

# ZT-257x DIO Data Concentrator

## Quick Start Guide

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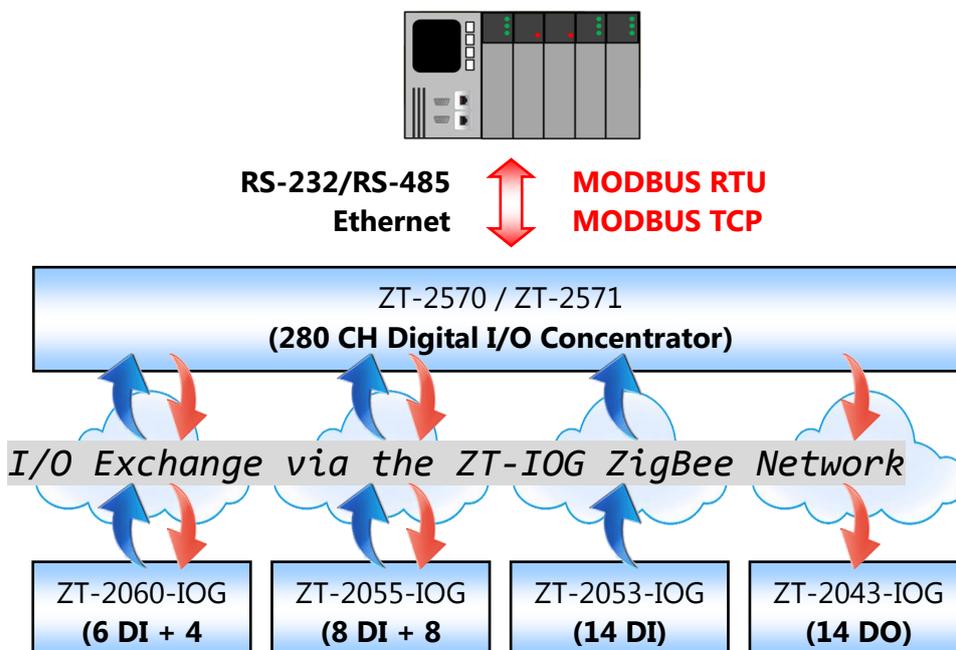
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# 1 Introduction to the ZigBee DIO Data Concentrator

## Overview of the Functions

ZT-257x series modules contain a built-in ZigBee DIO data concentrator function. This function can be used to automatically retrieve the status of a remote DIO channel via a ZigBee wireless network, and then temporarily save the data to the corresponding Modbus register. After the data has been stored, it means that the remote PAC is able to read the data once, and then, using the Modbus protocol, write the data to multiple DIO channels on remote ZigBee modules connected to the ZT-257x module via the Ethernet, RS-232, or RS-485 interface.



The ZigBee DIO data concentrator function can be used to easily establish communication between a ZigBee wireless network and the Ethernet, meaning that the distributed DIO data can be integrated, allowing a remote monitoring system to be quickly implemented.

The ZigBee DIO data concentrator supports a maximum of 280 digital channels and a maximum of 32 ZT-2000-IOG series modules. Using the ZigBee DIO data concentrator allows the architecture of a system to be simplified, while simultaneously expanding system flexibility and reducing the traffic load on an Ethernet and ZigBee wireless network, thereby improving system performance.

## Overview of the ZT-257x Series

The ZT-2570 and ZT-2571 series modules are small-sized wireless ZigBee converters based on the IEEE802.15.4 standard that allow devices based on the RS-232, RS-485 and Ethernet interfaces to be integrated into a personal area ZigBee network. In addition, the transmission frequency can be adjusted in the range from 2405 MHz to 2480 MHz, separated into 5 MHz sectors, providing 16 channels and 16384 PAN IDs (i.e., Pan ID, 0x0000 to 0x3FFF).

The ZT ZigBee series of products conform to the ZigBee 2007 (ZigBee Pro) specifications developed by the ZigBee Alliance for a suite of high-level communication protocols using small, low-power digital radio modules. Only one ZigBee Host, e.g., a ZT-2570 module, can be used in a single ZigBee network. This module is known as the “ZigBee Coordinator”, and is used to manage the network initialization and routing. In addition, up to 255 ZigBee Slave devices can be used in a single ZigBee network. Each of these devices is defined as a “ZigBee Router”, and can be used to receive or forward data to or from a nearby node.

Further information related to the **ZT-2570** (Host, ZigBee Coordinator) and the **ZT-2571** (Slave, ZigBee Router) series of converters can be found at:

[http://www.icpdas.com/root/product/solutions/industrial\\_wireless\\_communication/wireless\\_solutions/zt-2570.html](http://www.icpdas.com/root/product/solutions/industrial_wireless_communication/wireless_solutions/zt-2570.html)

## Overview of the ZT-2000-IOG Series

The ZT-2000-IOG series is a range of active wireless I/O modules developed by ICP DAS that can be configured to operate as either a ZigBee Coordinator or a ZigBee Router by adjusting the DIP/Rotary switch, while also being able to automatically provide updates related to the status of the I/O channels. In addition, ICP DAS also provides a user-friendly GUI configuration utility that allows users to perform advanced functions designed to meet the various needs of customized applications.

More information related to the **ZT-20xx-IOG series** of I/O modules (ZigBee Coordinator/Router) can be found at:

[http://www.icpdas.com/root/product/solutions/industrial\\_wireless\\_communication/wireless\\_solutions/wireless\\_selection.html#e](http://www.icpdas.com/root/product/solutions/industrial_wireless_communication/wireless_solutions/wireless_selection.html#e)

Documents providing more details about these devices can be downloaded from:

[http://ftp.icpdas.com/pub/cd/usbcd/napdos/zigbee/zt\\_series/document/](http://ftp.icpdas.com/pub/cd/usbcd/napdos/zigbee/zt_series/document/)

# 2 Parameters

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## 2.1 An Overview of the Configuration Procedure

When using the ZT-257x module as a ZigBee DIO data concentrator, the following configuration procedure should be performed:

- ① Create a ZigBee wireless connection between the ZT-257x module and a remote ZT-20xx-I/O module. See Section 2.2 – (1) to (5) for more details.
- ② Specify the method to determine the conditions for how the status of the DIO channels will be updated. See Section 2.2 – (6) to (7) for more details.
- ③ Specify the protection mechanism that should be activated if the ZigBee wireless communication is interrupted. See Section 2.2 – (8) to (9) for more details. Note that this function is not essential to be enabled, but could be especially useful as it helps to protect the module should an error occur or if communication is lost.
- ④ Set the mapping between the DIO channels (ZT-20xx-I/O) and the Modbus register(s). See Section 2.2 – (10) to (11) for more details.

## 2.2 Basic Configuration

The main parameters used to perform the configuration procedure for the ZT-20xx-IOG and ZT-257x modules described in Section 2.1 are listed below. For more information related to each parameter, refer to the Sections indicated.

Configuration Parameters		Details	ZT-20xx-IOG	ZT-257x
Pan ID	①	<a href="#">Section 2.2-(1)</a>	<a href="#">Section 3.1.4</a>	<a href="#">Section 3.2</a>
Node ID		<a href="#">Section 2.2-(2)</a>	<a href="#">Section 3.1.3 (DIP Switch 4-8)</a>	
Encryption		<a href="#">Section 2.2-(3)</a>	<a href="#">Section 3.1.3 (DIP Switch 3)</a>	
RF Channel		<a href="#">Section 2.2-(4)</a>	<a href="#">Section 3.1.3 (Rotary Switch)</a>	
RF Power		<a href="#">Section 2.2-(5)</a>	<a href="#">Section 3.1.4</a>	
Trigger Mode	②	<a href="#">Section 2.2-(6)</a>	<a href="#">Section 3.1.3 (DIP Switch 2)</a>	
Refresh Interval		<a href="#">Section 2.2-(7)</a>	<a href="#">Section 3.1.4</a>	
Check-Router-Alive	③	<a href="#">Section 2.2-(8)</a>	<a href="#">Section 3.1.4</a>	
Safe Value		<a href="#">Section 2.2-(9)</a>	<a href="#">Section 3.1.4</a>	
Channel Offset (DI/DO)	④	<a href="#">Section 2.2-(10)</a>	<a href="#">Section 3.1.4</a>	
Modbus Slave ID		<a href="#">Section 2.2-(11)</a>	N/A	

### 1. Pan ID: ([Overview](#))

- This parameter is used to configure the Pan ID, which is the group ID for the ZigBee network, and must be the same for all modules that exist in the same ZigBee network. The valid value range is from 0x0000 to 0x3FFF.
- The factory default Pan ID for a ZT-20xx-IOG module is 0x0000, but will be set to 0x3FFFF when operating in INIT mode.
- Normally, ZigBee network groups can be separated by adjusting the RF Channel without setting the Pan ID. See the **RF Channel** section (4) below for more details.

## 2. Node ID: [\(Overview\)](#)

- This parameter is used to configure the Node ID, which is the identification number for the module, and must be unique within a single ZigBee network.
- **The Node ID for the ZigBee Coordinator is fixed to 0x0000**, whereas the Node ID for ZigBee Router can be configured in the range from 0x0001 to 0xFFFF7.
- Up to 32 Node IDs can be configured for a ZT-20xx-IOG module in the range from 0x0000 to 0x001F. However, if the module is set to INIT mode, the Node ID will be set to 0x0020.
- One of the devices in a single ZT-IOG network must be assigned as the ZigBee Coordinator (0x0000), and must be always powered on or else the IOG system will not function correctly.

## 3. Encryption: [\(Overview\)](#)

- This parameter is used to switch support for the AES 128-bit encryption algorithm either ON or OFF.
- When using the ZT-20xx-IOG module, this function can be set using the rotary switch. When using the ZT-257x module, this function can be configured using software.
- When using the ZT-20xx-IOG module as a ZigBee Router, data encryption function will passively be performed.

## 4. RF Channel: [\(Overview\)](#)

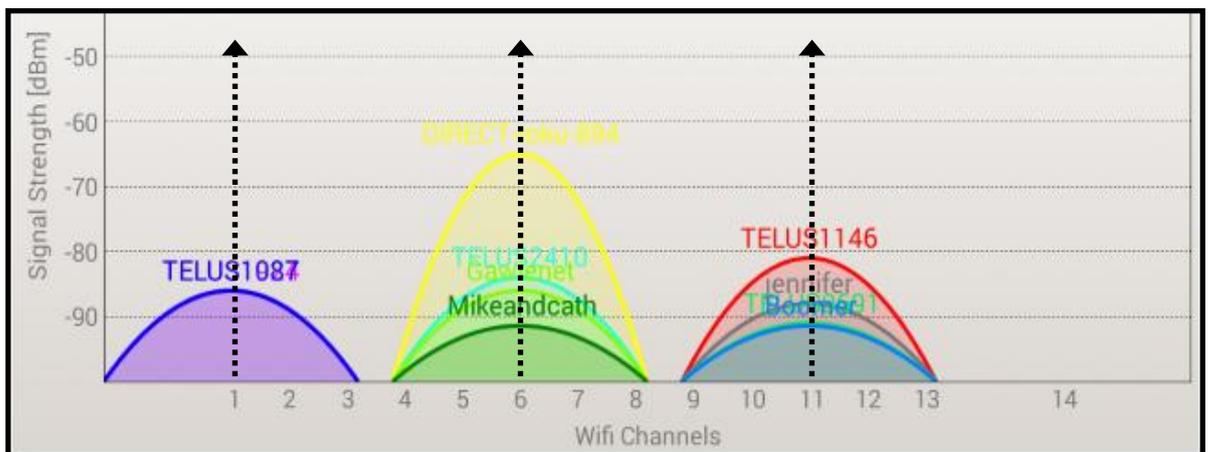
- This parameter is used to configure the radio-frequency channel, and all modules must be set to the same frequency if they are connected to the same ZigBee network, as indicated in the following table.

Channel	0x00	0x01	0x02	.....	0x0E	0x0F
Frequency (MHz)	2405	2410	2415	.....	2475	2480

✧ Determining which Wi-Fi channels are available:

Use a Smartphone (or PC) App such as **Wi-Fi Analyzer** to analyze the wireless network environment, scan which WLAN frequency bands (e.g., Wi-Fi) are being used for the Wi-Fi channels in the local vicinity. For example:

As illustrated in the screenshot from **Wi-Fi Analyzer** below, several Wi-Fi signals are being used for specific Wi-Fi channels (i.e., channels 1, 6, and 11).



