

2.7 #AAN

Description:

Reads the digital input counter of channel N.

Syntax:

#AAN [CHKSUM](CR)

#	Delimiter character
AA	Address of the module to be set (00 to FF)
N	The channel to be read (0 to F)

Response:

Valid Command: **!(Data)[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command. An invalid command is returned if the specified channel is incorrect.
(Data)	Five decimal digits representing the digital input counter data of the specified channel (00000 to 65535).
AA	Address of the responding module (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.

Examples:

Command:#011

Response:!0100005

Reads data from channel 1 of module 01 and the returned counter value is 00005.

Command:#015

Response:!0100005

Reads data from channel 5 of module 01 and the returned counter value is 00005.

Related Commands:

Section 2.13 #AACN

2.8 $AA2

Description:

Reads the module configuration.

Syntax:

$AAN [CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be set (00 to FF)
2	Command to read the module configuration

Response:

Valid Command: **!AATTCCFF[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (00 to FF)
TT	Type code of the module, should be 40 for DIO module.
CC	Baud Rate code of the module,should be 0A
FF	Checksum and counter update direction settings of the module, see Section 1.1 for details.

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.

Examples:

Command:$012

Response:!01400A80

Reads the configuration of module 01.

FF (Sets the counter update)

80 : Reads the counter update (Rising Edge)

00 : Reads the counter update (Falling Edge)

Command:$012

Response:!01400AC0

Reads the configuration of module 01.

FF (Sets the counter update)

C0 : Reads the counter update (Rising Edge), checksum enabled.

Related Commands:

Section 2.1 %AANNTTCCFF

Related Topics:

Section 1.1

2.9 $AA4

Description:

Reads the synchronized data that was retrieved by the last #** command.

Syntax:

$AA4 [CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be set (00 to FF)
4	Command to read the synchronized data

Response:

Valid Command:	**!S[CHKSUM](CR)**
Invalid Command:	**?AA[CHKSUM](CR)**
!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (00 to FF)
S	Status of the synchronized data 1：first read 0：not the first read
(Data)	Synchronized data. See Section 1.2 for the data format.

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.

Examples:

Command:#**

Response: No response

Sends the synchronized sampling command.

Command:$014

Response:!10F0000

Reads the synchronized data for module 01. The module returns 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 (ZB-2053)

Command:$024

Response:!0053F00

Reads the synchronized data for module 01. The module returns the synchronized data and sets thestatus byte to 0 to indicate that the synchronized data has been read
Digital Output : 05
Digital Input : 3F (ZB-2060)

Related Commands:

Section 2.2 #**

2.10 $AA5

Description:

Reads the reset status of a module.

Syntax:

$AA5 [CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be set (00 to FF)
5	Command to read the module reset status.

Response:

Valid Command: **!AAS[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (00 to FF)
S	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.

Examples:

Command:$015

Response:!011

Reads the reset status of module 01. The response shows that it is the first time the $AA5 command has been sent since the module was powered-on.

Command:$015

Response:!010

Reads the reset status of module 01. The response shows that there has been no module reset since the last $AA5 command was sent.

2.11 $AA6

Description:

Reads the status of the digital input/output channels.

Syntax:

$AA6 [CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be set (00 to FF)
6	Command to read the digital input/output channels

Response:

Valid Command: **!(Data)[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (00 to FF)
(Data)	Status of the digital input/output channels, a four- digit hexadecimal value followed by 00. See Section 1.2 for details.

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.

Examples:

Command:$016

Response:!FF0000

Reads the digital input/output channel status of module 01. Digital Iutput : FF (ZB-2053)

Command:$026

Response:!070F00

Reads the digital input/output channel status of module 02.
Digital Output : 07
Digital Iutput : 0F (ZB-2060)

Related Commands:

Section 2.3 #AA00(Data)、2.4 #AA0A(Data)
2.5 #AA1cDD、2.6 #AAAcDD、2.19 @AA
2.20 @AA(Data)

2.12 $AAC

Description:

Clears the status of the latched digital input channels.

Syntax:

$AAC [CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be set (00 to FF)
C	Command to clear the status of the latched digital input channels

Response:

Valid Command: **!AA[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (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.

Examples:

Command:@016

Response:>

Sets DO1、2 to on、DO0、3 to off (ZB-2060)

Command:$01C

Response:!01

Sends the command to clear the status of the latched digital input channels of module 01 and returns a valid response.

Command:$01L0

Response:!093F00

Sends the command to read the status of the low latched digital input channels of module 01.

Low Latched DI：3F

Low Latched DO：09 (ZB-2060)

Related Commands:

Section 2.15 $AALS

2.13 $AACN

Description:

Clears the digital input counter of channel N.

Syntax:

$AACN [CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be set (00 to FF)
C	Command to clear the digital input counter
N	The channel to be cleared (0 to F).

Response:

Valid Command: **!AA[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (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.

Examples:

Command:#011

Response:!0100009

Reads counter data from channel 1 of module 01 and the returned counter value is 00009.

Command:$01C1

Response:!01

Clears the counter value of channel 1 of module 01 and returns a valid response.

Command:#011

Response:!0100000

Reads counter data from channel 1 of module 01 and the returned counter value is 0.

Related Commands:

Section 2.7 #AAN

2.14 $AAF

Description:

Reads the firmware version of a module.

Syntax:

$AAF [CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be set (00 to FF)
F	Command to read the firmware version

Response:

Valid Command: **!AA(Data)[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (00 to FF)
(Data)	Firmware version string of the module

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.

Examples:

Command:$01F

Response:!0102.00

Reads the firmware version of module 01, and shows that it is version 02.00.

2.15 $AALS

Description:

Reads the status of the latched digital input channels.

Syntax:

$AALS [CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be set (00 to FF)
L	Command to read the latched status
S	0 : read the low latched status 1 : read the high latched status

Response:

Valid Command: **!(Data)[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (00 to FF)
(Data)	Status of the latched digital input channels, a four- digit hexadecimal value followed by 00. See Section 1.2 for details.

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.

Examples:

Command:@016

Response:>

Sets DO1、2 to on、DO0、3 to off. (ZB-2060)

Command:$01C

Response:!01

Sends the command to clear the status of the latched digital input channels of module 01 and returns a valid response.

Command:$01L0

Response:!093F00

Sends the command to read the status of the low latched digital input channels of module 01.

Low Latched DI : 3F

Low Latched DO : 09 (ZB-2060)

Command:$01L1

Response:!060000

Sends the command to read the status of the high latched digital input channels of module 01.

High Latched DI : 00

High Latched DO : 06 (ZB-2060)

Related Commands:

Section 2.12 $AAC

Related Topics:

Section 1.2

2.16 $AAM

Description:

Reads the name of a module.

Syntax:

$AAM [CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be set (00 to FF)
M	Command to read the module name

Response:

Valid Command: **!AA(Data)[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (00 to FF)
(Data)	Name string of the module

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.

