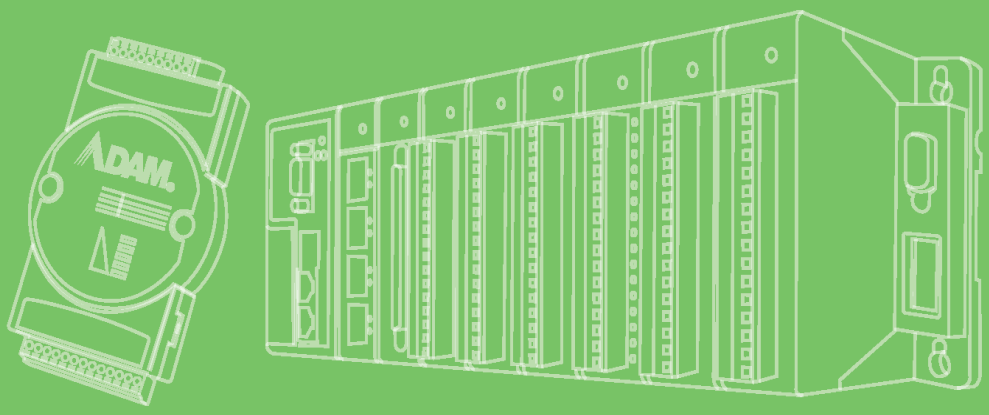

User Manual

WSN-4000 Series

Wireless Sensor Network I/O and Data Acquisition Modules

ADVANTECH
eAutomation

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Product Warranty (2 years)

Advantech warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which have been subject to misuse, abuse, accident or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most of our customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult your dealer for more details.

If you think you have a defective product, follow these steps:

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages you get when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain an RMA (return merchandize authorization) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.
5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

Part No. 2003W00000 Edition 1

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Declaration of Conformity

CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech. Please contact your local supplier for ordering information.

CE

This product has passed the CE test for environmental specifications. Test conditions for passing included the equipment being operated within an industrial enclosure. In order to protect the product from being damaged by ESD (Electrostatic Discharge) and EMI leakage, we strongly recommend the use of CE-compliant industrial enclosure products.

Technical Support and Assistance

1. Visit the Advantech web site at www.advantech.com/support where you can find the latest information about the product.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
   - Product name and serial number
   - Description of your peripheral attachments
   - Description of your software (operating system, version, application software, etc.)
   - A complete description of the problem
   - The exact wording of any error messages

Warnings, Cautions and Notes

Warning! *Warnings indicate conditions, which if not observed, can cause personal injury!*

Caution! *Cautions are included to help you avoid damaging hardware or losing data. e.g.*

There is a danger of a new battery exploding if it is incorrectly installed. Do not attempt to recharge, force open, or heat the battery. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Note! *Notes provide optional additional information.*

Document Feedback

To assist us in making improvements to this manual, we would welcome comments and constructive criticism. Please send all such - in writing to: support@advan-tech.com

Packing List

Before setting up the system, check that the items listed below are included and in good condition. If any item does not accord with the table, please contact your dealer immediately.

- 1x WSN-4000 Series Device
- 1x 2dBi Antenna
- 1x Mounting Kit
- 1x CD

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:
15. The power cord or plug is damaged.
16. Liquid has penetrated into the equipment.
17. The equipment has been exposed to moisture.
18. The equipment does not work well, or you cannot get it to work according to the user's manual.
19. The equipment has been dropped and damaged.
20. The equipment has obvious signs of breakage.
21. DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 60° C

(140° F). THIS COULD DAMAGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.

22. CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
23. The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

Safety Precaution - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

- To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.

Disconnect power before making any configuration changes. The sudden rush of power as you connect a jumper or install a card may damage sensitive electronic components.

Contents

Chapter 1

Understanding Your System

1.1 Introduction

WSN-4000 series is comprised of several modules. These modules are divided into three categories. Communication gateways/coordinators, routers/repeaters and I/O modules. With different combinations of these modules, wireless data acquisition, I/O control, and networking, a wide variety of cost-effective distributed monitoring and control solutions can be implemented. A combination of the RS-485 protocol and wireless technology, WSN-4000 series modules provide a good DA&C system for Building Automation, Environmental Monitoring, Facility Management, and eManufacturing applications. Please refer to Figure 1-1 for a brief overview of the WSN-4000 Series system architecture.

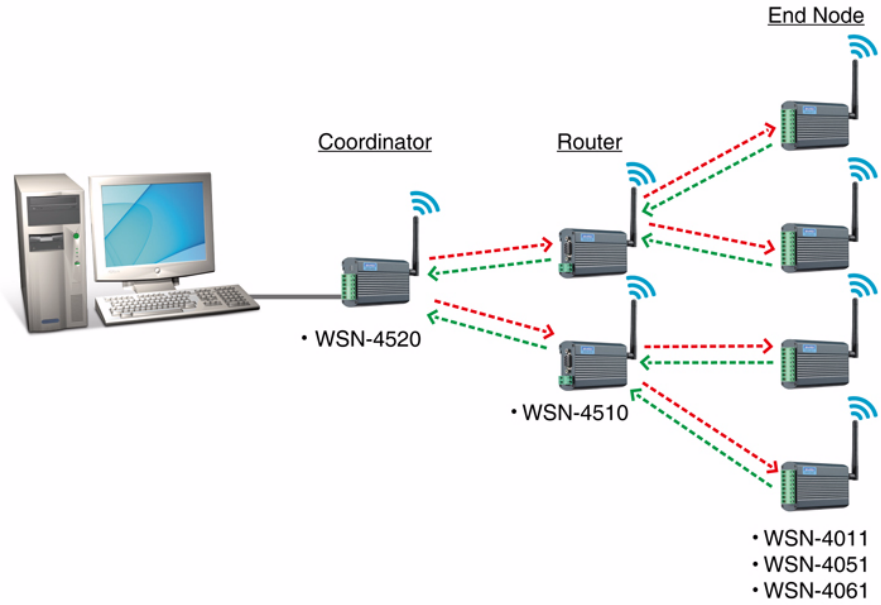

Figure 1.1 WSN-4000 Series System Architecture

1.1.1 IEEE 802.15.4 Standard

IEEE 802.15.4 standard defines the protocol and interconnection of devices via radio communication in a wireless personal area network, WPAN. It focuses on low-power ubiquitous communication between devices. The standard uses carrier sense multiple access with collision avoidance, CSMA-CA, medium access mechanism and supports star as well as peer-to-peer topologies.

