



Horizon Series

Modbus RTU Access Control Protocol

Doc: Jan 2025

Version: 1.0.3

Changelog

Ver	Contents	Symbol	Editor
1.0.0	Created Document	C	Clover, Darren
1.0.1	Added Door Relay Status in 401XY registers	A	Clover
1.0.2	1. Added Door Alarm Status registers: 40004 , 40104 , 40204 , and 40304 .	A	Clover
	2. Modified AC Power Fail and Battery Fail in register 40002 and 40003 which updated to reflect more accurate status definitions	M	Clover
	3. Adjusted logical-to-offset address mapping rules for better clarity. Enhanced Sample Code with improved logical and offset address explanations.	M	Clover
1.0.3	1. Add How to deploy?	A	Clover
	2. Add How to test?	A	Clover

C: Create

A: Add

M: Modify

D: Delete

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1 *Communication Protocol*

Protocol Type: Modbus RTU

Communication Interface: RS-485

Data Format: 1 start bit, 8 data bits, 1 stop bit, no parity

Baud Rates: Supports 9600, 19200, 38400, 57600, 115200 (default: 9600 bps)

Checksum: CRC16

Device Address: Default address is 1, can be modified via DIP switches or configuration software.

Supported Function Codes:

- 03H: Read Holding Registers
- 06H: Write Single Holding Register

2 Communication Parameters

Parameter	Default/Range
Device Address	Default: 1, Range: 1-247
Baud Rate	Default: 9600 bps, Supports: 9600, 19200, 38400, 57600, 115200
Data Bits	8 bits
Stop Bits	1 bit
Parity	None
Timeout	1000ms

Explanation of the Relationship Between Logical Address and Offset Address

3 Relationship Between Logical Address and Offset Address

In Modbus, the logical address (e.g., 40500) is a high-level representation used in documentation or user interfaces to make it easier for humans to read and understand. However, Modbus communication frames use an offset address, which starts from 0.

For example, the logical address 40500 corresponds to the 500th holding register. To calculate the offset address used in the Modbus frame, subtract the base address of the holding register range (40001) from the logical address:

$$\text{Offset Address} = \text{Logical Address} - 40001$$

Example:

$$\text{Logical Address} = 40500$$

$$\text{Offset Address} = 40500 - 40001 = 499$$

In the Modbus frame, this is represented as 0x01F3 (499 in hexadecimal).

4 Register Definitions

4.1 Monitoring Register Definitions

4.1.1 Controller Status(400XY)

Naming Rule

400	X	Y
Controller		Object ID

Controller Status Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40001	Device Online Status	0-1	0	0=Offline, 1=Online
40002	AC Power Fail Status	0-1	0	0=AC Power On 1=AC Power Fail
40003	Battery Fail Status	0-1	0	0=Battery Normal 1=Battery Fail
40004	Tamper Status	0-1	0	0=Normal 1=Tamper

4.1.2 Door Status(401XY)

Naming Rule

The controller can have 1, 2, or 4 doors. Based on the type of controller, the corresponding door objects are retrieved.

401	X	Y
Door	Door ID-1(ex. Door id=4, so X=4-1=3)	Object ID

Door 1 Status Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40100	Door 1 Enable Status	0-2	0	0=Disabled 1=Enabled 2=Locked
40101	Door 1 Door Sensor Status	0-3	0	0=Inactive 1=Active 2=Open 3=Short
40102	Door 1 Request to Exit Button Status	0-3	0	0=Inactive 1=Active 2=Open 3=Short
40103	Door 1 Relay Status	0-1	0	0=Relay Close 1= Relay Open
40104	Door 1 Alarm Status	0-3	0	0=No alarm

				1=Door Forced Open (unauthorized door opening) 2=Door Held Open (door left open beyond the allowed time) 3=Both Door Forced Open and Door Held Open
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Door 2 Status Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40110	Door 2 Enable Status	0-2	0	0=Disabled, 1=Enabled, 2=Locked
40111	Door 2 Door Sensor Status	0-3	0	0=Inactive 1=Active 2=Open 3=Short
40112	Door 2 Request to Exit Button Status	0-3	0	0=Inactive 1=Active 2=Open 3=Short
40113	Door 2 Relay Status	0-1	0	0=Relay Close 1= Relay Open
40114	Door 2 Alarm Status	0-3	0	0=No alarm 1=Door Forced Open (unauthorized door opening) 2=Door Held Open (door left open beyond the allowed time) 3=Both Door Forced Open and Door Held Open

Door 3 Status Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40120	Door 3 Enable Status	0-2	0	0=Disabled, 1=Enabled, 2=Locked
40121	Door 3 Door Sensor Status	0-3	0	0=Inactive 1=Active 2=Open 3=Short
40122	Door 3 Request to Exit Button Status	0-3	0	0=Inactive 1=Active 2=Open 3=Short
40123	Door 3 Relay Status	0-1	0	0=Relay Close 1= Relay Open
40124	Door 3 Alarm Status	0-3	0	0=No alarm 1=Door Forced Open (unauthorized door opening) 2=Door Held Open (door left open beyond the allowed time) 3=Both Door Forced Open and Door Held Open

Door 4 Status Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40130	Door 4 Enable Status	0-2	0	0=Disabled, 1=Enabled, 2=Locked
40131	Door 4 Door Sensor Status	0-3	0	0=Inactive 1=Active 2=Open 3=Short
40132	Door 4 Request to Exit Button Status	0-3	0	0=Inactive 1=Active 2=Open 3=Short
40133	Door 4 Relay Status	0-1	0	0=Relay Close 1= Relay Open
40134	Door 4 Alarm Status	0-3	0	0=No alarm 1=Door Forced Open (unauthorized door opening) 2=Door Held Open (door left open beyond the allowed time) 3=Both Door Forced Open and Door Held Open

4.1.3 Reader Status(402XY)

Naming Rule

402	X	Y
Reader	Reader ID-1(ex. Reader id=8, so X=8-1=7)	Object ID

Reader 1 Status Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40200	Reader 1 Online Status	0-1	0	0=Offline 1=Online
40201	Reader 1 Tamper Status	0-1	0	0=Normal 1=Tamper

Reader 2 Status Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40210	Reader 2 Online Status	0-1	0	0=Offline 1=Online
40211	Reader 2 Tamper Status	0-1	0	0=Normal 1=Tamper

Reader 3 Status Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40220	Reader 3 Online Status	0-1	0	0=Offline 1=Online
40221	Reader 3 Tamper Status	0-1	0	0=Normal 1=Tamper

Reader 4 Status Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40230	Reader 4 Online Status	0-1	0	0=Offline 1=Online
40231	Reader 4 Tamper Status	0-1	0	0=Normal 1=Tamper

Reader 5 Status Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40240	Reader 5 Online Status	0-1	0	0=Offline 1=Online
40241	Reader 5 Tamper Status	0-1	0	0=Normal 1=Tamper

Reader 6 Status Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40250	Reader 6 Online Status	0-1	0	0=Offline 1=Online
40251	Reader 6 Tamper Status	0-1	0	0=Normal 1=Tamper

Reader 7 Status Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40260	Reader 7 Online Status	0-1	0	0=Offline 1=Online
40261	Reader 7 Tamper Status	0-1	0	0=Normal 1=Tamper

