



io mini

# Installation Guide





# CONTROL SHEET

Issue	Date YYYY/MM/DD	Description	Originator
1	2024-07-10	iO mini	SB



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# 1. HARDWARE INSTALLATION

## 1.1 PREPARING TO INSTALL IO MINI

In accordance with Articles 100-16, 100-17, and 110-18 of the National Electrical Code, ANSI/NFPA # 70 1987, this equipment should be installed in a restricted access area. It should be installed by qualified personnel as close as possible to the equipment to be monitored to reduce cabling and installation time. These are maximum distances that should not be exceeded to maintain the highest level of performance.

Table 1 - Maximum Distances

Description	Cabling	Maximum Distance
Logic Ground	24, 26	2000 ft
Input Power	22, 20 twisted pairs	250 ft
Ethernet	Cat-5	328 ft*
RS-485	22, 24 twisted pairs	Up to 4000 ft**

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### NOTE \*

Ethernet Maximum Distance is specified at 328 ft, but depending on the configuration, it may be possible to reach greater distances though not guaranteed. Therefore, it is recommended to use a booster or a router/switch at each 328 ft to stabilize the network.

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### NOTE \*\*

RS-485 Maximum Distance will depend on the baud rate. The greater the baud rate is, the lower the maximum distance will be.

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Before proceeding with the iO mini's installation, it is important to have a good understanding of the possible device relationships and interconnections with third-party smart devices. This type of information can be found in engineering or interconnection diagrams, methods of procedure, or other specific application guides.

For additional support, do not hesitate to contact the Multitel Customer Service Engineering Group at [support@multitel.com](mailto:support@multitel.com).



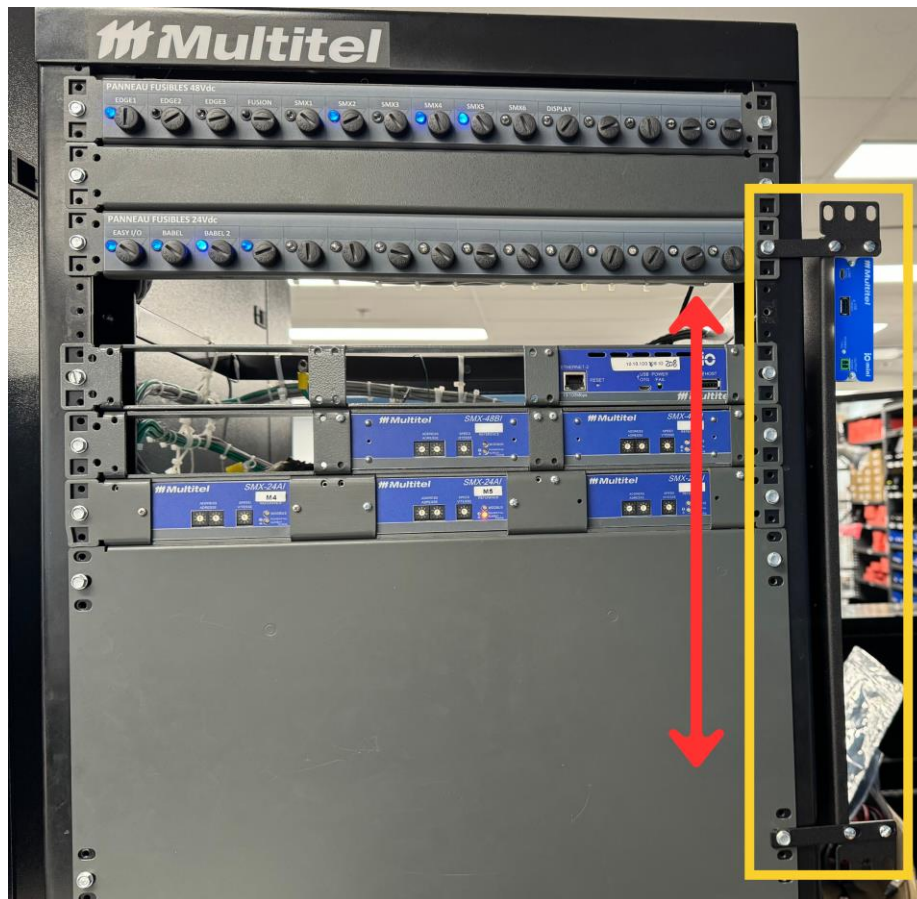
## 1.2 IO MINI RACK INSTALLATION

There are two ways to install the bracket: vertically or horizontally.