1.1.2 IEEE 802.15.4 Functionality

There are two physical device types for the lowest system cost defined by the IEEE. Full function device, FFD, can function in any topology, is capable of being the network coordinator and can talk to any other device. Reduced function device, RFD, is limited to star topology, can't become a network coordinator, talks only to a network coordinator has very simple implementation. The wireless sensor network comprises with three kinds of devices, coordinator, router and end node.

The coordinator is the most capable device of the WPAN. It forms the root of the network tree. Only one coordinator is available in a specific network since it is the device that started the network originally. It is able to store information about the network and act as a gateway to transfer data. The router acts as an intermediate router or repeater passing on data from other devices. The end node contains just enough functionality to talk to the parent node, either the coordinator or a router. It cannot relay data from other devices. This relationship allows the node to be asleep a significant amount of the time thereby giving long battery life. An end node requires the least amount of memory.

1.1.3 Wide Range Wireless Network Coverage

WSN-4000 series supports two types of network topologies, star and tree.

The characteristic of the star topology is as of the following:

- One central node, coordinator, single hop
- Only coordinator can have child nodes
- Network is simple to setup and deployment

The characteristic of the tree topology is as of the following:

- Peer-to-peer data transfer model, multiple hops
- Routers are able to have child nodes
- Direct communication is possible only in terms of parent and child
- With routers, the network can be easily extended.

1.1.4 Multiple I/O Solutions

WSN-4000 I/O series function as a basic I/O device for integration with coordinator. With wireless technology, coordinator collects data from input device or controls output device.

The WSN-4000 I/O series comes with digital I/O, including four-channel digital input and three-channel relay output. It also comes with a three-channel analog input that accept both voltage and current input for data acquisition. Various sensors can be integrated to become part of WSN.

1.1.5 Industrial Standard Modbus Protocol

Modbus is an industrial standard serial communication protocol, and a commonly available means of connecting industrial electronic devices. Modbus allows for communication between many devices connected to the same network. Modbus RTU is used in serial communication and makes use of a compact binary representation of the data for protocol communication. The RTU format follows the commands/data with a cyclic redundancy check checksum as an error check mechanism to ensure the reliability of data.

1.1.6 Modbus Software Support

WSN-4000 supports industrial standard Modbus protocol and can be integrated into third-party Modbus software. Through embedded standard protocol firmware, WSN-4000 is able to control relay output, On/Off, to acquire status from digital input, On/Off, and to acquire status from analog input. Modbus commands are listed below:

Code	Name	Function
01	Read Coil Status	Read Relay Output status
02	Read Input Status	Read Digital Input status
03	Read Holding Registers	Reserved
04	Read Input Registers	Read Analog Input data
05	Force Single Coil	Set single Relay output On/Off
17	Report Slave ID	Send node information to coordinator

1.1.7 Integration with ADAM .NET Utility

The configuration function of WSN-4000 series had been fully integrated into the ADAM .NET Utility. With the powerful utility, only few steps and item need to be executed then the wireless sensor network is ready to work in seconds.

1.2 Dimensions

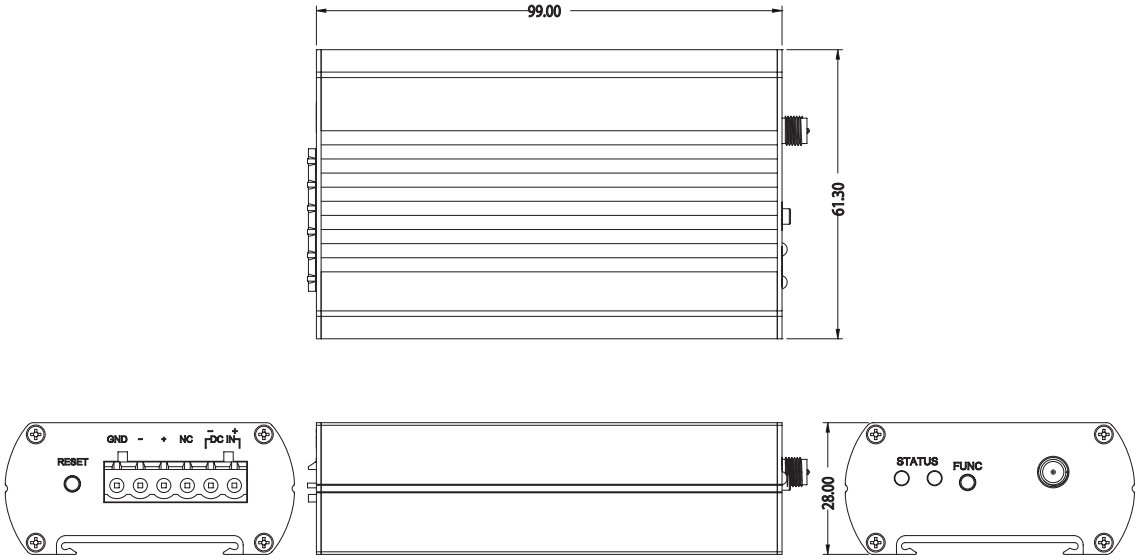

Figure 1.2 WSN-4000 Series Dimensions

LED Status

There are two LEDs on the WSN-4000 series side panel.

1. Wireless Link/activity: Green LED.
2. System status: Red LED.

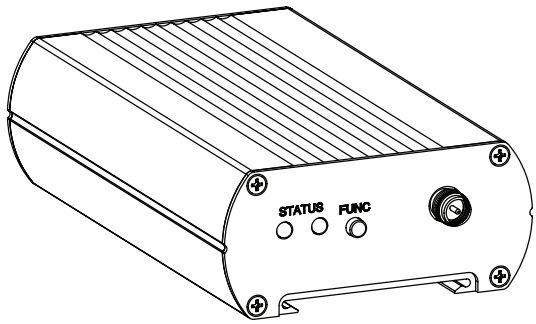

Figure 1.3 LED Indicators

Table 1.1: LED indication Definitions				
Green \ Red	ON	OFF	Blinking	Blinking, random
ON	N/A	**Normal mode** Linked w/o Tx/Rx	Configuration mode	**Normal mode** Linked w/ Tx/Rx
OFF	N/A	N/A	Configuration mode	N/A
Blinking	N/A	N/A	No Wireless Connection	N/A

Note! *If the green and red LED blink at the same time check the following:*

1. Make sure the antenna installed properly.

2. Ensure PAN ID and channel are set properly to pair with coordinator.

3.Make sure only one coordinator is set in the PAN ID and channel.

