How to Use SNMPv3 to Get Modbus RTU Data From the ioThinx 4510 Series

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About Moxa

Moxa is a leading provider of edge connectivity, industrial computing, and network infrastructure solutions for enabling connectivity for the Industrial Internet of Things (IIoT). With over 30 years of industry experience, Moxa has connected more than 57 million devices worldwide and has a distribution and service network that reaches customers in more than 70 countries. Moxa delivers lasting business value by empowering industries with reliable networks and sincere service. Information about Moxa's solutions is available at <u>www.moxa.com</u>.

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How to Use SNMPv3 to Get Modbus RTU Data From the ioThinx 4510 Series

The ioThinx 4510 supports Modbus RTU Master for retrieving field site data from serial meters. After collecting data, users can convert serial data to a variety of protocols, including Modbus TCP, SNMP, MQTT, and RESTful, allowing users to get field site data in their protocol of choice.

In this tutorial, you will learn how to use SNMPv3 to read/write data from/to Modbus RTU devices (we use a UPort device to demonstrate) via the ioThinx 4510.

Prepare the Following Items

- ioThinx 4510 device
- UPort device
- Mini DB9F-to-TB

Connect the ioThinx 4510's Serial Port to the UPort

Wiring

Refer to the following diagram for instructions on how to wire the ioThinx 4510 to the Mini DB9F-to-TB:

| ioTh Seri | ninx al Po | 4510 ort | M to | ini D -TB | B9F |
|--------------|---------------|-------------|---------|--------------|-----|
| | 1 | | | 1 | |
| | 2 | | | 2 | |
| | 3 | | | 3 | |
| | 4 | | | 4 | |
| | 5 | | | 5 | |

UPort Configuration

The following screenshot shows how to change the UPort interface to RS-485 2W mode.

| General Ports Config | juration | Driver | Details | | |
|---|-------------|----------------------|--------------------------|--|-----------|
| Basic Settings Port Select Port 1 Port 2 Port 3 | -Param | eters (1 po 1 No. | rt(s) select COM8 (cu | ed. 1st port i urrent) g COM Numbe | s port 1) |
| Port 4 | Frie | ndly Name | MOXA UP | ort COM | |
| | UAF Tx N | RT FIFO Node | Enable Hi-Perfor | папсе | • • |
| | Fast | t Flush | Enable | | • |
| | Inter | face | RS-485 2 | W | • |
| | | Reset | default | View all | settings |
| Advance Settings | | | | | |
| Save | | Rest | tore | Cle | ar |
| | | He | lp | Loc | ate |
| | | | | OK | Cancel |

For detailed information, see the user's manual of the UPort you are using for this demo.

https://www.moxa.com/en/products/industrial-edge-connectivity/usb-to-serial-converters-usb -hubs/usb-to-serial-converters/uport-1000-series#resources

https://www.moxa.com/en/products/industrial-edge-connectivity/usb-to-serial-converters-usb -hubs/usb-to-serial-converters/uport-2210-2410-series#resources

Connect the ioThinx 4510 to the Modbus RTU Device

Introduction to Modbus Slave Simulator

Modbus slave is a slave simulator for simulating 32 slave device/address areas. See the following web page for more information:

https://www.modbustools.com/modbus slave.html

Install the Modbus Slave Simulator

Download the Modbus Slave Simulator from the following website, and then install the simulator:

https://www.modbustools.com/download.html

Simulate a Modbus Device

1. Open the **Slave Definition** dialog from **Setup** in the top menu. Configure the device settings as follows:

Slave ID: 1

Function: 01 Coil Status

| 🕄 Mo | dbus Slave - Mb | oslave1 | | Slave Definition | > |
|---------|----------------------|--------------------|-------------|--|-------|
| File Ed | lit Connection | Setup Display View | Window Help | Slave ID: 1 | OK |
| 🗅 🖨 🛛 | 3 8 1 1 1 2 6 | Slave Definition | F8 | Eunction: 01 Coil Status (0x) V | ancel |
| 📆 Mb | slave1 | Use as Default | | Address mode | |
| ID = 1 | : F = 03 | | | Dec OHex | |
| No co | nnection | | | Address: 0 PLC address = 00001 | |
| | Name | 00000 | | Quantifier 10 | |
| 0 | | 0 | | | |
| 1 | | 0 | | View | |
| 2 | | 0 | | Rows | |
| 3 | | 0 | | ● <u>1</u> 0 ○ <u>2</u> 0 ○ <u>5</u> 0 ○ 10 <u>0</u> ○ Fit to Quantity | |
| 4 | | 0 | | Hide Name Columns PLC Addresses (Base | : 1) |
| 5 | | 0 | | Address in Cell | |
| 6 | | 0 | | | |
| 7 | | 0 | | Error Simulation | |
| 8 | | 0 | | Skip response | or |
| | | | | (Not when using | |

