EMU-200 Series

Arm-based IoT Gateway

User's Manual



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LEADING EDGE COMPUTING

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Revision History

Revision	Release Date	Description of Change(s)
1.0	2023-10-03	Initial release

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Preface

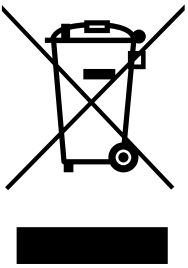
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Conventions

Take note of the following conventions used throughout this manual to make sure that users perform certain tasks and instructions properly.

NOTE: Additional information, aids, and tips that help users perform tasks.

CAUTION: Information to prevent ***minor*** physical injury, component damage, data loss, and/or program corruption when trying to complete a task.

WARNING: Information to prevent ***serious*** physical injury, component damage, data loss, and/or program corruption when trying to complete a specific task.

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1 Introduction

The EMU-200 Series IoT Energy Gateway provides communication conversion between different Ethernet or serial-based protocols allowing for wider integration of devices into a network with the ability to send data to the cloud. The EMU-200 Series is designed to work under a large variety of applications such as monitoring energy consumption, electric vehicle charging control and monitoring, solar power monitoring, and smart manufacturing.

1.1 Features

- Python-enabled programmable open platform for customized applications at the edge
- Supported communication protocols for powered devices including Modus TCP/RTU, MQTT, OPCUA and Restful
- Supports Azure, AWS cloud connection
- Flexible configuration for different user scenarios with EGiFlow
- 2x RS-232/422/485 ports for serial communication with Modbus RTU protocol
- Two 1 Gb Ethernet ports for cascading
- WiFi and cellular communication (optional)
- SD card for external storage

1.2 Applications

- Asset energy management
- Power consumption monitoring
- Solar and wind power generation monitoring
- ESG Policy for Energy Management System
- IoT for Smart Factory
- Electric Vehicle Charging Control and Monitoring System

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1.3 Specifications

Model	EMU-200	EMU-200-W
System		
Processor	ARM Cortex A9 1.0 GHz	
Memory	1 GB DDR3	
NAND Flash (eMMC)	32 GB eMMC	
WiFi	N/A	2.4GHz/5GHz
OS	Debian 11	
Configuration Interface	EGiFlow Interface	
I/O Interface		
Ethernet	2x RJ45 10BASE-T/100BASE-TX/1000BASE-T ports	
Serial Ports	2x RS-232/422/485, 300 bps to 115.2 kbps	
USB	2x USB 2.0 Type-A (front panel)	
Antenna	5	
M.2	1	
Micro-SIM	1	
Storage		
Storage Slot	1x microSD	
Mechanical		
Dimensions	110.90 (L) x 40 (W) x 131.4 (H) mm	
Weight	307g	
Mounting	DIN rail kit / wall mount kit	
Housing	Metal, IP40	
Power Supply		
DC Input	9 to 30V	
Environmental		
Operating Temperature	-40°C to 70°C	
Storage Temperature	-40°C to 85°C	
Humidity	approx. 95% @ 40°C (non-condensing)	
Vibration Resistance	IEC 60068-2-64 compliant Operating: 2 Grms, 5-500 Hz, 3 axes	
Shock Resistance	IEC 60068-2-27 compliant Operating: 20 G, Pulse width: 11 ms duration, 3 times per axis	

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Model	EMU-200	EMU-200-W
Certifications		
EMC	CE/FCC/ICES-003/RCM/BSMI, Class A EN 55032, EN 55035, EN 61000-6-2, EN 61000-6-4, CNS 15936	
Safety	IEC/EN/UL 62368-1	
RF	N/A	CE-RED (EN 300328, EN300440, EN 301489 -1/-17, EN301893), RCM, FCC, ISED, NCC

Model	EMU-200-W	
Function	**Frequency**	**Maximum Output Power (EIRP)**
WiFi	2412MHz to 2472MHz	20dBm
	5180MHz to 5240MHz	19dBm
	5745MHz to 5825MHz	13.98dBm

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1.4 Functional Block Diagram

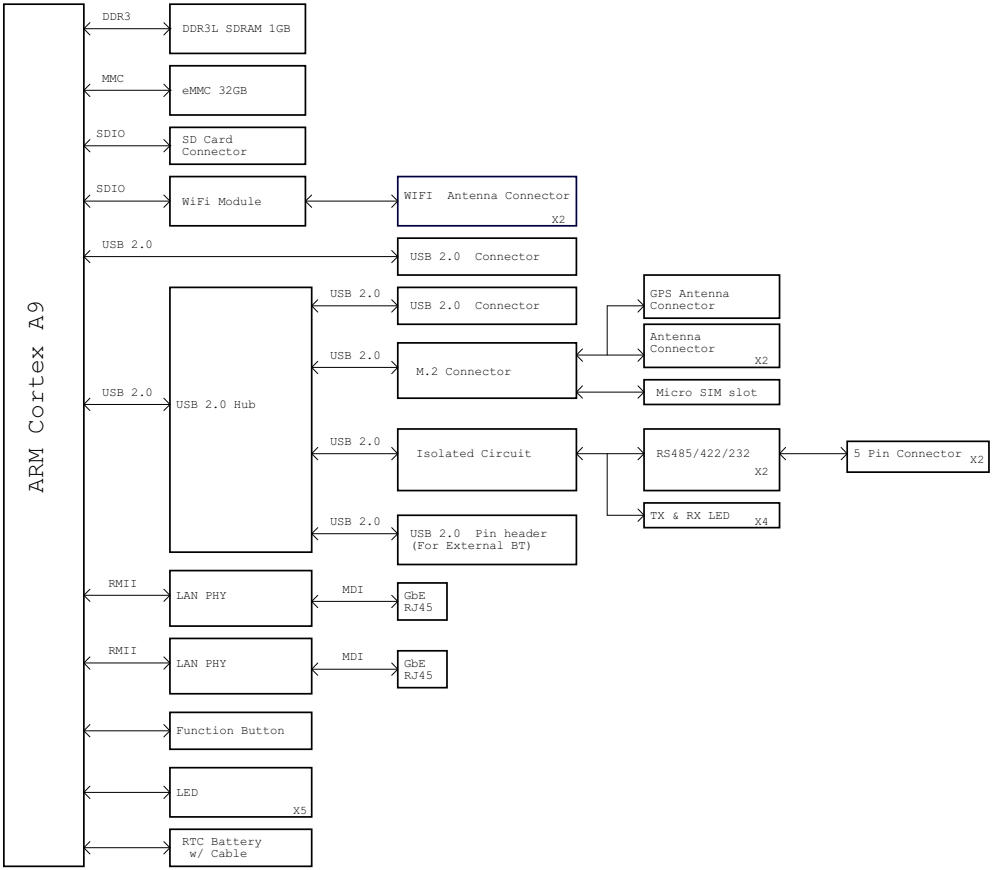


Figure 1-1: Functional Block Diagram

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1.5 Mechanical Drawings

NOTE: All dimensions are in millimeters unless noted.

1.5.1 Dimensions

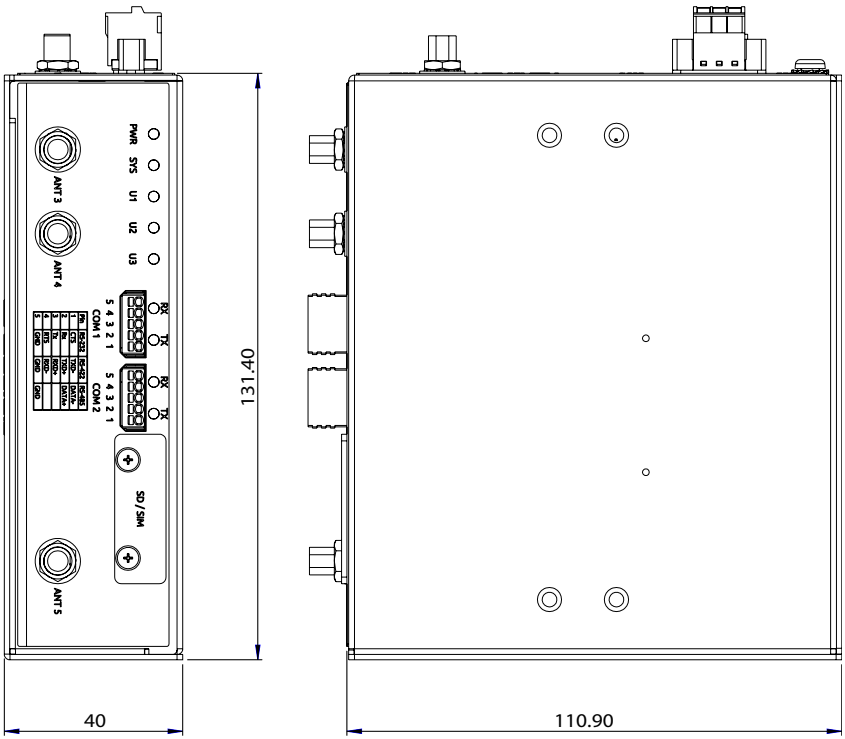


Figure 1-2: EMU-200 Series Dimensions

1.5.2 DIN Rail Mounting

The DIN rail mount can be attached to the EMU-200 Series with two screws included in the wall mounting kit.

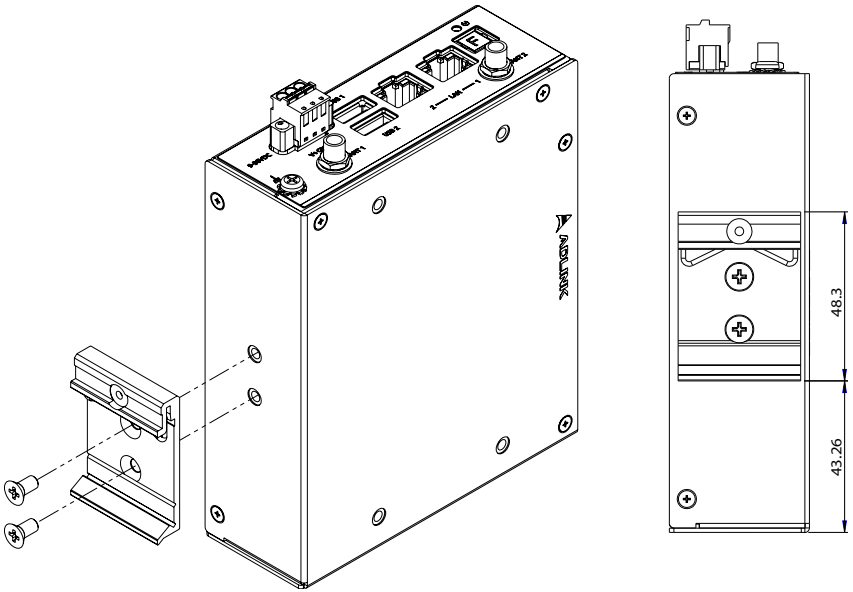


Figure 1-3: DIN Rail Mount 1

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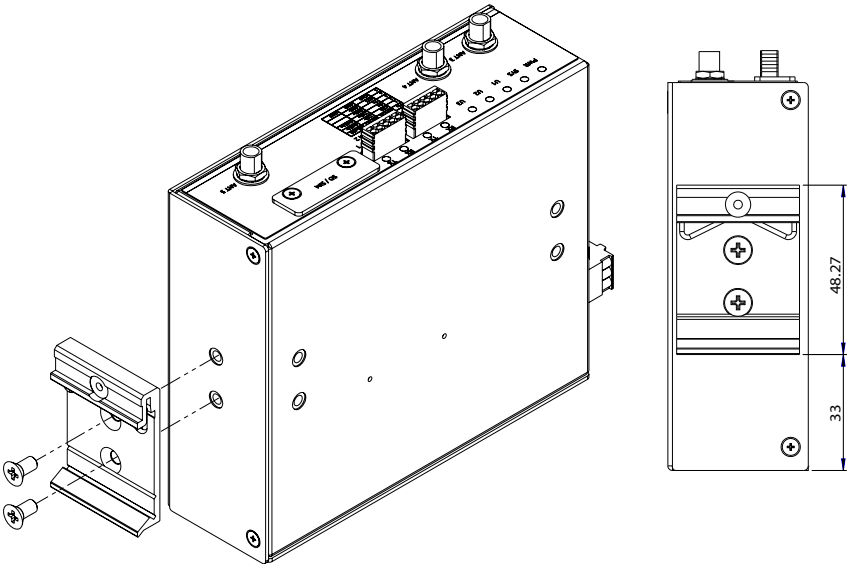


Figure 1-4: DIN Rail Mount 2

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1.5.3 Wall Mounting

Each wall mount bracket can be attached to the EMU-200 Series with two screws included in the wall mounting kit.

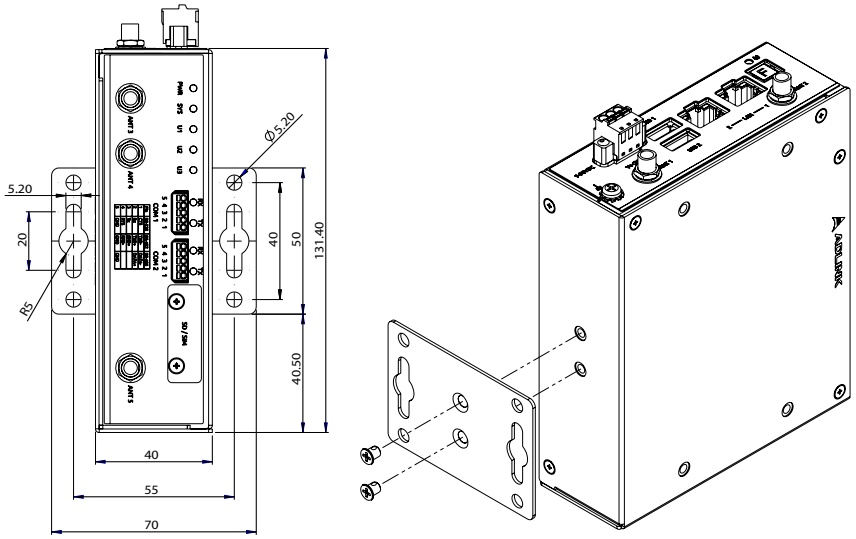


Figure 1-5: Wall Mount 1

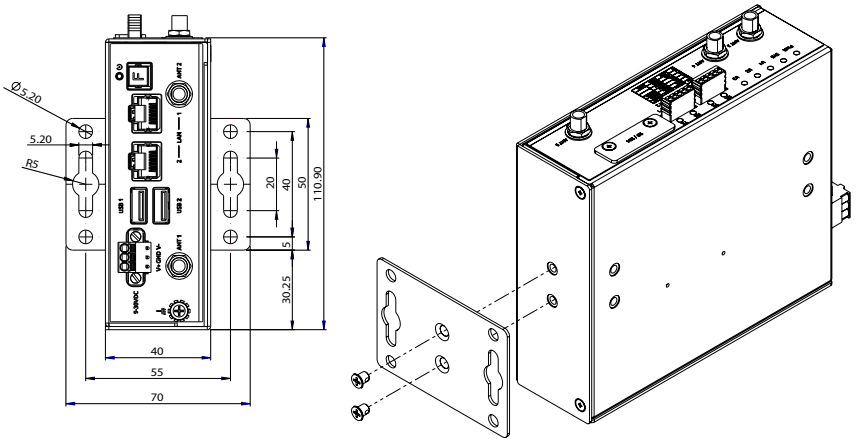


Figure 1-6: Wall Mount 2

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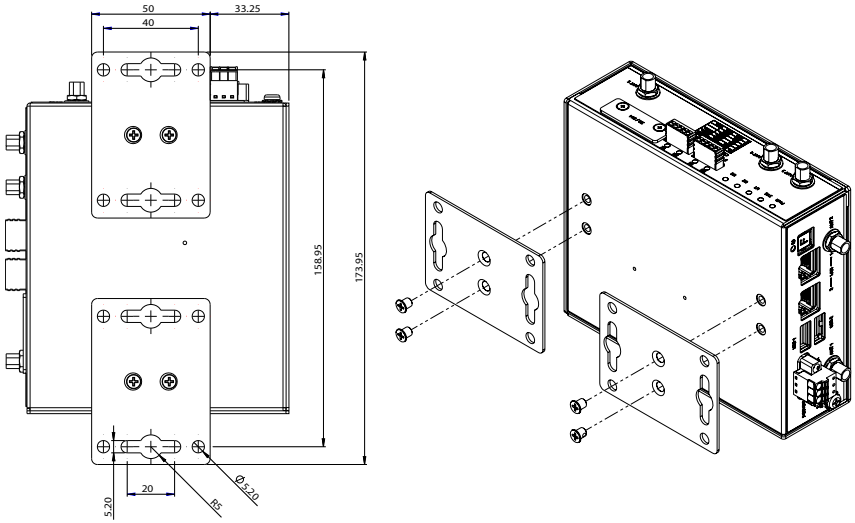