Chapter 2

Selecting Your Hardware

2.1 Selecting a Communication Module

To organize a WSN series remote data acquisition and control system, you need to select communication modules to link with the host, PC for example. What you need to consider is what type of communication interface exist in your host system. With the WSN-4520, you can connect through RS-485. The WSN-4520 works as a Modbus Slave with Modbus RTU protocol. In addition, if extending transmission range or improving communication link quality is necessary, a WSN-4510 router/repeater node can be optionally added.

Table 2.1: Communication Module Selection Guidelines

Choose this communication module:	Description:
WSN Router Node	Extend transmission range Improve communication link quality
WSN Modbus RTU Gateway	RS-485 interface with Modbus RTU support

2.2 Selecting an I/O Module

To organize a WSN-4000 series remote data acquisition and control system, you need to select I/O modules to connect to field devices or processes that you have previously determined. There are several things should be considered when you select the I/O modules.

- What type of I/O signal is applied in your system?
- How much I/O is required to your system?
- How will you place the modules to handle I/O points in individual areas of an entire field site?
- How many modules are required for distributed I/O point arrangement?
- What is the required voltage range for each I/O module?
- What isolation environment is required for each I/O module?
- What are the noise and distance limitations for each I/O module?

Table 2.2: I/O Selection Guidelines

Choose this I/O module:	For these types of field devices or operations (examples):	Description:
4-ch Digital Input Node	Selector switches Pushbuttons Photoelectric eyes Limit switches Circuit breakers Proximity switches Level switches Motor starter contacts Relay contacts Thumbwheel switches	Input modules sense: On/Off signals or Open/ Closed signals.
3-ch Relay Output Node	Alarms Control relays Fans Lights Horns Valves Motor Starters Solenoids	Output module signals with On/Off or Open/ Closed devices
3-ch Analog Input Node	Thermocouple signals RTD signals Temperature transducers, Pressure transducers Load Cell transducers Humidity transducers Flow transducers, Potential meters	Convert continuous analog signals into digital input values for host device

2.3 Selecting Topology

There is a simple rule of thumb to determine the network topology supported by WSN-4000. The first choice is Star topology. A benefit of the Start topology is its simplicity. There will be only one hop between coordinator and end node. But the transmission distance depends on the capability of coordinator. If the transmission range is beyond the capability of coordinator, then, the tree topology should be selected. As a matter of fact, the tree topology is automatic selected whenever a router is added to the WSN to extend the transmission range between coordinator and end node.

2.4 Selecting a Link Terminal & Cable

The interface of WSN-4520 is RS-485. The symbol + on the side panel of WSN-4520 is Data+ and symbol - is Data-. Use the twisted pair wire to connect it to the host.

Use the twisted paired wires to connect WSN-4520 to the host.

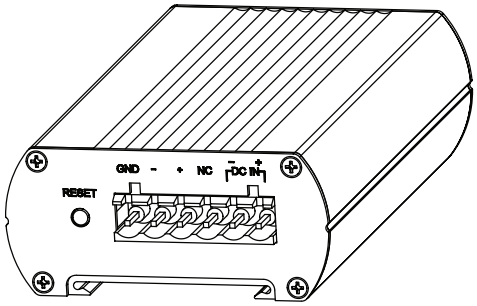

Figure 2.1 RS-485 Terminal Connection for WSN-4520

2.5 Selecting an Operator Interface

To complete your data acquisition and control system, selecting an operator interface is necessary. Adopting the Modbus protocol, WSN-4000 series I/O modules exhibit high ability in system integration for various applications. For reading the real-time status of WSN-4000 series modules anywhere without any engineering effort, there is a lot of third-party Modbus software available.

To integrate WSN-4000 series I/O with HMI, Human Machine Interface, software in a SCADA, Supervisory Control and Data acquisition, system, there are a lot of HMI software packages which support Modbus driver.

- Advantech Studio
- Wonderware InTouch
- Intellution Fix of i-Fix
- Any other software support Modbus protocol

Chapter 3

Hardware Installation Guide

3.1 Determining the Proper Environment

Prior to installing WSN-4000 series modules, please check the following.

3.1.1 Package Contents

Unpack the package and make sure that the contents include:

- WSN-4000 series module
- 2 dBi antenna
- Mounting with plastic button
- WSN series CD (User manual, datasheet, ADAM .NET Utility.)

3.1.2 System Requirements

- IBM PC compatible computer with at least 486 CPU (Pentium recommended)
- Microsoft Windows 2000, XP, 7, Vista
- At least 32 MB RAM
- 20 MB of hard disk space available
- VGA color monitor
- 2x or higher speed CD-ROM
- Mouse or other pointing devices
- Power supply for WSN-4000 series

3.2 Mounting

WSN-4000 series modules are designed as compact units and are allowed to be installed in the field site with the following method.

3.2.1 Wallmount

The WSN-4000 series module can be secured with a wall-mount rail. Mount the WSN-4000 series module as Figure 3-1. When slip the module into the mounted rail, make sure pressing the button into holes on the rail to secure the module in place.

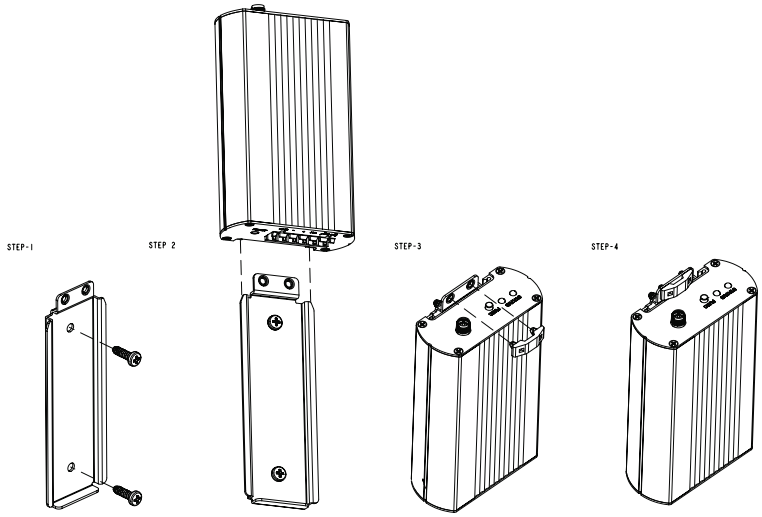

Figure 3.1 Secure Module via Wallmount

3.3 Wiring & Connections

This section provides basic information of wiring the power supply, I/O units, communication units, and network connection.