✧ Determining which ZigBee channels do not overlap with the available Wi-Fi channels:

By referring to the corresponding Wi-Fi and ZigBee channel table below, based on the IEEE802.15.4 standard, the ZigBee transmission frequency can be adjusted in the range from 2405 MHz to 2480 MHz, separated into 5 MHz sectors, providing 16 channels. In the table below, it can be determined that ZigBee channels 4, 9, E, and F and Wi-Fi channels 1, 6, and 11 do not overlap. In this case, RF channels 4, 9, E, and F can be selected.



## 5. RF Power: ([Overview](#))

- This parameter is used to configure the strength of the radio frequency signal, as indicated in the following table.

Code (Hex.)	Description
0x0F	Typical maximum output
0x08	Meets CE/FCC certification
0x00	Typical minimum output

- ※ Be aware that any adjustment of this parameter is based purely on individual circumstances. ICP DAS cannot guarantee that the CE/FCC certification will be applicable if this parameter is adjusted, nor does ICP DAS assume any liability derived from the illegal adjustment of this parameter.

## 6. Trigger Mode: ([Overview](#))

- This parameter is used to modify the trigger type and logic for the DIO channels, including both the **Level** and the **Pulse** trigger modes.
- Refer to the user manual for the ZT-20xx-IOG module for more details. Select the **Level Mode** option when using the ZigBee DIO data concentrator function.

## 7. Refresh Interval: ([Overview](#))

- This parameter is used to modify the time interval between I/O channel updates (in seconds).
- When the DIO state changes from Low to High, one time unit is required for the updated data to be synchronized.
- When the DIO state changes from High to Low, two time units are required for the updated data to be synchronized.

## 8. Check-Router-Alive: ([Overview](#))

- This parameter is used to monitor the status of the connection so that the wireless module can determine whether the module is connected or disconnected. See Section [5.2 Advanced functions: Status Detection Schemes in Wireless Environments](#) for more details.
- This parameter is only applicable to the ZT-2570 (Host, ZigBee Coordinator) module, or when a ZT-20xx-IOG series module is acting as the ZigBee Coordinator (i.e., when the Node ID = 0x0000).

## 9. Safe Value: ([Overview](#))

- This parameter is used to configure the Safe value for a DO channel. If a module is disconnected for the specified time, the status of the DO channel will be set to the Safe value. See Section [5.2 Advanced functions: Status Detection Schemes in Wireless Environments](#) for more details.
- This parameter is only applicable to the ZT-2571 (Slave, ZigBee Router) module, or when a ZT-20xx-IOG series module is acting as the ZigBee Router. See item **2. Node ID** above for more details.

## 10. Channel Offset (DI/DO): ([Overview](#))

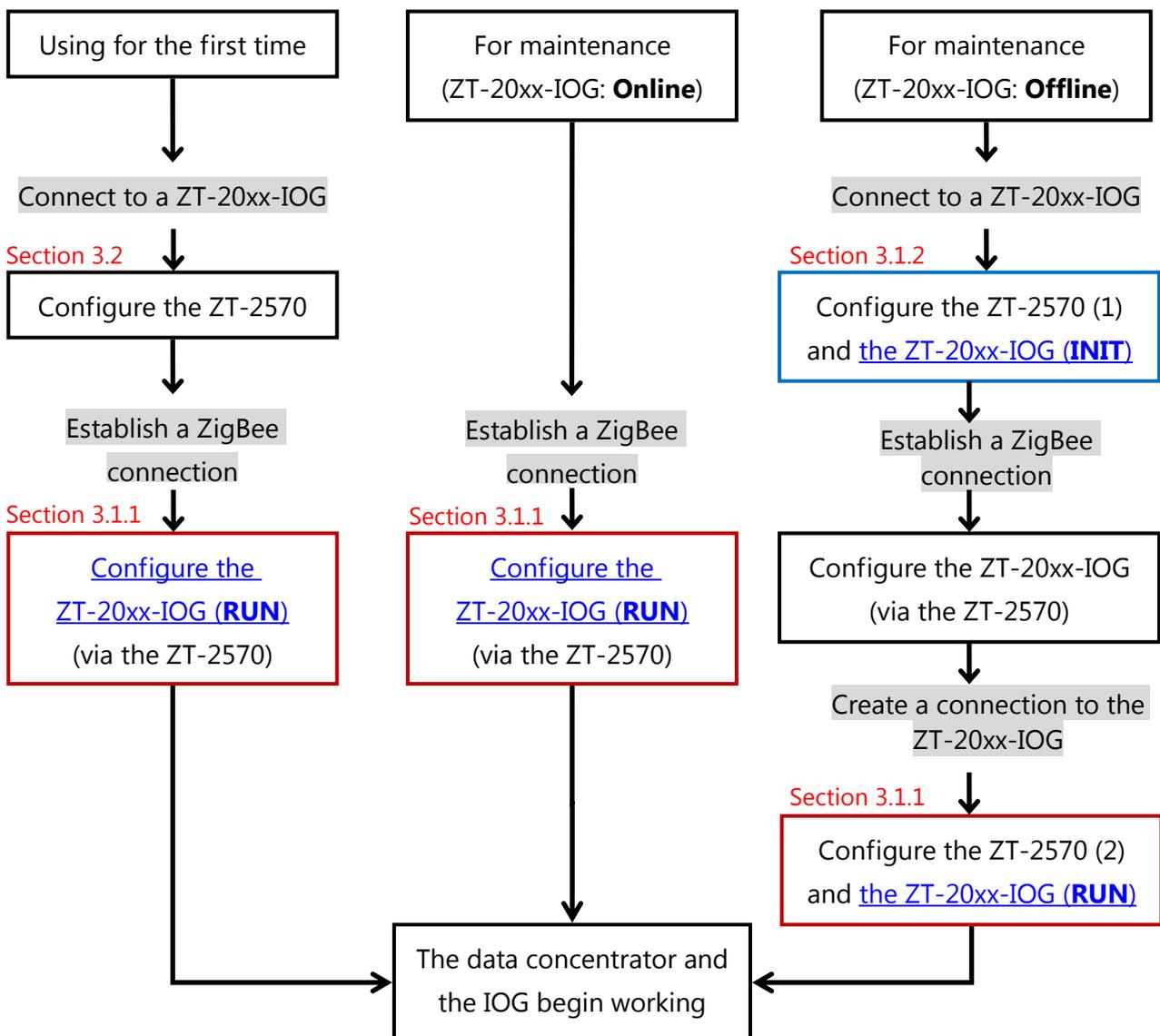
- This parameter is used to configure the I/O mapping between the DIO channels on a ZT-20xx-IOG module and the Modbus register on the ZT-257x module. See Section [5.1 Advanced functions: DIO Channel Offset](#) for more details.
- This parameter is only applicable to ZT-20xx-IOG series modules.

## 11. Modbus Slave ID: ([Overview](#))

- This parameter is used to configure the Modbus Slave ID for a ZT-257x module. When using a ZT-257x module as a ZigBee DIO data concentrator, the module allows the external host (or controller) to read data from or write data to the ZT-20xx-IOG DIO module using the Modbus protocol. Consequently, a Modbus ID must be assigned to the ZT-257x module.

# 3 ZT Series Module Settings

When using the ZT-257x module as a data concentrator, the first task that must be performed is to establish a ZigBee network between the ZT-257x module and the remote ZT-20xx-IOG module so that the physical DIO channel data can be automatically and correctly sent to the Modbus Register on the ZT-257x module. For more details about configuring the ZT-257x module, follow the instructions below.



## 3.1 Configuring the ZT-20xx-IOG Module

### Establishing ZigBee Wireless Communication

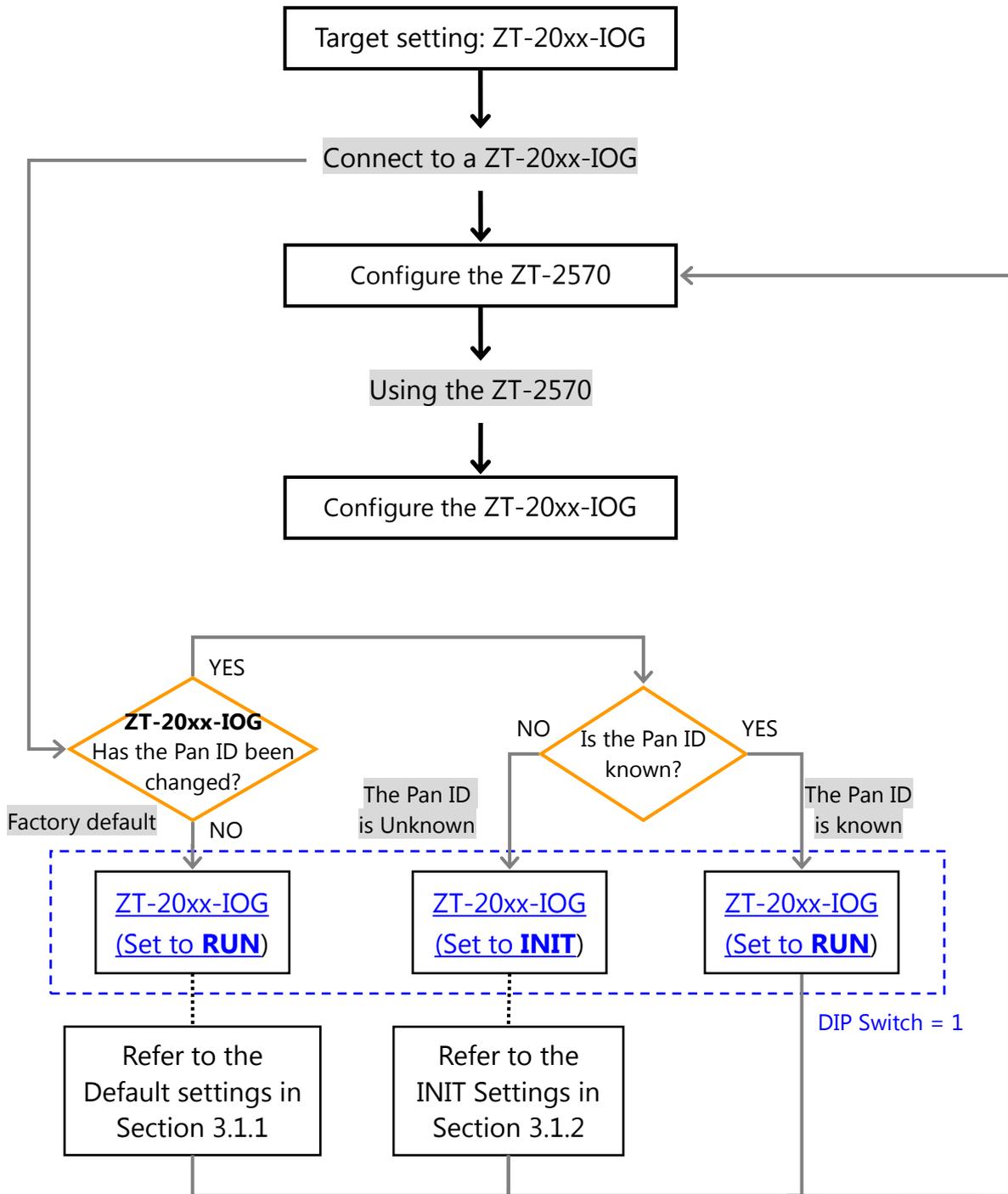
As the ZT-20xx-IOG module has no physical communication port, a ZigBee wireless connection needs to be established using the ZigBee convertor (e.g., ZT-2570, ZT-2550, or ZT-USBC) in order to configure the ZT-IOG module via wireless communications.

There are three main parameters that need to be configured are shown below.

Parameters	ZT-20xx-IOG	ZT-2550/ ZT-2570	ZT-USBC	Value
(1) Pan ID	Set via software	Set via software		Set to the same value
(2) Node ID	Set via DIP Switch	Set via software		Set to a unique value
(3) RF Channel	Set via Rotary Switch	Set via software		Set to the same value

- The **Node ID** and **RF Channel** for the ZT-20xx-IOG module are set using either the DIP or the Rotary switch. See Section [3.1.3 Hardware Settings for the ZT-20xx-IOG Module](#) for details of how to create a ZigBee wireless connection.
- The **Pan ID** for the ZT-20xx-IOG module is set remotely using software and cannot be adjusted using an external hardware switch. There are two methods of creating a connection between the ZT-2570 module and the ZT-20xx-IOG module:
  - ① If the Pan ID **is known**: Set the ZT-20xx-IOG module to **RUN** mode, and then configure it remotely via wireless communication using a ZT-2570 module.
  - ② If the Pan ID **is unknown**: Set the ZT-20xx-IOG module to **INIT** mode, and then configure it remotely via wireless communication using a ZT-2570 module.