Reader 8 Status Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40270	Reader 8 Online Status	0-1	0	0=Offline 1=Online
40271	Reader 8 Tamper Status	0-1	0	0=Normal 1=Tamper

4.1.4 Aux In Status (403XY)

Naming Rule

403	X	Y
-----	---	---

Auxiliary Input	AUX IN ID-1(ex. AUX id=8, so X=8-1=7)	Object ID
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Aux In Status Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40300	AUX IN 1 Status	0-3	0	0=Inactive 1=Active 2=Open 3=Short
40310	AUX IN 2 Status	0-3	0	0=Inactive 1=Active 2=Open 3=Short
40320	AUX IN 3 Status	0-3	0	0=Inactive 1=Active 2=Open 3=Short
40330	AUX IN 4 Status	0-3	0	0=Inactive 1=Active 2=Open 3=Short

4.2 Control Register Definitions

4.2.1 Door Control(405XY)

Naming Rule

405	X	Y
Door Control	Door ID-1(ex. Door id=4, so X=4-1=3)	Object ID

Door Control Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40500	Door 1 Control	0-8	0	See control values below
40510	Door 2 Control	0-8	0	See control values below
40520	Door 3 Control	0-8	0	See control values below
40530	Door 4 Control	0-8	0	See control values below

Control Values (applies to all doors)

Each door has independent control registers, with values ranging from 0 to 6, used to control various door operations. These registers allow for remote door opening, closing, locking, etc.

Value	Action
0	No Operation (Invalid)
1	Remote Door Open
2	Remote Door Close
3	Remote Door Normally Open

4	Cancel Door Normally Open
5	Remote Door Activate Lockdown
6	Remote Door Deactivate Lockdown
7	Enable Intraday Passage Mode Time Zone
8	Disable Intraday Passage Mode Time Zone

4.2.2 Aux Out Control(406XY)

Naming Rule

406	X	Y
Aux Out Control	Aux Out ID-1(ex. Aux Out id=4, so X=4-1=3)	Object ID

Aux Out Control Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40600	Aux Out 1 Control	0-2	0	See control values below
40610	Aux Out 2 Control	0-2	0	See control values below
40620	Aux Out 3 Control	0-2	0	See control values below
40630	Aux Out 4 Control	0-6	0	See control values below

Control Values (applies to all AUX Output)

Value	Action
0	No Operation (Invalid)
1	Remote AUX OUT Open
2	Remote AUX OUT Close
3	Remote AUX OUT Normally Open
4	Cancel AUX OUT Normally Open
5	Enable AUX OUT Intraday Normally Open Mode Time Zone
6	Disable AUX OUT Intraday Normally Open Mode Time Zone

4.3 Configuration Register Definitions

4.3.1 Configuration (407XX)

Naming Rule

407	XX
Configuration	Object ID

Configuration Registers

Register Address	Parameter	Decimal Range	Decimal Points	Description
40700	RS-485 Device Address	1-247	0	Modify the RS-485 device address (default: 1).

5 Modbus Function Code Descriptions

Function Code	Name	Description
03H	Read Holding Registers	This function code allows the master to read the status and data from the slave. Monitoring registers and configuration information are read using this function code.
06H	Write Single Holding Register	This function code allows the master to send control commands to the slave. Control values are written into the control registers defined above.

6 Communication Frame Examples

6.1 Remote Door 1 Open

Write to register **40500** with the value of 1, which represents remote door opening.

Logical Register Address (40500): The actual address in the Modbus frame is calculated as $40500 - 40001 = 499$, which is $0x01F3$ in hexadecimal.

Request Frame:

01 06 01 F3 00 01 29 30

0x01 0x06	0x01 0xF3
0x01: Slave Address 0x06: Function Code (Write Single Register)	Register Offset Address (499, corresponding to 40500)
0x00 0x01	0x29 0x30
Data to Write (1=Remote Door Open)	CRC Checksum

Response Frame:

01 06 01 F3 00 01 29 30

The response frame is identical to the request frame, indicating a successful write.

6.2 Remote Door2 Activate Lockdown

Write to register **40510** with the value of 5, which represents remote door locking.

Logical Register Address (40510): The actual address in the Modbus frame is calculated as 40510 - 40001 = 509, which is 0x01FD in hexadecimal.

Request Frame:

01 06 01 FD 00 05 68 30

0x01 0x06	0x01 0xFD
0x01: Slave Address 0x06: Function Code (Write Single Register)	Register Offset Address (509, corresponding to 40510)
0x00 0x05	0x68 0x30
Data to Write (5=Remote Door Lock)	CRC Checksum

Response Frame:

01 06 01 FD 00 05 68 30

The response frame is identical to the request frame, indicating a successful write.

6.3 Read Door 3 Enable Status

Read register **40120** to check whether Door 3 is enabled or locked.

Logical Register Address (40120): The actual address in the Modbus frame is calculated as 40120 - 40001 = 119, which is 0x0077 in hexadecimal.

Request Frame:

01 03 00 77 00 01 45 D3

0x01 0x03	0x00 0x77
0x01: Slave Address 0x03: Function Code (Read Holding Registers)	Register Offset Address (119, corresponding to 40120)
0x00 0x01	0x45 0xD3
Number of Registers to Read (1)	CRC Checksum

Response Frame:

01 03 02 00 02 79 84

0x01 0x03	0x02
0x01: Slave Address 0x03: Function Code	0x02: Data (2 = Locked)
0x00 0x02	0x79 0x84
0x02: Enable Status (2=Locked)	CRC Checksum

6.4 Read Reader 1 Status

Read register **40200** to get the online/offline status of Reader 1.

Logical Register Address (40200): The actual address in the Modbus frame is calculated as 40200 - 40001 = 199, which is 0x00C7 in hexadecimal.

Request Frame

01 03 00 C7 00 01 45 8E

0x01 0x03	0x00 0xC7
0x01: Slave Address 0x03: Function Code (Read Holding Registers)	Register Offset Address (199, corresponding to 40200)
0x00 0x01	0x45 0x8E
Number of Registers to Read (1)	CRC Checksum

Response Frame

01 03 01 00 01 B8 44

0x01 0x03	0x01
0x01: Slave Address 0x03: Function Code	0x01: Data (1 = Online)
0x00 0x01	0xB8 0x44
0x01: Register Data (Reader 1 Status=online)	CRC Checksum

7 Notes

Device Address Conflicts: Ensure that each device on the Modbus bus has a unique address.

Matching Communication Parameters: The baud rate, parity, stop bits, etc., of the master and slave devices must match, or communication will fail.

CRC Checksum: All Modbus RTU communication frames must include a CRC16 checksum to ensure data transmission accuracy.