2. Double click on the register value and modify the coil value as follows:

| Name | 00000 |
|------|-------|
| 0 | 1 |
| 1 | 0 |
| 2 | 1 |
| 3 | 0 |
| 4 | 1 |
| 5 | 0 |
| 6 | 1 |
| 7 | 0 |
| 8 | 1 |
| 9 | 0 |

3. Click Connection in the top menu to open the Connect dialog. Configure the Com port settings as shown below, and then press **OK** to start the RTU slave server (in this tutorial we use COM3 as the interface):

Baudrate: 9600 bps Data Bits: 8 Parity: None Stop Bits: 1 Flow Control: None

| 🕉 Modbus Slave - Mbsl | ave1 — | □ × | | |
|------------------------|--|-----------------------------|----------------------------------|--------|
| Eile Edit Connection S | etup <u>D</u> isplay <u>V</u> iew <u>V</u> | <u>M</u> indow <u>H</u> elp | | |
| 🗅 🖨 🖬 🔹 Connect | F3 | | | |
| Disconnect | t F4 | | | |
| ID = 1: F Auto Conn | ect > | | | |
| No conn Quick Con | nect F5 | | Connection Setup | |
| Name | 00000 | | | |
| 0 | 1 | | Connection | OK |
| 1 | 0 | | Serial Port V | |
| 2 | 1 | | | Cancel |
| 3 | 0 | | Serial Settings | |
| 4 | 1 | | MOXA UPort COM Port 1 (COM3) ~ | |
| 5 | 0 | | Mode | |
| 6 | 1 | | 9600 Baud V | |
| 7 | 0 | | 8 Data bits | |
| 8 | 1 | | Flow Control | |
| 9 | U | | None Parity V DSR CTS RTS Toggle | в |
| | | | 1 [ms] RTS disable delay | |
| | | | 1 Stop Bit V | |
| | | | 700.00 | |
| | | | TCP/IP Server | |
| | | | PAddress Po | ort |
| | | | 127.0.0.1 | 32 |
| | | | Any Address IPv4 | |
| | | | Ignore Unit ID IPv6 | |
| Connect | Port 3: 9600-8-N-1 | | | |

Enable the Modbus RTU Master Service on the ioThinx 4510

1. Log in to the ioThinx 4510

Step 1: Open your web browser and browse to the IP address of the device (default: 192.168.127.254).

Step 2: On the login page, type in the username/password (default: admin/moxa) to log in to the Web Console.

2. Click Security (item 1) in the left menu. Select Service Setting (item 2) at the top of the page and then enable the Modbus/RTU Master (item 3) service.

| MOXA | ioThinx | 4510 | | | | | | | |
|--------------------|-----------|------------------|-----------------|--------------------------------|--|-----------------------|------------------------|---------|---------------|
| Dashboard | s | Service Settings | 2 | User Settings | Account Sett | ings | Access Control | Certifi | cate Settings |
| System Security | Service | Settings | | | | | | | |
| Network | | No. | | | Service | | | TCP/UDP | Port |
| Module | | 1 | | | Web Service via HTTP | | | TCP | 80 |
| I/O Serial Port | | 2 | MUST import the | self-signed certificate before | Web Service via HTTPS e enabling the web service via http | s, or the browsers ma | y block the connection | TCP | 443 |
| Internal Register | | 3 | | | RESTful API via HTTP | | | TCP | 80 |
| Protocol + | | 4 | | | RESTful API via HTTPS | | | тср | 443 |
| | | 5 | | 9 | SNMP Agent/Trap/Inform | | | UDP | 161 |
| | | 6 | | | Modbus/TCP Slave | 3 | | TCP | 502 |
| | | 7 | | | Modbus/RTU Master | | | | |
| | | 8 | | | MQTT Client | | | тср | |
| | \square | 9 | | 0 | IOxpress/MCC Tool/MXIO | | | TCP/UDP | 10124/4800 |