※ See Section [3.1.4 Software Settings for the ZT-20xx-IOG Module](#) for more details.



### 3.1.1. Connecting to the ZT-20xx-IOG Module (RUN)

**Step1** Configure the ZT-2570 module to establish a common ZigBee network with the ZT-20xx-IOG module

- ① See Section [3.2 Configuring the ZT-257x Module](#) for details of how to configure the ZT-2570 module. In order to create a connection between the ZT-2570 module and the ZT-20xx-IOG module, configure the ZT-2570 module using the settings indicated in the table below.
- ② After completing the configuration, set the DIP switch on the ZT-2570 module to the "ZBRUN" position, and then reboot the module.

Parameter	ZT-20xx-IOG	ZT-2550	ZT-USBC
	RUN	ZT-2570	
Pan ID (ZigBee Group ID)	User-defined <b>(Default: 0x0000)</b>	Set to the same ID as the ZT-20xx-IOG	
Node ID (*)	<b>ZigBee Router</b>	<b>ZigBee Coordinator</b>	
	Set using DIP switches 4-8. The Node ID can be set a value in the range of 0x0001 to 0x001F (see item 4 in <a href="#">Section 3.1.3</a> - Hardware Settings of for the ZT-20xx-IOG Module for more information regarding the positions of DIP Switches 4-8)	0x0000	
RF Channel (*)	Set using the Rotary switch (0 - F)	Set to the same frequency as the ZT-20xx-IOG	
Application Mode (*)	Level Mode	Level Mode/Transparent Mode	N/A
Data Format	N/A	None, 8, 1	
Baud Rate	N/A	115200 bps	

Note that the Pan ID must be the same for all modules that exist in the same ZigBee network.

(\*): See item2 in step 2 below.

## **Step2** Configure the ZT-20xx-IOG module via the ZT-2570 module

- ① Set the DIP switch on the ZT-20xx-IOG module to the “**RUN**” position (i.e., move DIP switch 1 to the OFF position).
- ② Configure the ZT-20xx-IOG module, and then adjust the hardware switches based on the Node ID, RF Frequency and Application Mode settings indicated in the table above. See Section [3.1.3 Hardware Settings for the ZT-20xx-IOG Module](#) for details of how to adjust the ZT-20xx-IOG module.
- ③ Reboot the ZT-20xx-IOG module and wait until a connection is established.
- ④ See Section [3.1.4 Software Settings for the ZT-20xx-IOG Module](#) for details of how to configure the I/O mapping for the ZT-20xx-IOG module.

### **Example:**

Set the ZT-20xx-IOG module to “**RUN**” mode (i.e., move DIP switch 1 to the OFF position) to remotely connect to the ZT-2570 module. The relevant settings are provided in the table below.

<b>ZT-20xx-IOG</b>			<b>ZT-2570</b>	
Config. Mode	DIP1	<b>OFF</b>	Pan ID	0x0000
Application Mode	DIP2	OFF	Application Mode	Level Mode/Transparent Mode
Encryption	DIP3	OFF	Encryption	Disabled
Node ID	DIP4	<b>OFF</b>	Node ID	0x0000 (ZigBee Coordinator)
	DIP5	<b>OFF</b>	RF Channel	0x00
	DIP6	<b>OFF</b>	Data Format	None, 8, 1
	DIP7	<b>OFF</b>	Baud Rate	115200 bps
	DIP8	<b>ON</b>		
RF Channel	Rotary	<b>0</b>		

### 3.1.2. Connecting to the ZT-20xx-IOG Module (INIT)

**Step1** Configure the ZT-2570 module to establish a common ZigBee network with the ZT-20xx-IOG module

- ① In order to create a connection between the ZT-2570 module and the ZT-20xx-IOG module, configure the ZT-2570 module using the settings indicated in the table below. See Section [3.2 Configuring the ZT-257x Module](#) for details of how to configure the ZT-2570 module.
- ② After completing the configuration, set the DIP switch on the ZT-2570 module to the **ZBRUN** position, and then reboot the module.

Parameter	ZT-20xx-IOG	ZT-2550	ZT-USBC
	<b>INIT</b>	ZT-2570	
Pan ID (ZigBee Group ID)	<b>0x3FFF</b>	Set to the same ID as the ZT-20xx-IOG	
Node ID (*)	<b>ZigBee Router</b>	<b>ZigBee Coordinator</b>	
	0x0020	0x0000	
RF Channel (*)	Set using the Rotary switch (0 - F)	Set to the same frequency as the ZT-20xx-IOG	
Application Mode (*)	Level Mode	<b>Transparent Mode</b>	N/A
Data Format	N/A	None, 8, 1	
Baud Rate	N/A	115200 bps	

Note that the Pan ID must be the same for all modules that exist in the same ZigBee network.

(\*): See item2 in step 2 below.

**Step2** Configure the ZT-20xx-IOG module via the ZT-2570 module

- ① Set the DIP switch on the ZT-20xx-IOG module to the **"INIT"** position (i.e., move DIP switch 1 to the ON position).
- ② Configure the ZT-20xx-IOG module, and then adjust the hardware switches based on the Node ID, RF Frequency and Application Mode settings indicated in the table above. See Section [3.1.3 Hardware Settings for the ZT-20xx-IOG Module](#) for details of how to adjust the ZT-20xx-IOG module.

- ③ Reboot the ZT-20xx-IOG module and wait until a connection is established.
- ④ See Section [3.1.4 Software Settings for the ZT-20xx-IOG Module](#) for details of how to configure the I/O mapping for the ZT-20xx-IOG module.

**Example:**

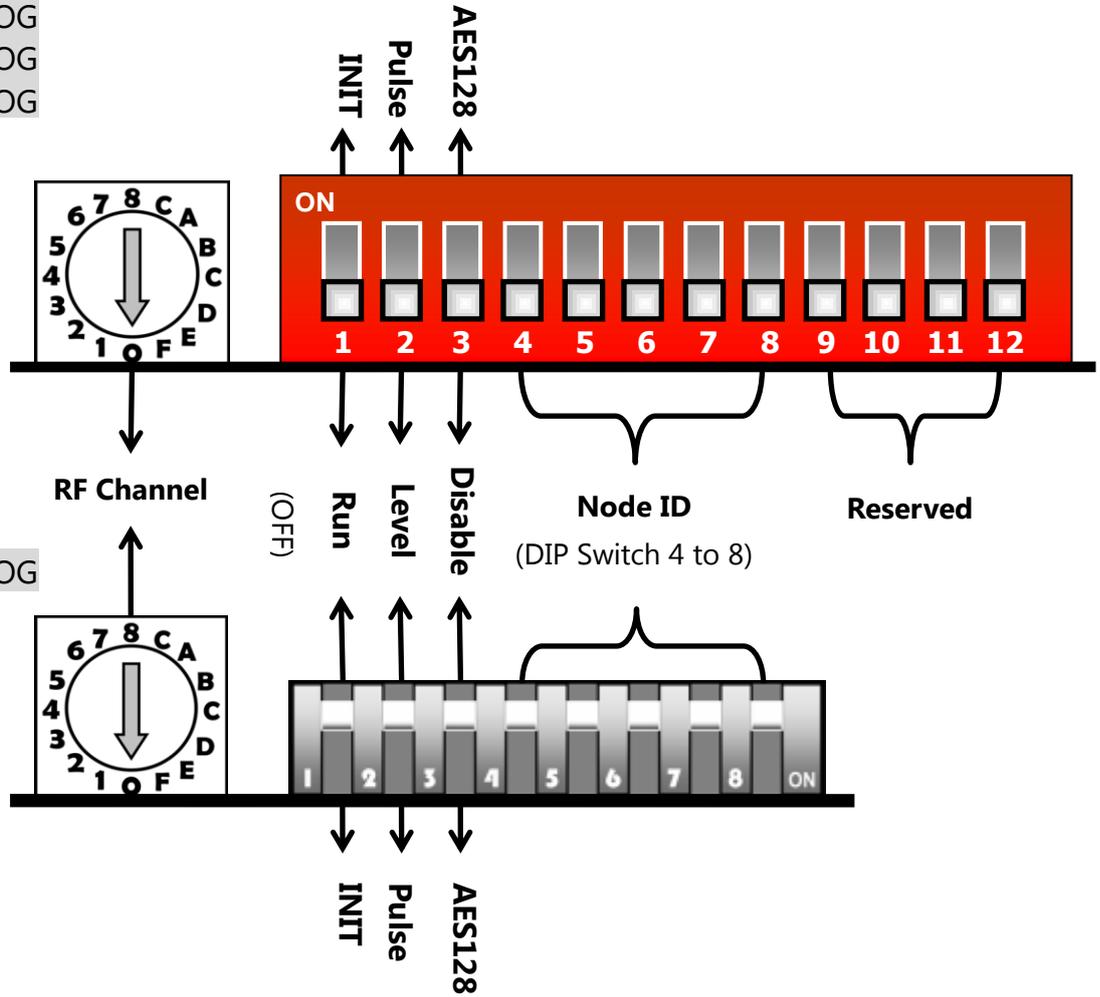
Set the ZT-20xx-IOG module to “**INIT**” mode (i.e., move DIP switch 1 to the ON position) to remotely connect to the ZT-2570 module. The relevant settings are provided in the table below.

ZT-20xx-IOG			ZT-2570	
Config. Mode	DIP1	<b>ON</b>	Pan ID	0x3FFF
Application Mode	DIP2	OFF	Application Mode	Transparent Mode
Encryption	DIP3	OFF	Encryption	Disabled
Node ID	DIP4	<b>OFF</b>	Node ID	0x0000 (ZigBee Coordinator)
	DIP5	<b>OFF</b>	RF Channel	0x00
	DIP6	<b>OFF</b>	Data Format	None, 8, 1
	DIP7	<b>OFF</b>	Baud Rate	115200 bps
	DIP8	<b>ON</b>		
RF Channel	Rotary	<b>0</b>		

### 3.1.3. Hardware Settings for the ZT-20xx-IOG Module

ZT-20xx-IOG modules contain two types of hardware switches depending the model. The definitions for the Rotary and DIP switches are illustrated in the diagrams below:

- ✓ ZT-2043-IOG
- ✓ ZT-2053-IOG
- ✓ ZT-2055-IOG



The following is an overview of the hardware settings for both the Rotary and the DIP switches.

### ① **DIP Switch 1: Module Initialization Mode**

The ZT-20xx-IOG module provides two initialization modes: **RUN** and **INIT**

- For normal operation, set DIP switch 1 to the **RUN** position.
- To configure the advanced settings, set DIP switch 1 to the **INIT** position, and then perform the configuration using the software utility.

Trigger Mode	Position	Description
<b>RUN</b>	<b>OFF</b>	<u>Communication mode:</u> Used to update the I/O Pair-connection data <ul style="list-style-type: none"> <li>- Pan ID: Based on the software settings (Default = 0x0000)</li> <li>- Node ID: Based on the DIP switch settings</li> <li>- RF Channel: Based on the rotary switch settings</li> </ul>
<b>INIT</b>	<b>ON</b>	<u>Initialization (INIT) mode:</u> Used to remotely configure the ZT-IOG using either a ZT-2550 or ZT-2570 module, or a ZT-USBC <ul style="list-style-type: none"> <li>- Pan ID = 0x3FFF</li> <li>- Node ID: fixed to 0x0020</li> <li>- RF Channel: Based on the Rotary switch settings</li> </ul>

## ② DIP Switch 2: Event trigger mode or method

- DIP Switch 2 is used to specify the trigger mode or update method to be used for the DIO channels. Select **Level Mode** when using the ZigBee DIO data concentrator. See Section [2.2 Basic Configuration](#) for more details.

Trigger Mode	Position	Description
<b>Level</b>	<b>OFF</b>	If the state of any <b>DI</b> channel is High, the state of all <b>DO</b> channels will be set to High. If the state of all <b>DI</b> channels is Low, the state of all <b>DO</b> channels will be set to Low.
<b>Pulse</b>	<b>ON</b>	If the state of any <b>DI</b> channel is triggered on a rising edge (rising edge-triggered), the state of all <b>DO</b> channels will be set to the reverse (1 to 0 or 0 to 1).