The bracket for a horizontal installation is a 19-inch bracket.

The 19-inch bracket can be installed directly on either the left or right rail of the rack without requiring any RU spaces.

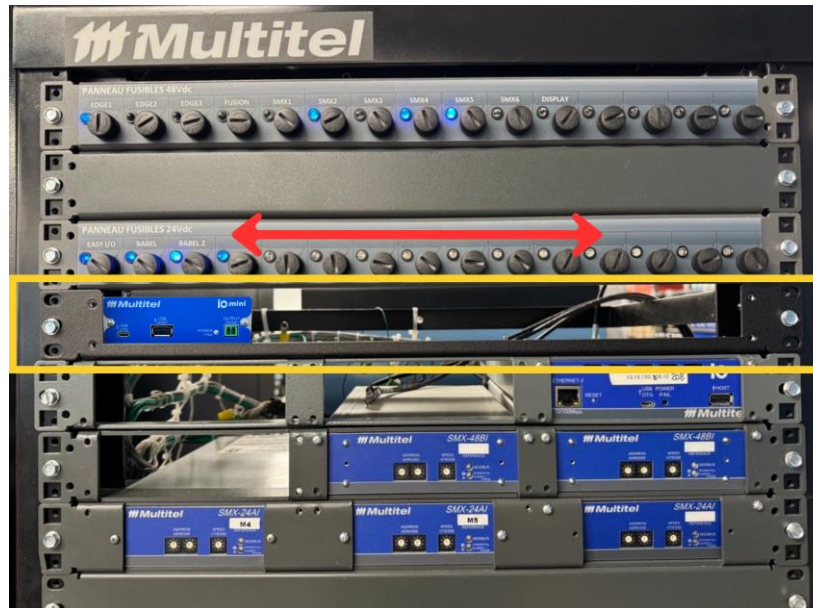
Figure 1: Rack Vertical Installation





The bracket can also be installed within a single RU if there is available space.

Figure 2: Rack RU Installation



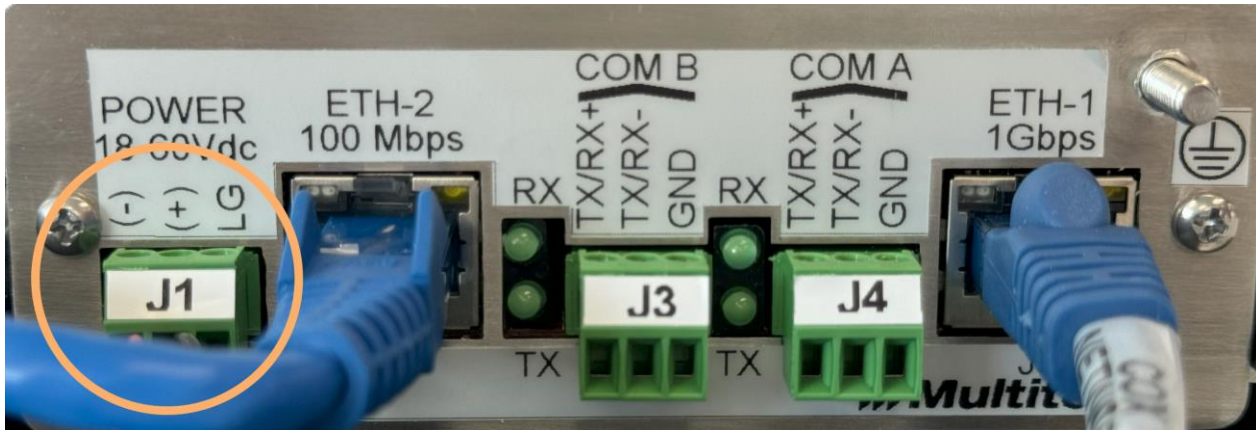
The bracket can be installed and used in different rack types.