Serial Port and Modbus RTU Master Service Setting on the ioThinx 4510

1. Click **Serial Port** in the left menu and configure the serial interface as shown below:

Port 1 Mode: RS-485 2-Wire Baudrate: 9600 bps Data Bits: 8 Parity: None Stop Bits: 1 Flow Control: None

| ΜΟΧΛ | ioThinx 4510 | | | Save & Restart Logout |
|--------------------|-----------------------|---|-------------------|-------------------------|
| Dashboard | Port 1 | | Port 2 | |
| System Security | Port Settings | | | |
| Network Module | Mode RS-485 2-Wire | × | Baudrate 9600 | v |
| I/O Serial Port | Parity | | Data Bits | |
| Internal Register | NONE | ~ | 8 | ~ |
| Protocol + | Stop Bits 1 | ~ | Flow Control None | v |

2. Select ModbusRTUDev_1 (item 1), Enable Device (item 2), and set the Device ID (item 3) to 1.

| Service Enabled Note: enable/disable this service through | Security Service Settings |
|---|---------------------------|
| ModbusRTUDev_1 | |
| Device Setting | |
| Enable Device | 9 |
| Device Name | Device ID |
| ModbusRTUDev_1 | 1 |
| Advanced | |
| Delay between Polls (Unit: 100ms) | |
| 10 | |
| Polling Timeout (Unit: 100ms) | Polling Retries |
| 10 | 3 |
| | |

3. Set up the Modbus RTU parameters to poll the data from the RTU devices.

Point Type: 01 Coil Status (R/W) Start Address: 0 Length: 10 IR Type: BOOL IR Start Index: 0

| Profile Setting - Profile-00 | | |
|--|------|-------------------------|
| Profile Name | | Point Type |
| Profile-00 | | 01: Coil Status (R/W) v |
| Start Address | | Length |
| 0 | | 10 |
| Scan Rate (Unit: 100ms) | | |
| 10 | | |
| IR type | | IR Start Index |
| BOOL | ~ | 0 |
| Swapped Value | | |
| - | ~ | |
| Exception Code Setting - WORD IR Index | | |
| - | ~ | |
| | DELI | ETE this Profile |

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4. Click **Save & Restart** (item 1) in the top right corner of the page and then click **Save and Restart** (item 2) in the center of the page.



The ioThinx 4510 will now poll the data from Modbus RTU devices and save the data to the internal register (IR). You can use either Modbus TCP, MQTT, RESTful API, or SNMP to get the data.

Using SNMP via the iReasoning MIB Browser

Introduction to the iReasoning MIB Browser

The iReasoning MIB browser is a tool for managing SNMP-enabled network devices and applications. It allows users to load MIBs, issue SNMP requests, and receive traps.

Refer to the following web page for detailed information about the iReasoning MIB Browser: http://ireasoning.com/mibbrowser.shtml

Note: You will need to download the **Professional** or **Enterprise** Edition to use SNMPv3.

Enable SNMP Service on the ioThinx 4510

1. Log in to the ioThinx 4510

Step 1: Open your web browser and browse to the IP Address (default: 192.168.127.254). **Step2:** On the login page, type in the username/password (default: admin/moxa) to log in to the Web Console.

2. Click **Security** (item 1) in the left menu. Select **Service Setting** (item 2) at the top of the page and then enable the **SNMP Agent/Trap/Inform** (item 3) service.

| MOXA | ioThinx 4510 | 2 | | | | Save & Restart |
|--------------------|------------------|--|---|----------------------------|---------|----------------|
| Dashboard | Service Settin | igs User Settings | Account Settings | Access Control | Certifi | cate Settings |
| Security 1 | Service Settings | | | | | |
| Network | No. | | Service | | TCP/UDP | Port |
| Module | ⊠ 1 | We | b Service via HTTP | | TCP | 80 |
| I/O Serial Port | 2 | Web MUST import the self-signed certificate before enable | Service via HTTPS ling the web service via https, or the browser | s may block the connection | TCP | 443 |
| Internal Register | 3 | RE | STful API via HTTP | | TCP | 80 |
| Protocol + | □ 4 | RES | STful API via HTTPS | | TCP | 443 |
| 3 | ☑ 5 | SNM | P Agent/Trap/Inform | | UDP | 161 |
| | 6 | м | odbus/TCP Slave | | TCP | 502 |
| | □ 7 | Mc | odbus/RTU Master | | | |
| | 8 | | MQTT Client | | TCP | (T) |
| | g 🛛 | IOxpr | ress/MCC Tool/MXIO | | TCP/UDP | 10124/4800 |