## ③ DIP Switch 3: Encryption

- DIP Switch 3 is used to specify whether AES 128-bit encryption is enabled or disabled for wireless communication. See Section [2.2 Basic Configuration](#) for more details.

Encryption	Position	Description
<b>Disabled</b>	<b>OFF</b>	Encryption will not be used
<b>Enabled</b>	<b>ON</b>	AES 128-bit encryption will be used for wireless communications

#### ④ DIP Switch 4-8, Node ID

- DIP Switches 4 to 8 are used to specify the Node ID for a ZigBee device, which must be unique within a ZigBee network. See Section [2.2 Basic Configuration](#) for more details.

	DIP Switch						DIP Switch				
Node ID	4	5	6	7	8	Node ID	4	5	6	7	8
0x0000	OFF	OFF	OFF	OFF	OFF	0x0010	ON	OFF	OFF	OFF	OFF
0x0001	OFF	OFF	OFF	OFF	ON	0x0011	ON	OFF	OFF	OFF	ON
0x0002	OFF	OFF	OFF	ON	OFF	0x0012	ON	OFF	OFF	ON	OFF
0x0003	OFF	OFF	OFF	ON	ON	0x0013	ON	OFF	OFF	ON	ON
0x0004	OFF	OFF	ON	OFF	OFF	0x0014	ON	OFF	ON	OFF	OFF
0x0005	OFF	OFF	ON	OFF	ON	0x0015	ON	OFF	ON	OFF	ON
0x0006	OFF	OFF	ON	ON	OFF	0x0016	ON	OFF	ON	ON	OFF
0x0007	OFF	OFF	ON	ON	ON	0x0017	ON	OFF	ON	ON	ON
0x0008	OFF	ON	OFF	OFF	OFF	0x0018	ON	ON	OFF	OFF	OFF
0x0009	OFF	ON	OFF	OFF	ON	0x0019	ON	ON	OFF	OFF	ON
0x000A	OFF	ON	OFF	ON	OFF	0x001A	ON	ON	OFF	ON	OFF
0x000B	OFF	ON	OFF	ON	ON	0x001B	ON	ON	OFF	ON	ON
0x000C	OFF	ON	ON	OFF	OFF	0x001C	ON	ON	ON	OFF	OFF
0x000D	OFF	ON	ON	OFF	ON	0x001D	ON	ON	ON	OFF	ON
0x000E	OFF	ON	ON	ON	OFF	0x001E	ON	ON	ON	ON	OFF
0x000F	OFF	ON	ON	ON	ON	0x001F	ON	ON	ON	ON	ON

#### ⑤ Rotary Switch: RF Channel

- The Rotary switch is used to specify the radio frequency (RF) channel to be used by the module.

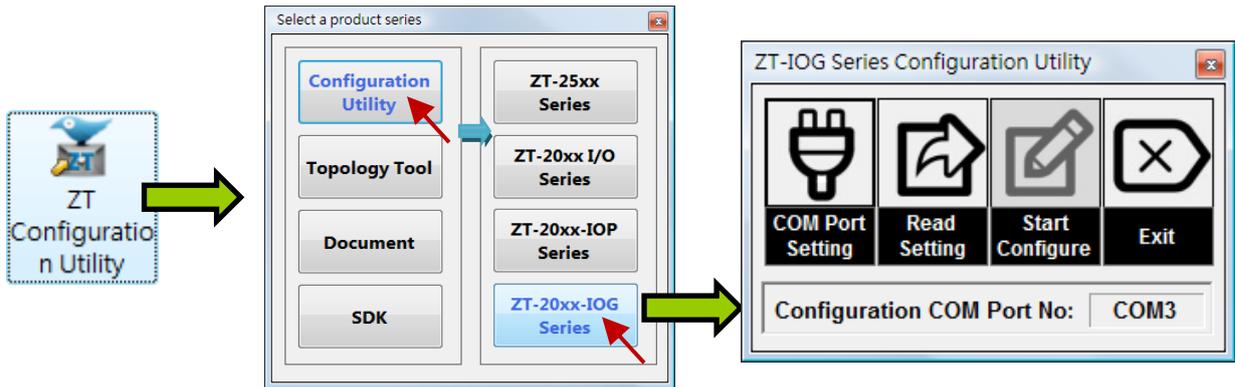
	Position	Description
<b>Rotary Switch</b>	0 to F	The radio frequency which can range from 2405 MHz to 2480 MHz in 5 MHz intervals. See Section <a href="#">2.2 Basic Configuration</a> for more details.

### 3.1.4. Software Settings for the ZT-20xx-IOG Module

The ZT-20xx-IOG Configuration Utility is a Windows-based tool that can be used to remotely configure a ZT-20xx-IOG module via software. The utility can be downloaded from:

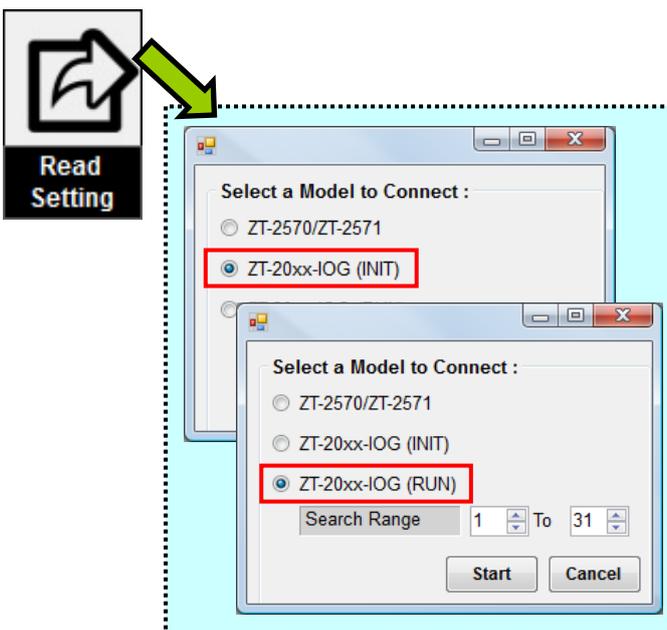
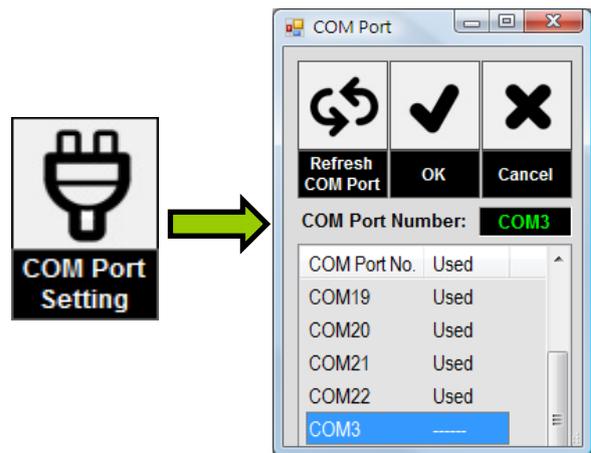
[http://ftp.icpdas.com.tw/pub/cd/usbcd/napdos/zigbee/zt\\_series/utility/](http://ftp.icpdas.com.tw/pub/cd/usbcd/napdos/zigbee/zt_series/utility/)

① Execute the ZT-20xx-IOG Configuration Utility.



② Use the ZT-IOG Configuration Utility to connect to the ZT-20xx-IOG module.

- Click the **COM Port Settings** button and then select the COM port that is being used by the ZT-2570 module.



- Click the **Read Settings** button to read the current settings that are configured for the ZT-20xx-IOG module, and then choose RUN or INIT mode depending on the configuration of the DIP switches. (See [Section 3.1.3 Hardware Settings](#) for more details)

- ③ After the current settings have been read from the ZT-20xx-IOG module, simply adjust the parameters by entering the new value in the "New" field for the relevant parameter. There are a number of parameters that can be set, each of which are described below.

General Configurations		Current	New	
Pan ID		00 00	00	00
Node ID		----	----	----
RF Channel		----	----	▼
RF Power		0A	0A	▼
Encryption		----	----	▼
Interface		----	----	▼
Trigger Mode		----	----	▼ ZC
Refresh Interval		1	1	▼ ZC
Check-Router-Alive		Enabled	More Info.	ZC
Safe Value		Enabled	More Info.	ZR
Channel Offset (DI)		----	0	▲▼
Channel Offset (DO)		----	0	▲▼
Modbus Slave ID		----	1	▲▼

- [RF Power:](#)

This parameter is used to configure the strength of the radio frequency signal. See Section [2.2 Basic Configuration](#) for more details.

- [Refresh Interval:](#)

This parameter is used to modify the time interval between I/O channel updates (in seconds). See Section [2.2 Basic Configuration](#) for more details.

- [Safe Value:](#)

This parameter is used to set the Safe values for the Digital Output channels. Note that the **Check-Router-Alive** function must be enabled before this parameter can be edited.

- [Channel Offset \(DI/DO\):](#)

This parameter is used to configure the I/O mapping between the DIO channels and the Modbus Register.

- ④ After configuring the parameters, click the **Write Setting** button and wait until the new configuration data is written to the module. This may take several seconds.



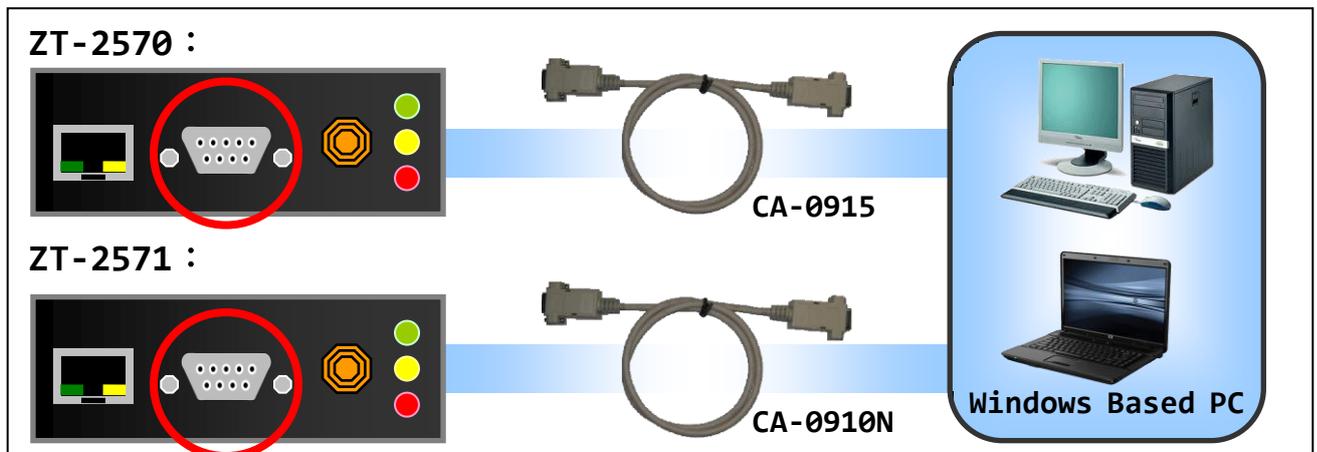
## 3.2 Configuring the ZT-257x Module

### Configuration Procedure

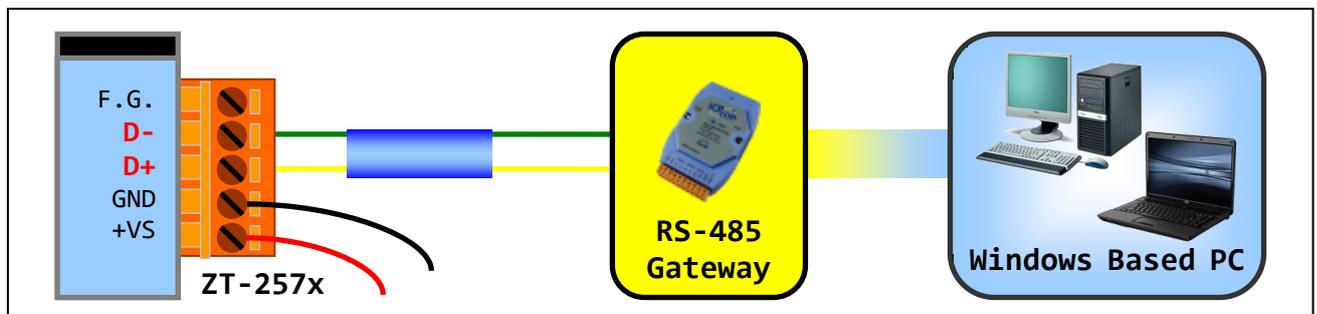
When using the ZT-257x module as a data concentrator, complete the configuration by following the procedure described below.