Figure 1-7: Wall Mount 3

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1.6 I/O Connectors

The EMU-200 Series provides rich peripherals, including:

- 2 RS-232/422/485 ports (COM1, COM2)
- 2 Gigabit Ethernet ports
- 1 microSD slot
- 1 Micro-SIM slot
- 2 USB 2.0 Type-A ports
- 5 antenna ports
- 9 status indicator LEDs
- 1 system reset button
- Function Key

1.6.1 Gigabit Ethernet Ports

There are two Gigabit Ethernet (GbE) ports on the front panel with two MAC address. Either port can be used for connecting to a host PC

- LAN1: The default is DHCP
- LAN2: The default static IP address is 192.168.50.2

Pin	10BASE-T/ 100BASE-TX	1000BASE-T
1	TX+	LAN_TX0+
2	TX-	LAN_TX0-
3	RX+	LAN_TX1+
4	-	LAN_TX2+
5	-	LAN_TX2-
6	RX-	LAN_TX1-
7	-	LAN_TX3+
8	-	LAN_TX3-

Table 1-1: Ethernet Port Pin Definition

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LED1 (Orange)	LED2 (Green)	Link/Activity
OFF	OFF	Link off
OFF	ON	1000 Link/Activity (Tx, Rx)
ON	OFF	100 Link/Activity (Tx, Rx)
ON	ON	10 Link/Activity (Tx, Rx)

Table 1-2: Active/Link/Speed LED Indicators

1.6.2 LED Indicators

The EMU-200 Series has nine LEDs located on the front panel.

LED	Function	Description
PWR (Green)	Power input	▶ OFF: Device is not powered ▶ Steady green: Device is powered
SYS (Red/Green)	Boot up and system status	▶ OFF: Powered off ▶ Green LED flashing slowly: Booting up ▶ Green LED steady on: Boot up completed without errors ▶ Red LED steady on: Boot up with errors indicates hardware issues with the WiFi module or COM ports.
U1 (Green)	User LED1	User-programmable LED1
U2 (Green)	User LED2	User-programmable LED2
U3 (Green)	User LED3	User-programmable LED3
COM1 TX (Green)	COM1 TX LED	Data is being transmitted at serial port 1
COM1 RX (Red)	COM1 RX LED	Data is being received at serial port 1
COM2 TX (Green)	COM2 TX LED	Data is being transmitted at serial port 2
COM2 RX (Red)	COM2 RX LED	Data is being received at serial port 2

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1.6.3 USB 2.0 Ports

The EMU-200 Series provides two USB 2.0 Type-A ports. All USB ports are compatible with high-speed, full-speed and low-speed USB devices. USB ports can be used to add a USB dongle.

1.6.4 Reset Button

Restore the EMU-200 Series to factory default settings using a paper clip or similar item inserted into the reset pin hole and pressing the reset button until the device reboots.

Item	Default Value
username	root
password	adlink
COM Port 1	RS-485/9600/N/8/1
COM Port 2	RS-485/9600/N/8/1
LAN 1	DHCP
LAN 2	Static IP:192.168.50.2
WiFi	▶ Disconnect WiFi network connection ▶ Clean all parameters
Cellular (optional)	▶ Disconnect cellular network connection ▶ Clean all parameters

1.6.5 Antenna Ports

Antenna ports ANT1-5 support the functions listed below.

Antenna ID	Function
ANT1	WiFi Main
ANT2	WiFi Aux
ANT3	LTE Main
ANT4	GNSS
ANT5	LTE Aux

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1.6.6 COM Port Connectors

The EMU-200 Series provides four COM ports through 5-pin connectors. The COM1 & COM2 ports support RS-232/422/485 modes. (Default RS-485)

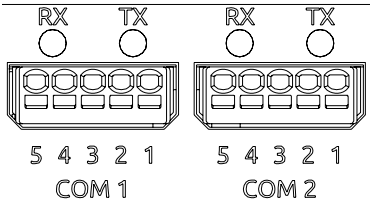


Figure 1-8: COM Port Pin Definition

Pin	Signal		
	RS-232	RS-422	RS-485
1	CTS	TXD-	DATA-
2	Rx	TXD+	DATA+
3	Tx	RXD+	
4	RTS	RXD-	
5	GND	GND	GND

Table 1-3: 5-pin Signal Function of COM Ports

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1.6.7 DC Power Input

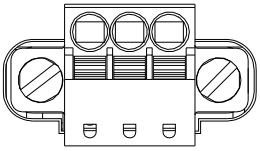


Figure 1-9: DC Power Input

Pin	Signal
1	V+ (DC_IN)
2	GND
3	V-

Table 1-4: DC Power Input Pin Definition

Use an approved power source as certified by IEC or UL. If you need an adaptor, optional accessories or further assistance, contact ADLINK for further information.

- Tma: 50°C
- Operating altitude: up to 2000 m, with LPS and SELV (ES1) compliant circuits

Power Source Rating

	Voltage	Current
DC Power Source	9 to 30V DC	1.68A to 0.51A
AC-to-DC Adapter	24V DC	0.63A



Before providing DC power, ensure the voltage and polarity provided are compatible with the DC input. Improper input voltage and/or polarity can cause system damage.

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Veuillez utiliser une source d'alimentation approuvée et certifiée par IEC ou UL.

Si vous avez besoin d'un adaptateur d'appareil, d'accessoires en option ou d'une assistance supplémentaire, veuillez contacter ADLINK pour plus d'informations.

- *Tma: 50°C*
- *L'altitude pendant le fonctionnement est jusqu'à 2000 m dont la sortie répond aux circuits LPS et SELV (ES1)*

Évaluation de la source d'alimentationg

	Tension	***Courant***
Source d'alimentation CC	*9 à 30V DC*	*1.68A à 0.51A*
Adaptateur CA vers CC	*24V DC*	*0.63A*



AVERTISSEMENT: Avant de fournir une alimentation CC à l'appareil, assurez-vous que la tension et la polarité fournies sont compatibles avec l'entrée CC. Une mauvaise tension d'entrée et / ou polarité peut être responsable des dommages au système.

1.6.8 Micro-SIM Slot

Insert a micro-SIM card into the slot. Make sure it is properly aligned and inserted all the way. Once the card is inserted, the EMU-200 Series can connect to a cellular network and access the Internet.

1.6.9 microSD Slot

Insert a microSD card into the slot for additional storage.

1.6.10 Function Key

Pressing the Function key for eight seconds will cause the system to reboot.

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2 Getting Started

2.1 Unpacking the EMU-200 Series

Ensure that the following items are included in the package. If any items are missing, contact your sales representative for assistance.

- EMU-200 Series
- DIN rail mount kit with 2x flat head screws
- Wall mount kit with 4x pan head screws
- Quick Start Guide
- Optional accessories (if applicable):
  - 40W AC-DC adapter



Before unpacking, check the shipping carton for any damage. If the shipping carton and/or contents are damaged, inform your dealer immediately. Retain the shipping carton and packing materials for inspection. Obtain authorization from your dealer before returning any product to ADLINK.

Déballage de la série EMU-200

Assurez-vous que les éléments suivants sont inclus dans le colis. Si des éléments sont manquants, veuillez contacter votre représentant commercial pour obtenir de l'aide.

- *EMU-200 Série*
- *Kit de montage sur rail DIN avec 2 vis à tête plate*
- *Kit de montage mural avec 4 vis à tête cylindrique*
- *Guide de Démarrage Rapide*
- *Accessoires optionnels (si applicables):*
  - *Adaptateur AC-DC 40W*



AVERTISSEMENT: Avant de déballer, vérifiez l'emballage d'expédition pour tout dommage. Si l'emballage d'expédition et/ou le contenu sont endommagés, informez immédiatement votre revendeur. Conservez l'emballage d'expédition et les matériaux d'emballage pour inspection. Obtenez l'autorisation de votre revendeur avant de retourner tout produit à ADLINK.

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2.2 Connecting to I/O

1 For serial ports, insert the signal wires into the terminal block.

2. Use a CAT 5 type Ethernet cable to connect a host PC to one of the Ethernet ports on the top panel.

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2.3 Connecting/Disconnecting Power

1 Before turning on the power source, connect the positive and negative wires from a 9 to 30V DC power source to the terminal block.

2. Turn on the power source. If the power was connected correctly, the front panel green PWR LED will light up.

If the EMU-200 Series needs to be shut down, turn off the power source.

To remove the power wires, use a flat head screwdriver to push the orange slots on the terminal block and then pull out the wires.



Ensure the power source is turned off before connecting or removing the power wires.

Connexion/Déconnexion de l'alimentation

1 Avant de mettre sous tension la source d'alimentation, connectez les fils positifs et négatifs d'une source d'alimentation en courant continu de 9 à 30V à la borne de connexion.

2. Mettez sous tension la source d'alimentation. Si l'alimentation a été connectée correctement, le voyant vert PWR du panneau avant s'allumera.

Si la série EMU-200 doit être éteinte, éteignez la source d'alimentation.

Pour retirer les fils d'alimentation, utilisez un tournevis à tête plate pour pousser les fentes oranges sur la borne de connexion, puis retirez les fils.



ATTENTION:Assurez-vous que la source d'alimentation est éteinte avant de connecter ou de retirer les fils d'alimentation.

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2.4 Checking Device Status and Connection

1 When power is supplied, the PWR LED will initially blink green while the system boots up, then change to a solid green indicating the device has successfully booted up.

2. Wait for the SYS LED to display solid green after powering on to confirm that the operating system kernel is ready.

3. Connect LAN2 of the EMU-200 Series to the host computer.

4. Set the network domain of the host computer to 192.168.50.xx.

5. Open a web browser (Google Chrome is recommended) on the host computer and enter http://192.168.50.2 to access EGiFlow (Figure 3-1).

6. Enter **admin** as the username and **adlink** as the password (Figure 3-1).

7. After logging in, EGiFlow displays. (Figure 3-2).

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2.5 Usage Scenarios

The EMU-200 Series is designed as a distributed protocol translator for different devices via ethernet/wireless communication and can be used in many kinds of scenarios. Choose the most suitable scenario depending on your system infrastructure. The EMU-200 Series is provided with three kinds of software support:

- No code. Users can transfer the different protocols to achieve different applications by using EGiFlow. For more information, see “EGiFlow” on page 23.
  (Supported models: EMU-200 & EMU-200-W)
- Users develop applications with iApp Creator through Python. For more information, see “EGiFlow” on page 23.
  (Supported models: EMU-200 & EMU-200-W)
- An open platform with Debian Linux for system integrators to develop customized applications. For more information, see “Debian Linux OS” on page 61.
  (Supported models: EMU-200L & EMU-200L-W)

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3 EGiFlow

This chapter describes how to use the built-in EGiFlow to configure the EMU-200 Series and start different kind of applications.

3.1 EGiFlow Login

After the EMU-200 Series has been successfully powered on, access EGiFlow via one of the default following options.

Option 1: With a host PC connected to the EMU-200 series LAN2 port, do the following:

1. Set the host PC's network setting to Static IP mode.
2. Modify the host PC's IP address to be on the same network segment as the device (192.168.50.x).
3. Open a web browser (Google Chrome is recommended) on the host PC to access EGiFlow: http://192.168.50.2, or enter the EMU-200 Series hostname in the address bar (e.g., http://emu200-2361100lba.local/)

Option 2: With a host PC connected to the EMU-200 series LAN1 port, do the following:

1. Set the host PC's network setting to DHCP mode.
2. Open a web browser (Google Chrome is recommended) on the host PC to access EGiFlow by entering the EMU-200 Series hostname in the address bar (e.g., http://emu200-2361100lba.local/)

Option 3: Connect the LAN1 port of the EMU-200 series to a network component (switch/router) with DNS functionality:

1. Set the host PC's network setting to DHCP mode and connect to network component (switch/router).
2. Open a web browser (Google Chrome is recommended) on the host PC to access EGiFlow by entering the EMU-200 Series hostname in the address bar (e.g., http://emu200-2361100lba.local/)

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A unique default hostname is generated for each EMU-200 series device and can be found on the label of the chassis it was shipped in. The hostname can be changed from EGiFlow (default username: **admin**, default password: **adlink**).

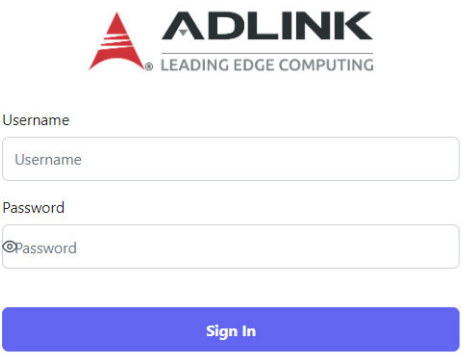


Figure 3-1: EGiFlow Login Page

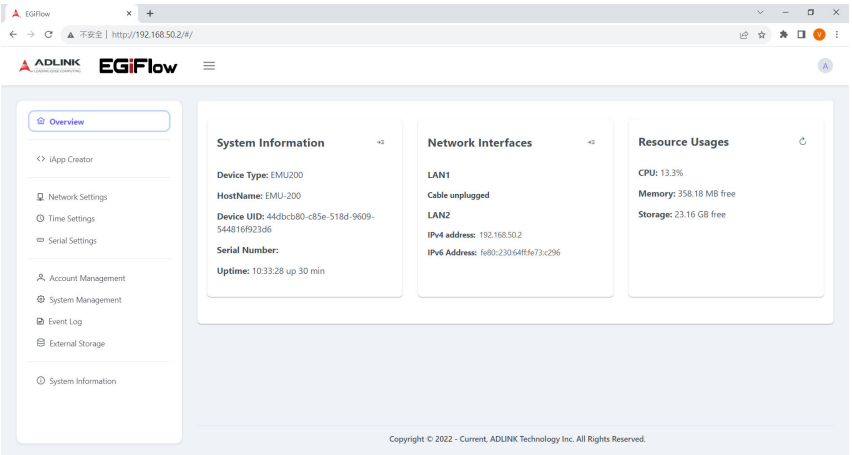


Figure 3-2: EGiFlow Main Page

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3.2 EGiFlow Menu

EGiFlow includes the following items for configuration and protocol translation in different field applications.