3.3.1 Power Supply Wiring

WSN-4000 series accept any power unit that supplies power from +9 to +15 V_{DC}. The power supply ripple must under 200 mV peak-to-peak, and the immediate ripple voltage should be maintained between +9 and +15 V_{DC}. Terminals marked with DC IN (+) and DC IN (-) are for power supply wiring.

Note! *The wires used should be at least 2 mm.*

Even with smart connection mechanism in place that allows power terminals wired with wrong polarity power, it is recommended to follow standard wiring guideline:

- \+ 9 ~ 15 V_{DC} (Red)
- \- GND (Black)

3.3.2 I/O Module Wiring

The system uses a plug-in screw terminal block as the interface between I/O modules and external devices. When connecting external devices to the I/O modules, follows the guideline below.

1. The maximum wire diameter allowed for the terminal block is 0.5 mm to 2.5 mm.
2. Always use an integrity wire.
3. Keep wires as short as possible.
4. Use wire trays or wire holders to secure wires.
5. Avoid running wires close to high energy wiring.
6. Keep input wiring and output wiring apart.
7. Avoid any sharp bend to the wires.
8. Follow the (+) and (-) symbols on the side panel to wire correctly.

The WSN-4011 has two input types, voltage and current. The default input type of the WSN-4011 is current mode. To set the current/voltage mode, follow the instructions below to set the Jumper of WSN-4011.

1. Open the case of the WSN-4011.

2. Set the J6 (AI1), J5 (AI2), J1 (AI3) to the "V" position for voltage mode, otherwise "A" position for current mode.

Note! *The AI1, AI2 and AI3 can not wire as serial connection to each other.*

Chapter 4

Module Introduction

4.1 Communication Modules

4.1.1 WSN-4510

WSN Router Node

WSN-4510 is a router/repeater which is used to extend transmission range between the coordinator/gateway and the end device.

4.1.1.1 WSN-4510 Specifications

Wireless:

- IEEE Standard: 802.15.4
- Modulation Type: O_QPSK
- Frequency Band: 2.4 ~ 2.4835 GHz
- Channels: 11-26
- RF Data Rate: 250 kbps
- Transmit Power: 19±1 dBm
- Receiver Sensitivity: -96 dBm
- Antenna Type: Dipole
- Antenna Gain: 2 dBi
- Outdoor Range : 1000 m
- Topology: Star/ Tree
- Network Depth (layer): 3
- Max Router (per layer): 5
- Max Node: 20
- Function: Router

General:

- Connectors: 1x DB9-F (RS-232)
- Power Input: 10 ~ 26 V_{DC}
- Power Consumption: 1.44 W @ 12 V_{DC}
- Dimension (L*W*H): 99 x 61.46 x 28 mm
- Net Weight: 123 g
- Gross Weight: 536 g
- Mounting: wall mount
- Operating Humidity: 0 ~ 90 % RH (non-condensing)
- Storage Humidity: 0 ~ 90 % RH (non-condensing)
- Operating Temperature: -10 ~ 65° C
- Storage Temperature: -20 ~ 80° C

4.1.2 WSN-4520

WSN Modbus RTU Gateway

WSN-4520 is designed based on the popular industrial RS-485 standards used today in most industrial environments. Users can easily add WSN-4520 module to existing RS-485 networks or use WSN-4520 module in new RS-485 enabled eManufacturing networks. WSN-4520 module supports industrial popular Modus/RTU protocol for data connection. Through RS-485 networking, system and controller can access or gather real-time data from WSN-4000 series I/O. And, these real-time data can be integrated with business system to create valuable, competitive business information immediately.

4.1.2.1 WSN-4520 Specifications

Wireless:

- IEEE Standard: 802.15.4
- Modulation Type: O_QPSK
- Frequency Band: 2.4 ~ 2.4835 GHz
- Channels: 11-26
- RF Data Rate: 250 kbps
- Transmit Power: 1±1 dBm
- Receiver Sensitivity: -96 dBm
- Antenna Type: Dipole
- Antenna Gain: 2 dBi
- Outdoor Range: 250 m
- Topology: Star/ Tree
- Network Depth (layer): 3
- Max Router (per layer): 5
- Max Node: 20
- Function: Coordinator

General:

- Connector: 1x Plug-in terminal block (#14-22 AWG)
- Protocol: Modbus RTU
- Power Input: 10 ~ 26 V_{DC}
- Power Consumption: 0.6 W @ 12 V_{DC}
- Dimension (L*W*H): 99 x 61.46 x 28 mm
- Net Weight: 115 g
- Gross Weight: 532 g
- Mounting: wall mount
- Operating Humidity: 0 ~ 90 % RH (non-condensing)
- Storage Humidity: 0 ~ 90 % RH (non-condensing)
- Operating Temperature: -10 ~ 65° C
- Storage Temperature: -20 ~ 80° C

4.2 I/O Modules

4.2.1 WSN-4011

3-ch Analog Input Node

WSN-4011 provides 3-ch analog input. Each channel can be used to acquire signal.

4.2.1.1 WSN-4011 Specifications

Wireless:

- IEEE Standard: 802.15.4
- Modulation Type: O_QPSK
- Frequency Band: 2.4 ~ 2.4835 GHz
- Channels: 11-26
- RF Data Rate: 250 kbps
- Transmit Power: 1±1 dBm
- Receiver Sensitivity: -96 dBm
- Antenna Type: Dipole
- Antenna Gain: 2 dBi
- Outdoor Range: 250 m
- Topology: Star/ Tree
- Network Depth (layer): 3
- Max Router (per layer): 5
- Max Node: 20
- Function: End point

General:

- Connector: 1x Plug-in terminal block (#14-22 AWG)
- Power Input: 10 ~ 26 V_{DC}
- Power Consumption: 0.28 W @ 12 V_{DC}
- Dimension (L*W*H): 99 x 61.46 x 28 mm
- Net Weight: 112 g
- Gross Weight: 536 g
- Mounting: wall mount
- Operating Humidity: 0 ~ 90 % RH (non-condensing)
- Storage Humidity: 0 ~ 90 % RH (non-condensing)
- Operating Temperature: -10 ~ 65° C
- Storage Temperature: -20 ~ 80° C

Analog Input:

- Channels: 3
- Resolution: 12 bit
- Input Impedance: > 5 MΩ (voltage) 120Ω (current)
- Input Type: mV, V, mA
- Input Range: 0~5 V, 0~10 V, 4~20 mA
- Sampling Rate: 1 sample/second
- Accuracy: ± 0.4% or Better (voltage), ± 0.4% or Better (current)
- CMR @ 50/60 Hz: 120 dB
- NMR @ 50/60 Hz: 100 dB

4.2.2 WSN-4051

4-ch Digital Input Node

WSN-4051 provides four channels of digital input.