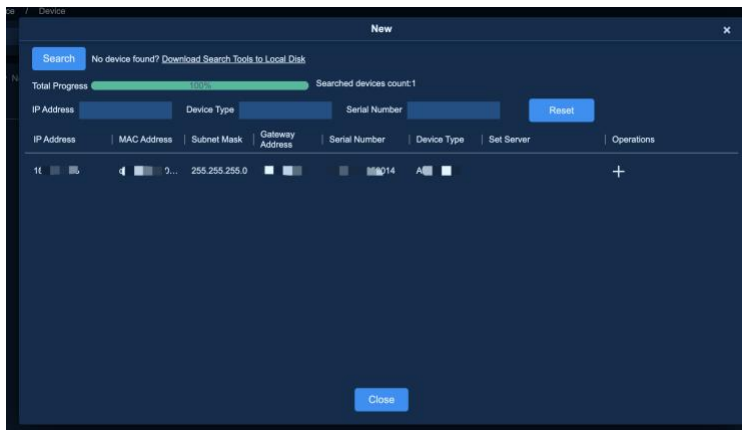
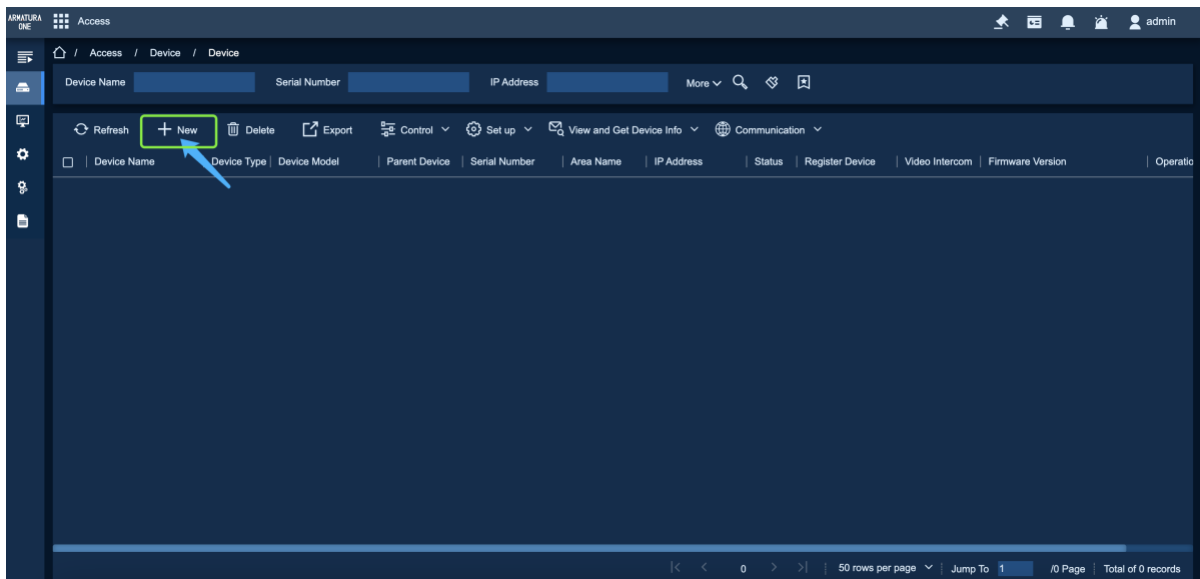
8 How to deploy?

8.1 Preparation

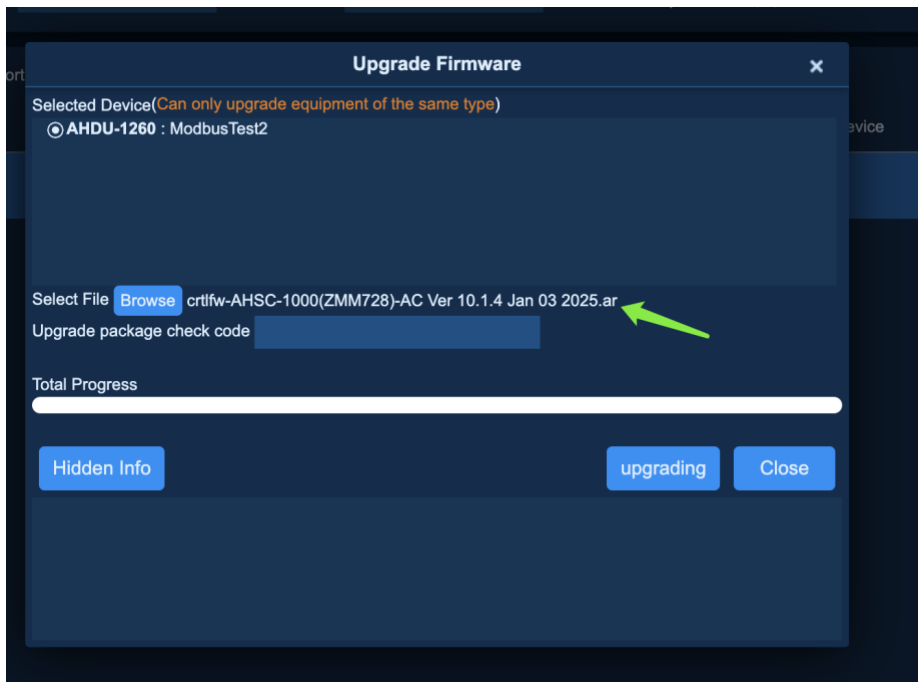
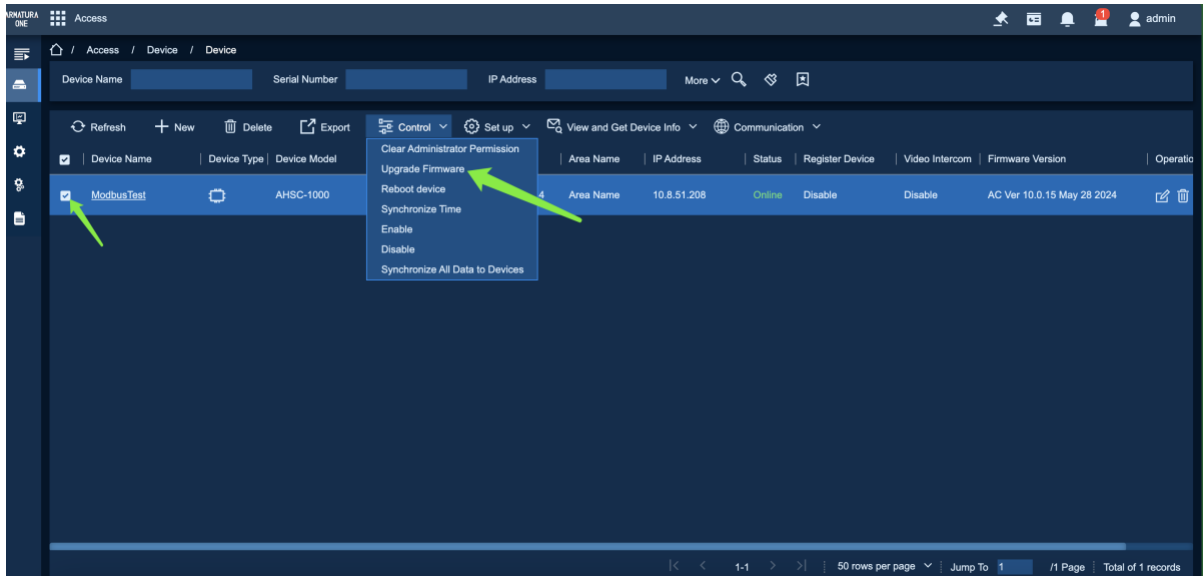
Model	Version
Armatura One	Armatura ONE 4.0.2_RELEASE_OCM2185
AHSC/AHDU Controller	Before Update: AC Ver 10.0.15 May 28 2024 After Update: AC Ver 10.1.4 Jan 3 2025