Command:$02M

Response:!022060

Reads the module name of module 02 and returns the name.

Related Commands:

Section 2.21 ~AAO(Name)

2.17 $AAP

Description:

Reads the communication protocol information.

Syntax:

$AAP [CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be set (00 to FF)
P	Command to read the communication protocol

Response:

Valid Command: **!AASC[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (00 to FF)
S	The protocols supported by the module 0: DCON 1: DCON and Modbus RTU 3: DCON and Modbus RTU/ASCII
C	The current protocol that is saved in the EEPROM that will be used at the next power-on reset

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.

Examples:

Command:$01P

Response:!0130

Reads the communication protocol of module 01 and returns a response of 30 meaning that it supports the DCON and Modbus RTU/ASCII protocols and the protocol that will be used at the next power-on reset is DCON.

Related Commands:

Section 2.18 $AAPN

2.18 $AAPN

Description:

Sets the communication protocol. (ZB DIO does not support)

Syntax:

$AAP [CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be set (00 to FF)
P	Command to set the communication protocol
N	0: DCON
	1: Modbus RTU
	3: Modbus ASCII

Response:

Valid Command: **!AA[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (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.

2.19 @AA

Description:

Reads the status of the digital input/output ports.

Syntax:

@AA [CHKSUM](CR)

@	Delimiter character
AA	Address of the module to be set (00 to FF)

Response:

Valid Command: **>(Data)[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

>	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (00 to FF)
(Data)	Status of the digital input/output ports, a four-digit hexadecimal value. See Section 1.2 for details.

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.

Examples:

Command:@02

Response:>0F0F

Reads the digital input/output port status of module 02 and returns >030F, which denotes that RL1, RL2, RL3 and RL4 are on and IN1, IN2, IN3 and IN4 are on . (ZB-2060)

Related Commands:

Section 2.3 #AA00(Data)、2.4 #AA0A(Data)
2.5 #AA1cDD、2.6 #AAAcDD、2.11 $AA6
2.20 @AA(Data)

Related Topics:

Section 1.2

2.20 @AA(Data)

Description:

Sets the digital output channels.

Syntax:

@AA(Data)[CHKSUM](CR)

@	Delimiter character
AA	Address of the module to be set (00 to FF)
(Data)	Data to be written to the digital output channels. Bit 0 of the value corresponds to DO0 and bit 1 of the value 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: **>[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

Ignored Command: **![CHKSUM](CR)**

>	Delimiter for a valid command.
?	Delimiter for an invalid command.
!	Ignored Delimiter character

watchdog timeout has occurred, the digital output ports are set to 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.

Examples:

Command:@02F

Response:>

Sets DO0、DO1、DO2、DO3 to on. (ZB-2060)

Related Commands:

Section 2.3 #AA00(Data)、2.4 #AA0A(Data)、2.5 #AA1cDD、2.6#AAAcDD、2.11 $AA6、2.19 @AA

2.21 ~AAO(Name)

Description:

Sets the name of a module.

Syntax:

~AAO(Name) [CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
O	Command to set the module name
(Name)	New name of the module (max. 6 characters)

Response:

Valid Command: **!AA[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (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.

Examples:

Command:$01M

Response:!012053

Reads the name of module 01 and returns the name 2053.

Command:~01OZ2053

Response:!01

Sets the name of module 01 to be “ Z2053” and returns a valid response.

Command:$01M

Response:!01Z2053

Reads the name of module 01 and returns the name Z2053.

2.22 ~AAD

Description:
Reads Digital I/O Active status.

Syntax:
~AAD [CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
D	Command to read the DI/O active status

Response:
Valid Command: **!AAVV[CHKSUM](CR)**
Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (00 to FF)
VV	A two-digit hexadecimal value indicating the DI/O active status.

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.

Examples:

Command:~02D03

Response:!02

Sets DI/O active status.

Command:~02D

Response:!0203

Reads DI/O active status.

7	6	5	4	3	2	1	0
Reserved						OAS	IAS

Key	Description
OAS	DO Active Status 0: output value 1 for relay active output value 0 for relay inactive 1: output value 0 for relay active output value 1 for relay inactive
IAS	DI Active Status 0: input value 1 for non-signal or the low voltage; input value 0 for high voltage 1: input value 0 for non-signal or the low voltage; input value 1 for high voltage

(DI/O Active Status)

Related Commands:

Section 2.23 ~AADVV

2.23 ~AADVV

Description:
Sets Digital I/O Active status.

Syntax:
~AADVV [CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
D	Command to set the DI/O active status.
VV	A two-digit hexadecimal value indicating the DI/O active status.

Response:
Valid Command: **!AA[CHKSUM](CR)**
Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (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.

Examples:

Command:~02D03

Response:!02

Sets DI/O active status.

Command:~02D

Response:!0203

Reads DI/O active status.

7	6	5	4	3	2	1	0
Reserved						OAS	IAS

Key	Description
OAS	DO Active Status 0: output value 1 for relay active output value 0 for relay inactive 1: output value 0 for relay active output value 1 for relay inactive
IAS	DI Active Status 0: input value 1 for non-signal or the low voltage; input value 0 for high voltage 1: input value 0 for non-signal or the low voltage; input value 1 for high voltage

Related Commands:

Section 2.22 ~AAD

2.24 ~AAI

Description:
The Soft INIT command is used to enable modification of the Baud Rate and checksum settings using software only. (ZB DIO does not support)

Syntax:
~AAI [CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
I	Command to set the Sort INIT

Response:
Valid Command: **!AA[CHKSUM](CR)**
Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (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.

2.25 ~AATnn

Description:

Sets the soft INIT timeout value. (ZB DIO does not support)

Syntax:

~AATnn [CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
T	Command to set the Sort INIT timeout value
nn	Two hexadecimal digits representing the time out value in seconds.The maximum timeout value is 60 seconds.

Response:

Valid Command: **!AA[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module

There will be no response if the command syntax is incorrect, there is a communication error, or there is

2.26 ~**

Description:

Informs all modules that the host is OK.

Syntax:

~ [CHKSUM](CR)**

~ Delimiter character

** Host OK command

Response:

No response

Examples:

Command: ~**

Response: No response

Related Commands:

Section 2.27 ~AA0、2.28 ~AA1、2.29 ~AA2

2.27 ~AA0

Description:

Reads the host watchdog status of a module.

Syntax:

~AA0 [CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
0	Command to read the module status

Response:

Valid Command: **!AASS[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (00 to FF)
SS	Two hexadecimal digits that represent the host watchdog status, where: Bit 7: 0 indicates that the host watchdog is disabled, and 1 indicates that the host watchdog is enabled, Bit 2: 1 indicates that a host watchdog timeout has occurred, and 0 indicates that no 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.