4.2.2.1 WSN-4051 Specifications

Wireless:

- IEEE Standard: 802.15.4
- Modulation Type: O_QPSK
- Frequency Band: 2.4 ~ 2.4835 GHz
- Channels: 11-26
- RF Data Rate: 250 kbps
- Transmit Power: 1±1dBm
- Receiver Sensitivity: -96 dBm
- Antenna Type: Dipole
- Antenna Gain: 2 dBi
- Outdoor Range: 250 m
- Topology: Star/ Tree
- Network Depth (layer): 3
- Max Router (per layer): 5
- Max Node: 20
- Function: End point

General:

- Connectors: 1x Plug-in terminal block (#14-22 AWG)
- Power Input: 10 ~ 26 V_{DC}
- Power Consumption: 0.5 W @ 12 V_{DC}
- Dimension (L*W*H): 99 x 61.46 x 28 mm
- Net Weight: 115 g
- Gross Weight: 539 g
- Mounting: wall mount
- Operating Humidity: 0 ~ 90 % RH (non-condensing)
- Storage Humidity: 0 ~ 90 % RH (non-condensing)
- Operating Temperature: -10 ~ 65° C
- Storage Temperature: -20 ~ 80° C

Digital Input

- Channels: 4
- Input Level:

  Dry Contact: Logic level 0: close to GND

  Logic level 1: open

4.2.3 WSN-4061

3-ch Relay Output Node

WSN-4061 provides three channels of relay output.

4.2.3.1 WSN-4061 Specifications

Wireless:

- IEEE Standard: 802.15.4
- Modulation Type: O_QPSK
- Frequency Band: 2.4 ~ 2.4835 GHz
- Channels: 11-26
- RF Data Rate: 250 kbps
- Transmit Power: 1±1 dBm
- Receiver Sensitivity: -96 dBm
- Antenna Type: Dipole
- Antenna Gain: 2 dBi
- Outdoor Range: 250 m
- Topology: Star/ Tree
- Network Depth (layer): 3
- Max Router (per layer): 5
- Max Node: 20
- Function: End point

General:

- Connector: 1x Plug-in terminal block (#14-22 AWG)
- Power Input: 10 ~ 26 V_{DC}
- Power Consumption: 1.07 W @ 12 V_{DC}
- Dimension (L*W*H): 99 x 61.46 x 28 mm
- Net Weight: 127 g
- Gross Weight: 550 g
- Mounting: wall mount
- Operating Humidity: 0 ~ 90 % RH (non-condensing)
- Storage Humidity: 0 ~ 90 % RH (non-condensing)
- Operating Temperature: -10 ~ 65° C
- Storage Temperature: -20 ~ 80° C

Relay Output

- Channels: 3 x form A
- Contact Rating: 5 A @ 250 V_{AC}
  5 A @ 30 V_{DC}
- Insulation Resistance: 1 GΩ min. at 500 V_{DC}
- Breakdown Voltage: 500 V_{DC} (50/60 Hz)
- Relay on time: 8 msec
- Relay off time: 4 msec
- Max Switching Rate: 10 operations/minute

Chapter 5

System Configuration Guide

5.1 System Hardware Configuration

5.1.1 Communication Interface

One WSN-4520 connects to the host and WSN-4011/WSN-4051/WSN-4061/WSN-4510 needs to be configured with WSN-4520 through wireless connection.

5.1.2 Configuration Mode

To configure the WSN-4000 series, set all WSN-4000 series to configuration mode.

1. Before power on, press and hold FUNC button. Green LED will start blinking. Green LED will then turn on. And finally after red LED blinking, release FUNC button to enter configuration mode.
2. After power on and green LED still blink, press and hold FUNC button. Release FUNC button after red LED start blinking and green LED turn on to enter configuration mode.

5.2 Installing ADAM.NET Utility Software

Advantech provides a free download of ADAM.NET Utility software for module operation and configuration. You can find the Utility installation file in the CD with your module, or on our website at: *http://www.advantech.com* and click the Download Area under Service & Support to get the latest version of the ADAM.NET Utility. Once you download and setup the Utility software, there will be a shortcut of the Utility program on the desktop.

Note! *Before installing ADAM.NET Utility, you need to install .NET Framework 1.1 or later.*

5.3 ADAM.NET Utility Overview

The ADAM.NET Utility software offers a graphical interface that helps you configure the WSN-4000 series. It is also very convenient to test and monitor your remote data acquisition and control system. The following guidelines will give you some brief instructions on how to use this Utility.

5.3.1 ADAM.NET Utility Operation Window

After you have successfully installed ADAM.NET Utility, there will be one shortcut icon on the desktop. Double click the shortcut icon that you should be able to see the operation window.

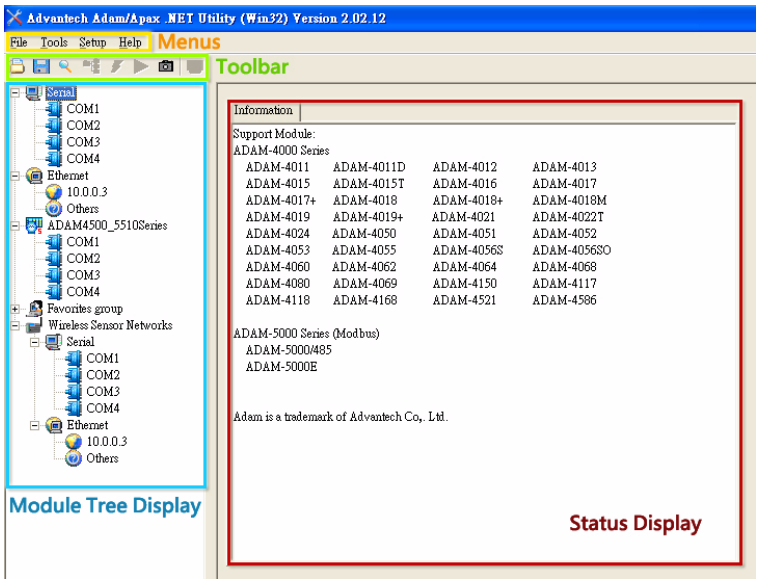

Figure 5.1 ADAM.NET Utility Operation Window

The operation window consists of four areas --- the **Menus**, the **Toolbar**, the **Module Tree Display** Area and the **Status Display** Area.