- ① Before beginning the configurations, connect an RS-232 or RS-485 cable between the module and the Host PC, as illustrated below.

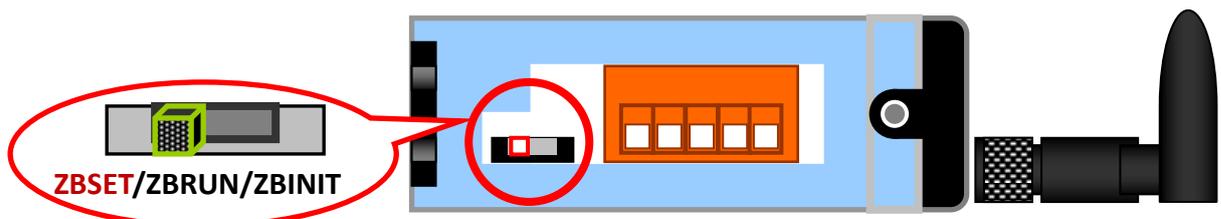
➤ RS-232:



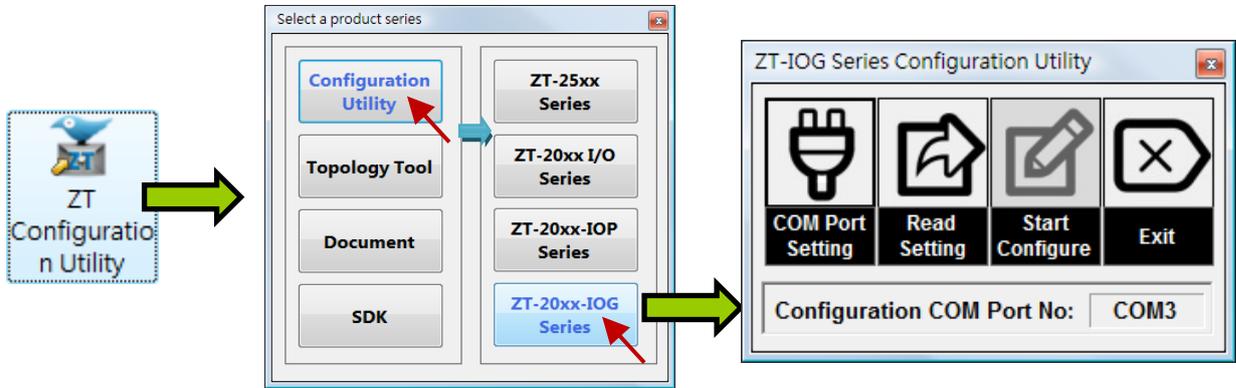
➤ RS-485:



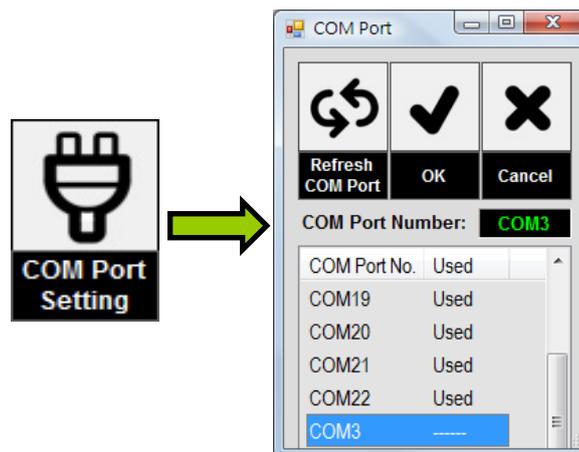
- ② Ensure that the DIP switch indicated in the figure below is in the **ZBSET** position.



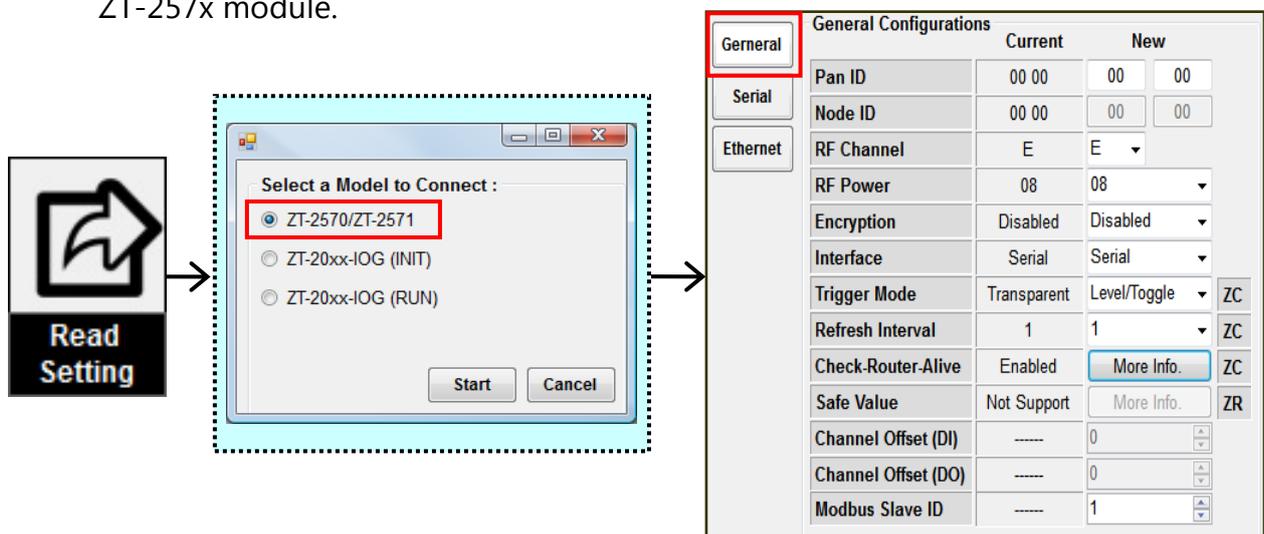
- ③ Power on the module. If the LED light is blinking red, it means that the device is active and is now in **Configuration** mode.
- ④ Execute the ZT-20xx-IOG Configuration Utility. See Section 3.1.4 Software Settings for more details relating to the ZT-20xx-IOG Configuration Utility.



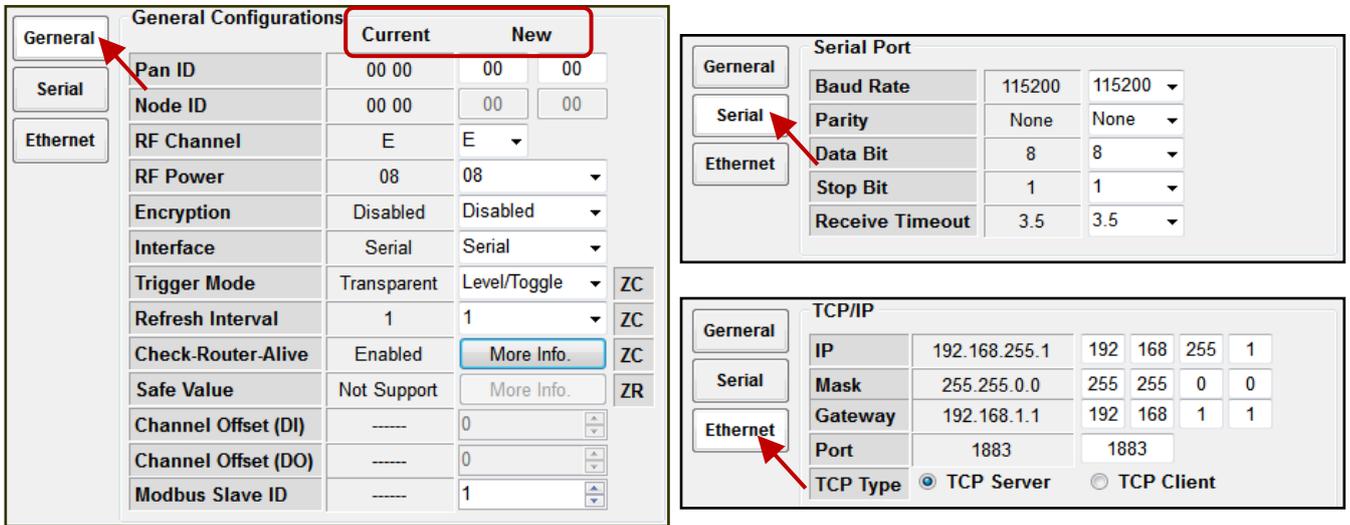
- Click the **COM Port Settings** button and then select the COM port that is being used by the ZT-2570 module.



- Click the **Read Settings** button to read the current settings that are configured for the ZT-257x module.



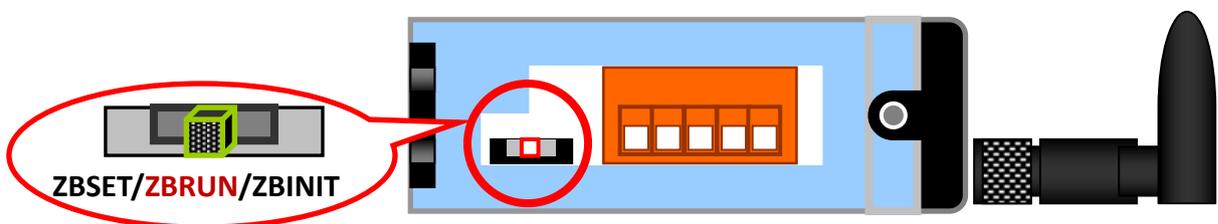
- ⑤ After the current settings have been read, all parameters related to the ZigBee, Serial, and Ethernet communications and the IOG modules can be configured by entering the new value in the "New" field for the relevant parameter.



- ⑥ After configuring the parameters, click the **Write Setting** button and wait until the new configuration data is written to the module. This may take a few seconds.



- ⑦ Once the configuration has been completed, return the DIP switch to the **ZBRUN** position to enable **Communication Mode**.



- ⑧ Power on the module. If the LED indicator is continuously red, it means that the device is active and is now in **Communication Mode**.

# 4 Technical Support

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If you encounter any difficulties while operating your device, send an email to [service@icpdas.com](mailto:service@icpdas.com) containing a description of the problem and include the following information:

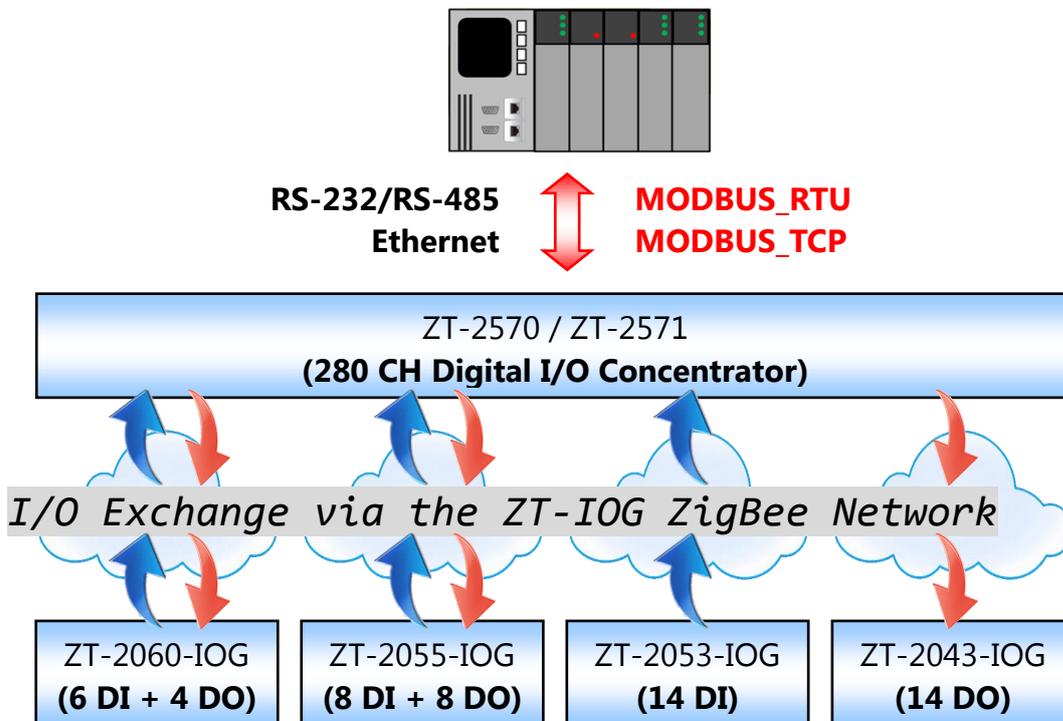
- ① The status and position of the DIP switches and the Rotary switch, details of the current configuration for the device, and the status of the LEDs on the ZT-257x module.
- ② The status and position of the DIP switches and the Rotary switch, details of the current configuration for the device, and the status of the LEDs on the ZT-20xx-IOG module.