Examples:

Command:~030

Response:!0304

Reads the host watchdog status of module 03 and returns 04, meaning that a host watchdog timeout has occurred.

Command:~030

Response:!0300

Reads the host watchdog status of module 03 and returns 00, meaning that the host watchdog is disabled and no host watchdog timeout has occurred.

Command:~030

Response:!0380

Reads the host watchdog status of module 03 and returns 08, meaning that the host watchdog is enabled. Sents ~** to clear watchdog timeout value.

Related Commands:

Section 2.26 ~**、2.28 ~AA1、2.29 ~AA2
2.30 ~AA3EVV、2.31 ~AA4V、
2.32 ~AA5V

2.28 ~AA1

Description:

Resets the host watchdog timeout status of a module.

Syntax:

~AA1 [CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
1	Command to reset the host watchdog timeout status

Response:

Valid Command: **!AA[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (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.

Examples:

Command:~030

Response:!0304

Reads the host watchdog status of module 03 and shows that a host watchdog timeout has occurred.

Command:~031

Response:!03

Resets the host watchdog timeout status of module 03 and returns a valid response.

Related Commands:

Section 2.26 ~**、2.27 ~AA0、2.29 ~AA2
2.30 ~AA3EVV、2.31 ~AA4V、
2.32 ~AA5V

2.29 ~AA2

Description:

Reads the host watchdog timeout value of a module.

Syntax:

~AA0 [CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
2	Command to read the host watchdog timeout value

Response:

Valid Command: **!AAEVV[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (00 to FF)
E	1: the host watchdog is enabled 0: the host watchdog is disabled
VV	Two hexadecimal digits to represent the timeout value in tenths of a second, for example, 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.

Examples:

Command:~032

Response:!03190

Reads the host watchdog timeout value of module 03 and returns 0x90, which denotes that the host watchdog is enabled and the host watchdog timeout value is 14.4 seconds

Related Commands:

Section 2.26 ~**、2.27 ~AA0、2.28 ~AA1
2.30 ~AA3EVV、2.31 ~AA4V、
2.32 ~AA5V

2.30 ~AA3EVV

Description:

Enables/disables the host watchdog and sets the host watchdog timeout value of a module.

Syntax:

~AA3EVV [CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
3	Command to set the host watchdog
E	1: enable the host watchdog 0: disable the host watchdog
VV	Two hexadecimal digits to represent the timeout value in tenths of a second, for example, 01 denotes 0.1 seconds and FF denotes 25.5 seconds.

Response:

Valid Command: **!AA[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (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.

Examples:

Command:~013164

Response:!01

Enables the host watchdog of module 01 and sets the host watchdog timeout value to 10.0 seconds. The module returns a valid response.

Command:~012

Response:!01164

Reads the host watchdog timeout value of module 01. The module returns 164, which denotes that the host watchdog is enabled and the host watchdog timeout value is 10.0 seconds.

Related Commands:

Section 2.26 ~**、2.27 ~AA0、2.28 ~AA1
2.29 ~AA2、2.31 ~AA4V、
2.32 ~AA5V

2.31 ~AA4V

Description:

Reads the power-on DO value or the safe DO value of a module.

Syntax:

~AA4V [CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
4	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)[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module(00 to FF)
(Data)	Power On Value 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.

Examples:

Command:~034P

Response:!030700

Reads the power-on DO value of module 03 and returns 0700.

Command:~034S

Response:!030F00

Reads the safe DO value of module 03 and returns 0F00.

Related Commands:

Section 2.32 ~AA5V

2.32 ~AA5V

Description:

Sets the current DO value as the power-on DO value or the safe DO value.

Syntax:

~AA5V [CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
5	Command to set the power-on value or the safe DO value
V	P: Power On Value S: Safe Value

Response:

Valid Command: **!AA[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (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.

Examples:

Command:@037

Response:>

Sets DO0、DO1、DO2 to on，DO3 to off

Command:~035P

Response:!03

Sets the power-on DO value and the module returns a valid response.

Command:@03F

Response:>

Sets DO0、DO1、DO2、DO3 to on

Command:~035S

Response:!03

Sets the safe DO value and the module returns a valid response.

Command:~034S

Response:!030F00

Reads the safe DO value of module 03.

Related Commands:

Section 2.31 ~AA4V

2.33 ~AARDvv

Description:

Sets the Response Delay Time of a module.

Syntax:

~AARDvv [CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be set (00 to FF)
RD	Command to set the Response Delay Time of a module.
vv	Response Delay Time (0~30,in 1ms)

Response:

Valid Command: **!AA[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (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.

Examples:

Command:~03RD1E

Response:!03

Sets the Response Delay Time, the value is 1E. (30ms)

Command:~03RD

Response:!0300

Reads the Response Delay Time, the value is 00. (0ms).

Related Commands:

Section 2.34 ~AARD

2.34 ~AARD

Description:

Reads the Response Delay Time of a module.

Syntax:

~AARD [CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
RD	Command to read the Response Delay Time of a module.(0~30,in 1ms)

Response:

Valid Command: **!AA(Data)[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module(00 to FF)
(Data)	Response Delay Time 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.

Examples:

Command:~03RD1E

Response:!03

Sets the Response Delay Time, the value is 1E. (30ms)

Command:~03RD

Response:!0300

Reads the Response Delay Time, the value is 00. (0ms).

Related Commands:

Section 2.33 ~AARDvv

2.35 ~AAZBWnn

Description:

Sets the Network Survival Detecting Time. ZB DIO will connect with Parent(ZB-2570) periodically to confirm the survival of network. If it detects unsuccessfully, and it process initialize network again to find a new parent.

Syntax:

~AAZBWnn [CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
ZBW	Command to set the Network Survival Detecting Time.
nn	Network Survival Detecting Time (0~0xFF,in 1s) 0 : Disabled 1~0xFF : Enabled

Response:

Valid Command: **!AA[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module (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.

Examples:

Command:~03ZBW05

Response:>

Sets the Network Survival Detecting Time, the value is 05. (5s)(Enabled)

Command:@03ZBW

Response:!0305

Reads the Network Survival Detecting Time, the value is 05. (5s)(Enabled).

Related Commands:

Section 2.36 ~AAZBW

2.36 ~AAZBW

Description:

Reads the Network Survival Detecting Time. ZB DIO will connect with Parent(ZB-2570) periodically to confirm the survival of network. If it detects unsuccessfully, and it process initialize network again to find a new parent.

Syntax:

~AAZBW [CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
ZBW	Command to read the Network Survival Detecting Time .

Response:

Valid Command: **!AA(Data)[CHKSUM](CR)**

Invalid Command: **?AA[CHKSUM](CR)**

!	Delimiter for a valid command.
?	Delimiter for an invalid command.
AA	Address of the responding module(00 to FF)
(Data)	Network Survival Detecting Time 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.