Menus

The menus at the top of the operation window contain:

File Menu:

1. Open Favorite Group - You can configure your favorite group and save the configuration into one file. Using this option, you can load your configuration file for favorite group.
2. Save Favorite Group - You can configure your favorite group and save the configuration into one file. Using this option, you can save your favorite group into one configuration file.
3. Auto-Initial Group - If you want to have the same favorite group configuration when you exit ADAM.NET utility and launch it again, you need to check this option.
4. Exit - Exit ADAM.NET Utility.

Tools Menu:

1. Search - Search all the WSN-4000, ADAM-5000/TCP and ADAM-6000 modules you connected. The operation process will be described in Section 5.3.2.
2. Add Devices to Group - You can add WSN-4000 modules to your favorite group by this option. You need to select the device you want to add in the **Module Tree Display** area (it will be described below) first, and then select this option to add.
3. Print Screen - You can save current ADAM.NET Utility screen into an image file by this option.

Setup Menu:

1. Favorite Group - You can configure your favorite group including add one new device, modify or delete one current device, sort current devices and diagnose connection to one device.
2. Refresh COM and LAN node - ADAM.NET utility will refresh the serial and LAN network connection situation.
3. Add COM Port Tree Nodes - This option is used to add serial COM ports in ADAM.NET Utility.
4. Show TreeView - Check this option to display the **Module Tree Display** area.

Help Menu:

1. Check Up-to-Date on the Web - Choose this option, it will automatically connect to Advantech download website.You can download the latest utility there.
2. About Adam.NET Utility - Choose this option, you can see version of ADAM.NET Utility installed on your computer.

Toolbar

There are 7 graphical icons on the toolbar for 7 common used options of Menus. Figure 5.2 below shows definition for each graphical icon.

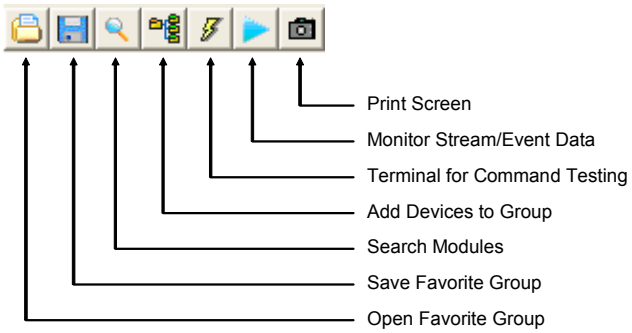

Figure 5.2 ADAM.NET Utility Toolbar

Module Tree Display Area

ADAM.NET Utility is one complete software tool that all ADAM remote I/O module and controller can be configured and operated in this utility. The **Module Tree Display** is on the left part of the utility operation window. There are five categories in the **Module Tree Display** Area:

- **Serial**
  All serial I/O Modules (ADAM-4000 and ADAM-5000 RS-485 serial modules) connected to the host PC will be listed in this category.
- **Ethernet**
  All Ethernet I/O Modules (ADAM-6000 and ADAM-5000 TCP modules) connected to the host PC will be listed in this category.
- **ADAM-4500_5510 Serie**s
  This is a DOS interface utility for remote controllers such as ADAM-4500 and ADAM-5510 series.
- **Favorite Group**
  You can define which devices listed in the three categories above into your personal favorite group. This will make you easier to find your interested modules. Right click on the ADAM device item under the Favorite Group item and you can select **New >> Group** to create a new group. After you create your own group, right click on your group and select **New >> Adam device** to add ADAM devices into your group. You can also select **Diagnose connection** to check the communication.
- **Wireless Sensor Networks**
  The category contains the WSN-4000 series. You can connect the WSN-4000 series, through the serial interface. The WSN-4000 series will be listed for further configuration.

Status Display Area

Status Display area, on the right part of utility operation window, is the main screen for operation. When you select different items in **Module Tree Display, Status Display** will change dependently. You can do all configurations and test in this area.

5.3.2 Search and Configure the WSN-4000 Series

The WSN-4000 series can be searched and configured through ADAM .NET Utility.

Set the modules in configuration mode before using the ADAM .NET Utility by pressing the "func" button in the side panel of WSN-4000 series until the green LED is on and red LED is blinking. The WSN-4520 can be set through RS-485 interface in configuration mode. The WSN-4011/WSN-4051/WSN-4061 can be set through wireless interface of WSN-4520 in configuration mode, but only one end node (WSN-4011/WSN-4051/WSN-4061) can be set at the same time.

In the section, we will demonstrate how to search and configure WSN-4520/WSN-4011.

Click the Wireless Sensor Networks, the supported WSN-4000 series will be listed in the **Status Display** Area.

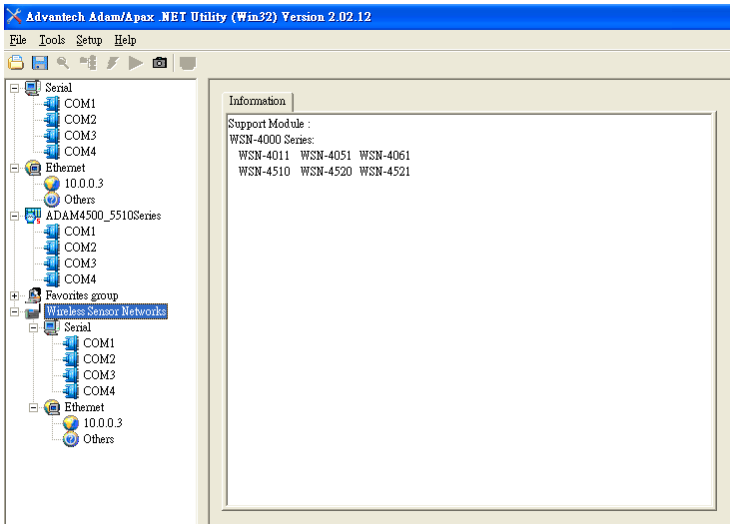

Figure 5.3 WSN-4000 Series ADAM .NET Utility Support

WSN-4520

Connect the WSN-4520 to the PC.

Set the WSN-4520 and WSN-4011 in configuration mode.

Click the COM1 in the Wireless Sensor Networks category then click right button to select the "Search" function. The ADAM .Net Utility is going to search the gateways of WSN-4000 series.