We guarantee to respond within two working days.

# 5 Appendix

## 5.1 Advanced functions: DIO Channel Offset

The ZT-257x series module contains a built-in ZigBee DIO data concentrator function. This function can be used to automatically connect to a number of remote DIO channels via a ZigBee wireless network. Once connected, the status of a remote DIO channel can be retrieved, and the data temporarily saved to the corresponding Modbus register. After the data has been stored, it means that the remote PAC is able to read the data once and then, using the Modbus protocol, write the data to multiple DIO channels on any remote ZigBee modules connected to the ZT-257x module via the Ethernet, RS-232, or RS-485 interface.

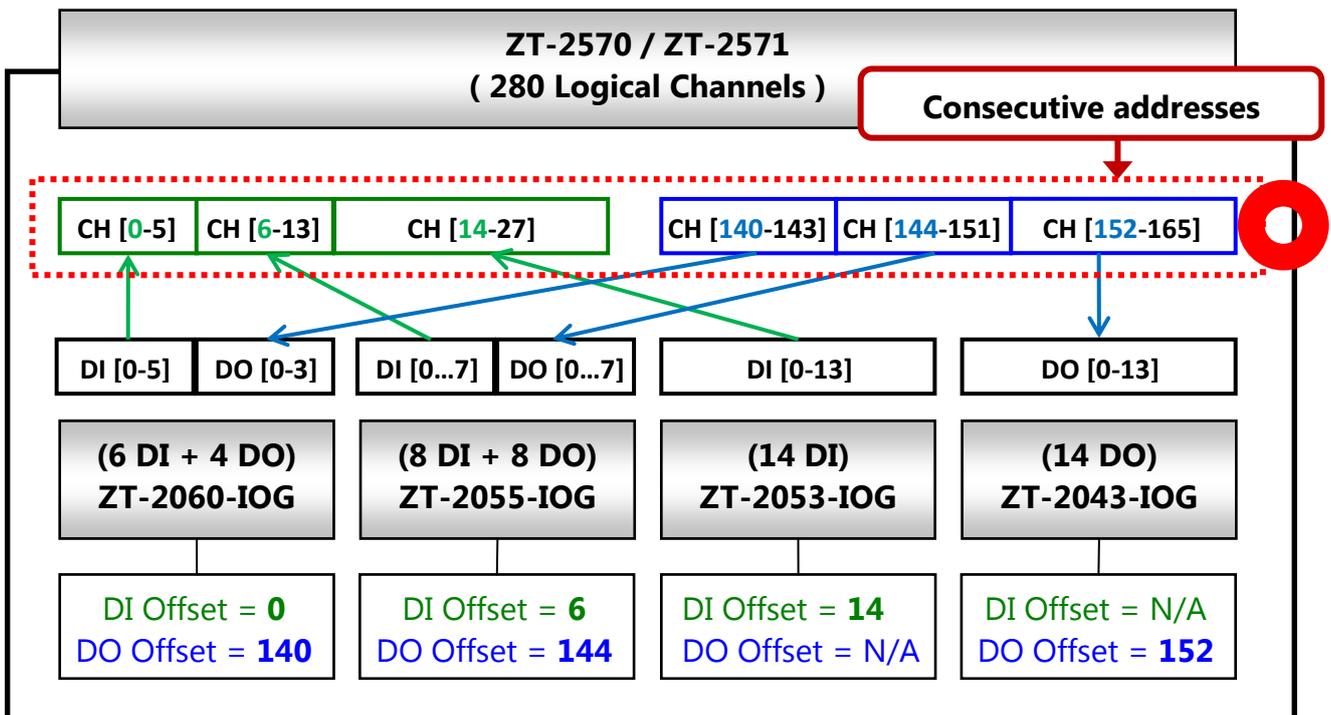


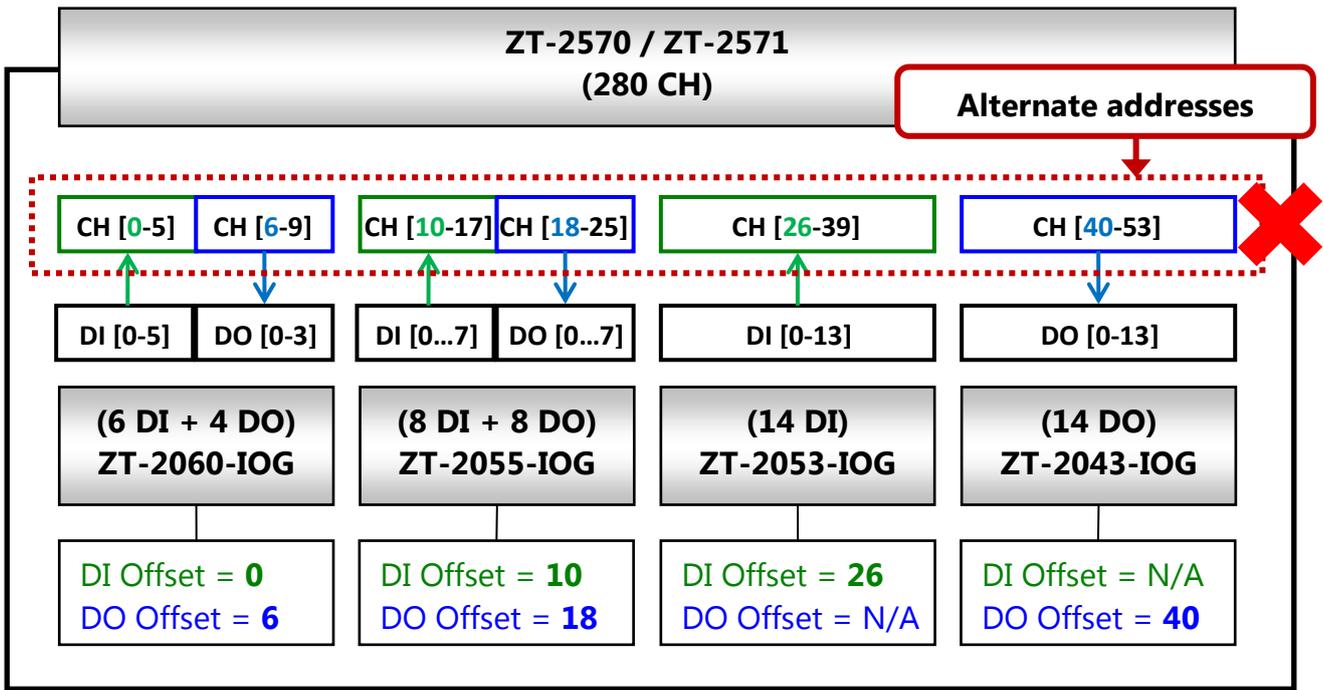
A maximum of 280 digital channels are available when the ZT-257x module is acting as a DIO data concentrator. These channels can be used to temporarily store the status of the DIO channels on a ZT-20xx-IOG module via the network. However, before this function can be used, a Channel Offset (DI/DO) must be configured for each ZT-20xx-IOG module, i.e., the mapping between the Digital I/O channels on the ZT-20xx-IOG module and the Modbus Register on the ZT-257x module must be set so that the status of the DIO channels on the ZT-20xx-IOG modules can be remotely read or written using the mapping address.

## Setting the Channel Offset (DI/DO)

When using the ZT-257x module as a DIO data concentrator, the mapping for the I/O channels must first be configured. To configure the mapping, follow the procedure described below:

- ① **Channel Limits:** A maximum of **280** virtual/logical digital channels can be accessed on a single ZigBee network.
- ② **Channel Mapping:** Each virtual/logical digital channel only can be mapped to either a single DI or DO channel on the ZT-2000-IOG module.
  - ※ If both the DI and the DO channels are assigned to a single logical channel field, i.e., the Modbus Register, they will be treated in the same way as if the I/O Pair-connection function was being used.
- ③ If a DI channel is not physically wired, the channel will be regarded as being unused and so the status of the channel will not be updated.
- ④ It is recommended that the addresses for the DI or DO channels be configured as consecutive addresses so that the external host only needs to read or write data once, as illustrated in the figure below.





The **Channel Offset** value can be set by using the ZT-20xx-IOG Configuration Utility. The following example is based on the ZT-20xx-IOG module.

**Select Model Name**

ZT-257x-IOG    ZT-20xx-IOG

Cancel

---

**General Configurations**

	Current	New		
Pan ID	00 00	00	00	
Node ID	----	----	----	
RF Channel	----	----	▼	
RF Power	08	08	▼	
Encryption	----	----	▼	
Interface	----	----	▼	
Trigger Mode	----	----	▼	ZC
Refresh Interval	1	1	▼	ZC
Check-Router-Alive	Enabled	More Info.		ZC
Safe Value	Disabled	More Info.		ZR
Channel Offset (DI)	----	0	▲▼	
Channel Offset (DO)	----	0	▲▼	

Using the **ZT-2055-IOG** module (8 DI and 8 DO channels) as an example,

(a) If the **Channel Offset (DI)** value is set to **"0"**:

The status of DI Channels 0-7 on the ZT-2055-IOG module will be recorded on Channels 0-7 on the ZT-257x module.

(b) If the **Channel Offset (DI)** value is set to **"128"**:

The status of DI Channels 0-7 on the ZT-2055-IOG module will be recorded on Channels 128-135 on the ZT-257x module.

(c) If the **Channel Offset (DO)** value is set to **"0"**:

The data from DO Channels 0-7 on the ZT-2570 module will be transmitted to DO Channels 0-7 on the ZT-2055-IOG module.

(d) If the **Channel Offset (DO)** value is set to **"48"**:

The data from DO Channels 48-55 on the ZT-2570 module will be transmitted to DO Channels 0-7 on the ZT-2055-IOG module.

## To Read/Write the status of the DIO Channels

The states of the DIO channels on the ZT-20xx-IOG module are temporarily saved in the mapped field (Modbus Register) on the ZT-257x module. This means that the host only needs to perform a single action in order to remotely read and write data from multiple DIO channels on the ZT-20xx-IOG module via the ZT-257x module using the Modbus RTU (RS-232/RS-485) or Modbus TCP (Ethernet) protocol. See Section [5.3 Modbus Register](#) for more details.

## 5.2 Advanced functions: Status Detection Schemes in Wireless Environments

The main principle for monitoring the I/O channels on the ZT-IOG system is to use the ZigBee Coordinator module as a logical I/O coordinator that is responsible for synchronizing the status of the DIO channels. This allows an I/O pair-connection function to be implemented without the need to use additional PC/PAC devices. However, if any of the wireless devices suffers a malfunction, or is disconnected, the Host will be unable to transmit a warning message or take any appropriate action to resolve the issue.

To overcome this, two mechanisms are available on ZT-IOG series modules that can be implemented to provide notifications when wireless communication is interrupted.

- ① The Check-Router-Alive function
- ② The Safe Value function

### 5.2.1. The Check-Router-Alive function

The **Check-Router-Alive** function provided on the ZigBee Coordinator allows the status of the connection between the ZigBee Router and the ZigBee Coordinator to be automatically detected at a rate of one module per second. Details of the connection status will then be sent to an external Host PC or PAC via either the Modbus RTU or TCP protocol.

#### - **For a ZT-20xx-IOG module (being used as a ZigBee Coordinator)**

The ZT-20xx-IOG module provides a DO channel that can be used as a Disconnection Alarm Channel. If the connection to any ZigBee Router on the network is interrupted, the **Disconnection Alarm Channel** (DO channel) will immediately be active. In addition, an alarm device (e.g., a buzzer or a warning light, etc.) can be connected to this DO channel on the ZT-20xx-IOG module so that an alert will be triggered if the module is disconnected, thereby allowing the on-site staff to be notified in order to prevent unexpected hazards while the wireless communications are interrupted.