Examples:

Command:~03ZBW00
Response:>
Sets the Network Survival Detecting Time, the value is 00. (0s)(Disabled)

Command:@03ZBW
Response:!0300
Reads the Network Survival Detecting Time, the value is 00. (0s)(Disabled).

Related Commands:

Section 2.35 ~AAZBWnn

3. Modbus RTU Protocol

The Modbus protocol is developed by Modicon Inc., originally developed for Modicon controllers. Detailed information can be found at http://www.modicon.com/techpubs/toc7.html. You can also visit http://www.modbus.org to find more valuable information.

Address Mapping		
Address	**Description**	**Attribute**
00000、10000 (0x00-0x1F)	Digital Output Channel	R/W
10032(0x20-0x3F)	Digital Input Channel	R
10064(0x40-0x5F)	High Latched DI/O Channels	R
10096(0x60-0x7F)	Low Latched DI/O Channels	R
00128、10128 (0x80-0x9F)	Safe Value	R/W
00160、10160 (0xA0-0xBF)	Power On Value	R/W
30485、40485(0x1E4)	Module address, valid range:1~247	R/W
40486(0x1E5)	bits 5:0 (Baud rate) Baud rate, valid range:0x03-0x0A bits 7:6 00: no parity, 1 stop bit 10: even parity, 1 stop bit 11: odd parity, 1 stop bit	R/W
00264(0x107)	Clear Latched DI/Ot	W
00513(0x200-0x220)	Clear DI Count	W
30481(0x1E0-0X1E1)	Firmware version	R

30483(0x1E2-0x1E3)	Module name	R
30000(0x00-0x1F)	DI Count Value	R
00270、10270(0x10D)	Host watch dog timeout status, write 1 to clear host watchdog timeout status.	R/W
30488、40488(0x1E7)	Modbus reponse delay time in ms, valid range:0~30	R/W
30492、40492(0x1EB)	Host watchdog timeout count,write 0 to clear	R/W
00260、10260(0x103)	Modbus host watchdog mode 0 : same as I-7000 1 : can use AO and DO command to clear host watchdog timeout status	R/W
00261、10261(0x104)	1 : enable, 0 : disable host watchdog	R/W
30489、40489(0x1E8)	Host watchdog timeout value, 0~255, in 0.1s	R/W
00257、10257(0x100) 00258、10258(0x101)	Protoco, 0 : DCON, 1 : Modbus RTU 3 : Modbus ASCII	R/W
10273(0x110)	Reset status, 1: first read after powered on, 0 : not the first read after powered on	R
3012345(0x3038)	Informs all modules that the host is OK	R

1. Modbus RTU Function Description：
   (0xxxx) : 0x05、0x0F Function code
   (1xxxx) : 0x01 Function code
   (3xxxx) : 0x03 Function code
   (4xxxx) : 0x06 Function code

2. Address mapping 0481 is Decimal(Base 1).
   Address mapping 0x1E0 is Hexadecimal(Base 0).

Function code	Description	Section
0x01	Read coils	3.1
0x02	Read discrete inputs	3.2
0x03	Read multiple registers	3.3
0x04	Read multiple input registers	3.4
0x05	Write single coils	3.5
0x06	Write multiple registers	3.6
0x0F	Write multiple coils	3.7
0x46	Read/Write module settings	3.8

If the function specified in the message is not supported, then the module responds as follows.

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	Function code + 0x80
02	Exception code	1 Byte	01

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

3.1 01(0x01) Read coils

This function code is used to read the current digital output readback value of the ZB DIO module.

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x01
02-03	Starting channel numbers or address mapping	2 Byte	● 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 WDT Mode : 0x0103 ● Reads WDT Enable : 0x0104 ● Reads WDT Status : 0x010D ● Reads Protocol : 0x0100 ● Reads Reset Status : 0x0110
04-05	Output channel number or bit count	2 Byte	0x0001-0x0020 (Bit count)

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x01
02	Byte Count	1 Byte	Byte count of response (B=(bit count + 7)/8)
03	Bit values	B Byte	(Bit values)

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x81
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:05 01 00 00 00 04 [3C 4D]

Response:05 01 01 06 D0 BA

Reads digital output value

[Command]

Byte 2~3 : 00 00 (starting channel numbers)

Byte 4~5 : 00 04 (output channel number)

Byte 6~7 : 3D 4D(CRC)

[Response]

Byte 1 : 01 (Function Code)

Byte 2 : 01 (Byte count of response)

Byte 3 : 06 (DO0~DO3 Value)

Byte 4~5 : D0 BA (CRC)

Command:05 01 00 40 00 04 [3D 99]
Response:05 01 01 07 11 7A
Reads digital input high latch

Command:05 01 01 03 00 01 [0D B2]
Response:05 01 01 00 50 B8
Reads modbus host watchdog's mode

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

Command:05 01 01 04 00 01 [BC 73]
Response:05 01 01 00 50 B8
Reads host watchdog setting (enabled or not)

Command:05 01 01 0D 00 01 [6C 71]
Response:05 01 01 00 50 B8
Resets the host watchdog timeout status of a module

Command:05 01 01 00 00 09 [6C 71]
Response:05 01 02 01 00 49 AC
Reads protocol of module

Supported modules :

ZB-2060

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

ZB-2053

Valid starting channel	DI：0x0020~0x0027
	High Latched DI Channel：0x0040~0x0047
	Low Latched DI Channel：0x0060~0x0067

3.2 02(0x02) Read discrete inputs

This function code is used to read the current digital input value of the ZB DIO module.

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x02
02-03	Starting channel numbers	2 Byte	● DI : 0x0000-0x001F
04-05	Input channel number	2 Byte	0x0001-0x0020 (Bit count)

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x02
02	Byte Count	1 Byte	Byte count of response (B=(bit count + 7)/8)
03	Bit values	B Byte	Bit values

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x82
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:01 02 00 00 00 08 [79 CC]

Response:01 02 01 FF E1 C8

Reads digital iutput value

[Command]

Byte 2~3 : 00 00 (starting channel numbers)

Byte 4~5 : 00 08 (input channel number)

Byte 6~7 : 79 CC (CRC)

[Response]

Byte 1 : 02 (Function Code)

Byte 2 : 01 (Byte count of response)

Byte 3 : FF (DI0~DI7 Value)

Supported modules :

ZB-2060

Valid Starting channel	DI : 0x0020~0x0025

ZB-2053

Valid Starting channel	DI : 0x0020~0x0027

3.3 03(0x03) Read multiple registers

This function code is used to read the current digital input counter value of the ZB DIO module

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x03
02-03	Starting channel numbers or address mapping	2 Byte	● Reads DI count value : 0x0000-0x001F ● Reads module address:0x01E4 ● Reads firmware version:0x01E0 ● Reads module name:0x01E2 ● Reads modbus delay response time : 0x01E7 ● Reads timeout count : 0x01EB ● Reads timeout value : 0x01E8 ● Host OK : 0x3038
04-05	Input channel number	2 Byte	0x0001-0x0020 (Word count)

