ZB-2510/2510P Application Note

Warranty

All products manufactured by ICP DAS are warranted against defective materials for a period of one year from the date of delivery to the original purchaser.

Warning

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This is an introduction to the usage of user-defined routes and applications for wireless ZigBee repeaters.

1. Forward

The ZigBee protocol is based on the IEEE 802.15.4 standard, which is a type of WPAN (Wireless Personal Area Network) technology that also includes IR, Ultra Wideband, Bluetooth and Home RF. The IEEE 802.15.4 standard also defines the maximum data transmission rate, up to 250 kb/s; which is fast enough for converting from commonly-used interfaces such as RS-232/RS-485 in the industrial field. Functions such as automatic Network organization, auto-detection of Network interruptions, wireless repeater and mesh Network capabilities, also makes the ZigBee protocol stronger and more reliable. The method used to implement the ICP DAS ZigBee repeater function is introduced here.

2. ZigBee repeater

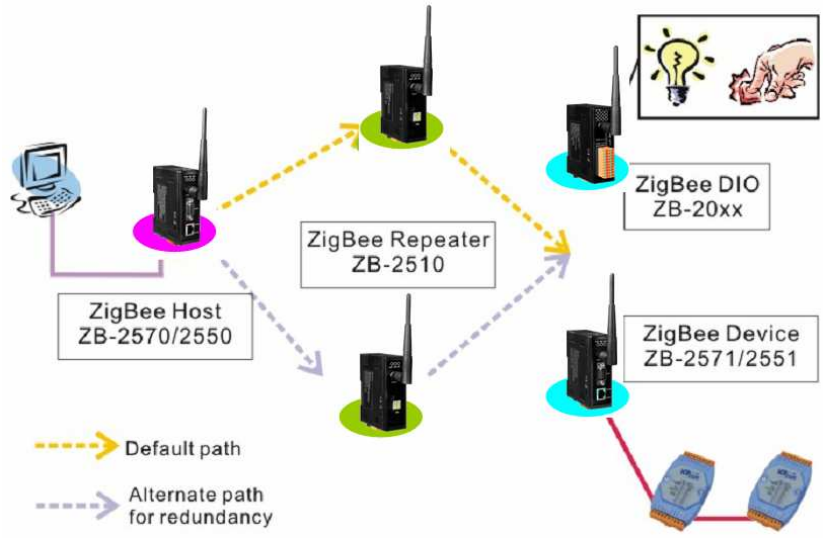
2-1. Description of the operating modes

The ZB-2510 and ZB-2510P are two ZigBee-based repeater modules included in the ICP DAS product line. The main difference between these two products is the transmission range. The ZB-2510 supports an extended transmission range of up to 100 meters whereas the ZB-2510P can transmit to a maximum of 700 meters. Both modules are able to operate in broadcast and user-defined route modes. When the repeater is set to broadcast mode, the transmission route is constructed by the ZigBee Host. The repeater will forward any data that it receives using broadcast mode. The advantage of this mode is that the repeater can be deployed in a "haphazard" manner without any concern about positioning. However, the main flaw of this mode is that if there are too many broadcast data packets in a ZigBee network, it will cause the network to crash. In contrast, when the repeater is set to user-defined route mode, it will only forward data using the user-configured route. The benefit of this mode is that the data loading of the ZigBee network will be reduced, but the user must plan the data transmission route for the entire ZigBee network before setting up the application. If a mistake is made on even one repeater point, the entire ZigBee network will be invalid.

2-2. ZigBee Repeater usage

- *Broadcast Mode:*

  A diagram showing the typical usage for a ZigBee repeater that is forwarding data using broadcast mode is shown below:



In the initial stages of constructing a ZigBee network, the ZigBee Host will determine which repeater will be the forward spot of the default data transmission route. The designated repeater will forward the host data to the ZigBee Device and ZigBee DIO modules.

- *User-defined Route Mode:*

Any repeater operating in this mode needs to be configured using a unique repeater ID number and with a second repeater ID number (*1, *2) that defines where this repeater should forward data to when it receives the ZigBee Device data (*3).