- EGiFlow iApp
  - Modbus TCP/RTU to AWS and Azure
  - Modbus TCP/RTU to MQTT
  - Modbus TCP/RTU to RESTful
  - Modbus RTU to Modbus TCP
  - OPCUA to AWS
- Python iApp
  - Development
  - Deploy and Run
- Gateway Configuration & Management
  - Network Setting (LAN) (IPv4 IPv6)
  - Network Setting (WiFi) (IPv4 IPv6)"
  - Network Setting (Cellular) (IPv4 IPv6)"
  - Time Sync Setting, NTP
  - Account Management
  - System Management
  - Event Log
  - External Storage
  - System Information
  - Serial Settings

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3.2.1 EGiFlow iApp

EGiFlow iApp provides an intuitive and straightforward configuration method, allowing the EMU-200 Series to acquire the required sensor data for measurement through various communication protocols. It then converts and transmits the data to various services, including edge servers, local SCADA, or the cloud, for applications such as energy monitoring in buildings, factories, smart factories, and for energy storage monitoring.

Below are a few commonly used scenarios to illustrate how to create and use EGiFlow iApp to complete the conversion and data transmission of various communication protocols.

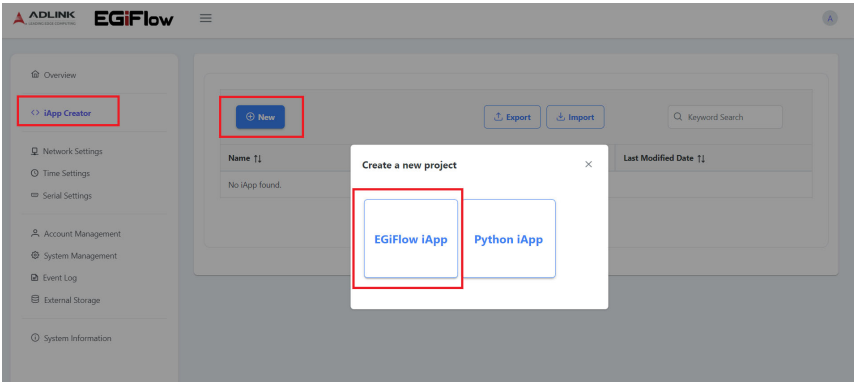


Figure 3-3: Create EGiFlow iApp

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Modbus TCP/RTU to AWS and Azure

The overall architecture of the application is shown below, aiming to acquire sensor data from the Modbus interface and send it to cloud services such as Azure and AWS.

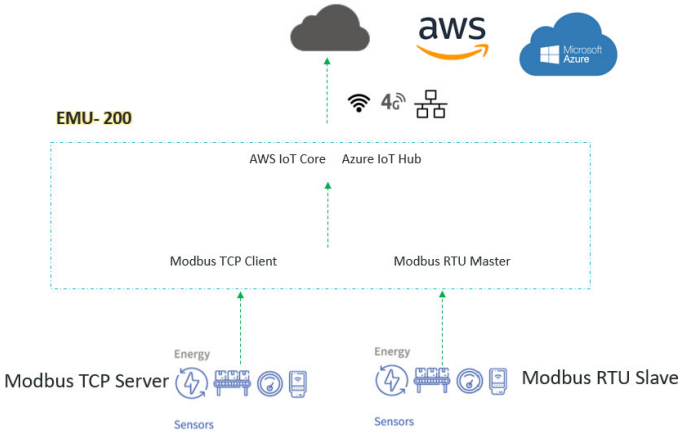


Figure 3-4: Modbus TCP/RTU to Cloud

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To achieve this, you can utilize EGiFlow iApp as a middleware component.

1. **Modbus TCP Client (Master):** Use EGiFlow iApp's intuitive setup to create and configure the Modbus TCP client (master) functionality. Specify the Modbus server's IP address, port number, and other necessary parameters. EGiFlow iApp provides an interface to define the data registers to be read from the Modbus server.

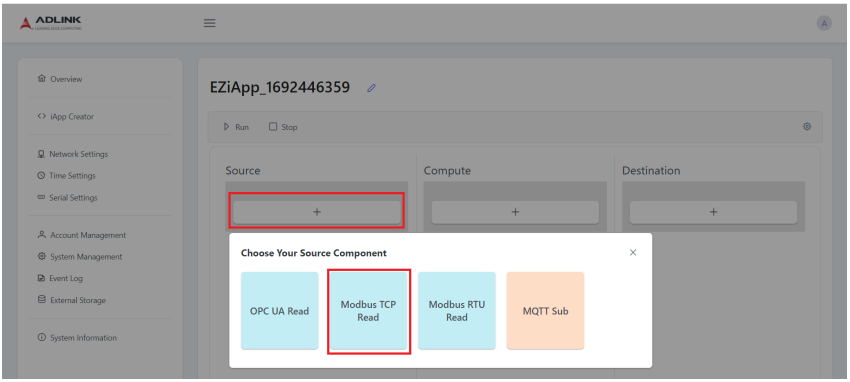


Figure 3-5: Create Modbus TCP

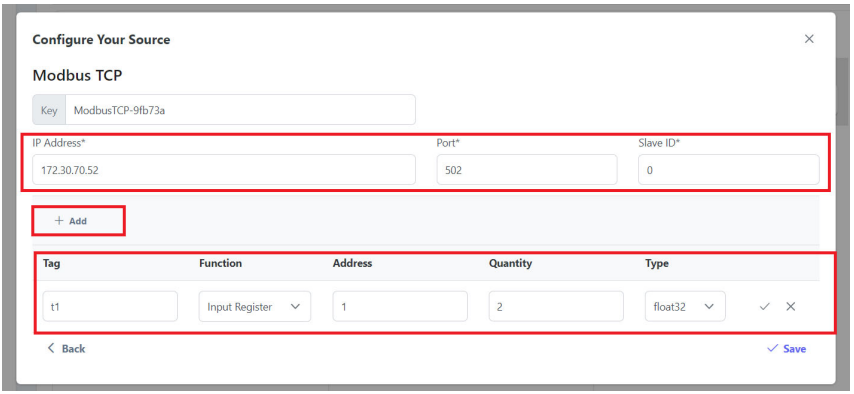


Figure 3-6: Configure Modbus TCP

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2. **Modbus RTU Master**: Use EGiFlow iApp's setup to create and configure the Modbus RTU Master functionality. Determine the serial parameters required for communication, such as baud rate, parity, data bits, and stop bits. EGiFlow iApp provides an interface to define the data registers to be read from the Modbus slave.

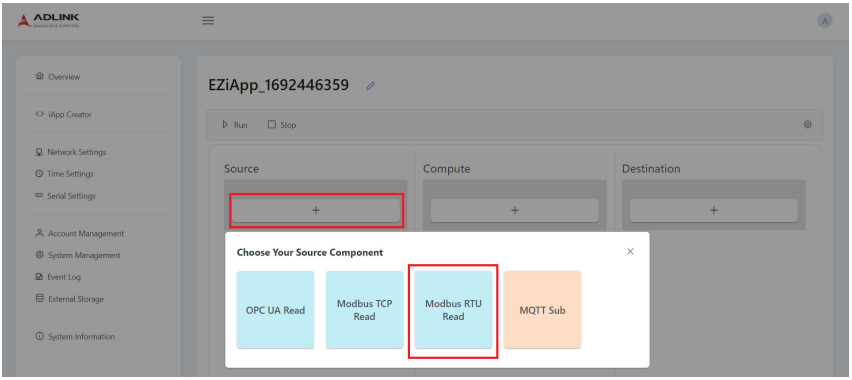


Figure 3-7: Create Modbus RTU

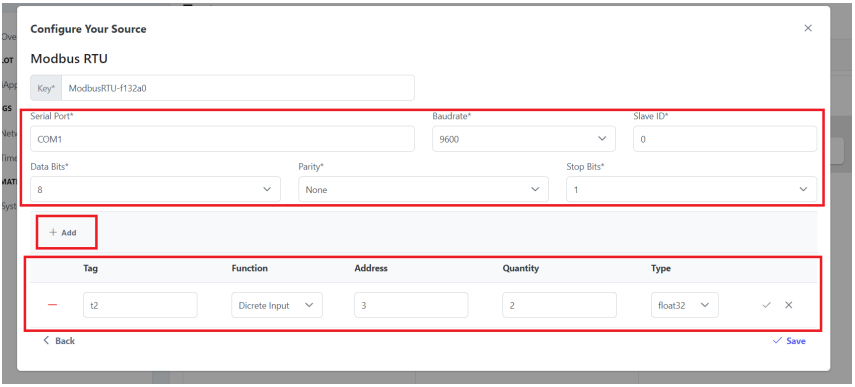


Figure 3-8: Configure Modbus RTU

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3. **Data Conversion by Compute**: Upon receiving the sensor data from the Modbus server/slave, EGiFlow iApp can perform any required data conversions or formatting as per the specific requirements of Azure and AWS. This may include transforming the data into the appropriate format, applying data preprocessing or aggregation, and ensuring compatibility with the cloud service APIs.

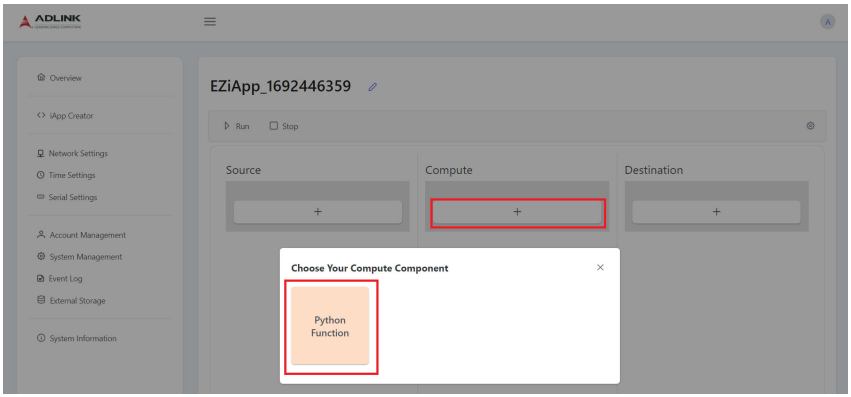


Figure 3-9: Create Compute

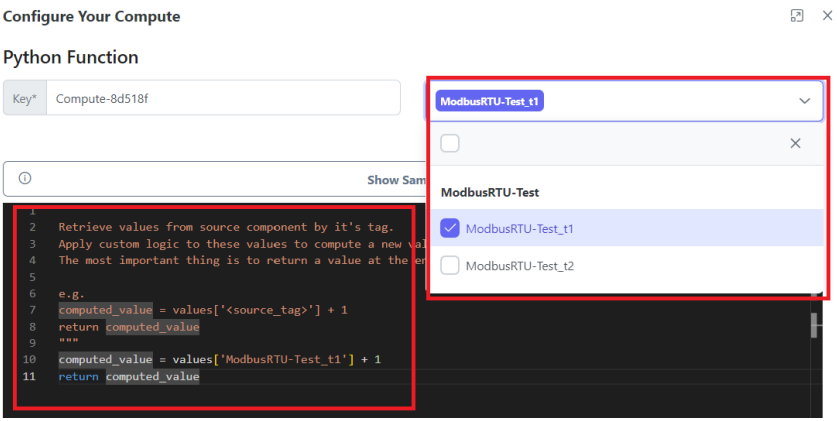


Figure 3-10: Develop Customized Data Conversion

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4. **Data Transmission to Azure**: EGiFlow iApp can utilize Azure IoT Hub to securely transmit the converted sensor data. It establishes a connection with Azure and publishes the data to the desired Azure endpoint.

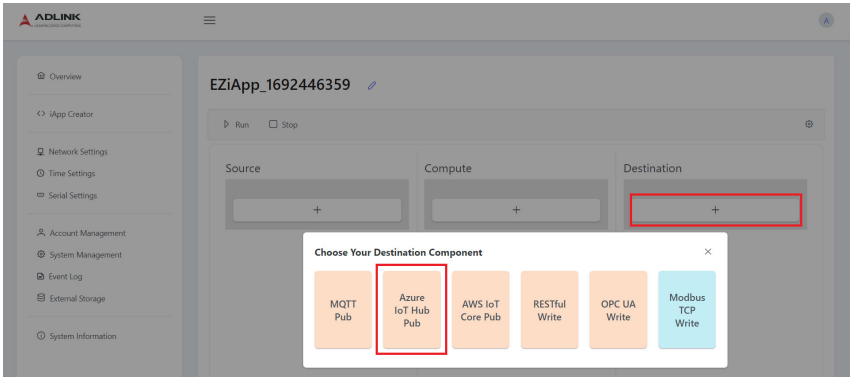


Figure 3-11: Create Azure

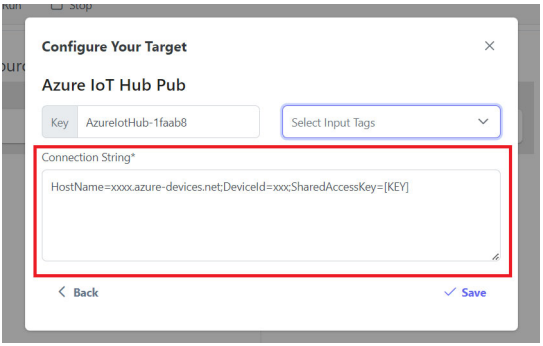


Figure 3-12: Configure Azure

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5. **Data Transmission to AWS**: Similarly, EGiFlow iApp can leverage AWS IoT Core to securely transmit the converted sensor data. It establishes a connection with AWS and publishes the data to the desired AWS end-point.

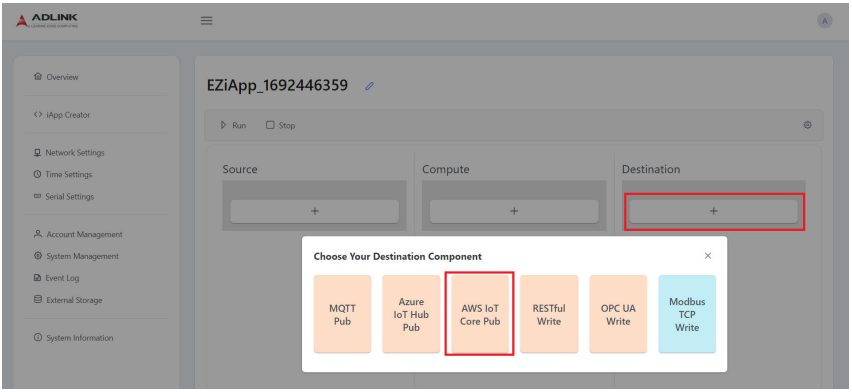


Figure 3-13: Create AWS

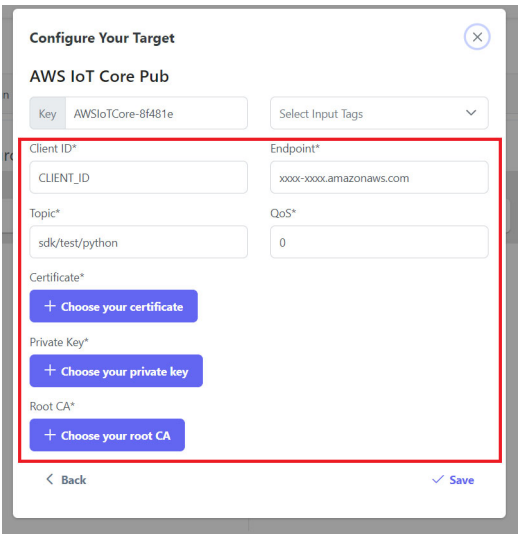


Figure 3-14: Configure AWS

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6. **Run and Deploy**: Click **Run** and wait for the deployment to finish.