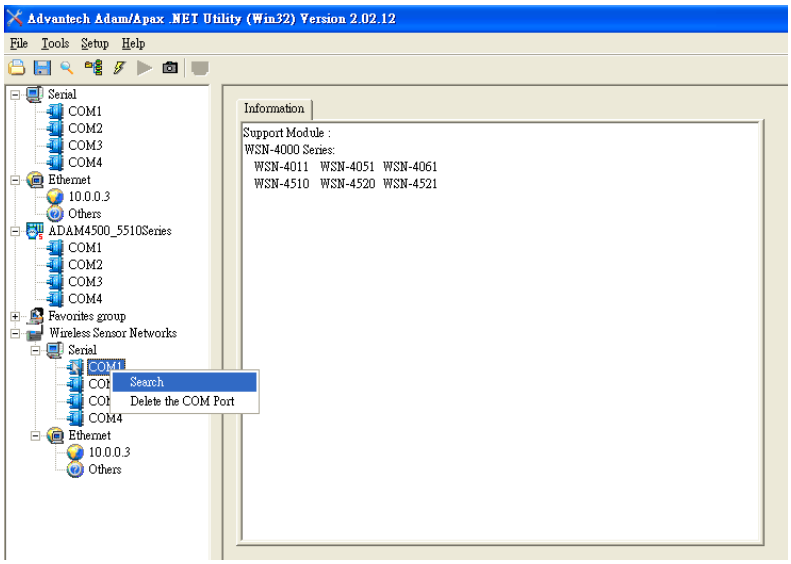

Figure 5.4 WSN-4000 Series Gateway Search

The WSN-4520 will be listed in the tree view with model name.

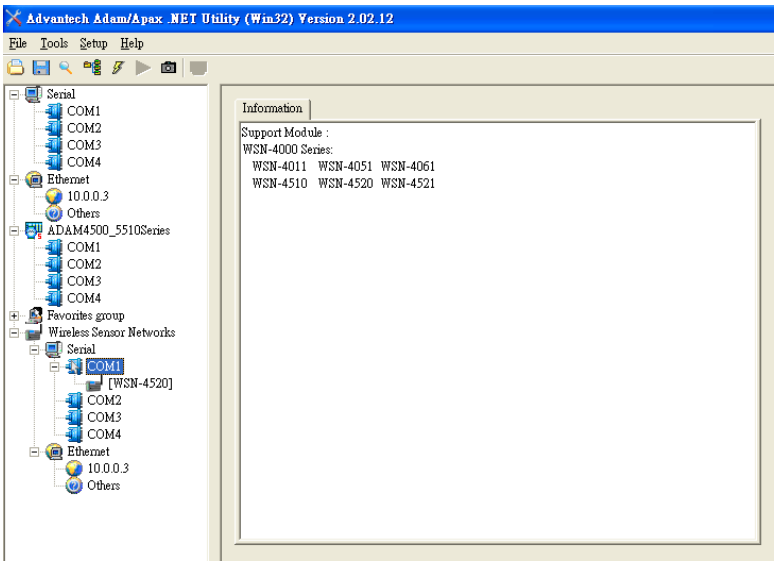

Figure 5.5 WSN-4520 Tree View

Click on the WSN-4520, you can find the parameters of WSN-4520 in the Status Display Area and it will find the end node in configuration mode.

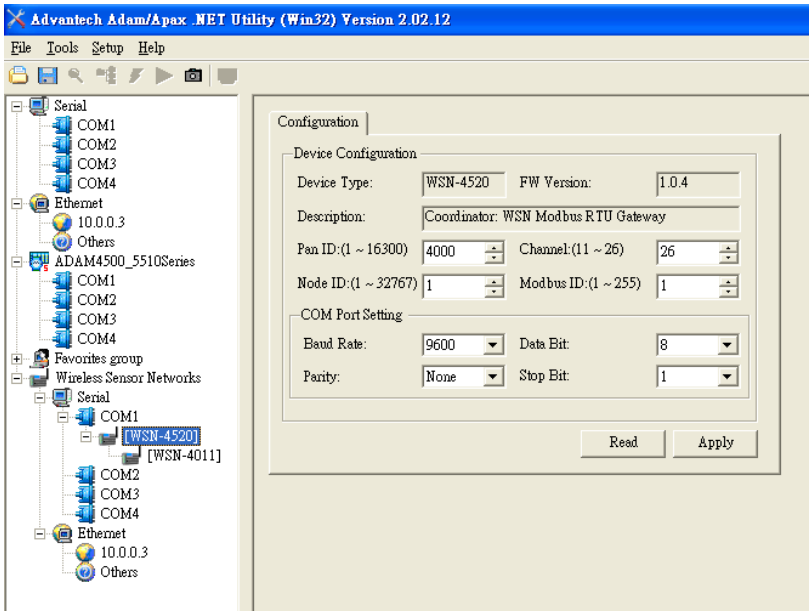

Figure 5.6 WSN-4520 and WSN-4011 Parameters

Click on the WSN-4011, you can find the parameters of WSN-4011 in the Status Display Area.

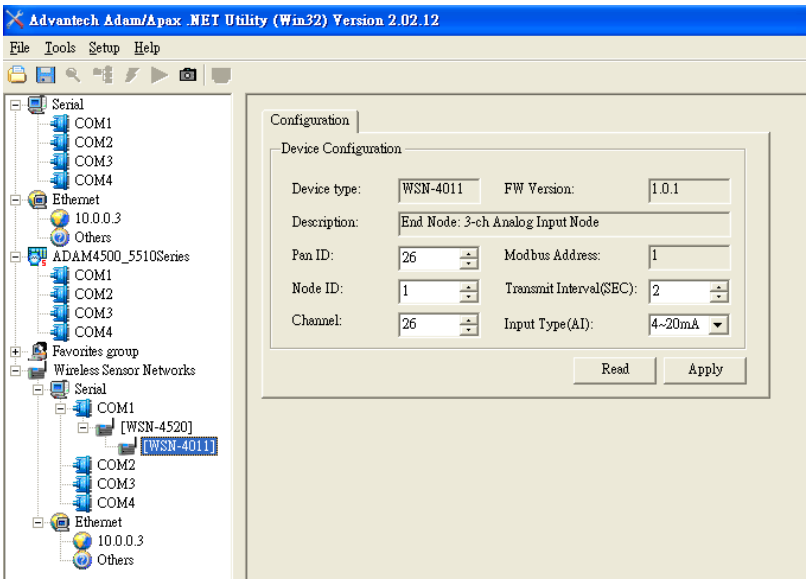

Figure 5.7 WSN-4011 Parameters

Configuration Parameters

Channel: 11~26

PAN ID: 1~16300

Node ID: 1-32767

Modbus ID: 1~255 (WSN-4520)

Update Interval (SEC): 1~65535 (WSN-4011, WSN-4051, WSN-4061)

Input Type: 4~20 mA, 0~5 V, 0~10 V (WSN-4011)

There are three basic parameters of wireless communication to build up the network. To build up a network, all end nodes (WSN-4011/WSN-4051/WSN-4061), all routers (WSN-4510) must be set in the same channel and PAN ID with different Node ID, and only one gateway (WSN-4520) is available in a PAN ID network. The WSN-4520 works as a Modbus slave, therefor it has to be assign a Modbus ID, then the data of WSN-4011/WSN-4051/WSN-4061 can be access through internal address of WSN-4520. For more information, please refer to the chapter 6.