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x03
02	Byte Count	1 Byte	Byte count of response (B=2 * word count)
03~	Register values	(B*2) Byte	Register values

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x83
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:01 03 01 E2 00 02 [65 C1]

Response:01 03 04 20 53 00 00 01 E2

Reads module's name

[Command]

Byte 2~3 : 01 E2 (Address mapping)

Byte 4~5 : 00 02 (Word count)

[Response]

Byte 2 : 04 (Byte count of response)

Byte 3~6 : 20 53 00 00, 20 53(Low word of module name), 00 00(High word of module name)

Command:05 03 01 E4 00 01 [C4 45]
Response:05 03 02 00 05 89 87
Reads address of modules

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 DI count of modules

Command:05 03 01 E7 00 01 [34 45]
Response:05 03 02 00 00 49 84
Reads modbus response delay time

Command:05 03 01 EB 00 01 [F4 46]
Response:05 03 02 00 00 49 84
Reads the host watchdog timeout value of a module

Command:00 03 30 38 00 01 [0B 16]
Response:No response
Informs all modules that the host is OK

Supported modules :

ZB-2060

Valid starting channel	DI Count Value : 0x0000-0x0005

ZB-2053

Valid starting channel	DI Count Value : 0x0000-0x0007

3.4 04(0x04) Read multiple registers

This function code is used to read the current digital input counter value of the ZB DIO module

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x04
02-03	Starting channel numbers or address mapping	2 Byte	● Reads DI count value : 0x0000-0x001F ● Reads module address:0x01E4 ● Reads firmware version:0x01E0 ● Reads module name:0x01E2 ● Reads modbus delay response time : 0x01E7 ● Reads timeout count : 0x01EB ● Reads timeout value : 0x01E8 ● Host OK : 0x3038
04-05	Input channel number	2 Byte	0x0001-0x0020 (Word count)

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x04
02	Byte Count	1 Byte	Byte count of response (B=2 * word count)
03~	Register values	(B*2) Byte	Register values

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x83
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:05 04 01 E2 00 02 [D1 85]
Response:05 04 04 20 60 00 00 B5 9A
Reads module's name

Command:01 04 01 E4 00 01 [70 01]
Response:01 04 02 00 01 78 F0
Reads address of modules

Command:01 03 00 00 00 02 [C4 0B]
Response:01 03 04 00 15 00 15 2A 38
Reads DI count of modules

Command:05 04 01 E7 00 01 [81 85]
Response:05 04 02 00 00 48 F0
Reads modbus response delay time

Command:05 04 01 EB 00 01 [41 86]
Response:05 04 02 00 00 48 F0
Reads the host watchdog timeout value of a module

Command:00 04 30 38 00 01 [BE D6]
Response:No response
Informs all modules that the host is OK

Supported modules :

ZB-2060

Valid starting channel	DI Count Value : 0x0000-0x0005

ZB-2053

Valid starting channel	DI Count Value : 0x0000-0x0007

3.5 05(0x05) Write single coils

This function code is used to write the digital output value of the ZB DIO module.

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x05
02-03	Output channel numbers	2 Byte	● DO : 0x0000-0x001F ● Clear DI count value : 0x0200-0x021F ● Safe Value : 0x0080-0x009F ● Power On Value : 0x00A0-0x00BF ● Clear Latched : 0x0107 ● Set WDT Mode : 0x0103 ● Set WDT Enable : 0x0104 ● Clear WDT Status : 0x010D
04-05	Output value	2 Byte	A value 0xFF00 sets the output to ON A value 0xFF00 sets the output to OFF

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x05
02-03	Output channel numbers	2 Byte	The value is the same as byte 02 and 03 of the Request
04-05	Output value	2 Byte	The value is the same as byte 04 and 05 of the Request

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x85
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:05 05 00 83 FF 00 [7C 56]
Response:05 05 00 83 FF 00 7C 56
Sets DO3 power-on value to on

Command:05 05 02 00 FF 00 [8C 06]
Response:05 05 02 00 FF 00 8C 06
Clear digital input count

Command:05 05 00 02 FF 00 [2C 7E]
Response:05 05 00 02 FF 00 2C 7E
Sets DO2 to on

Command:05 05 01 07 FF 00 [3D 83]
Response:05 05 01 07 FF 00 3D 83
Clear DIO latch of modules

Command:05 05 01 03 FF 00 [7C 42]
Response:05 05 01 03 FF 00 7C 42
Sets host watchdog mode (Mode 1)

Command:05 05 01 03 00 00 [3D B2]
Response:05 05 01 03 00 00 3D B2
Sets host watchdog mode (Mode 0)

Command:05 05 01 04 FF 00 [CD 83]
Response:05 05 01 04 FF 00 CD 83
Sets host watchdog enable

Command:05 05 01 0D FF 00 [1D 81]
Response:05 05 01 0D FF 00 1D 81
Clear host watchdog status

Supported modules :

ZB-2060

Valid starting channel	DO：0x0000~0x0003
	Clear DI Count Value : 0x0200-0x0205
	Safe Value : 0x0080~0x0083
	Power On Value : 0x00A0~0x00A3

ZB-2053

Valid starting channel	Clear DI Count Value : 0x0200-0x0207

3.6 06(0x06) Write multiple registers

This function code is used to set the settings of the module.

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x06
02-03	Address mapping	2 Byte	● Sets modbus reponse delay time : 0x01E7 ● Clear watchdog timeout count : 0x01EB ● Sets watchdog timeout value : 0x01E8
04-05	Register value	2 Byte	Register value

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	06
02-03	Address mapping	2 Byte	The value is the same as byte 02 and 03 of the Request
04-05	Register value	2 Byte	Register value

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x86
02~	Exception code	n Byte	Refer to Modbus standard for more details

Examples:

Command:05 06 01 E7 00 10 [38 49]

Response:05 06 01 E7 00 10 38 49

Sets modbus response delay time (0~30,in 1ms)

[Command]

Byte 2~3 : 01 E7 (Address mapping)

Byte 4~5 : 00 10 (delay 16 ms)

[Response]

Byte 1 : 06 (Function Code)

Command:05 06 01 E8 00 C8 [08 10]

Response:05 06 01 E8 00 C8 08 10

Sets host watchdog timeout value (0~255,in 0.1s)

Command:09 06 01 EB 00 00 [F9 4A]

Response:09 06 01 EB 00 00 F9 4A

Clear host watchdog timeout count

3.7 15(0x0F) Write multiple coils

This function code is used to write the digital output value of the ZB DIO module.