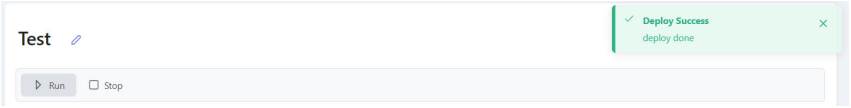


Figure 3-15: Run and Deploy

Modbus TCP/RTU to MQTT

The overall architecture of the application is in Figure 3-16, with the objective of acquiring sensor data from the Modbus interface and transmitting it via MQTT to an Edge Server or Local SCADA.

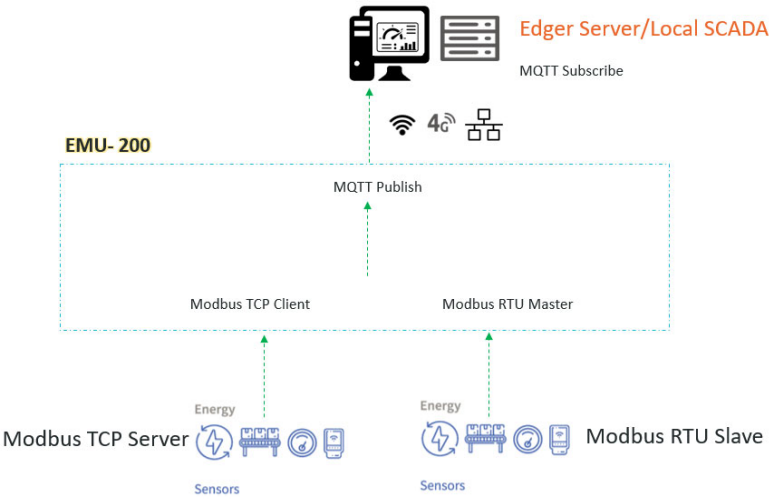


Figure 3-16: Modbus TCP/RTU to MQTT

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To accomplish this, you can follow the steps below using EGiFlow iApp:

1. **Modbus TCP Client (Master)**: Use EGiFlow iApp's setup to create and configure the Modbus TCP client (master) functionality. Specify the Modbus server's IP address, port number, and other necessary parameters. EGiFlow iApp provides an interface to define the data registers to be read from the Modbus server. (See Figure 3-5 and Figure 3-6)
2. **Modbus RTU Master**: Use EGiFlow iApp's setup to create and configure the Modbus RTU Master functionality. Determine the serial parameters required for communication, such as baud rate, parity, data bits, and stop bits. EGiFlow iApp provides an interface to define the data registers to be read from the Modbus slave. (See Figure 3-7 and Figure 3-8)
3. **Data Conversion by Compute**: Upon receiving the sensor data from the Modbus server/slave, EGiFlow iApp can perform any necessary data conversion or formatting to ensure compatibility with MQTT. This may involve transforming the data into a suitable format, applying any required preprocessing or aggregation, and ensuring adherence to the MQTT payload structure. (See Figure 3-10)

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4. **MQTT Communication**: EGiFlow iApp integrates MQTT functionality to connect to an MQTT broker. It establishes a connection with the broker and publishes the converted sensor data as MQTT messages. The MQTT broker can be located on the Edge Server or within the Local SCADA environment.

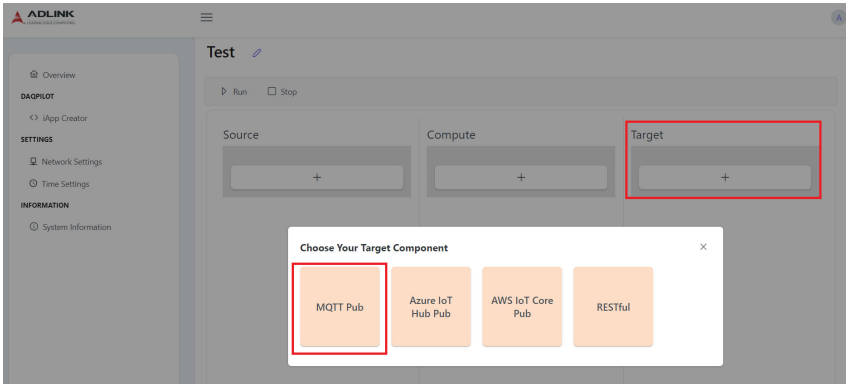


Figure 3-17: Create MQTT Publish

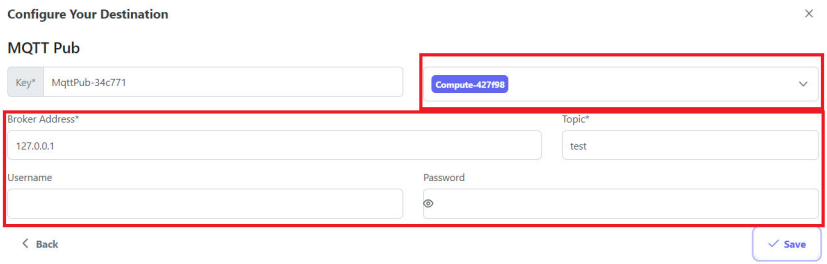


Figure 3-18: Configure MQTT Publish

5. **Run and Deploy**: Click **Run** and wait for the deployment to finish. (See Figure 3-15)

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Modbus TCP/RTU to RESTful

The overall architecture of the application is in Figure 3-19, with the objective of acquiring sensor data from the Modbus interface and transmitting it via RESTful API to an Edge Server or Local SCADA.

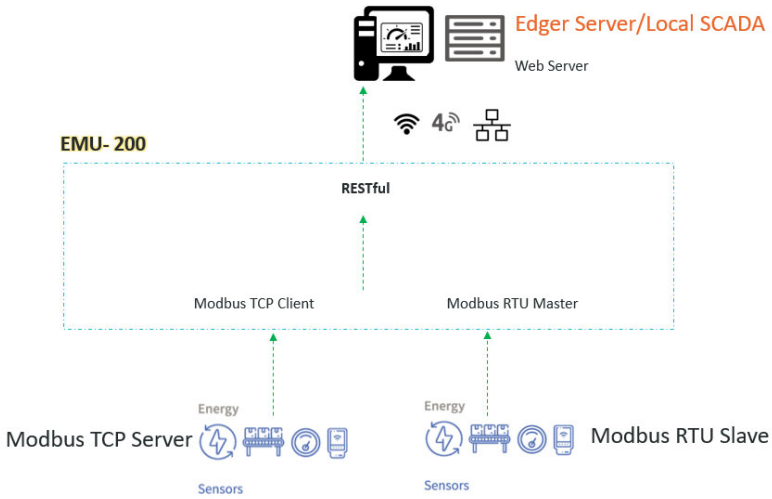


Figure 3-19: Modbus TCP/RTU to RESTful

To achieve this, you can follow the steps below using EGiFlow iApp:

1. **Modbus TCP Client (Master)**: Use EGiFlow iApp's setup to create and configure the Modbus TCP client (master) functionality. Specify the Modbus server's IP address, port number, and other necessary parameters. EGiFlow iApp provides an interface to define the data registers to be read from the Modbus server. (See Figure 3-5 and Figure 3-6)
2. **Modbus RTU Master**: Use EGiFlow iApp's setup to create and configure the Modbus RTU Master functionality. Determine the serial parameters required for communication, such as baud rate, parity, data bits, and stop bits. EGiFlow iApp provides an interface to define the data

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registers to be read from the Modbus slave. (See Figure 3-7 and Figure 3-8)

3. **Data Conversion by Compute**: Upon receiving the sensor data from the Modbus server/slave, EGiFlow iApp can perform any required data conversion or formatting to prepare it for RESTful API transmission. This may involve transforming the data into a compatible format, applying preprocessing or aggregation, and organizing it according to the RESTful API payload structure. (See Figure 3-9)
4. **RESTful API Communication**: EGiFlow iApp integrates RESTful API functionality to connect to the Edge Server or Local SCADA system. It establishes an HTTP/HTTPS connection with the designated API endpoint and sends the converted sensor data as RESTful API requests. The API endpoint should be configured to receive and process the incoming data accordingly.

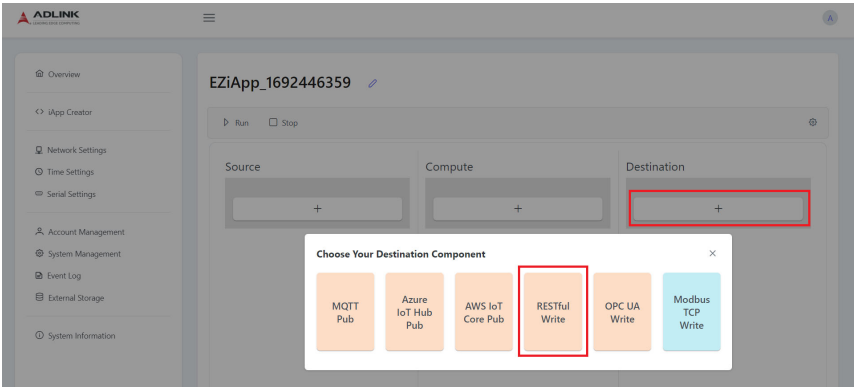


Figure 3-20: Create RESTful

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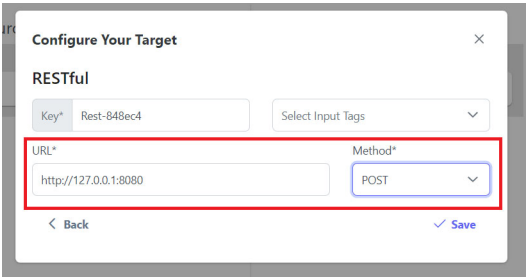


Figure 3-21: Configure RESTful

5. **Run and Deploy**: Click **Run** and wait for the deployment to finish. (See Figure 3-15)

Modbus RTU to Modbus TCP

The overall architecture of the application, as shown in Figure 3-22, aims to convert Modbus RTU to Modbus TCP.

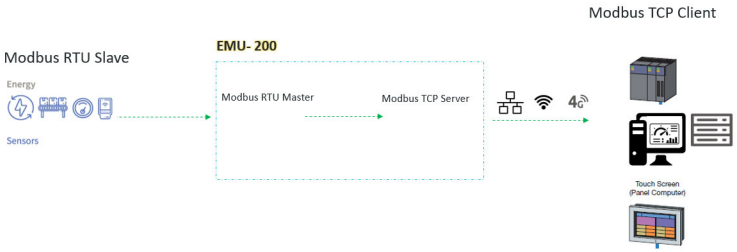


Figure 3-22: Modbus RTU to Modbus TCP

1. **Modbus RTU Master**: Use EGiFlow iApp's setup to create and configure the Modbus RTU Master functionality. Determine the serial parameters required for communication, such as baud rate, parity, data bits, and stop bits. EGiFlow iApp provides an interface to define the data registers to be read from the Modbus slave. (See Figure 3-7 and Figure 3-8)

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2. **Modbus TCP Conversion**: Modbus RTU requests are recieved from the RTU devices and converted into Modbus TCP requests.

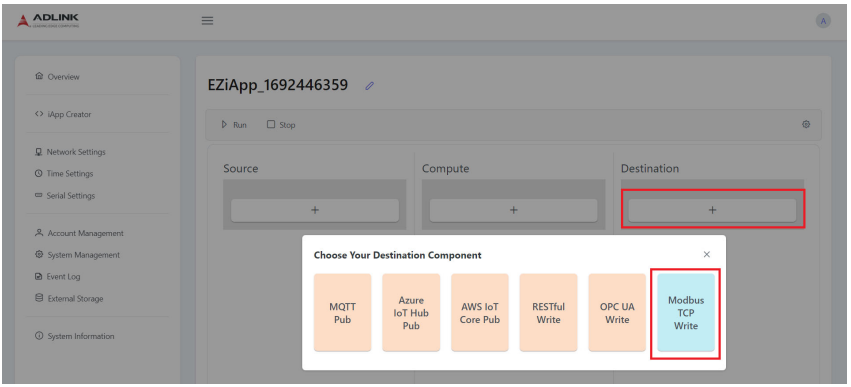


Figure 3-23: Create Modbus TCP Write

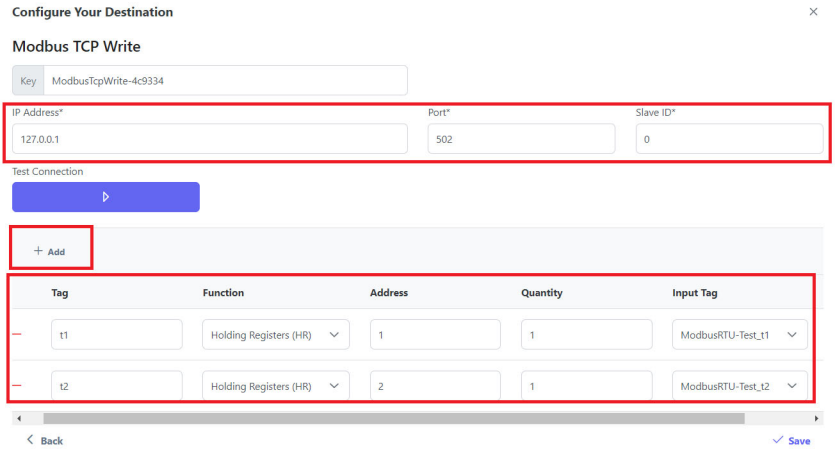


Figure 3-24: Configure Modbus TCP Write

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OPC UA to AWS

The overall architecture of the application is in Figure 3-25.

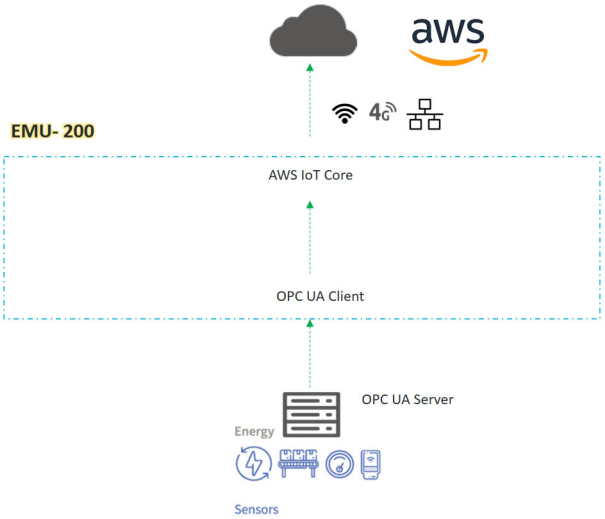


Figure 3-25: OPC UA to AWS

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To achieve this, you can follow the steps below using EGiFlow iApp:

1. **OPC UA Client**: Use EGiFlow iApp's intuitive setup to create and configure the OPC UA client functionality. Specify the OPC UA server's IP address, port number, and other necessary parameters. EGiFlow iApp provides an interface to browse node information from the server.