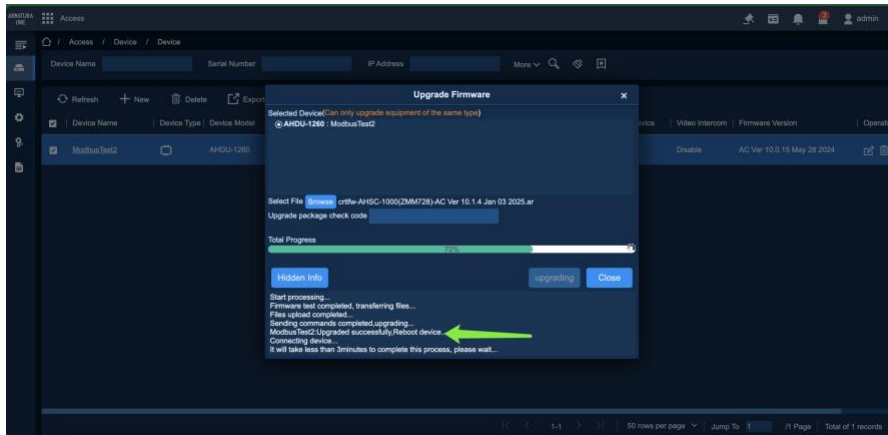
8.2 Add device and Upgrade Firmware

1. Search and add device to software

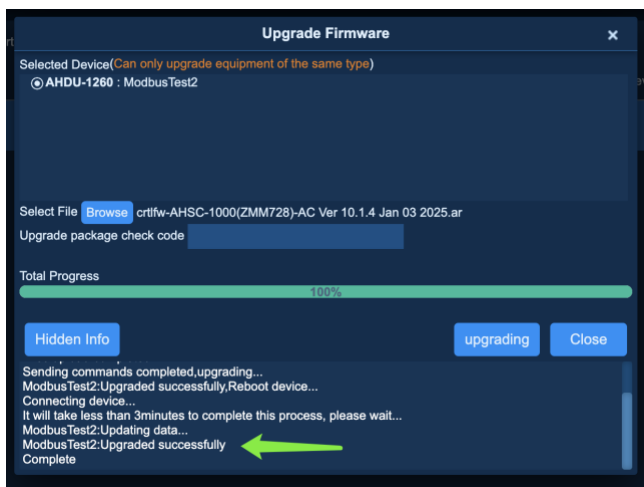


2. Select device and click “Upgrade Firmware”

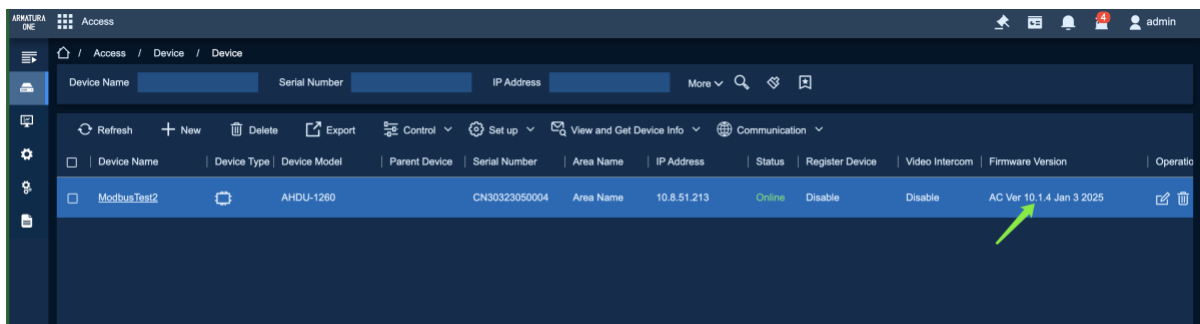




3. When upgrading, Device will reboot

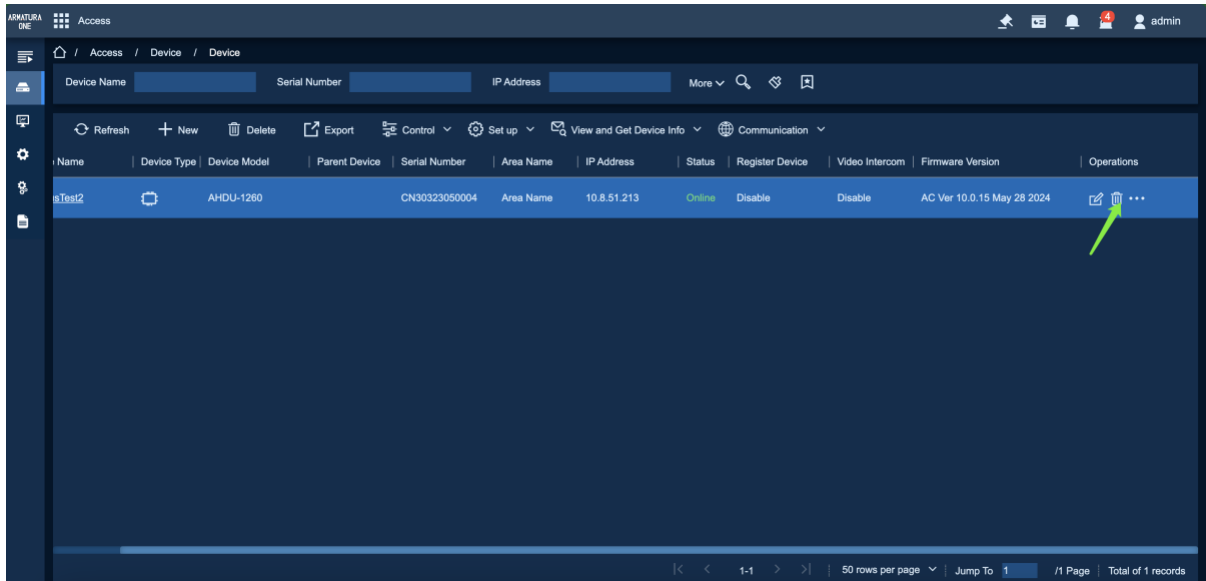


4. After Upgrade, Device firmware will become **AC Ver 10.1.4 Jan 3 2025**