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x0F
02-03	Starting channel numbers	2 Byte	● DO : 0x0000-0x001F ● Clear DI count value : 0x0200-0x021F ● Safe Value : 0x0080-0x009F ● Power On Value : 0x00A0-0x00BF
04-05	Output channel number	2 Byte	0x0001-0x0020 (Bit count)
06	Byte Count	1 Byte	B=(bit count + 7)/8
07	Output value	2 Byte	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:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x0F
02-03	Starting channel numbers	2 Byte	The value is the same as byte 02 and 03 of the Request
04-05	Input channel number	2 Byte	0x0001-0x0020

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x8F
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:05 0F 00 A1 00 03 01 07 [72 BF]
Response:05 0F 00 A1 00 03 45 AC
Sets Safe value (DO1-DO3)

Command:05 0F 00 00 00 03 01 FF [CE E4]
Response:05 0F 00 00 00 03 14 4E
Sets DO value (DO0-DO3)

Command:01 0F 02 00 00 08 01 FF [BF 37]
Response:01 0F 02 00 00 08 55 B5
Clear DI count (DI0-DI7)

Supported modules :

M-2060

Valid starting channel	DO：0x0000~0x0003
	Clear DI Count Value : 0x0200-0x0205
	Safe Value : 0x0080~0x0083
	Power On Value : 0x00A0~0x00A3

M-2053

Valid starting channel	Clear DI Count Value : 0x0200-0x0207

3.8 46(0x46) Read/Write module settings

This function code is used to read the settings of the module or change the settings of the module. The following sub-function codes are supported

Sub-Function code	Description	Section
00 (0x00)	Read the module name	3.8.1
04 (0x04)	Set the module address	3.8.2
05 (0x05)	Read the communication settings	3.8.3
06 (0x06)	Set the communication settings	3.8.4
32 (0x20)	Read the firmware version	3.8.5
33 (0x21)	Set the DI count edge	3.8.6
34 (0x22)	Read DI count edge setting value	3.8.7
39 (0x27)	Set the DO power-on value	3.8.8
40 (0x28)	Read the DO power-on value	3.8.9
41 (0x29)	Set the DI/O active status	3.8.10
42 (0x2A)	Read the DI/O active status	3.8.11
53 (0x35)	Read the response delay time	3.8.12
54 (0x36)	Set the response delay time	3.8.13

Error Response

00	Address	1 Byte	1-247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	Refer to Modbus standard for more details

3.8.1 00(0x00) Read Module Name

This sub-function code is used to read the name of a module.

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x00

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x00
03-06	Module name	4 Byte	0x00 0x20 0x53 0x00 for ZB-2053

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:01 46 00 [12 60]

Response:01 46 00 00 20 53 00 38 5C

3.8.2 04(0x04) Set Module Address

This sub-function code is used to set the address of a module.(ZB DIO does not support)

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x04
03	Address	1 Byte	1-247
04-06	Reserved	3 Byte	0x00 0x00 0x00

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x00
03	Address	1 Byte	0 : OK Others : Error
04-06	Reserved	3 Byte	0x00 0x00 0x00

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	Refer to Modbus standard for more details

3.8.3 05(0x05) Read Communication

This sub-function code is used to read the communication protocol settings of a module

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x05
03	Reserved	1 Byte	0x00

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x05
03	Protocol support	1 Byte	0 ,1 : Modbus RTU 3 : Modbus RTU/ASCII
04	Baud Rate	1 Byte	0x0A
05	Reserved	1 Byte	0x00
06	Parity	1 Byte	0 : N81 1 : N82 2 : E81 3 : O81
07	Reserved	1 Byte	0x00
08	Protocol Mode	1 Byte	0 : DCON 1 : Modbus RTU 3 : Modbus ASCII
09-10	Reserved	2 Byte	0x00 0x00

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:02 46 05 00

Response:02 46 05 03 0A 00 00 00 01 00 00 6B 12

Reads protocol

3.8.4 06(0x06) Set Communication

This sub-function code is used to set the communication protocol of a module. (ZB DIO does not support)

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x06
03	Reserved	1 Byte	0x00
04	Baud Rate	1 Byte	0x0A
05	Reserved	1 Byte	0x00
06	Parity	1 Byte	0 : N81 1 : N82 2 : E81 3 : O81
07	Reserved	1 Byte	0x00
08	Protocol Mode	1 Byte	0 : DCON 1 : Modbus RTU 3 : Modbus ASCII
09-10	Reserved	2 Byte	0x00 0x00

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x06
03	Reserved	1 Byte	0x00

04	Baud Rate	1 Byte	0 : OK Others : Error
05	Reserved	1 Byte	0x00
06	Parity	1 Byte	0 : OK Others : Error
07	Reserved	1 Byte	0x00
08	Protocol Mode	1 Byte	0 : OK Others : Error
09-10	Reserved	2 Byte	0x00 0x00

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	Refer to Modbus standard for more details

3.8.5 32(0x20) Read Firmware Version

This sub-function code is used to read the firmware version information of a module.

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x20

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x20
03	Major version	1 Byte	0x00-0xFF
04	Minor version	1 Byte	0x00-0xFF
05	Build version	1 Byte	0x00-0xFF

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:01 46 20

Response:01 46 20 01 00 00 D2 05

3.8.6 33(0x21) Set Digital Input Count Edge

This sub-function code is used to set the digital input counter trigger edge value of a module.

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x21
03	Edge setting value	1 Byte	0x00-0xFF (DI0-DI7)
04	Edge setting value	1 Byte	0x00-0xFF (DI8-DI15)
05	Edge setting value	1 Byte	0x00-0xFF (DI16-DI23)
06	Edge setting value	1 Byte	0x00-0xFF (DI24-DI31)

*1 = rising edge, 0 = falling edge. For example 0x03 denotes that channels 0~1 are set as rising edge and channels 2~3 are set as falling edge

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x21
03	Edge setting value	1 Byte	0 : OK Others : Error

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:01 46 21 FF [B8 1D]

Response:01 46 21 00 F8 5D

Sets digital input count edge (Rising edge)

Examples:

Command:01 46 22 [92 79]

Response:01 46 22 FF B8 ED

Reads digital input count edge

3.8.7 34(0x22) Read Digital Input Count Edge

This sub-function code is used to read the digital input counter trigger edge value of a module.

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x22

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x22
03	Edge setting value	1 Byte	0x00-0xFF (DI0-DI7)
04	Edge setting value	1 Byte	0x00-0xFF (DI8-DI15)
05	Edge setting value	1 Byte	0x00-0xFF (DI16-DI23)
06	Edge setting value	1 Byte	0x00-0xFF (DI24-DI31)

*1 = rising edge, 0 = falling edge. For example 0x03 denotes that channels 0~1 are set as rising edge and channels 2~3 are set as falling edge

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:05 46 21 3F [B9 7D]

Response:05 46 21 00 F9 6D

Sets DI0-DI5 count edge (Rising edge)

Examples:

Command:05 46 22 [D3 B8]

Response:05 46 22 3F B9 8D

Reads digital input count edge

3.8.8 39(0x27) Set Power-on Value

This sub-function code is used to set the power-on value of a module.