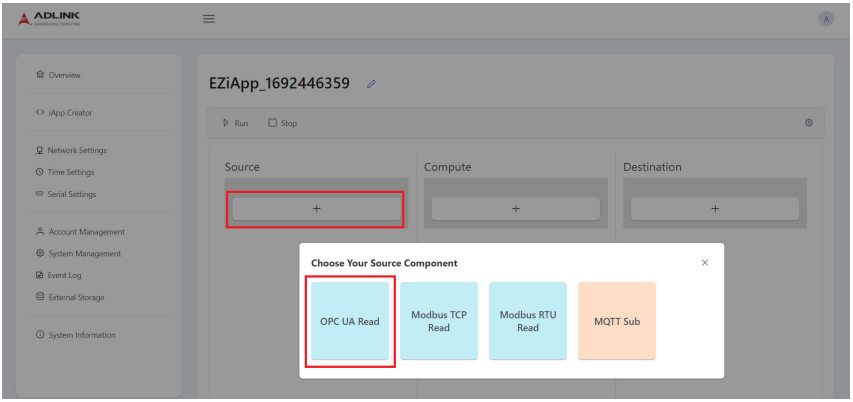


Figure 3-26: Create OPC UA

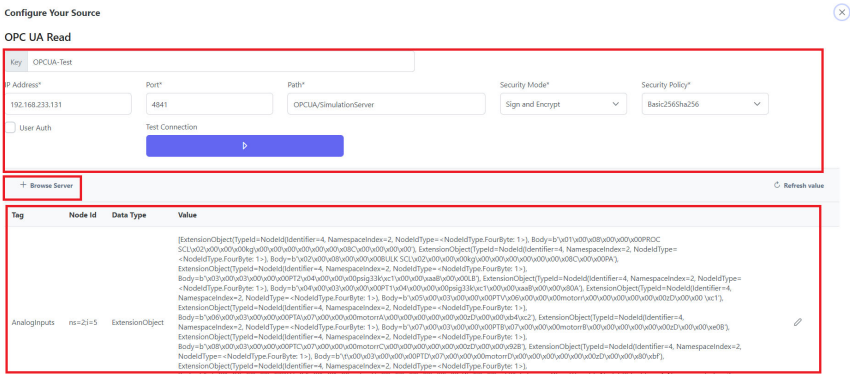


Figure 3-27: Configure OPC UA

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2. **Data Conversion by Compute**: Use EGiFlow iApp's setup to create python functions, import OPC UA server data from the drop-down menu, reference sample code or write your own algorithms.

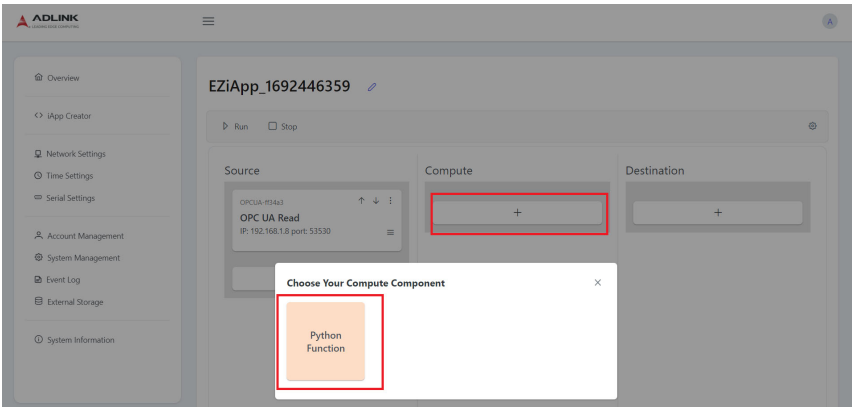


Figure 3-28: Create Compute

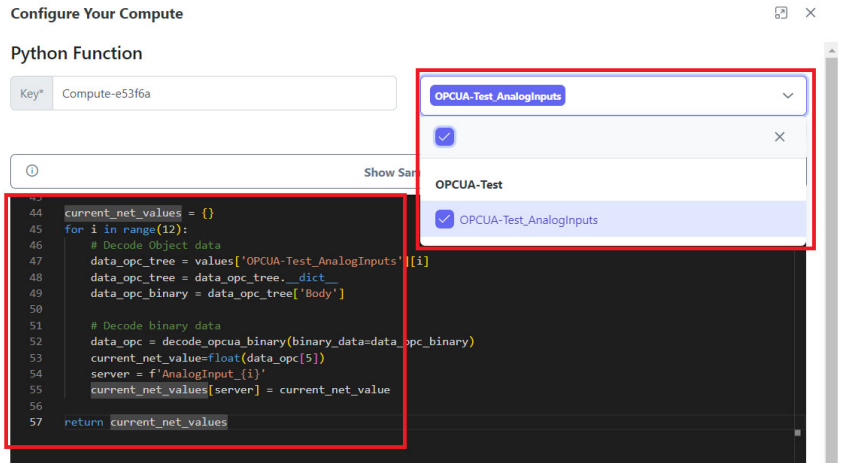


Figure 3-29: Develop Customized Data Conversion

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3. **Data Transmission to AWS**: Establishes a connection with AWS and publishes data to the desired AWS endpoint.

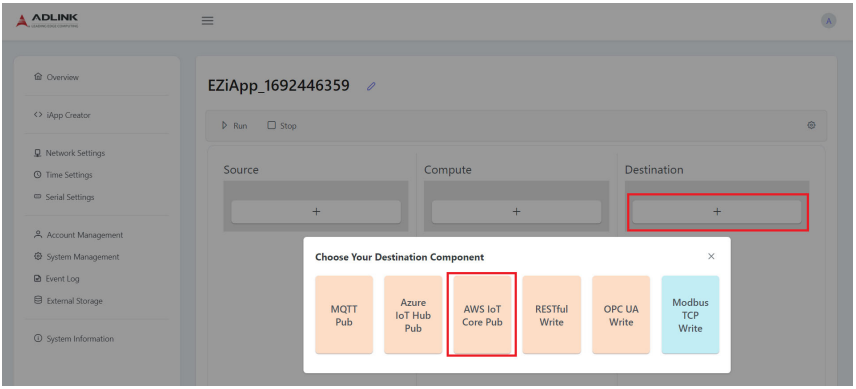


Figure 3-30: Create AWS

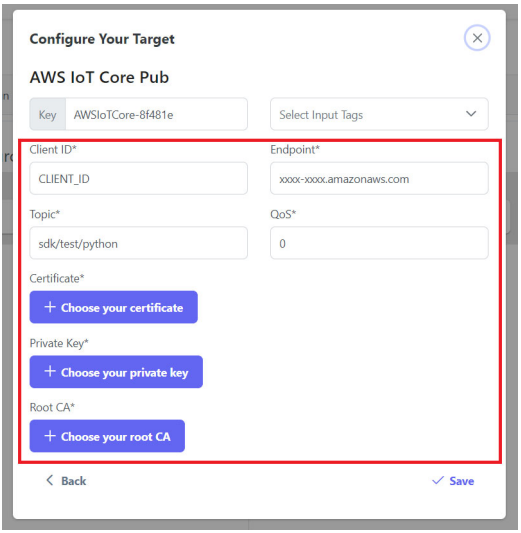


Figure 3-31: Configure AWS

4. **Run and Deploy**: Click **Run** and wait for the deployment to finish. (See Figure 3-15)

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3.2.2 Python iApp

This section includes a tutorial on how to create an iApp before deployment. iApps are saved in a repository and can be deployed to devices.

1. **Create and Development**: Click **iApp Creator** from the left sidebar and select **Python iApp**.
2. Select an iApp template and enter a name for it and then click **Create**. After creation, the a new iApp will be automatically loaded into the editor where it can be edited as necessary.

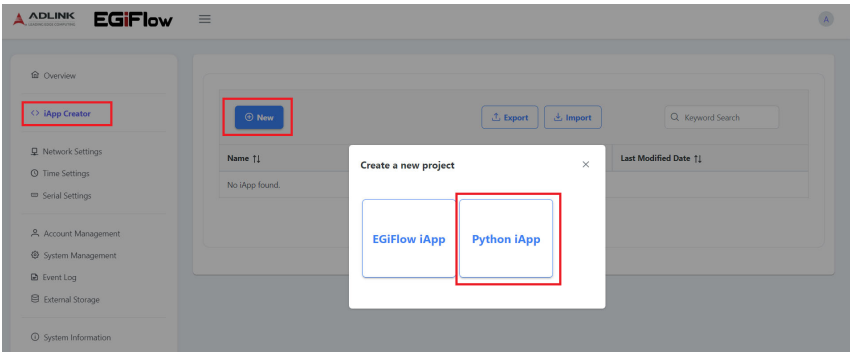


Figure 3-32: Create Python iApp

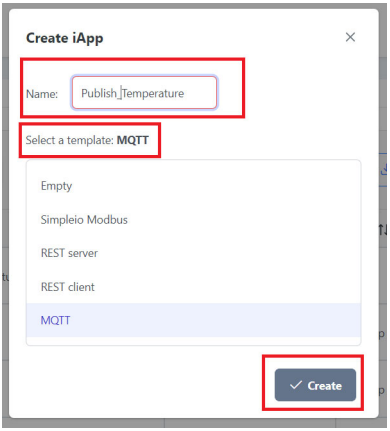


Figure 3-33: Select a template and enter a name

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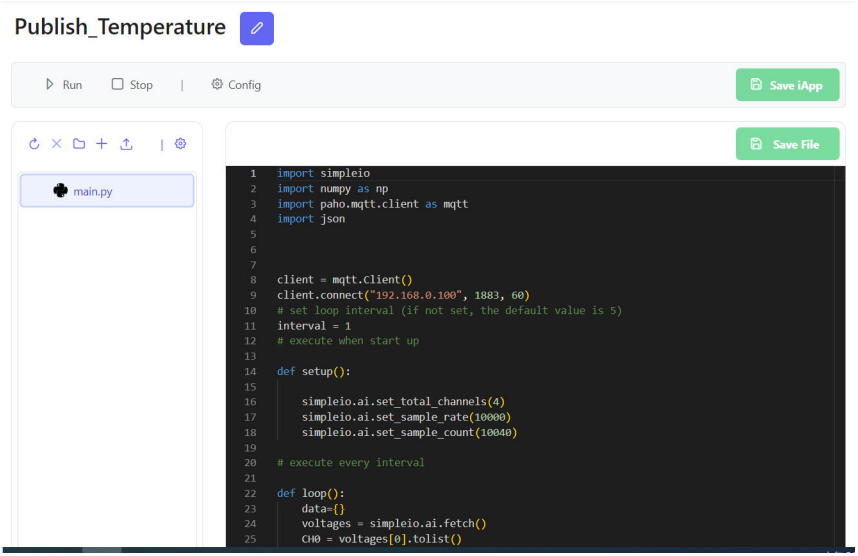


Figure 3-34: The new iApp can be edited

3. **Run and Deploy**: Click **Run** and wait for the deployment to finish.

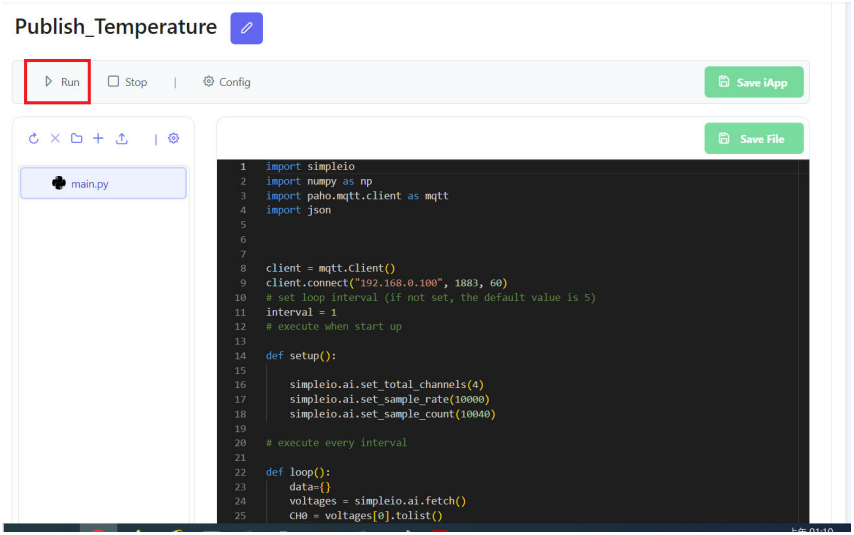


Figure 3-35: Run a new iApp

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3.2.3 Gateway Configuration & Management

LAN Network Settings

The EMU-200 Series has two Ethernet ports that can be configured to support IPv4 and IPv6 network modes.

1. Open the **Network Settings** page.

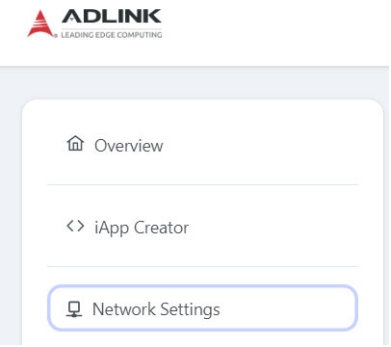


Figure 3-36: Network Settings

2. Select a LAN Port to set the wired network information.

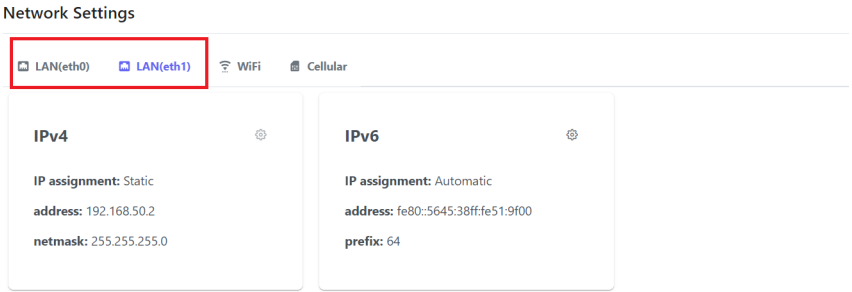


Figure 3-37: Select LAN Port

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3. Configure the DHCP or static IP settings.