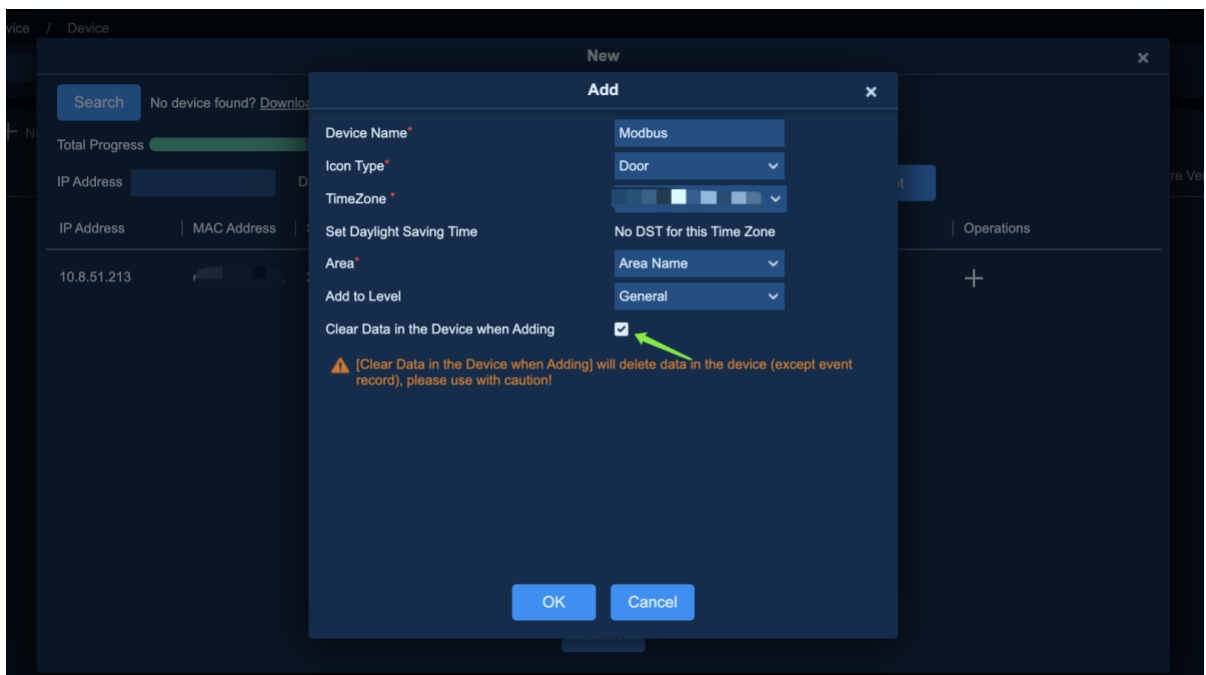


8.3 Initial Device Setting

1. Delete Device

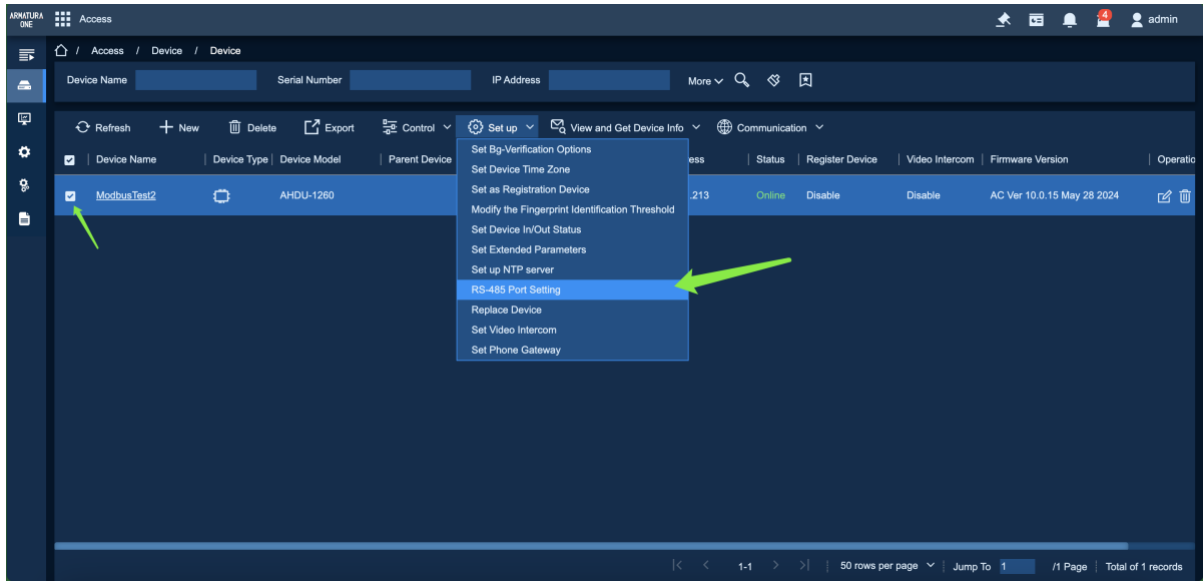


2. Readd Device and select “Clear Data in the Device when Adding”

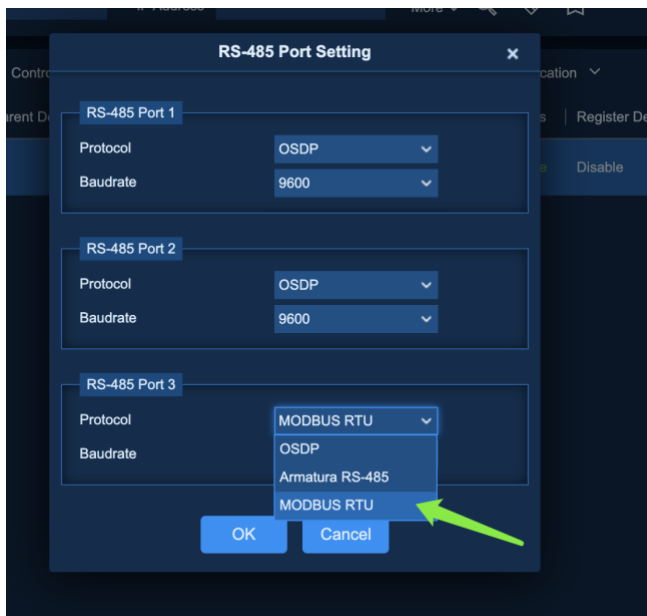


8.4 Controller Modbus Setting

1. Select device and click “Rs-485 Port Settings”



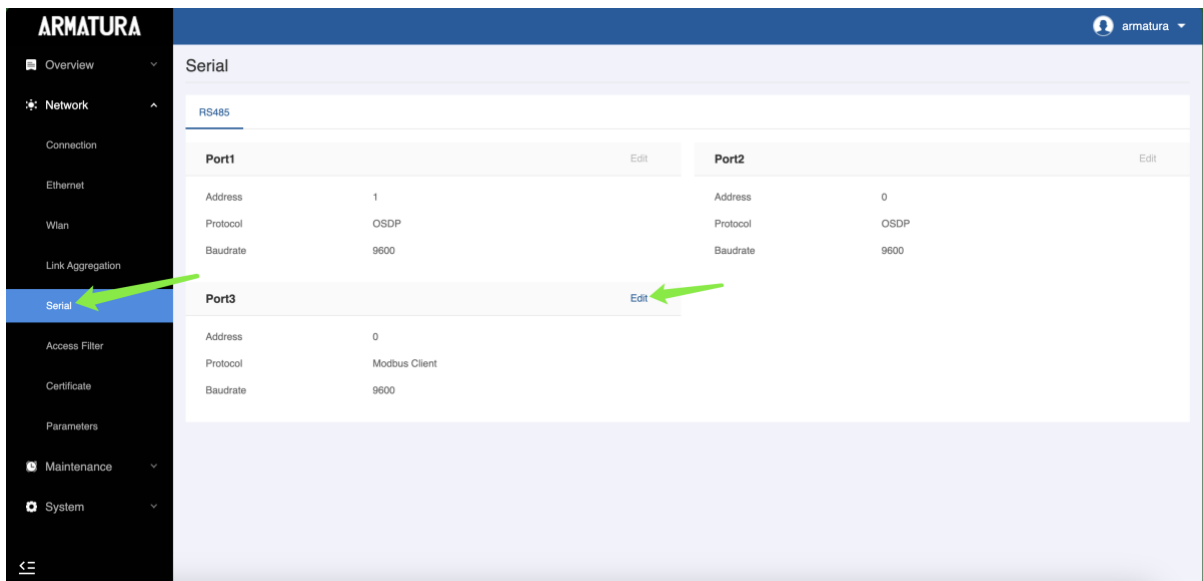
2. Select the correct port and set protocol as “Modbus RTU”