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x27
03	Power-on Value	1 Byte	0x00-0xFF (DOI0-DO7)
04	Power-on Value	1 Byte	0x00-0xFF (DO8-DO15)
05	Power-on Value	1 Byte	0x00-0xFF (DO16-DO23)
06	Power-on Value	1 Byte	0x00-0xFF (DO24-DO31)

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x27
03	Power-on Value	1 Byte	0 : OK Others : Error

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:05 46 27 0F [BA C9]

Response:05 46 27 00 FA CD

Sets DO0-DO3 power-on value

Examples:

Command:05 46 28 [53 BF]

Response:05 46 28 0F BF 39

Reads power-on value

3.8.9 40(0x28) Read Power-on Value

This sub-function code is used to read the power-on value of a module.

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x28

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x28
03	Power-on Value	1 Byte	0x00-0xFF (DOI0-DO7)
04	Power-on Value	1 Byte	0x00-0xFF (DO8-DO15)
05	Power-on Value	1 Byte	0x00-0xFF (DO16-DO23)
06	Power-on Value	1 Byte	0x00-0xFF (DO24-DO31)

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	Refer to Modbus standard for more details

3.8.10 40(0x29) Set DI/O Active Status

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

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x29
03	DI/O Active Status	1 Byte	0x00-0x03

7	6	5	4	3	2	1	0
Reserved						OAS	IAS

Key	Description
OAS	DO Active Status 0: output value 1 for relay active output value 0 for relay inactive 1: output value 0 for relay active output value 1 for relay inactive
IAS	DI Active Status 0: input value 1 for non-signal or the low voltage; input value 0 for high voltage 1: input value 0 for non-signal or the low voltage; input value 1 for high voltage

(DI/O Active Status)

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x29
03	DI/O Active Status	1 Byte	0 : OK Others : Error

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:01 46 29 02 [7E 5C]

Response:01 46 29 00 FF 9D

Sets the DI/O active states

Examples:

Command:01 46 2A [93 BF]

Response:01 46 2A 02 7E AC

Reads the DI/O active states

3.8.11 42(0x2A) Read DI/O Active Status

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

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x2A

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x2A
03	DI/O Active Status	1 Byte	0x00-0x03

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:01 46 29 02 [7E 5C]

Response:01 46 29 00 FF 9D

Sets the DI/O active states

Command:01 46 2A [93 BF]

Response:01 46 2A 02 7E AC

Reads the DI/O active states

7	6	5	4	3	2	1	0
Reserved						OAS	IAS

Key	Description
OAS	DO Active Status 0: output value 1 for relay active output value 0 for relay inactive 1: output value 0 for relay active output value 1 for relay inactive
IAS	DI Active Status 0: input value 1 for non-signal or the low voltage; input value 0 for high voltage 1: input value 0 for non-signal or the low voltage; input value 1 for high voltage

(DI/O Active Status)

3.8.12 53(0x35) Read the Response Delay Time

This sub-function code is used to read modbus response delay time of a module.

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x35

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x35
03	Response Delay Time	1 Byte	(Data)

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	Refer to Modbus standard for more details

Examples:

Command:01 46 36 1E [77 A5]

Response:01 46 36 1E 77 A5

Sets modbus response delay time (30ms)

Examples:

Command:01 46 35 [D2 77]

Response:01 46 35 1E 77 55

Reads modbus response delay time (30ms)

3.8.13 54(0x36) Set the Response Delay Time

This sub-function code is used to set modbus response delay time of a module.

Request

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x36
03	Response Delay Time	1 Byte	(Data)

Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0x46
02	Sub-Function code	1 Byte	0x36
03	Response Delay Time	1 Byte	(Data)

Error Response:

00	Address	1 Byte	1-247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	Refer to Modbus standard for more details

4. Modbus ASCII Protocol

Using Modbus ASCII Protocol, all command are coded in hexadecimal values, represented with readable ASCII characters. Only the characters 0...9 and A...F are used for coding.

Using Modbus ASCII Protocol, characters are used to start and end a frame. The Leading Character ':' is used to flag the start of a command and each command is ended with a CR•LF combination. The LRC characters are appended to the command preceding the CR•LF characters.

Command Format:

Leading Character	Module Address	Command	[LRC]	CR	LF

Response Format:

Leading Character	Module Address	Data	[LRC]	CR	LF

LRC Calculation:

All characters except for Leading Character (:) and delimiter (CR•LF) are added with a carry being discarded.

Total value is converted to binary notation, is converted to 2's complements, then to hexadecimal figures, that is, LRC.

Example :

Modbus RTU => 01 46 00 [12 60]

Modbus ASCII => :014600B9(CR・LF)

(1.) hexadecimal = 01h+46h+00h = 47h

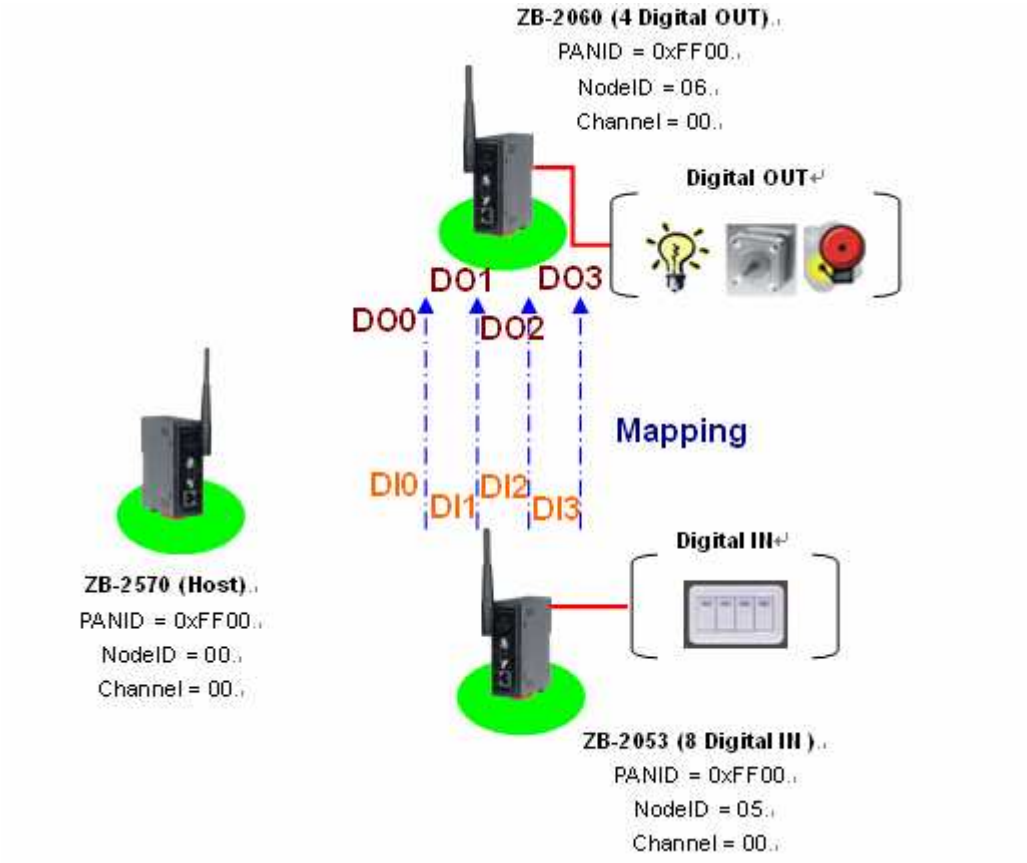
(2.) 2's complement: = B9h (LRC)