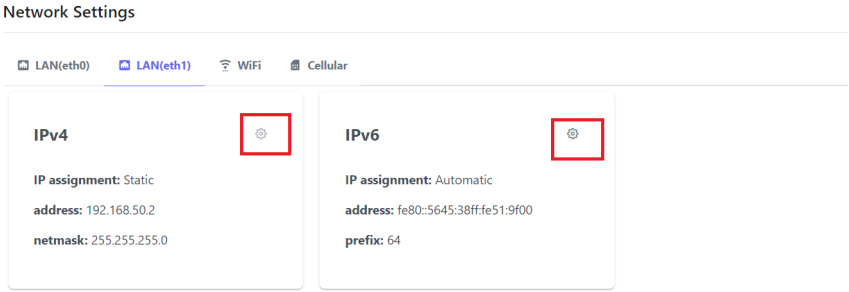


Figure 3-38: Configure LAN Port

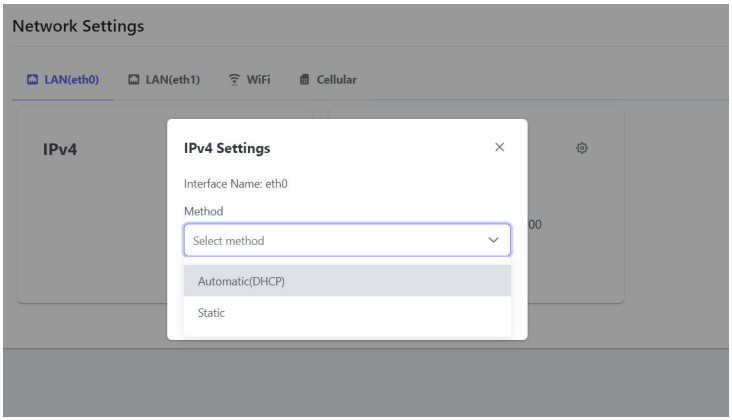


Figure 3-39: Select DHCP or Static

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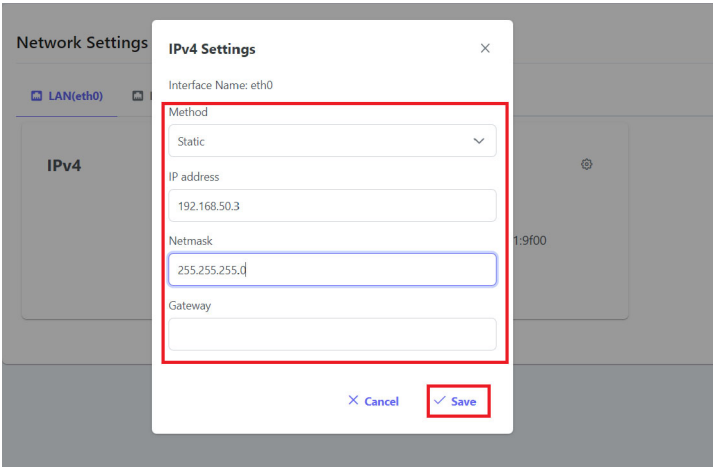


Figure 3-40: Configure Static IP (IPv4)

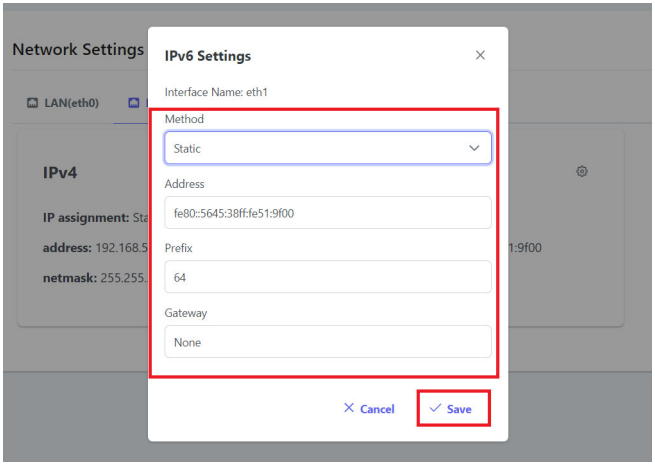


Figure 3-41: Configure Static IP (IPv6)

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4. For DNS settings, The DNS server will be used first.

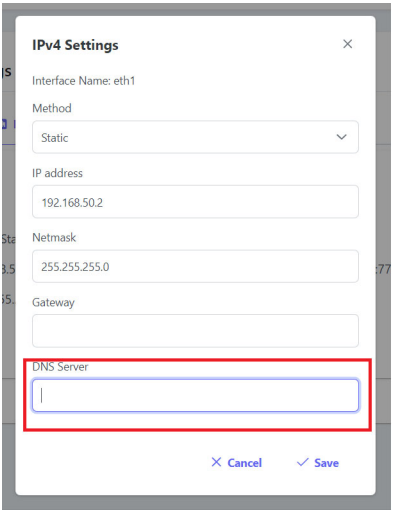


Figure 3-42: DNS Settings (IPv4)

WiFi Network Settings

Similar to the Ethernet port, the WiFi network client mode also supports IPv4 and IPv6 network mode settings.

1. Open the **Network Settings** page.

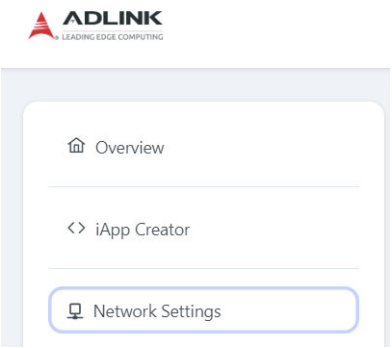


Figure 3-43: Network Settings

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2. Select to set WiFi network information.

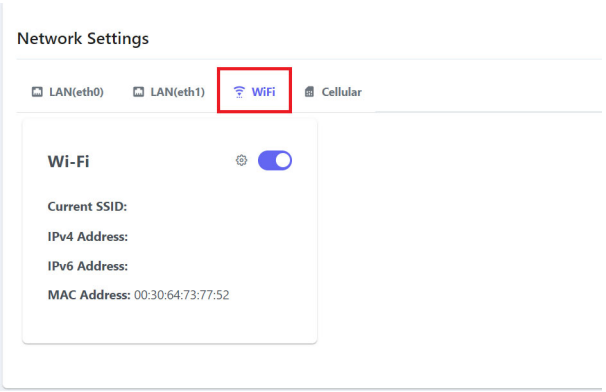


Figure 3-44: WiFi Network Information

3. Users need to select the Country Code, SSID name and security of the WLAN to join the network.

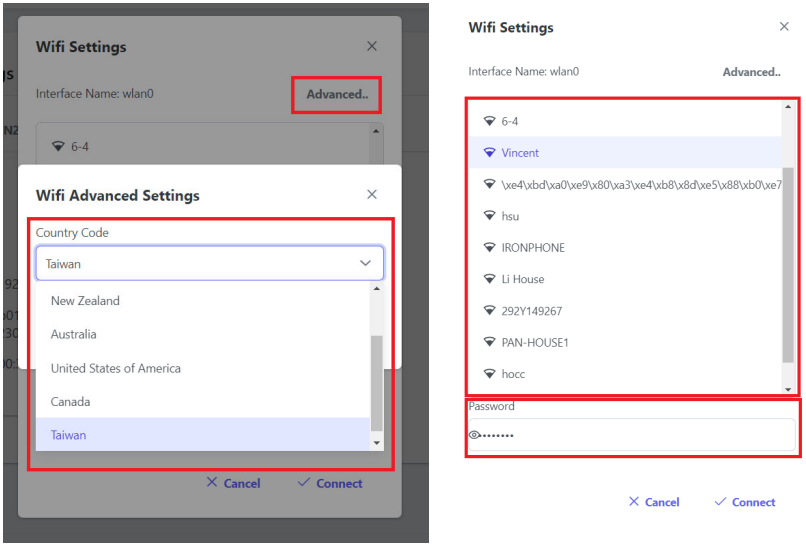


Figure 3-45: Select Country Code and SSID Name

4. Click **Apply** to complete the configuration.

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Cellular Network Settings (Optional)

1. Open the **Network Settings** page, and select to set Cellular network information.

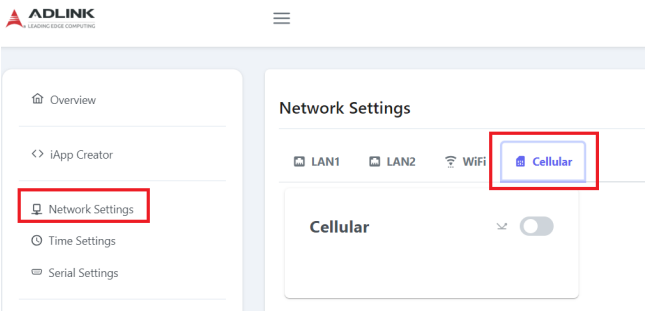


Figure 3-46: Cellular Network

2. Make sure the system has a 4G LTE module and SIM card installed, and then enable the cellular network.

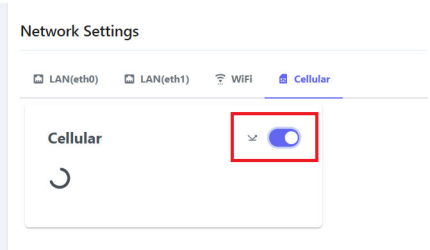


Figure 3-47: Enable Cellular Network

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Time Sync Setting, NTP

Users can adjust the time synchronization settings.

1. Double click **Time Settings** to enter the configuration page.

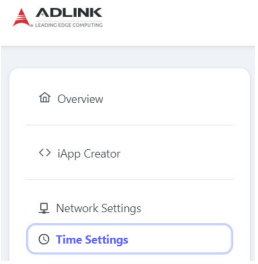


Figure 3-48: Select Time Settings

2. The selection of **synchronization with the NTP server** allows the device to synchronize with a source, and the address of the source can be a domain name or an IP address.

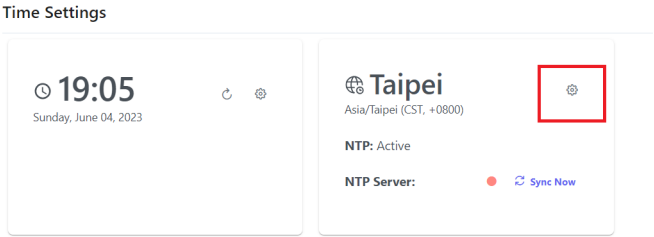


Figure 3-49: Configure Time Settings

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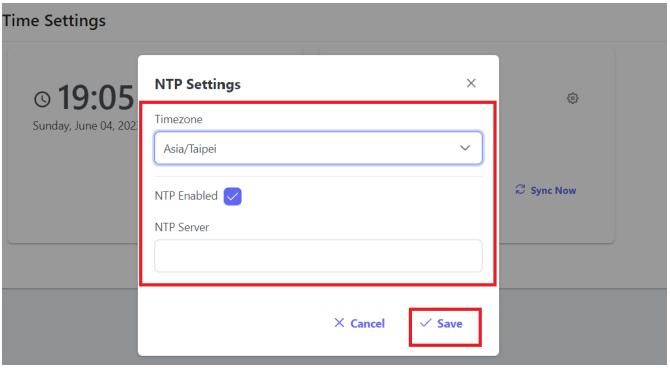


Figure 3-50: Configure NTP Settings

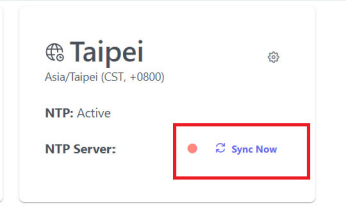


Figure 3-51: Synchronize Time

3. Check **serve as a NTP server** to enable the device to be a time synchronization source for other devices to synchronize their time with this device.

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Serial Settings

This page manages serial settings.

1. Double click **Serial Settings** to enter the configuration page.

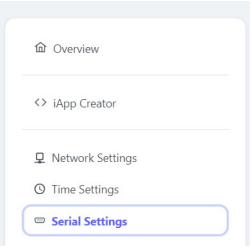


Figure 3-52: Serial Settings

2. Select the serial port to configure it.

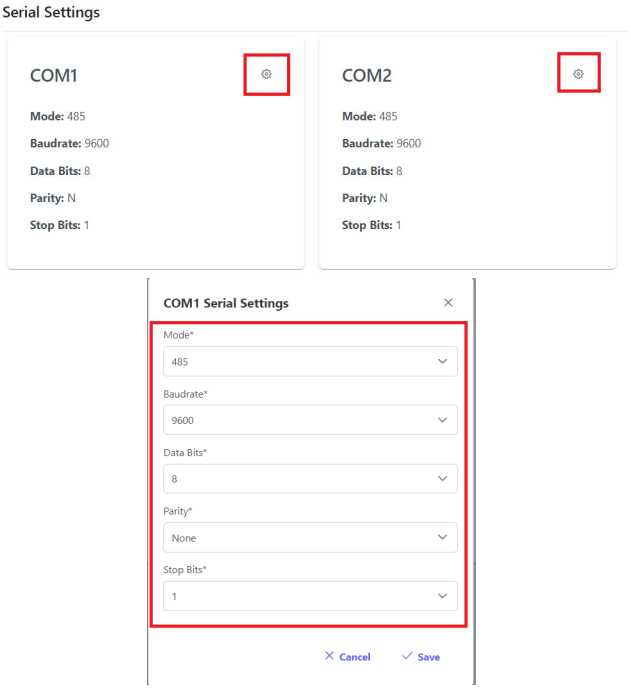


Figure 3-53: Configure Serial Port

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Account Management

This page manages user accounts.

1. Double click **Account Management** to enter the configuration page.

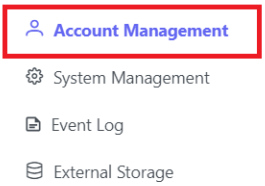
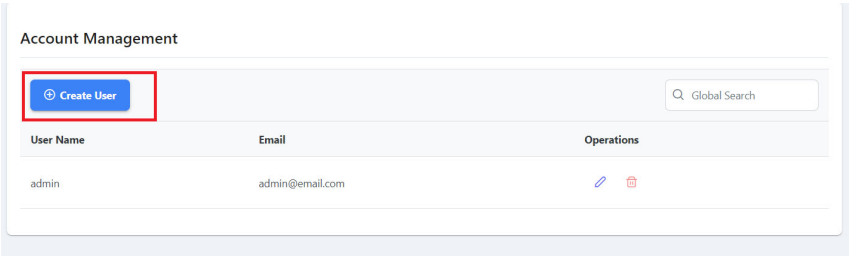


Figure 3-54: Account Management

2. Create user accounts and access privileges.



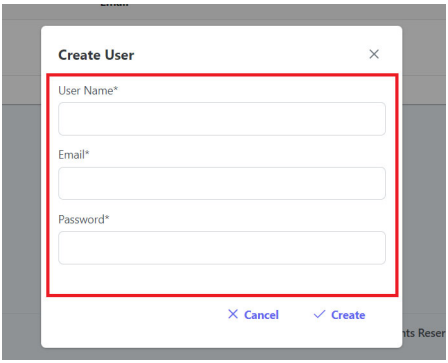


Figure 3-55: Create User Accounts

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System Management

This page manages restoring to factory defaults and firmware upgrades.

1. Double click **System Management** to enter the configuration page.

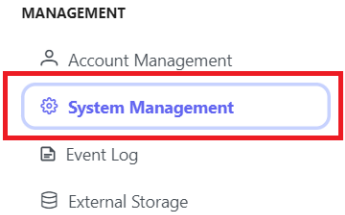


Figure 3-56: System Management

2. **Factory default**: Restores the EMU-200 to factory default settings.
3. **Firmware upgrade**: A firmware upgrade file can be uploaded to the EMU-200 through this feature. These files will periodically be provided through the product web page: https://www.adlinktech.com/Products/Industrial_IoT_and_Cloud_solutions/IoTGateway/EMU-200_Series.

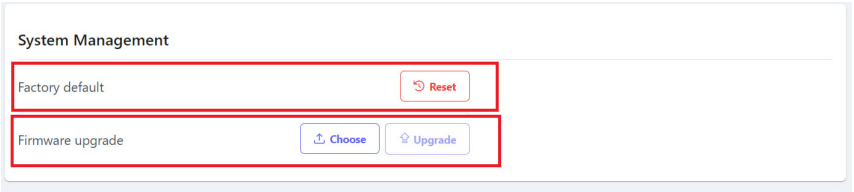


Figure 3-57: Factory Default and Firmware Upgrade

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Event Log

This page manages the system log.