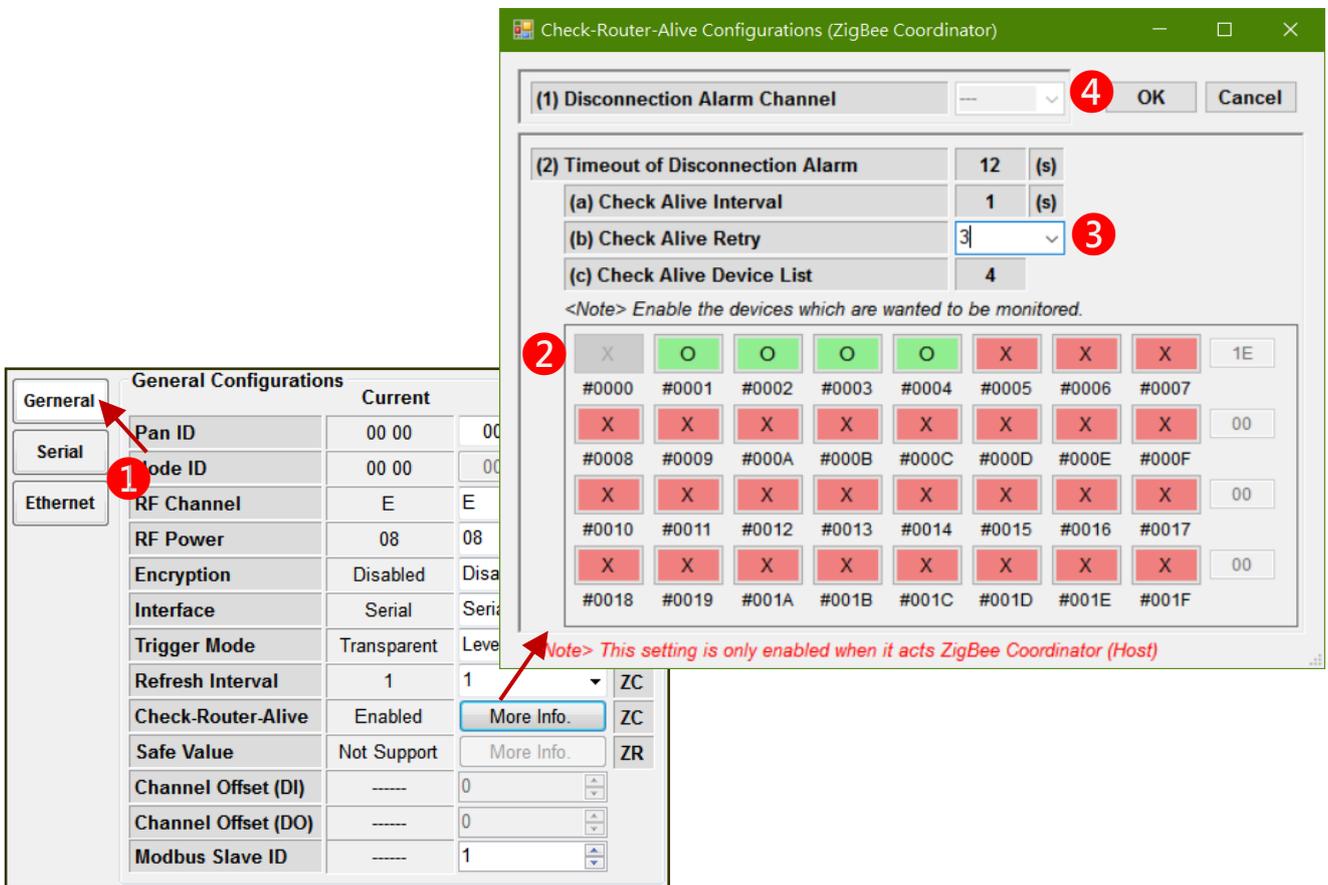
- **For a ZT-2570 module (ZigBee Coordinator)**

Details of the connection status of a remote module can be saved in a Modbus Register on the ZT-2570 module, and a Modbus Register is also provided to allow an external Host to read data from the module via the Modbus RTU or the Modbus TCP protocol. See Section [5.3.1 Read Coils](#) for more details.

- **Configuring the Check-Router-Alive Function**

Before monitoring of the connection status of a remote module can begin, the **Check-Router-Alive** function must be configured for the specific module. To configure the module, follow the instructions below.

- ① Execute the ZT-20xx-IOG Configuration Utility. See Section [3.2 Configuring the ZT-257x Module](#) and [3.1.4 Software Settings for the ZT-20xx-IOG Module](#) for details of how to configure the ZT-2570 and ZT-IOG modules.



- ② Specify the ZT-IOG modules that are to be monitored. For more details, refer to the description for the “**Check Alive Device List**” parameter in the table below.
- ③ Specify the number of times the connection should be checked during the detection process. For more details, refer to the description for the “**Check Alive Retry**” parameter in the table below.
- ④ Specify the Disconnection Alarm Channel. (Note that this is only applicable to ZT-20xx-IOG modules). For more details, refer to the description for the “**Disconnection Alarm Channel**” parameter in the table below.

<b>Disconnection Alarm Timeout</b>		
<u>Description:</u> This parameter is used to set the timeout value for the connection, in seconds. A module will be regarded as being disconnected if the timeout value expires, and then the Disconnection Alarm Channel will be triggered and the status will be set to “High”.		
Note: <b>Disconnection Alarm Timeout =</b> Check Alive Interval (1 sec.) x Check Alive Retry x Check Alive Device List  For more details, refer to the description for the parameters in the table below.		
<b>Parameters</b>		
<b>(1) Disconnection Alarm Channel</b>	ZT-2570	ZT-20xx-IOG
	<b>x</b>	<b>✓</b>
<u>Description:</u> If the connection to a module is interrupted, a High signal will be sent from the specified Digital Output channel to the alarm device connected to the module, if installed, notifying the staff to investigate the cause.		
<b>(2) Check Alive Retry</b>	ZT-2570	ZT-20xx-IOG
	<b>✓</b>	<b>✓</b>
<u>Description:</u> If there is no response from the module within the duration specified by the Disconnection Alarm Timeout parameter, and the number of retry times is greater than the value specified for the Check Alive Retry, parameter, the module will be regarded as being disconnected.		

<b>(3) Check Alive Device List</b>	ZT-2570	ZT-20xx-IOG
	✓	✓
<p><u>Description:</u></p> <p>The Check Alive Device List allows the status of the connection to all ZT-IOG modules in the ZigBee network to be monitored. To enable the status detection function for the specified address on the ZigBee Coordinator, set the Node ID for the module to “ON” .</p>		

### 5.2.2. The Safe Value function

The Safe Value function is an emergency measure that specifies the action to be taken if wireless communication is interrupted. The ZigBee Router will regularly be communicated with the ZigBee Coordinator, so that if wireless communication is interrupted for a duration that exceeds the value specified for the Watchdog Timer (WDT), the status of the DO channel(s) on the ZigBee Router will immediately be changed to the Safe Value.

- **For a ZT-20xx-IOG module (being used as a ZigBee Router)**

If the wireless communication is interrupted, the state of the channel will be automatically changed to the Safe Value. Once wireless communication resumes, the state of the DO channel will automatically return to the normal output value.

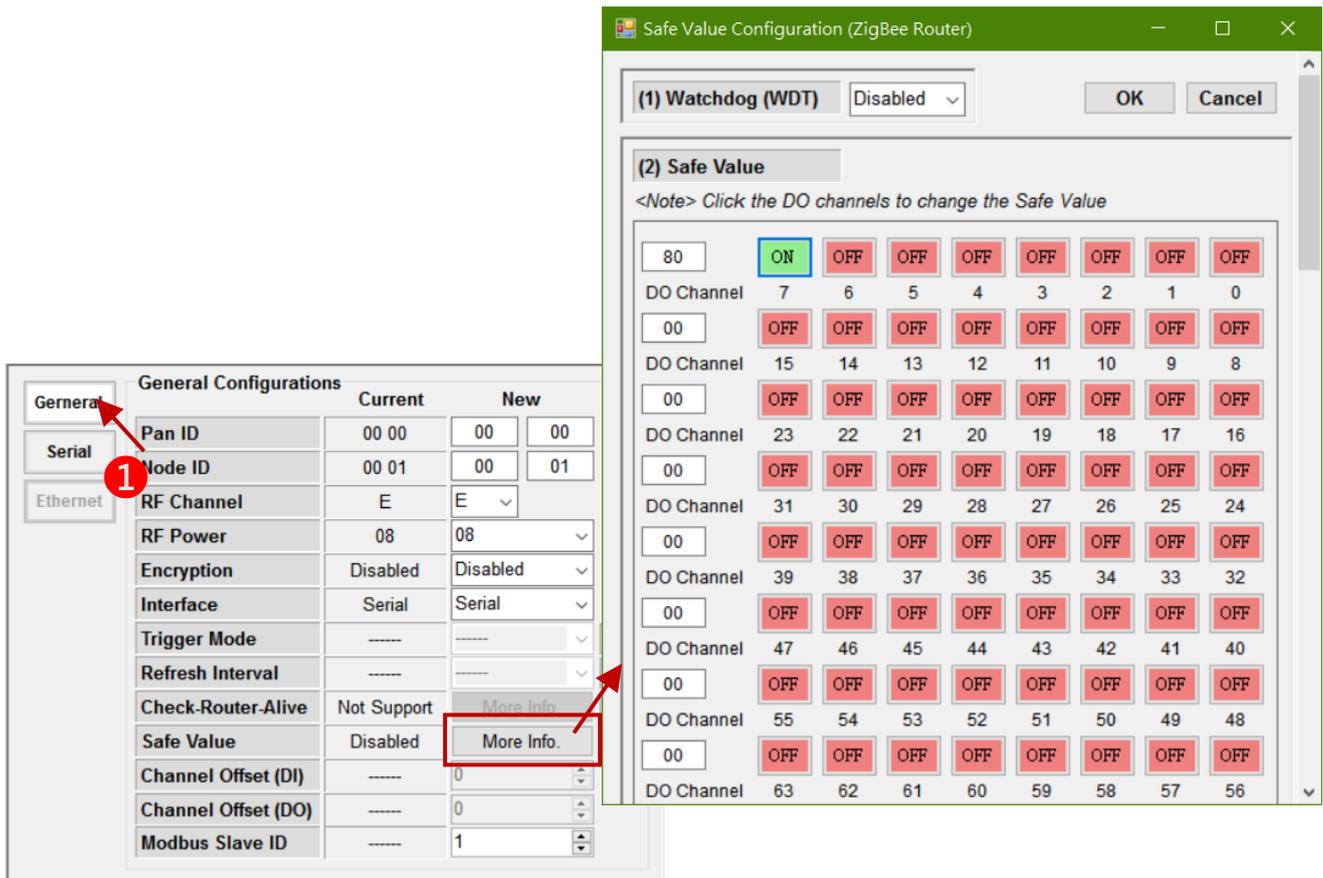
- **For a ZT-2571 module (ZigBee Router)**

If the wireless communication is interrupted, the state of the virtual/logical channel (Modbus Register) will be automatically changed to the Safe Value. Once wireless communication resumes, the state of the DO channel will automatically return to the normal output value.

## - Configuring the Safe Value

To configure the Safe Value for the ZT-IOG module, follow the instructions below.

- ① Execute the ZT-20xx-IOG Configuration Utility. See Section [3.2 Configuring the ZT-257x Module](#) and [3.1.4 Software Settings for the ZT-20xx-IOG Module](#) for details of how to configure the ZT-2570 and ZT-IOG modules.



- ② Assign the connection timeout value. Refer to the description for the “WDT (Watchdog Timer)” parameter in the table below.
- ③ Assign the Safe Value for the DO channel, Refer to the description for the “Safe Value” parameter in the table below.

<b>Parameters</b>		
<b>(1) WDT (Watchdog Timer)</b>	ZT-2570	ZT-20xx-IOG
	✓	✓
<u>Description:</u> This parameter is used to specify the timeout value and the valid range, which can be from 3 to 25 seconds.		
<b>(2) Safe Value (for DO channels)</b>	ZT-2570	ZT-20xx-IOG
	✓	✓
<u>Description:</u> If the module is disconnected and the timeout value specified for the WDT is exceeded, the status of all DO channels will be automatically changed to the assigned Safe Value.		