SNMP Settings on the ioThinx 4510

1. Modify the community settings:

Click **Protocol** (item 1) in the left menu, and select **SNMP** (item 2) from the extended menu. Set Version (item 3) to v3 Only.

| ^ ° | ioThinx 4510 | | | |
|------------|-------------------------------------|---|--|---|
| | SNMP | SNMP Trap/Ir | nform | Event Settings |
| | SNMP Settings | | | |
| - 1 | | | | |
| | Service Enabled Note: enable/disabl | le this service through <u>Security Service s</u> | <u>Settings</u> | |
| | Version | v3 Only ~ | 3 | |
| | Contact | | - | |
| | Location | | | |
| | Location | | | |
| | | | | |
| | SNMPv1, SNMPv2c Settings | | | |
| | Read Community | moxapublic | | |
| | Write Community | moxaprivate | | |
| | | | ioThinx 4510 SNMP SNMP Trap/li SNMP Settings Service Enabled Note: enable/disable this service through Security Service. Version v3 Only Contact Location SNMPv1, SNMPv2c Settings Read Community moxapublic Write Community | SIMP SIMP Trap/Inform SIMP Settings Service Enabled Version v3 Only Contact |

2. Type the SNMP parameters shown below in the **SNMPv3 Setting – Read/Write** panel. Username: moxav3rw

Authentication Protocol: SHA-256

Authentication Password: Moxav3rw!

Privacy Protocol: CBC-DES

Privacy Password: Moxav3rw!

| SNMPv3 Settings – Read/Write | | |
|------------------------------|----------|---|
| Username | moxav3rw | |
| Authentication Protocol | SHA-256 | ~ |
| Authentication Password | ••••• | |
| Privacy Protocol | CBC-DES | ~ |
| Privacy Password | ••••• | |

3. Click Save & Restart (item 1) in the top right of the page and then click Save and Restart (item 2) in the center of the page.

| MOXA [®] ioThinx 4510 | 1 Save & Restart Logout |
|--------------------------------|--|
| Dashboard | |
| System | |
| Security | |
| Network | |
| Module | |
| Serial Port | ★ |
| 1/0 | |
| Internal Register | |
| Protocol - | Configuration has been modified |
| Modbus | Do you want to save current setting to device? |
| SNMP | 2 Save and Restart Cancel |
| MQTT | |

Load the MIB File into the iReasoning MIB Browser

1. Download the appropriate version of the ioThinx 4510 MIB firmware from the product page.

https://www.moxa.com/en/products/industrial-edge-connectivity/controllers-and-ios/adva nced-controllers-and-i-os/iothinx-4510-series#resources

| NAME | TYPE | VERSION ~ | OPERATING SYSTEM | RELEASE DATE \sim |
|---|--------------------|-----------|------------------|-------------------------------|
| MIB file for ioThinx 4510 Series 40.3 KB | ↓ Software Package | v1.2.0 | - | Oct 31, 2019 Release notes |

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2. Select **File** \rightarrow **Load MIBs**, and then choose the downloaded ioThinx 4510 MIB file.



3. Expand the MIB Tree in the SNMP MIBs box. If the file was loaded successfully, you will see the ioThinx 4510 private MIB tree.

(Note: This is the only way to verify that the iReasoning MIB Browser was loaded successfully.)



Get and Send Data from iReasoning

Establish a Connection to the ioThinx 4510

1. Enter the IP address of the ioThinx 4510 in the Address field and then click the **Advanced** button.

| 💿 iReasoning MIB Browser | |
|---|-------------------------------|
| File Edit Operations Tools Bookmarks Help | |
| Address: 192.168.127.254 | 1.3.6.1.4.1.8691.10.4510.41.4 |
| SNMP MIBs More propertie | es of current SNMP agent |

2. Change the SNMP Version to 3. Fill in the required parameter as shown below, and then click **OK** to finish the configuration of the SNMP agent.

USM User: moxav3rw

Security Level: auth, priv Auth Algorithm: SHA-256

Auth Password: Moxav3rw!