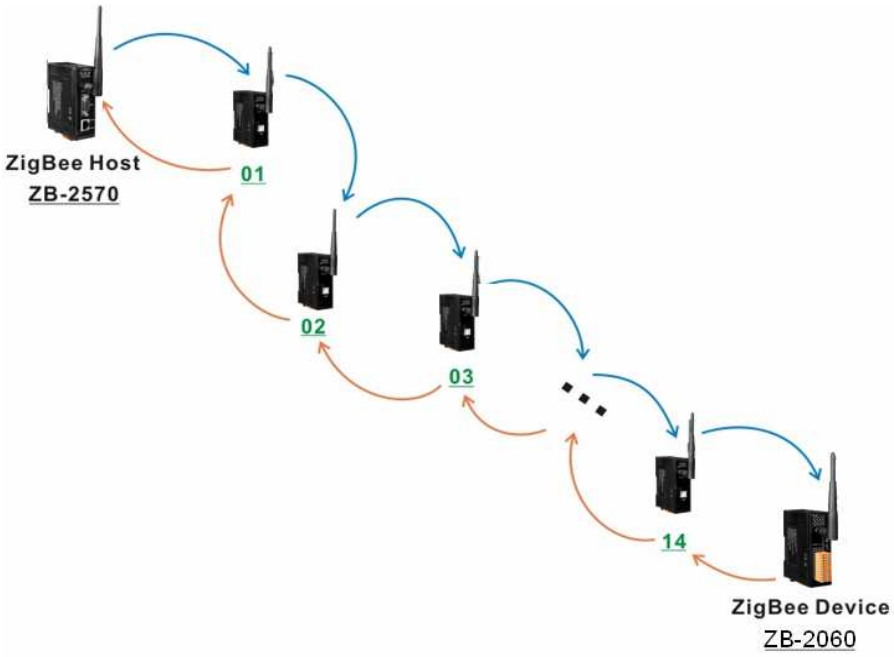
Repeater ID	01	02	03	04	...	...	13	14
Repeater forwarding data received from the ZigBee device (*a)	00 (*b)	01	02	03	...	...	12	13

Repeater configuration table 1

*a: Data transmission to the ZigBee Device from the ZigBee Host is in the opposite direction.

*b: Repeater ID 00 is reserved for the ZigBee Host. Repeater IDs should be set beginning from 1.

By following the above configuration, the data transmission route for this mode will be as follows:



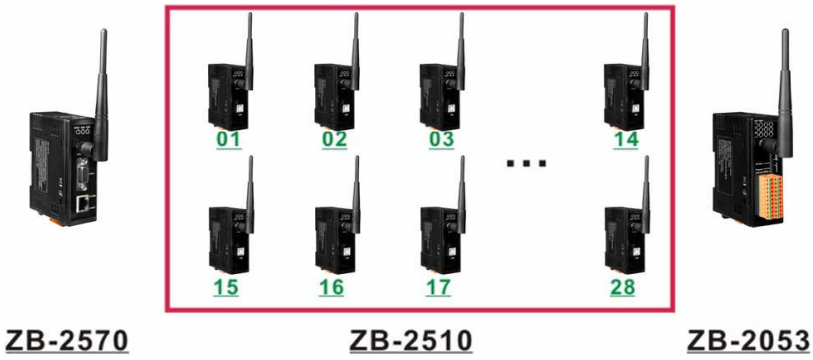
*1: ICP DAS provides two hardware and software versions that can be selected by the user depending on different environments.

*2: Not only does a unique PAN ID need to be set for the repeater, in the same way as any other ZigBee product, but a repeater ID number also needs to be set for use in user-defined route mode.

*3: Data transmission from the ZigBee Host to the ZigBee Device is in the opposite direction.

- *User-defined Route Mode with a back-up route:*

User-defined route mode allows more flexibility in the ZigBee application and more expansion of the network. There are times when we need to consider an application where one or more repeaters in the ZigBee network are invalid. Communication between the host and the device will be disrupted, which will cause the data to be trapped at the failed repeaters. Even if a scanning device is used to locate and replace the invalid repeater, the entire system will be inactive while time is wasted waiting for the engineer to repair the problem. Sometimes, if the weather causes a device to be inoperable, or the engineer is a long distance from the location, the recovery time will be increased. Thus, the network self-recovery and redundancy functions are very important in this kind of application. The method used to implement the above functions in user-defined route mode is to add a secondary repeater ID number using the software utility, and then deploy two repeaters in each of the planned repeater locations.



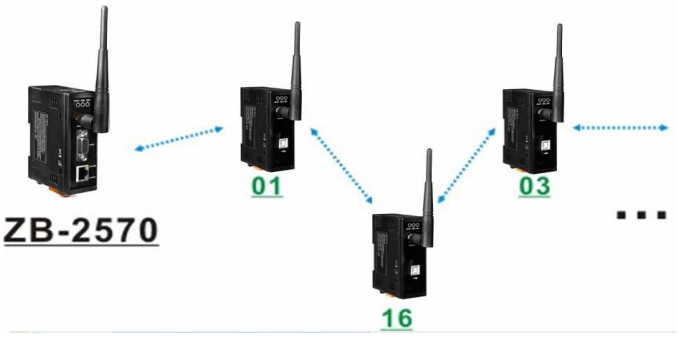
Repeater ID	01,15	02,16	03,17	04,18	...	...	13,27	14,28
Repeater forwarding data received from the ZigBee device	00	01	02	03	...	...	12	13
Back up repeater ID	-	15	16	17			26	27

Repeater configuration table 2

The above figure shows an example application and configuration table. If the repeater with the ID number 02 in the above application is invalid, the data transmission route will switch to the secondary repeater if the ZigBee self-detection time has elapsed (*4).