1. Double click **Event Log** to enter the page.

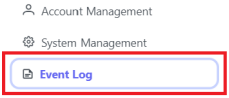


Figure 3-58: Event Log

2. The log information includes Date Time, Level, Module and Message.

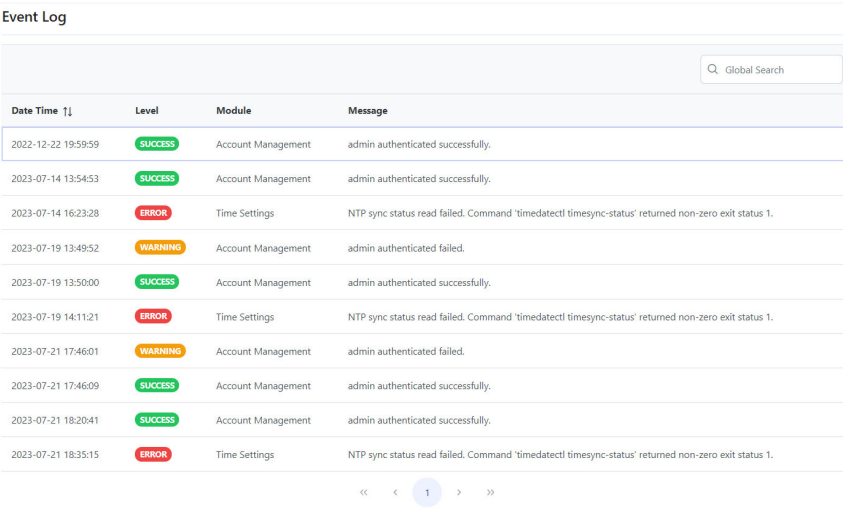


Figure 3-59: Event Log Information

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External Storage

This page manages external storage.

1. Double click **External Storage** to enter the page.

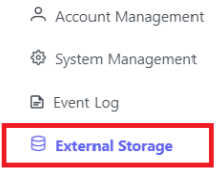


Figure 3-60: External Storage

2. Manage external storage.

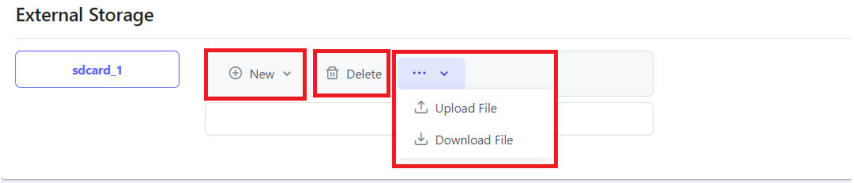


Figure 3-61: Manage External Storage

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System Information

This page manages system information.

1. Double click **System Information** to enter the page.



Figure 3-62: System Information

2. System information includes device information and software version.

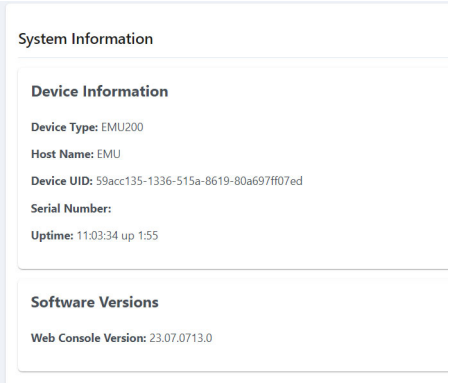


Figure 3-63: Device Information and Software Version

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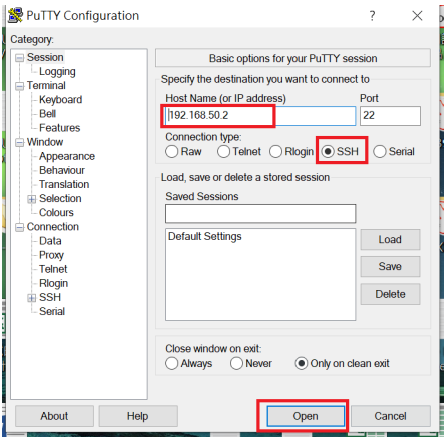
Appendix A Debian Linux OS

Debian Linux is used as the EMU-200 Series operating system for system integrators to develop customization applications.This appendix includes information on the following items.

- Connecting and Logging in via SSH
- User LED Control
- Serial Port Configuration
- Changing the static IP
- RTC Function
- Mounting/Unmounting a FAT32 USB Drive
- 4G LTE Module Configuration and Connection (optional)
- WiFi Configuration and Connection

A.1 Connecting and Logging in via SSH

1. Wait for the SYS LED to display a solid green light after powering on to confirm that the OS kernel is ready.
2. Set the network domain of the host computer that will be connected to the EMU-200 Series to 192.168.50.xx.
3. Open Putty on the host computer and enter the IP address of the EMU-200 Series: 192.168.50.2.



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4. Log in by username and password
   - ▷ Enter the username: root
   - ▷ Enter the password: adlink
5. You have successfully connected to the EMU-200 Series.

A.2 User LED Control

Turn on/Turn off User LED1 with the following commands:

```
$ cd /sys/class/leds/led_user1g
```

Turn on:

```
$ echo 1 > brightness
```

Turn off:

```
$ echo 0 > brightness
```

Turn on/Turn off User LED2 with the following commands:

```
$ cd /sys/class/leds/led_user2g
```

Turn on:

```
$ echo 1 > brightness
```

Turn off:

```
$ echo 0 > brightness
```

Turn on/Turn off User LED3 with the following commands:

```
$ cd /sys/class/leds/led_user3g
```

Turn on:

```
$ echo 1 > brightness
```

Turn off:

```
$ echo 0 > brightness
```


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A.3 Serial Port Configuration

Use the following command to check the current Serial Port Interface.

```
$ cat /etc/com_mode.conf
```

```
root@EMU-200:~# cat /etc/com_mode.conf
485
485
```

The first row is COM1, the second row is COM2.

Use the following command to set the Serial Port to RS-422 mode.

```
$ cd /usr/bin
$ ./set_com.sh COM1 422
$ ./set_com.sh COM2 422
```

```
root@EMU-200:~# cd /usr/bin
root@EMU-200:/usr/bin# ./set_com.sh COM1 422
COM setting has been updated.
root@EMU-200:/usr/bin# ./set_com.sh COM2 422
COM setting has been updated.
```

Use the following command to set the Serial Port to RS-232 mode.

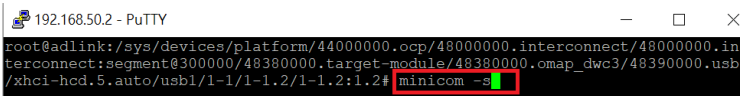
```
$ cd /usr/bin
$ ./set_com.sh COM1 232
$ ./set_com.sh COM2 232
```

```
root@EMU-200:~#  cd /usr/bin
root@EMU-200:/usr/bin# ./set_com.sh COM1 232
COM setting has been updated.
root@EMU-200:/usr/bin# ./set_com.sh COM2 232
COM setting has been updated.
```

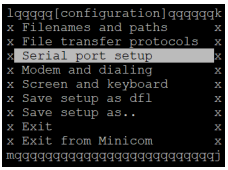

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Follow the steps below to set the Serial Device in Minicom to /dev/ttyXRUSB1, so that dev/ttyXRUSB0 is COM1 and /dev/ttyXRUSB1 is COM2.

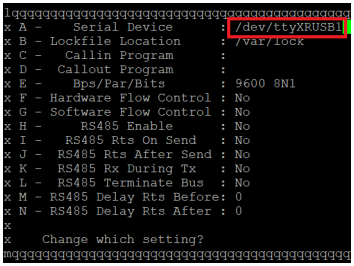
1. Enter the command: `$ minicom -s`



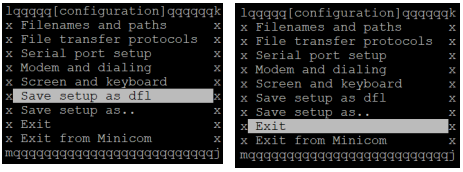
2. Select **Serial port setup**.



3. Select **Serial Device** and configure the parameters for the COM port. (dev/ttyXRUSB0 is COM1 and /dev/ttyXRUSB1 is COM2)



4. Save setup and then exit.



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A.4 LAN Configuration

A.4.1 LAN1 Configuration

1. Use the vi editor to enter the following command.

   ```
   $ vi /etc/systemd/network/10-eth.network
   ```

   ```
   root@EMU-200:~# vi /etc/systemd/network/10-eth.network
   ```

2. Press 'i' to enter edit mode.

   ```
   [Match]
   Name=eth0
   KernelCommandLine=!root=/dev/nfs

   [Network]
   DHCP=yes
   ~
   ```

   After editing, press **<Esc>**, type **:wq** and then press **<Enter>** to save and exit edit mode.

3. After configuring, restart the 'networkd' service. Execute the following command, and the system will reboot after a few seconds.

   ```
   $ systemctl restart systemd-networkd.service
   ```

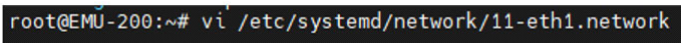
   ```
   root@EMU-200:~# systemctl restart systemd-networkd.service
   ```


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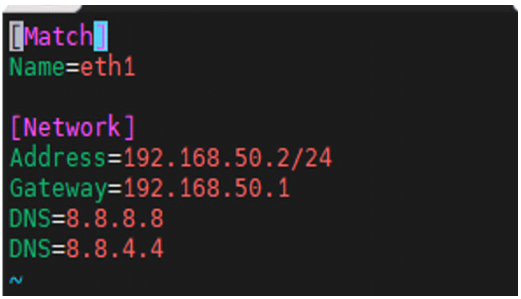
A.4.2 LAN2 Configuration

1. Use the vi editor to enter the following command.

```
$ vi /etc/systemd/network/11-eth1.network
```

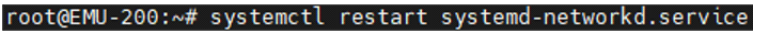


2. Press 'i' to enter edit mode.



3. After configuring, restart the 'networkd' service. Execute the following command, and the system will reboot after a few seconds.

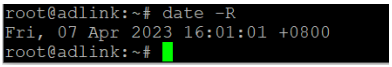
```
$ systemctl restart systemd-networkd.service
```



A.5 RTC

Enter the following command to check the current system time.

```
$ date -R
```

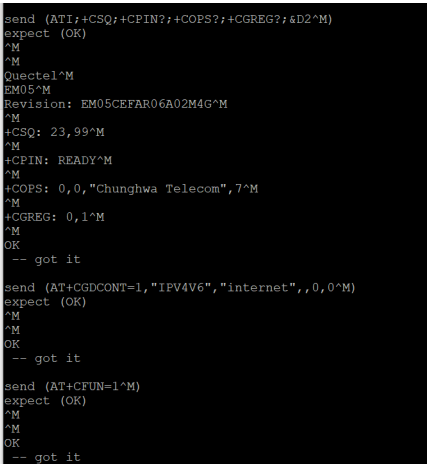


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A.6 4G LTE Module Configuration and Connection (optional)

1. Enter the following command for the 4G network dial-up settings (Module: QUECTEL/EM05-CE).

   ```
   $ modemon quectel
   ```



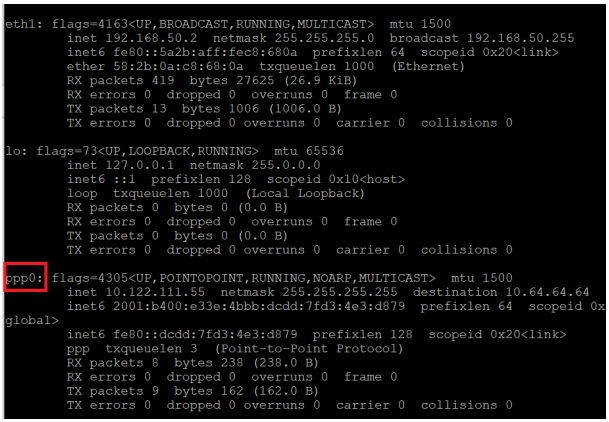
   Alternatively, enter the following command for the 4G network dial-up settings with a Sierra 4G LTE module.

   ```
   $ modemon sierra
   ```


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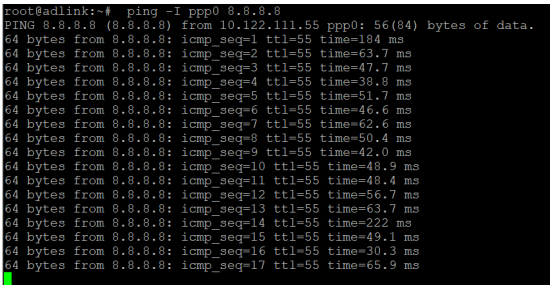
2. Enter the following command to check if the 4G network interface (ppp0) appears.

```
$ ifconfig
```



3. Enter the following command to execute a 4G Networking Functional Test (ping Google DNS).

```
$ ping -I ppp0 8.8.8.8
```

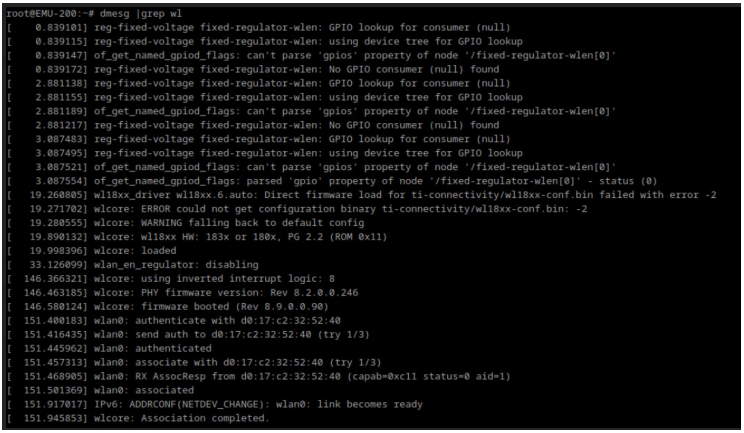


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A.7 WiFi Configuration and Connection

1. Enter the following EMU-200 search WIFI device command.

   ```
   $ dmesg | grep wl
   ```



2. Enter the following command to the following path to modify WIFI AP and password.

   ```
   $ vi /etc/wpa_supplicant/wpa_supplicant.conf
   ```



   After entering the screen, press 'i' to enter edit mode to make changes. After making the changes, press **<Esc>**, type **:wq** and then press **<Enter>** to save and exit edit mode.

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3. Enter the following command to set the country code. For example, to set the country code to The United States, enter:

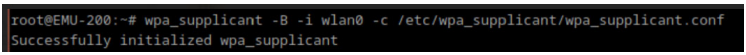
```
$ iw reg set US
```

Refer to the following table for the list of acceptable counrty codes.

Country	Code
Global	00
Australia	AU
Canada	CA
Europe	EU
New Zealand	NZ
Taiwan (Republic of China)	TW
Unites States	US

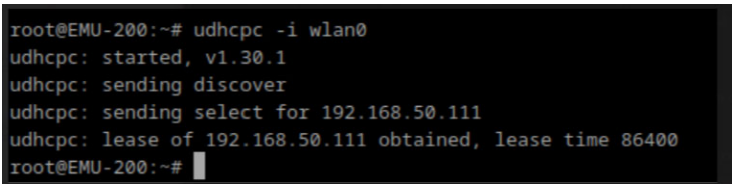
4. Enter the following command to turn on the WiFi and connect to the access point (AP).

```
$ wpa_supplicant -B -i wlan0 -c /etc/
wpa_supplicant/wpa_supplicant.conf
```



5. Enter the following command to automatically configure the IP address.

```
$ udhcpc -i wlan0
```



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6. Enter the following command to check if wlan0 is configured with an IP address before connecting to the internet.

```
$ ifconfig
```

```
wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
       inet 192.168.50.111  netmask 255.255.255.0  broadcast 192.168.50.255
       inet6 fe80::f6b8:98ff:fe38:e9b7  prefixlen 64  scopeid 0x20<link>
       ether f4:b8:98:38:e9:b7  txqueuelen 1000  (Ethernet)
       RX packets 4  bytes 966 (966.0 B)
       RX errors 0  dropped 0  overruns 0  frame 0
       TX packets 25  bytes 3252 (3.1 KiB)
       TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

7. Enter the following command to add a new route (based on the automatically configured IP address, changing the last octet to 1) to set a gateway (gw) for wlan0, as it needs a gateway to establish a connection to the external network.