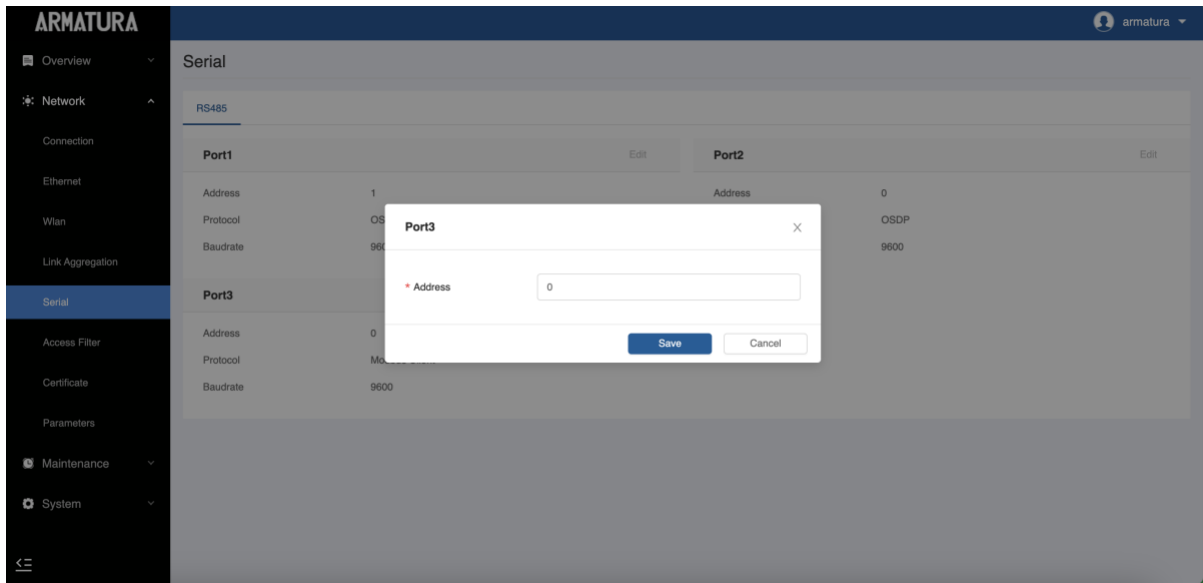
3. Login Controller Webserver



4. Set RS-485 Address



5. Set Address

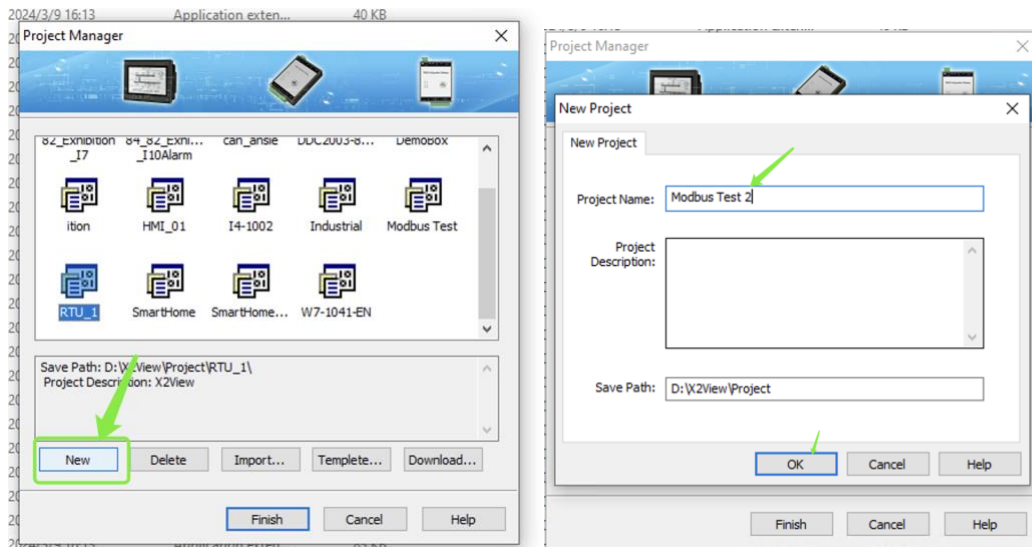


9 How to test?

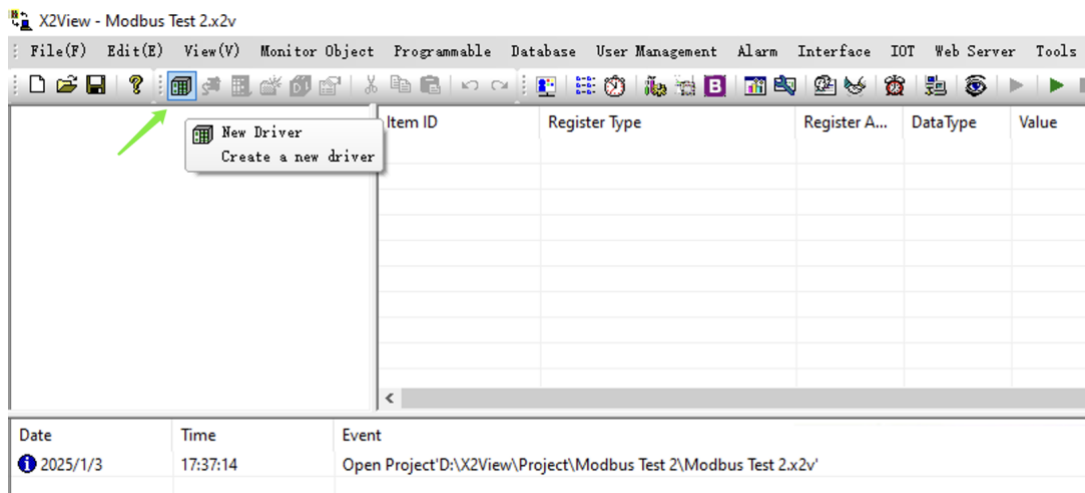
The AHPG1000 serves as our versatile communication gateway, fully supporting both Modbus and BACnet protocols. Schneider's EcoStruxure system is a building management platform, and our goal is to ensure that the AHDU's data can be collected by this system in the future. However, since we are unable to deploy the EcoStruxure system locally, we use the AHPG1000 to simulate its integration, enabling efficient connection with the AHDU for data acquisition and control testing. This approach ensures smooth communication and compatibility between the systems, paving the way for future interoperability.