Original data transmission route:

After the recovery:

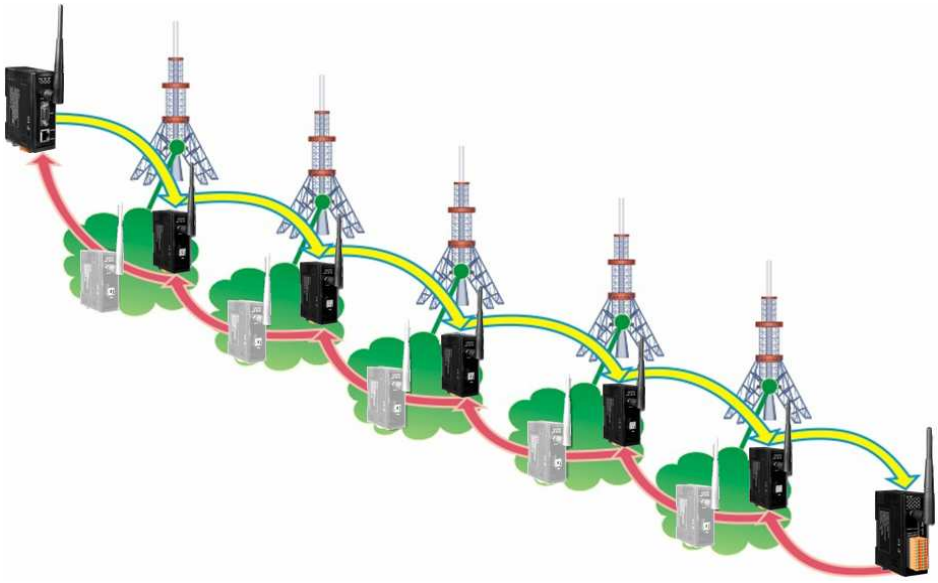


*4: The user can define this value based on the system environment. The minimum timeout is 4 seconds. The network will attempt to forward the data to the secondary route if there is a problem with the ZigBee network.

3. Applications

ZigBee repeater application 1

An example is as follows:



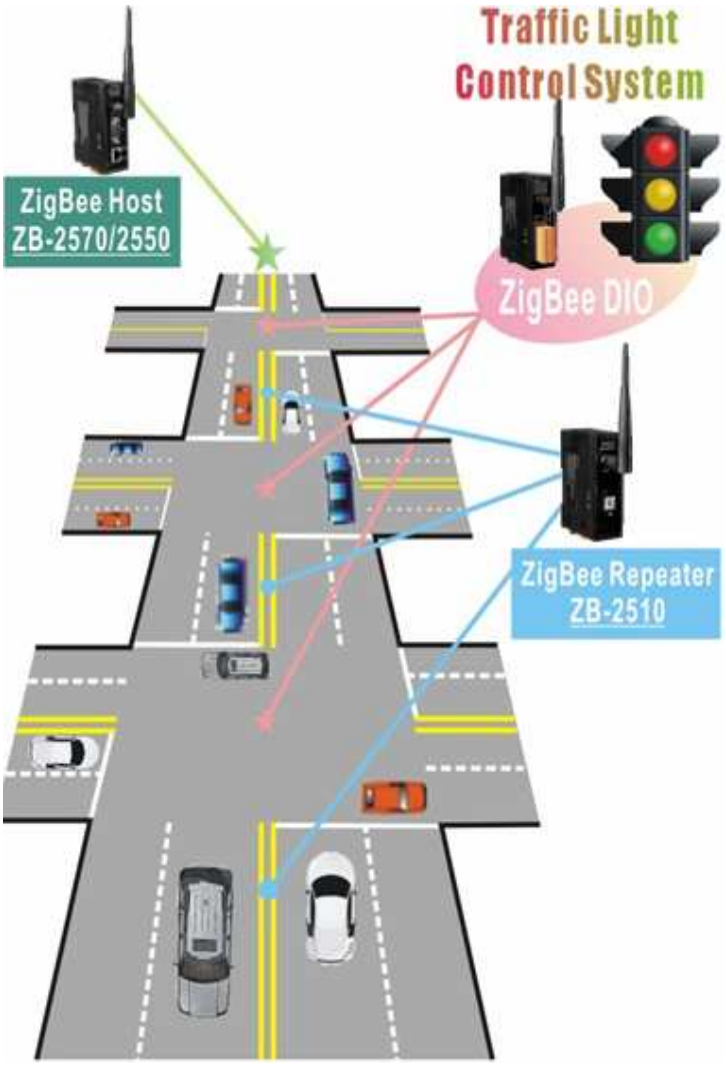
The locations of the repeater installation should be well planned. The repeater's forward route should be configured using user-defined route mode and then the locations of all devices should be set up.

If a back-up route solution is added to the application, then the installation will be as follows:

If a repeater at any of the locations is invalid, the data transmission route will be switched to the back-up route based on the user-defined timeout so that the ZigBee network transmission can be recovered.

ZigBee repeater application 2

An example of an application based on a repeater and a ZigBee DIO module is as follows:



The ZigBee DIO module can control and monitor each traffic light at the intersection based on the traffic light control system. During non-rush hour periods, the traffic light control system can operate on a standalone basis. However, when the traffic light control system needs to be operated manually, the module also allows the system to be controlled by a remote host. The remote host can be used to manage the time and the sequence of all traffic light control systems. If the distance between two intersections is beyond the ZigBee DIO module's default transmission range, a ZigBee repeater can be added to extend the transmission range.