```
$ route add default gw xxx.xxx.xxx.1
```

8. Enter the following command to execute a WiFi Networking Functional Test (ping Google DNS).

```
$ ping -I wlan0 8.8.8.8
```

```
root@EMU-200:~# ping -I wlan0 8.8.8.8
PING 8.8.8.8 (8.8.8.8) from 192.168.50.111 wlan0: 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=2 ttl=114 time=8.39 ms
64 bytes from 8.8.8.8: icmp_seq=1 ttl=114 time=1085 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=114 time=5.22 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=114 time=5.22 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=114 time=21.8 ms
64 bytes from 8.8.8.8: icmp_seq=6 ttl=114 time=5.25 ms
64 bytes from 8.8.8.8: icmp_seq=7 ttl=114 time=6.60 ms
```

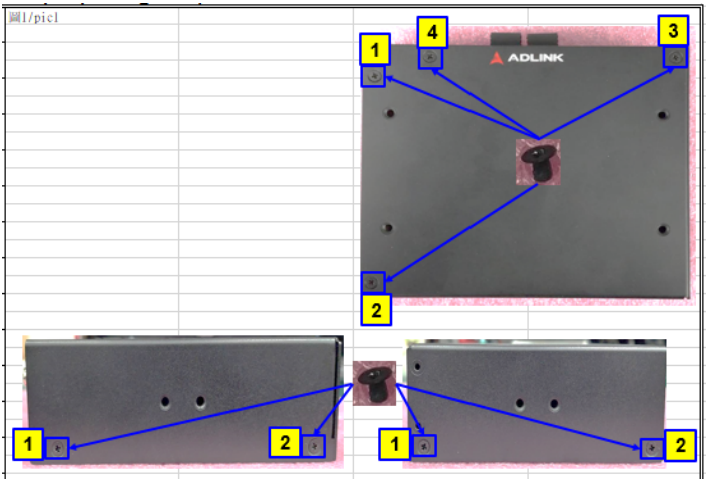

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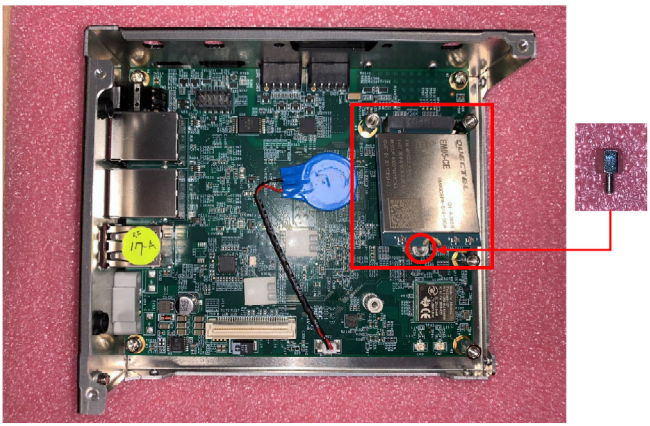
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Appendix B 4G LTE Module Assembly

1. Remove screws from chassis and open the top cover.

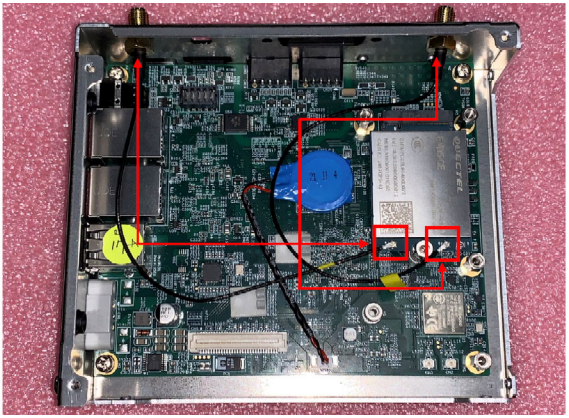


2. Insert 4G LTE module in M.2 slot and tighten the screw.

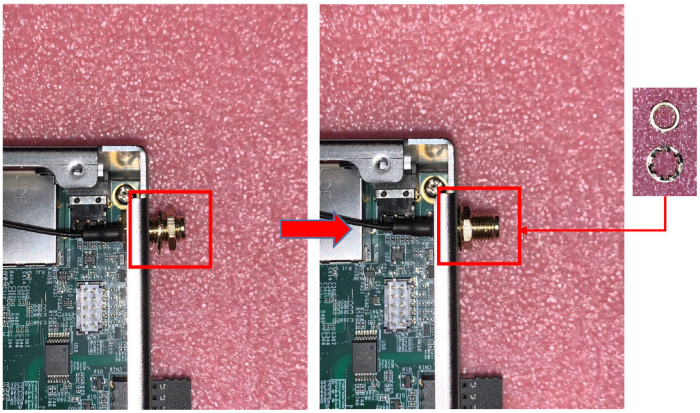


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3. Connect the RF cables from 4G LTE module to chassis.

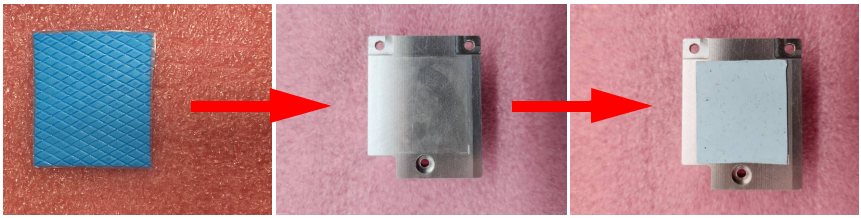


4. Tighten washer and hex nut of RF cable on chassis.

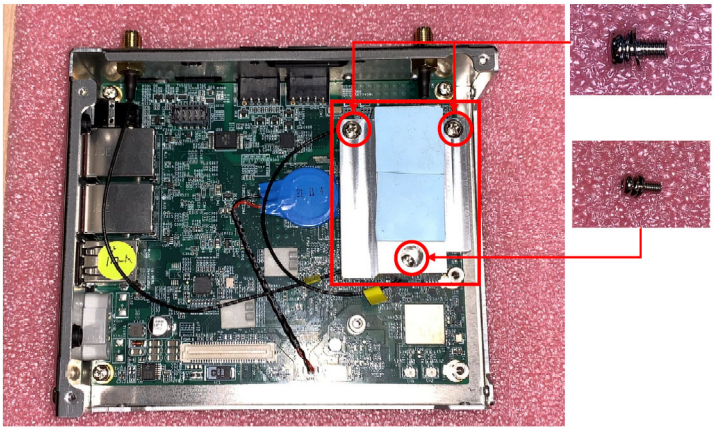


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5. Remove protective film from thermal pad and attach it on the spreader.

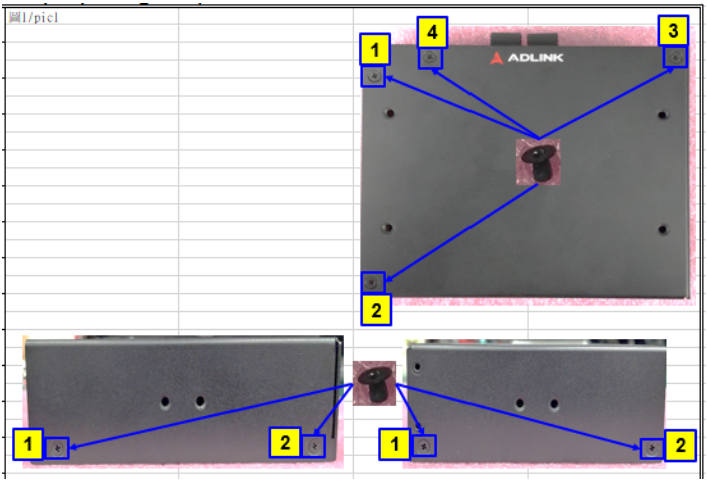


6. Put heat sink on 4G LTE module and tighten the screws.



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7. Replace the top cover.



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Important Safety Instructions

For user safety, please read and follow all instructions, Warnings, Cautions, and Notes marked in this manual and on the associated device before handling/operating the device, to avoid injury or damage.

- Read these safety instructions carefully.
- Keep the User's Manual for future reference.
- Read the Specifications section of this manual for detailed information on the recommended operating environment.
- The device can be operated at an ambient temperature of 50ºC for DC power source and adapter.
- It is recommended that the device be installed in Information Technology Rooms that are in accordance with Article 645 of the National Electrical Code and NFPA 75.
- When installing/mounting or uninstalling/removing device:
  - Turn off power and unplug any power cords/cables.
  - Reinstall all chassis covers before restoring power.
- To avoid electrical shock and/or damage to device:
  - Keep device away from water or liquid sources.
  - Keep device away from high heat or humidity.
  - Keep device properly ventilated (do not block or cover ventilation openings).
  - Always use recommended voltage and power source settings.
  - Always install and operate device near an easily accessible electrical outlet.
  - Secure the power cord (do not place any object on/over the power cord).
  - Only install/attach and operate device on stable surfaces and/or recommended mountings.
  - This apparatus is powered by adapter or DC source. Please ensure the adapter or DC source has a grounded connection.
- If the device will not be used for long periods of time, turn off and unplug it from its power source
- Never attempt to repair the device, which should only be serviced by qualified technical personnel using suitable tools

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- A Lithium-type battery may be provided for uninterrupted backup or emergency power.



Risk of explosion if battery is replaced with one of an incorrect type; please dispose of used batteries appropriately.
Risque d'explosion si la pile est remplacée par une autre de type incorrect. Veuillez jeter les piles usagées de façon appropriée.

- The device must be serviced by authorized technicians when:
  - The power cord or plug is damaged.
  - Liquid has entered the device interior.
  - The device has been exposed to high humidity and/or moisture.
  - The device is not functioning or does not function according to the User's Manual.
  - The device has been dropped and/or damaged and/or shows obvious signs of breakage.
- Disconnect the power supply cord before loosening the thumbscrews and always fasten the thumbscrews with a screwdriver before starting the system up.
- Terminal block wires should be fixed tightly by an authorized technician with the recommendation wire range: 16-24, str, sol, wire type: copper.
- It is recommended that the device be installed only in a server room or computer room where access is:
  - Restricted to qualified service personnel or users familiar with restrictions applied to the location, reasons therefor, and any precautions required.
  - Only afforded by the use of a tool or lock and key, or other means of security, and controlled by the authority responsible for the location.



BURN HAZARD
Touching this surface could result in bodily injury. To reduce risk, allow the surface to cool before touching.

RISQUE DE BRÛLURES
Ne touchez pas cette surface, cela pourrait entraîner des blessures.
Pour éviter tout danger, laissez la surface refroidir avant de la toucher.

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Consignes de Sécurité Importantes

Pour la sécurité de l'utilisateur, veuillez lire et suivre toutes les instructions, avertissements, mises en garde et notes marqués dans ce manuel et sur l'appareil associé avant de manipuler/ d'utiliser l'appareil, afin d'éviter toute blessure ou tout dommage.

- *Lisez attentivement ces consignes de sécurité*
- *Conservez le manuel de l'utilisateur pour pouvoir le consulter ultérieurement*
- *Lisez la section Spécifications de ce manuel pour des informations détaillées sur l'environnement d'exploitation recommandé*
- *L'appareil peut être utilisé à une température ambiante de 50 ° C pour la source d'alimentation et l'adaptateur CC.*
- *Il est recommandé d'installer l'appareil dans Information Salles technologiques conformes à l'article 645 du Code national de l'électricité et NFPA 75.*
- *Lorsque l'installation/le montage ou la désinstallation/le retrait du périphérique est requis:*
  Lorsque l'installation/le montage ou la désinstallation/le retrait du périphérique est necessaire:
  - *Mettez l'appareil hors tension et débranchez tous les cordons/câbles d'alimentation*
  - *Réinstallez tous les couvercles de châssis avant de rétablir l'alimentation*
- *Pour éviter les chocs électriques et/ou d'endommager l'appareil:*
  - *Tenez l'appareil à l'écart de toute source d'eau ou de liquide*
  - *Tenez l'appareil à l'écart d'une forte chaleur ou d'une humidité élevée*
  - *Maintenez l'appareil correctement ventilé (n'obstruer ou ne couvrez pas les ouvertures de ventilation)*
  - *Utilisez toujours les réglages de tension et de source d'alimentation recommandés*
  - *Installez et utilisez toujours l'appareil près d'une prise de courant facilement accessible*

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- *Fixez le cordon d'alimentation (ne placez aucun objet sur le cordon d'alimentation)*
- *Installez/fixez et utilisez l'appareil uniquement sur des surfaces stables et/ou sur les fixations recommandées*
- *Cet appareil est alimenté par un adaptateur ou une source DC. Veuillez vous assurer que l'adaptateur ou la source DC est relié à la terre s'il dispose d'une mise à la terre de protection.*

- *Si l'appareil ne doit pas être utilisé pendant de longues périodes, éteignez-le et débranchez-le de sa source d'alimentation*
- *N'essayez jamais de réparer l'appareil, qui ne doit être réparé que par un personnel technique qualifié à l'aide d'outils appropriés*
- *Une batterie de type Lithium peut être fournie pour une alimentation de secours ininterrompue ou d'urgence*.



Risque d'explosion si la pile est remplacée par une autre de type incorrect. Veuillez jeter les piles usagées de façon appropriée.

- *L'appareil doit être entretenu par des techniciens agrees lorsque:*
  - *Le cordon d'alimentation ou la prise est endommagé(e)*
  - *Un liquide a pénétré à l'intérieur de l'appareil*
  - *L'appareil a été exposé à une forte humidité et/ou de la buée*
  - *L'appareil ne fonctionne pas ou ne fonctionne pas selon le manuel de l'utilisateur*
  - *L'appareil est tombé et/ou a été endommagé et/ou présente des signes évidents de dommage*
- *Débranchez le cordon d'alimentation avant de desserrer les vis à oreilles et serrez toujours les vis à oreilles avec un tournevis avant de mettre le système en marche*
- *Le fil du bornier doit être fixé fermement par un technicien agréé et recommandé pour la gamme de fils : 16-24, str, sol, type de fil: Cu*

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- *Il est recommandé d'installer l'appareil uniquement dans une salle de serveurs ou une salle informatique où l'accès est:*
  - *Réservé au personnel de service qualifié ou aux utilisateurs familiarisés avec les restrictions appliquées à l'emplacement, aux raisons de ces restrictions et toutes les précautions requises*
  - *Uniquement autorisé par l'utilisation d'un outil, d'une serrure et d'une clé, ou d'un autre moyen de sécurité, et contrôlé par l'autorité responsable de l'emplacement*

	***RISQUE DE BRÛLURES*** *Ne touchez pas cette surface, cela pourrait entraîner des blessures.* *Pour éviter tout danger, laissez la surface refroidir avant de la toucher.*

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