5. DIO Mapping

When using the function of DIO Mapping, the DI module's DI channel status can be mapped to DO module's DO channel through ZigBee's communication. For example, the DI module's Address is 03, protocol is DIO Mapping, the DI module's DI channel status will one-to-one mapping to the DO channel of the DO module address 04.

You can put the Module's address into following value to work DIO mapping function. (Make sure that The PID and ZB Channel is the same setting value)

Protocol	DI Module's Address	DO Module's Address
DIO Mapping	0x01	0x02
	0x03	0x04
	0x05	0x06
	0x07	0x08
	0x09	0x0A
	0x0B	0x0C
	0x0D	0x0E


ZB-2060 (4 Digital OUT)
PANID = 0xFF00
NodeID = 06
Channel = 00
Digital OUT
DO1
DO3
DO0
DO2
Mapping
DI0
DI1
DI2
DI3
Digital III
ZB-2570 (Host)
PANID = 0xFF00
NodeID = 00
Channel = 00
ZB-2053 (8 Digital III)
PANID = 0xFF00
NodeID = 05
Channel = 00

A. Appendix

A.1 INIT Mode

Each ZB DIO module has a build-in EEPROM to store configuration information such as address, ZBPID, ZB Channel and other information. User may forget the configuration of module. Therefore, the ZB DIO have a special mode named “INIT mode”. The “INIT mode” is setting as Address = 0xFF, ZB PID = 0xFF00, ZB Channel = 0, Protocol = DCON, Checksum disabled. When the module is powered on in INIT mode the configuration of the module is reset as follows :

1. Address: 0xFF
2. Baud Rate: depend on ZB-2570
3. No checksum
4. Protocol: DCON .

The configuration information stored in the EEPROM is not changed and can be read by sending the $FF2(CR) command

A.2 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 circuit allows the module to work 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

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

A.3 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. It is cleared after the responding of the first $AA5 command. This can be used to check whether the module had been reset. When the $AA5 command responds that the reset status is cleared, that means the module has not been reset since the last $AA5 command was sent. When the $AA5 command responds that the reset status is set and it is not the first time $AA5 command is sent, it means the module has been reset and the digital output value had been changed to the power-on value.

A.4 Digital Output

Besides setting by the set digital output commands, the digital outputs can be set by two other conditions.

When the host watchdog is enabled and a host watchdog timeout occurs, the “safe value” is loaded into the digital output ports. The set 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. The status is not changed even after power-on reset. It can be cleared only by the reset host watchdog timeout status command ~AA1. See Section A.2 for host watchdog details.

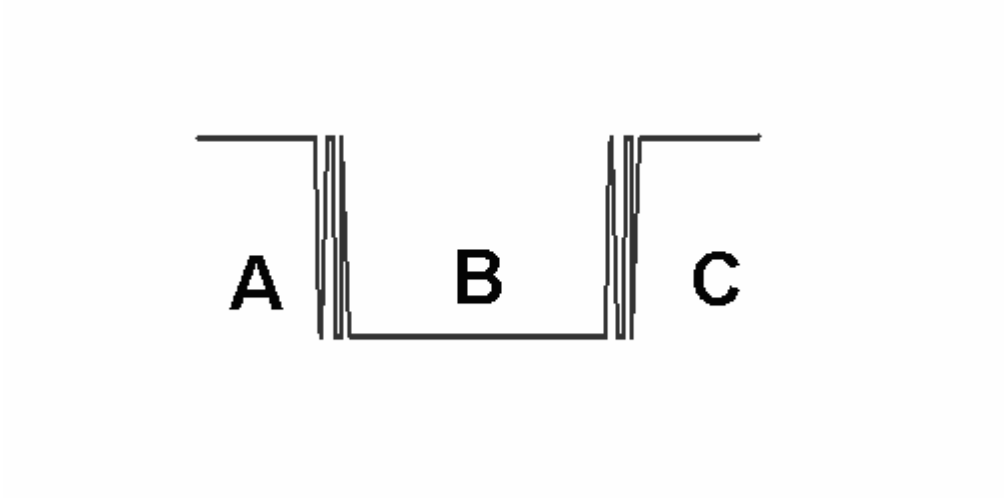
When the module is powered on and the host watchdog timeout status is cleared, the “power-on value” is loaded into the digital output ports. If the host watchdog timeout status is not cleared on power-on, then the safe value is loaded into the digital output ports.

Both the safe value and power-on value are set by the ~AA5V command. Refer to Section 2.32 for details.

A.5 Latched Digital Input

The ZB-2000 modules provide commands to read the latched high digital input and latched low digital input status. Following is an example to show the usefulness of the latched digital input. When we want to read the key stroke of a key switch which is connected to the digital input channel of a

module, the input signal of the key stroke is a pulse signal as shown in the following figure.



If we just use the read digital input status command to read the signal and we cannot send the command during the B period due to some reasons, then we will lose the key stroke information. However, with the read latched digital input command, we can still get the key stroke information even we are not able to send command in B period. For details of the read latched digital input command, please refer to Sections 2.15.

A.6 LED Display Status

An LED indicator is used for the PWR, the ZigBee, and each DI or DO channel status.

LED	Status	LED
PWR	Flash(per 100ms)	Power supply is ok. The module is reading ZigBee's setup parameter.
	Flash(per 50ms)	Power supply is ok. The ZigBee read failed, and All LED indicator will turn on. Please reset the power supply.
	Flash(per 250ms)	Power supply is ok. The firmware have loaded, and a host watchdog timeout occurs. It is normal operation.
	On	Power supply is ok. The firmware have loaded. It is normal operation.
	Off	Power supply have failed.
ZigBee	Flash	The ZigBee is searching the Net Server. (ZB-2570), the network isn't survival.
	On	The network is survival. (The PID is as same as ZB-2570)
	Off	Power supply have failed.
DI/DO	On/Off	The LED indicators to display the DI/O states