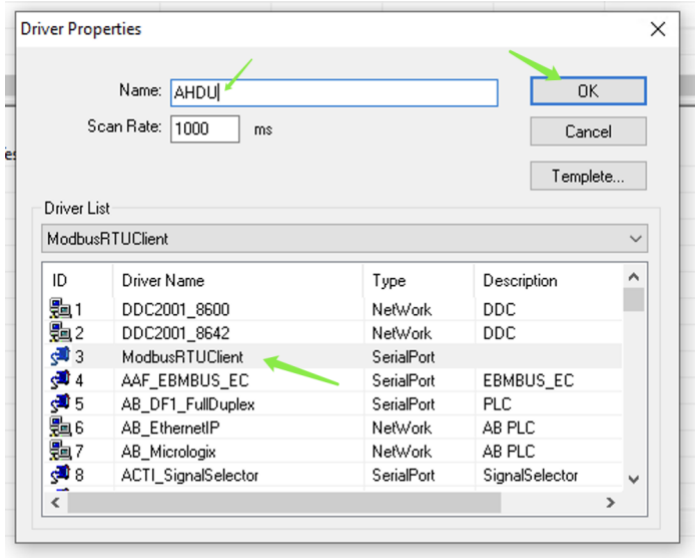
9.1 AHPG1000 Debug

1. create project

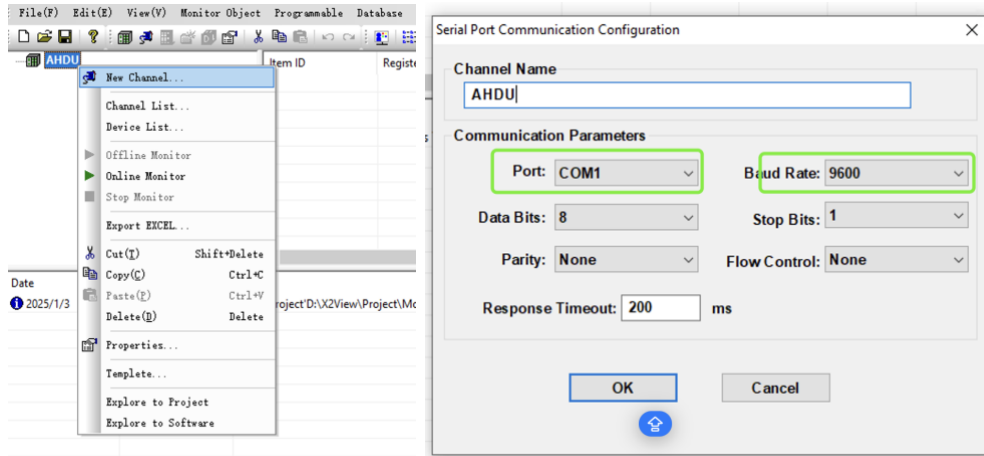


2. Create New Driver

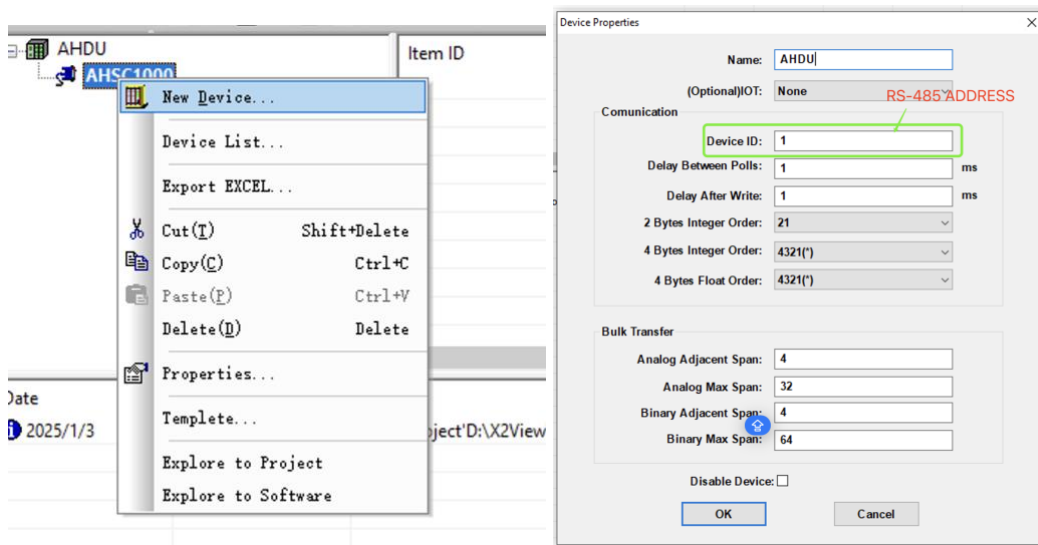




3. Create New Channel

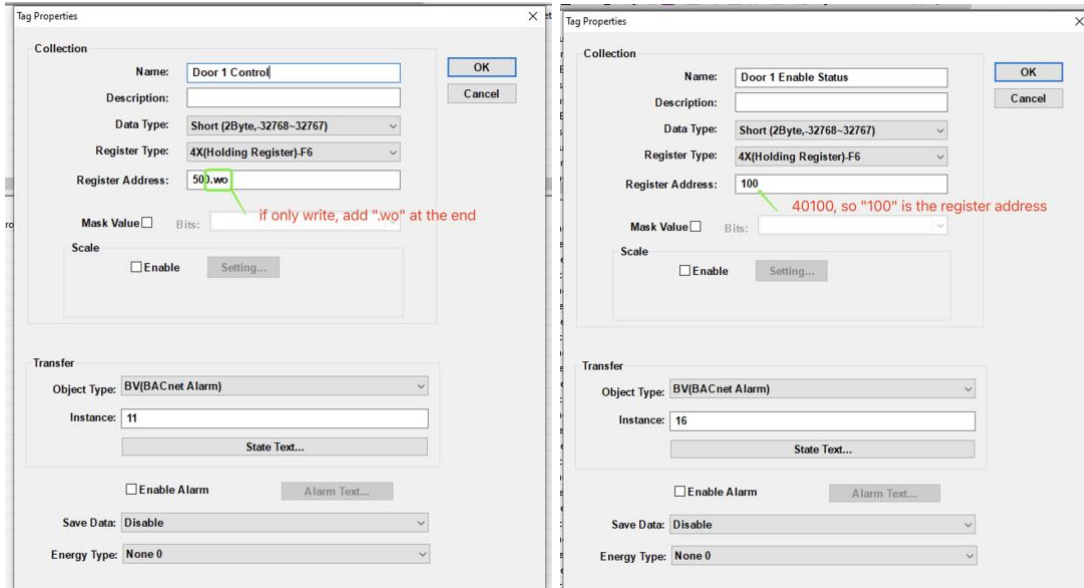


4. Create New Device

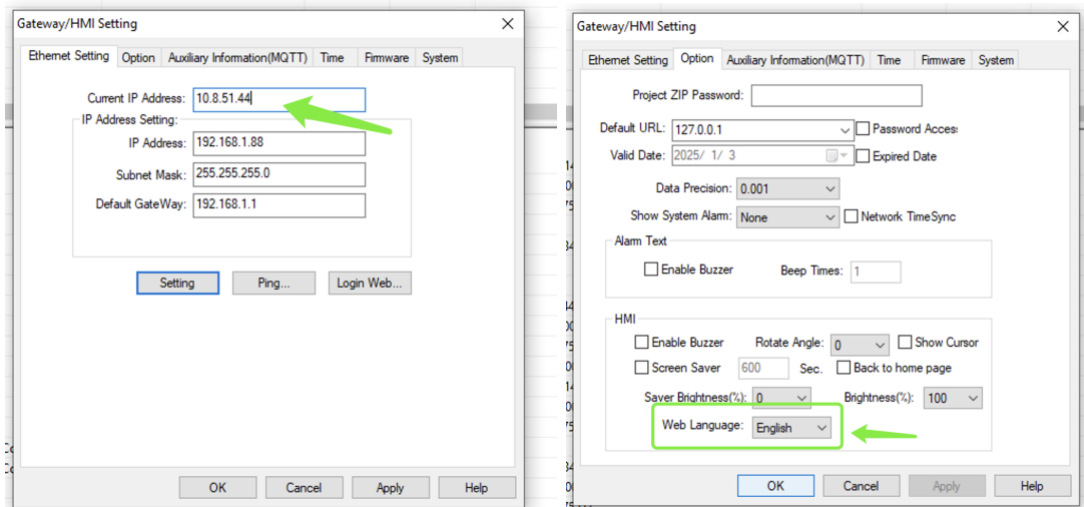
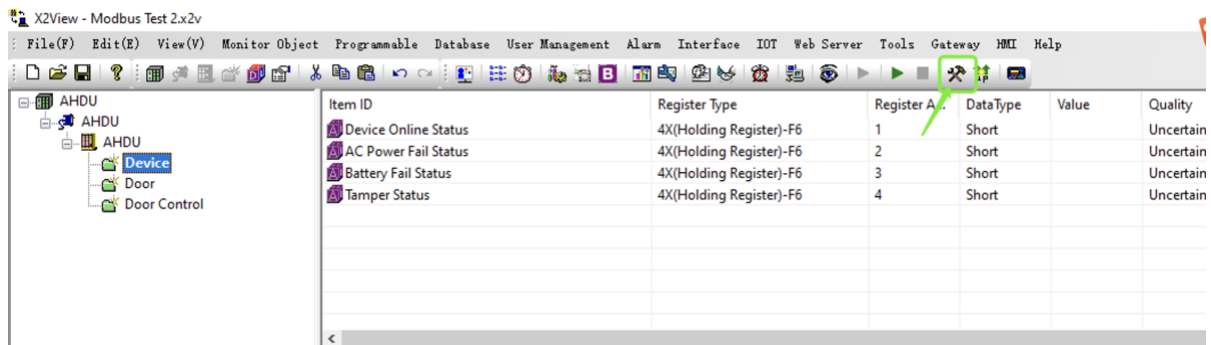


5. Create New Tag

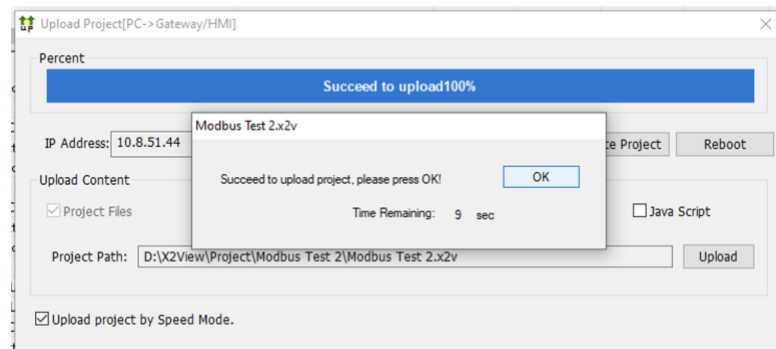
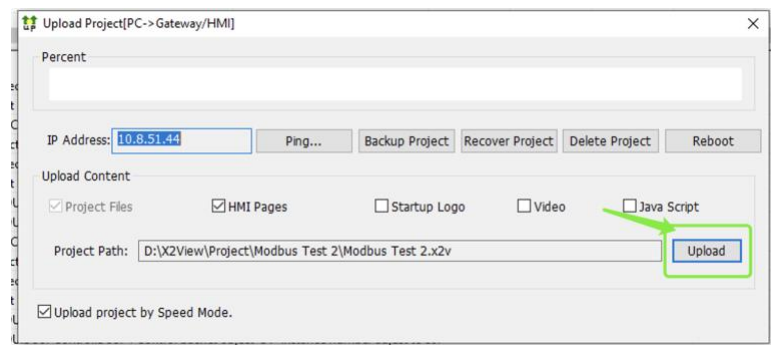
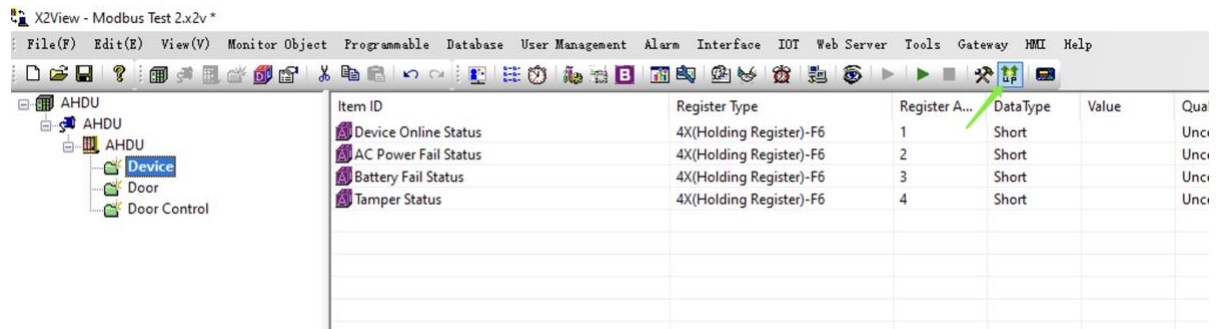
If Register Address is "40100" so select Register Type is 4X (Holding Register), Address is 100, if only for door control, add '.wo' at the end of address



6. Set Target AHPG-1000 address



7. Upload Project



8. Login AHPG1000 Webserver [Address: <http://AHPG1000Address>]

English

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Tag List

Tag Name	Register Name	Address	Data Type	Value	Quality	TimeStamp	Object Type	Instance Number	Description
Device Online Status	4X(Holding Register)-F6	1	Short	1	good	2025-01-03T18:07:47+08:00	BV	12	
AC Power Fail Status	4X(Holding Register)-F6	2	Short	0	good	2025-01-03T18:07:47+08:00	BV	13	
Battery Fail Status	4X(Holding Register)-F6	3	Short	0	good	2025-01-03T18:07:47+08:00	BV	14	
Tamper Status	4X(Holding Register)-F6	4	Short	1	good	2025-01-03T18:07:47+08:00	BV	15	

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9. Select Language as “English”

English

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Tag List

Tag Name	Register Name	Address	Data Type	Value	Quality	TimeStamp	Object Type	Instance Number	Description
Device Online Status	4X(Holding Register)-F6	1	Short	0	good	2025-01-03T18:14:45+08:00	BV	12	
AC Power Fail Status	4X(Holding Register)-F6	2	Short	0	good	2025-01-03T18:14:45+08:00	BV	13	
Battery Fail Status	4X(Holding Register)-F6	3	Short	0	good	2025-01-03T18:14:45+08:00	BV	14	
Tamper Status	4X(Holding Register)-F6	4	Short	1	good	2025-01-03T18:14:45+08:00	BV	15	

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