## 5.3 Modbus Register

### 5.3.1. 01 (0x01) Read Coils

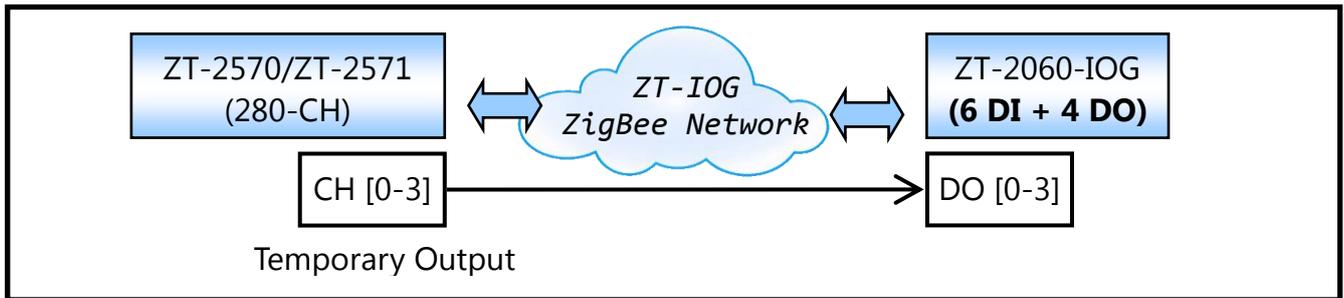
This function code is used to read the temporary Digital Output values from a range of virtual/logical channels on the ZT-257x module.

Request				
Byte	Description	Length	Value	
00	Address	1	0x01 to 0xF7 (1 to 247)	
01	Function Code	1	0x01	
02-03	Starting Channel Number or Address Mapping	2	DO (Temporary Output)	0x0000 to 0x0117
			DI (Temporary Input)	0x0200 to 0x0317
			Safe Value	0x0400 to 0x0517
			Check Router Alive Channel <See Note 1>	0x0601 to 0x061F
04-05	Output Channel Number or Bit Count	2	0x0001 to 0x0118 (Bit Count)	

Response				
Byte	Description	Length	Value	
00	Address	1	0x01 to 0xF7 (1 to 247)	
01	Function Code	1	0x01	
02	Byte Count	1	The 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 (1 to 247)	
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]
Response	05 01 01 06 [D0 BA]
Reads the temporary output value from channels DO0 to DO3 on ZT-2570 module (#05), and returns a response indicating that the command was valid.	



Example	
Command	01 01 06 01 00 04 [ 6C 81 ]
Response	01 01 01 05 [ 91 8B ]
Reads the status of the Check-Router-Alive function from the ZT-2570 (#01) module for devices #01 to #04, and returns a response indicating that the command was valid, with a value of 0x05, meaning that communication with devices #01 and #03 that are connected to the remote ZT-IOG module has been interrupted.	

## <Note 1>

Refer to the table below for details of how to read the status of the connection to the Check-Router-Alive channel from the ZigBee Coordinator using the Modbus Register address.

Check-Router-Alive		
Modbus Register	ZigBee Node ID	Description
0x0600	#0000 (Data Concentrator)	The ZigBee Coordinator is always alive
0x0601	#0001 (ZT-2571/ZT-20xx-IOG)	
0x0602	#0002 (ZT-2571/ZT-20xx-IOG)	
.....	.....	.....
0x061F	#001F (ZT-2571/ZT-20xx-IOG)	

### 5.3.2. 02 (0x02) Read Discrete Inputs

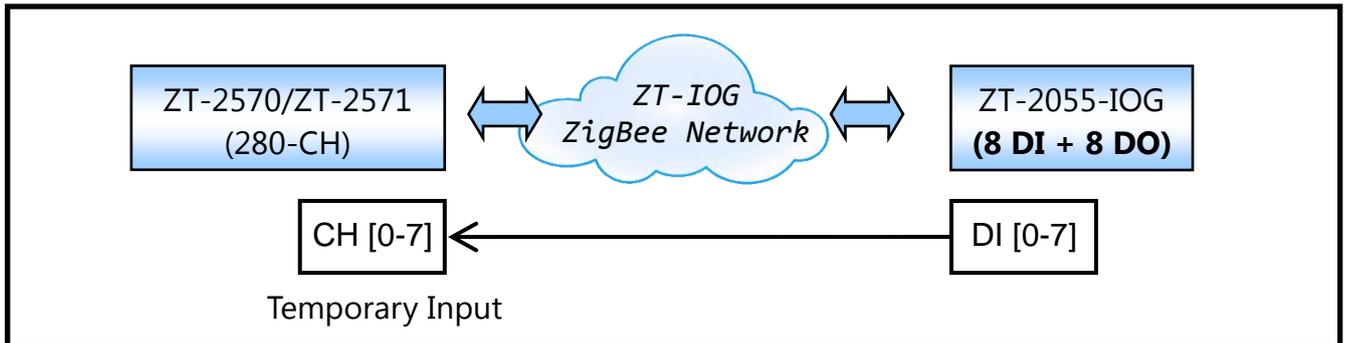
This function code is used to read the current status of the Digital Input channels on the ZT-257x module.

Request				
Byte	Description	Length	Value	
00	Address	1	0x01 to 0xF7 (1 to 247)	
01	Function Code	1	0x02	
02-03	Starting Channel Number or Address Mapping	2	DI (Temporary Input)	0x0000 to 0x0117
04-05	Output Channel Number or Bit Count	2	0x0001 to 0x0118 (Bit Count)	

Response				
Byte	Description	Length	Value	
00	Address	1	0x01 to 0xF7 (1 to 247)	
01	Function Code	1	0x02	
02	Byte Count	1	The 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 (1 to 247)	
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 ]
Response	01 02 01 FF [ E1 C8 ]
<p>Reads the temporary input value from ZT-2570 module (#01), and returns a response indicating that the command was valid, with a value of 0xFF, meaning that channels DI0 to DI7 on the remote ZT-IOG module are enabled.</p>	



### 5.3.3. 05 (0x05) Write Single Coil

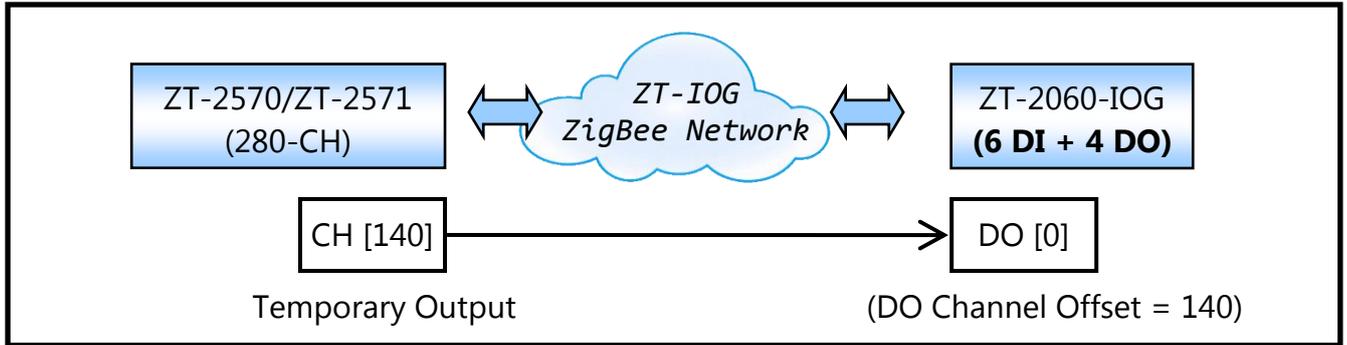
This function code is used to set the temporary Digital Output value for a specific channel on the ZT-257x module.

Request			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7 (1 to 247)
01	Function Code	1	0x01
02-03	Starting Channel Number	2	DO (Temporary Output)    0x0000 to 0x0117
			Safe Value                    0x0400 to 0x0517
04-05	Output Value	2	A value of 0xFF00 sets the Digital Output value to ON A value of 0x0000 sets the Digital Output value to OFF

Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7 (1 to 247)
01	Function Code	1	0x05
02-03	Address	2	This value is the same as bytes 02 and 03 of the Request
04-05	Output Channel Number	2	This value is the same as bytes 04 and 05 of the Request

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7 (1 to 247)
01	Function Code	1	0x85
02	Exception Code	1	Refer to the Modbus standard for more details

<b>Example</b>	
Command	01 05 00 8C FF 00 [ 4D D1 ]
Response	01 05 00 8C FF 00 [ 4D D1 ]
Sets the temporary Digital Output value for Channel DO140 on ZT-2570 module (#01) to ON, and returns a response indicating that the command was valid.	



### 5.3.4. 15 (0x0F) Write Multiple Coils

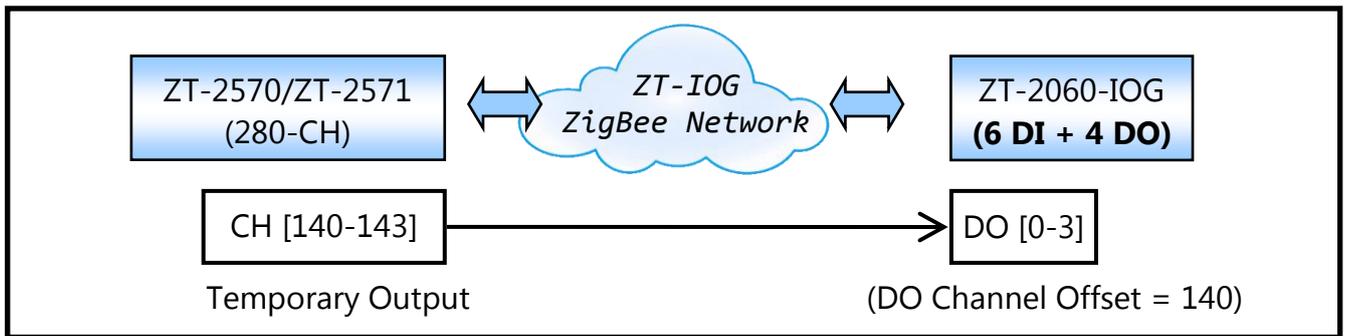
This function code is used to set the temporary Digital Output value for a range of channels on the ZT-257x module.

Request			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7 (1 to 247)
01	Function Code	1	0x0F
02-03	Starting Channel Number	2	DO (Local Output)
			Safe Value
04-05	Output Channel Number	2	0x0001 to 0x0118 (Bit Count)
06	Byte Count	1	$B = (\text{Bit Count} + 7) / 8$
07	Output Value	B	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 (1 to 247)
01	Function Code	1	0x0F
02-03	Starting Channel Number	2	This value is the same as bytes 02 and 03 of the Request
04-05	Output Channel Number	2	0x0001 to 0x0118 (Bit Count)

Error Response			
Byte	Description	Length	Value
00	Address	1	0x01 to 0xF7 (1 to 247)
01	Function Code	1	0x8F
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	01 0F 00 8C 00 04 01 0F [ 6F 4D ]
Response	01 0F 00 8C 00 04 [ 95 E3 ]
Sets the temporary Digital Output value for Channels DO140 to DO143 on the ZT-2570 module to ON, and returns a response indicating that the command was valid.	



## 5.4 LED Status Indicator Definitions

The following is a summary of the functionality provided by the different LED status indicators together with a description of the meaning of each.

LED Indicator	Status	Description
ZigBee Net (Green LED)	<b>ZigBee Coordinator (Host)</b>	
	Lit	A ZigBee network has been established
	Blinking to Lit	The same ZigBee network exist or to rejoin
	<b>ZigBee Router (Slave)</b>	
	Lit	The signal strength is High
	Blinking (500 ms)	The signal strength is Medium
	Blinking (1 second)	The signal strength is Low
	Blinking (2 seconds)	The signal strength is Low or no signal is unavailable
ZigBee RxD (Yellow LED)	<b>ZigBee Communication Status</b>	
	Blinking	The module is receiving ZigBee Data
	OFF	The module is waiting to receive ZigBee Data
ZigBee PWR (Red LED)	<b>ZigBee Module Status</b>	
	Lit	The power is ON and the module is in Communication mode
	Blinking (200 ms)	The power is ON, but the module has failed to initialize
	Blinking (200 ms)	The module is in Configuration Mode
	Blinking (1 s)	The Host watchdog is enabled
	OFF	The power is OFF