Privacy Algorithm: DES

Privacy Algorithm Moxav3rw!

| 🚳 Advanced | Properties of SNMP Agent X | |
|--------------------|-------------------------------------|---|
| Address | 192.168.127.243 | 1 |
| Port | 161 | 1 |
| Read Community | |] |
| Write Community | |] |
| SNMP Version | 3 ~ | |
| SNMPv3 | | - |
| USM User | moxav3rw | |
| Security Level | auth, priv 🗸 | |
| Auth Algorithm | SHA256 V | |
| Auth Password | ****** |] |
| Privacy Algorithm | DES ~ | |
| Privacy Password | ****** |] |
| Context Name | |] |
| Engine ID | 0x 80 00 21 F3 03 00 90 E8 76 2E 4C | |
| Localized Auth Key | | |
| Localized Priv Key | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | Ok Cancel | |

How to Use SNMPv3 to Get Modbus RTU Data From the ioThinx 4510 Series

Get Data from the ioThinx 4510

1. Find the **birTable** in the MIB Tree and then click it. The OID will show up in the OID field.



2. Change the **Operation** to **Table View** and then click the Go button. The MIB Browser will generate the birTable and the data from the Modbus RTU devices will be displayed.

| OID: .1.3.6. | 1.4.1.8691.10.451 | 0.41.1 | | | ~ | Operations: | Table View | ~ | in Go |
|--------------|-------------------|----------------|-------------|----------|--------|-------------|------------|---|-------|
| Result Table | 192.168.127.25 | 4 - birTable × | | | | | | | |
| \land Rotate | 🛃 Refresh | Export Export | Poll | SNMP SET | Create | Row | Delete Row | | |
| birIndex | birName | birValue | Index Value | 8 | | | | | |
| 0 | WeatherStatio | 1 | [1] 0 | | | | | | ^ |
| 1 | WeatherStatio | 0 | [2] 1 | | | | | | |
| 2 | WeatherStatio | 1 | [3] 2 | | | | | | |
| 3 | WeatherStatio | 0 | [4] 3 | | | | | | |
| 4 | WeatherStatio | 1 | [5] 4 | | | | | | |
| 5 | WeatherStatio | 0 | [6] 5 | | | | | | |
| б | WeatherStatio | 1 | [7] 6 | | | | | | |
| 7 | WeatherStatio | 0 | [8] 7 | | | | | | |
| 8 | WeatherStatio | 1 | [9] 8 | | | | | | |
| 9 | WeatherStatio | 0 | [10] 9 | | | | | | |

Send Data to the ioThinx 4510

1. Choose the value you want to modify and then click the SNMP SET button.

| 🕭 Rotate | 🔹 Refresh | Export . | Poll SNMP SET Create Row Delete Row |
|-----------|---------------|----------|--|
| bir Index | birName | birValue | Index Value Perform SNMP SET for selected table cells. Hold CTRL key to select multiple cells. |
| 0 | WeatherStatio | 1 | [1] 0 |
| 1 | WeatherStatio | 0 | [2] 1 |
| 2 | WeatherStatio | 1 | [3] 2 |
| 3 | WeatherStatio | 0 | [4] 3 |
| 4 | WeatherStatio | 1 | [5] 4 |
| 5 | WeatherStatio | 0 | [6] 5 |
| 6 | WeatherStatio | 1 | [7] 6 |
| 7 | WeatherStatio | 0 | [8] 7 |
| 8 | WeatherStatio | 1 | [9] 8 |
| 9 | WeatherStatio | 0 | [10] 9 |

2. Modify the value in the $\ensuremath{\mathsf{SNMP}}\xspace$ set dialog then click $\ensuremath{\mathsf{OK}}\xspace$ to send the data.

| SNMP | SET | × |
|-------------|--------------------------------------|---|
| Variable Bi | nd 1 (birValue.1) : | |
| OID | .1.3.6.1.4.1.8691.10.4510.41.1.1.3.1 | |
| Data Type | Integer | ~ |
| Value | 1 | |
| | | |
| Variable Bi | ind 2 (birValue.3) : | |
| OID | .1.3.6.1.4.1.8691.10.4510.41.1.1.3.3 | |
| Data Type | Integer | ~ |
| Value | 1 | |
| | | |
| Variable Bi | nd 3 (birValue.5) : | |
| OID | .1.3.6.1.4.1.8691.10.4510.41.1.1.3.5 | |
| Data Type | Integer | ~ |
| Value | 1 | |
| | | |
| | Ok Cancel | |

3. Check the Modbus Slave Simulator. If the value has been successfully written to the Modbus RTU devices, the value will appear in the table.

| Name | 00000 |
|------|-------|
| Name | 00000 |
| | 1 |
| | 1 |
| | 1 |
| | 1 |
| | 1 |
| | 1 |
| | 1 |
| | 0 |
| | 1 |
| | 0 |