The WSN-4011/WSN-4051/WSN-4061 is a low-duty rate and low-power consumption wireless I/O module, the "**Update Interval**" can be set from 1 through 65535 second to update the data. The longer transmit interval is set, the lower power consumes.

Besides, the WSN-4011 works as analog input node, the default setting of "**Input Type**" is 4~20 mA. 0~5 V and 0~10 V are also available. To perform the input type correctly, the hardware has to be set up properly, please refer to the 3.3.2 for more information.

After finishing setting up the WSN-4000 series. Power off and on without pressing the "FUNC" button of the side panel, the WSN-4000 series will reboot and operate in normal mode and work as Modbus devices.

Chapter 6

Operating the WSN-4000 Series

6.1 Introduction

WSN-4520 supports Modbus RTU protocol and serves as a Modbus slave that takes commands from a Modbus master. Each module has its own unique Modbus ID such that master can address each individual slave. Coordinator sends commands to end node and collects information from the end node.

WSN-4011, WSN-4051, and WSN-4061 as an internal address of the Modbus slave., will take command from coordinator and send status back to coordinator.

6.2 WSN-4000 I/O Modbus Mapping Table

6.2.1 WSN-4061

3-ch Relay Output Node

- 01 Read Coil Status

Address	Description
00001~00004	WSN-4061 Node ID 1
00005~00008	WSN-4061 Node ID 2
00009~00012	WSN-4061 Node ID 3
00013~00016	WSN-4061 Node ID 4
00017~00020	WSN-4061 Node ID 5
(X-1)*4+1_(X-1)*4+4 X<256	WSN-4061 Node ID X

WSN-4061 Node ID 1 Data Frame

Address	Description
00001	WSN-4061 DO1 status (Value 0 is off, 1 is on)
00002	WSN-4061 DO2 status (Value0 is off, 1 is on)
00003	WSN-4061 DO3 status (Value0 is off, 1 is on)
00004	reserved

6.2.2 WSN-4051

4-ch Digital Input Node

• 02 Read Coil Status

Address	Description
10001~00004	WSN-4051 Node ID 1
10005~00008	WSN-4051 Node ID 2
10009~00012	WSN-4051 Node ID 3
10013~00016	WSN-4051 Node ID 4
10017~00020	WSN-4051 Node ID 5
(X-1)*4+1_(X-1)*4+4 X<256	WSN-4051 Node ID X

WSN-4051 Node ID 1 Data Frame

Address	Description
10001	WSN-4051 DI1 status (Value 1 is open, 0 is close to GND)
10002	WSN-4051 DI2 status (Value 1 is open, 0 is close to GND)
10003	WSN-4051 DI3 status (Value 1 is open, 0 is close to GND)
10004	WSN-4051 DI4 status (Value 1 is open, 0 is close to GND)

6.2.3 WSN-4011

3-ch Analog Input Node

• 04 Read Coil Status

Address	Description
30001~30006	WSN-4011 Node ID 1
30007~30012	WSN-4011 Node ID 2
30013~30018	WSN-4011 Node ID 3
30019~30024	WSN-4011 Node ID 4
30025~30030	WSN-4011 Node ID 5
(X-1)*6+1_(X-1)*6+7 X<256	WSN-4011 Node ID X

WSN-4011 node1 Data Frame

Address	Description
30001	WSN-4011 AI1 status (Value range: 0~4096)
30002	WSN-4011 AI2 status (Value range: 0~4096)
30003	WSN-4011 AI3 status (Value range: 0~4096)
30004	Reserved
30005	Reserved
30006	Reserved

6.2.4 WSN-4520, WSN-4521

WSN Modbus RTU Gateway, WSN Modbus TCP Gateway
Listed below are the Modbus command descriptions and examples.

Code	Name	Function
01	Read Coil Status	Read Relay Output status
02	Read Input Status	Read Digital Input status
04	Read Input Registers	Read Analog Input data
05	Force Single Coil	Set single Relay output On/Off

Function Code 01

The function code 01 is used to read the discrete output's on/off status of WSN-4061 in a binary data format. The data format of the function code is listed below:

Command Format					
Slave Address	Function Code	Start Address High Byte	Start Address Low Byte	Requested Number of Coil High Byte	Requested Number of Coil Low Byte

Example : Read WSN-4061 node 17 address number 00001 to 00004

01 01 00 01 00 04

01 01 00 00 00 04 3D C9 (request)

01 01 01 00 51 88 (response)

Function Code 02

The function code 02 is used to read the discrete input's ON/OFF status of WSN-4051 in a binary data format.The data format of the function code is listed below:

Command Format					
Station Address	Function Code	Start Address High Byte	Start Address Low Byte	Requested Number of Input High Byte	Requested Number of Input Low Byte

Example : Read WSN-4051 node 2 address 10005 to 10008

01 02 00 05 00 04

Function Code 04

The function code 04 is used to read the binary contents of input registers

The data format of the function code is listed below:

Command format					
Station Address	Function Code	Start Address High Byte	Start Address Low Byte	Requested Number of Register High Byte	Requested Number of Register Low Byte

Example: Read WSN-4011 node 2 analog inputs in addresses 30010 to 30012

01 04 00 10 00 03

Function Code 05

Force a single coil to either on or off. The requested on/off state is specified by a constant in the data field. A value of 0xFF00 sets it to on. A value of 0x0000 sets it to off. All other values are illegal and will not affect the coil.

The data format of the function code is listed below:

Command Format					
Station Address	Function Code	Coil Address High Byte	Coil Address Low Byte	Force Data High Byte	Force Data Low Byte

Example: Force WSN-4061 DO3 address 00003 to on

01 05 00 03 FF 00

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Please verify specifications before quoting. This guide is intended for reference purposes only.