### 1.3 IO MINI POWER AND GROUD CONNECTION

The iO mini has one power feed (J1).

Figure 3: iO mini Power Feed



The input voltage range is between 18-60V DC. The input has reverse polarity protection, but the correct polarity should always be utilized.

Table 2: Power Connector Pinout

Connectors	PIN (left to right)	Name	Description
J1	1	(-)	Negative Feed
	2	(+)	Positive Feed
	3	LG	Logic Ground: Only used with EXP card binary inputs.

Table 3: iO mini Power Requirements

Typical Input Voltage	Input Voltage Range	Max Current	Max Power Consumption	Fuse
-48Vdc	±18Vdc to ±60Vdc	<b>Without 12Vdc output</b> 333mA at 18Vdc 125mA at 48 Vdc <b>With 12Vdc option</b> 666mA at 18Vdc 250mA at 48 Vdc	<b>Without 12Vdc output</b> 6W <b>With 12Vdc option</b> 12W	1 1/3 A Max.



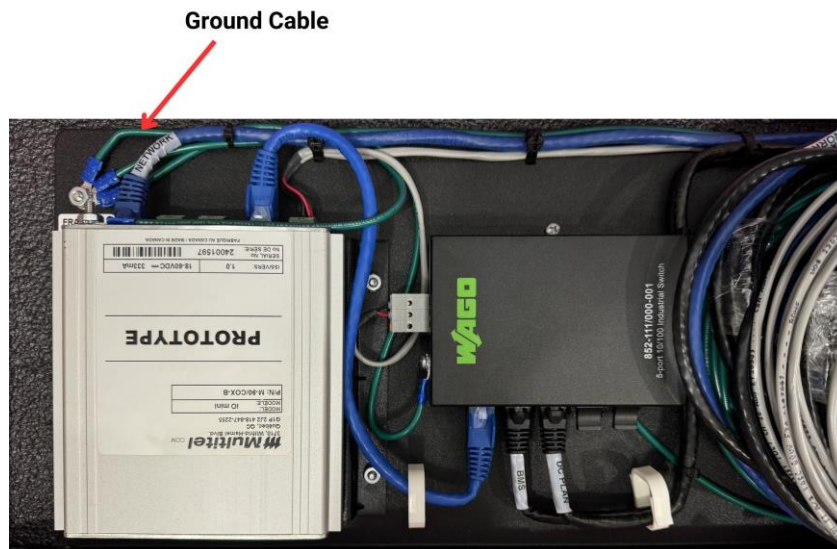
### 1.3.1 WIRING THE IO MINI

The iO mini is powered by a continuous 18 to 60Vdc power source. The module is equipped with a single feed J1. The Power Input status can be found in the General Parameters – System Information.

Through the use a wire-stripping tool, strip each of the two wires coming from the DC-input power source to 0.25 in (6.3 mm) + 0.02 in (0.5 mm). Do not strip more than 0.29 in (7.4 mm) of insulation from the wire. Stripping more than the recommended amount of wire can leave exposed wire from the terminal block plug. Insert the wires into the terminal block.

Connect the green wire to ground the device to your rack or ground bar.

Figure 4: iO mini Ground Cable







## 2 NETWORK CONFIGURATION

### 2.1 IO MINI NETWORK SETTINGS

The iO web interface can be accessed via a web browser client (such as Google Chrome, Firefox, and Edge). Note that Internet Explorer is not supported. The device can be accessed via the two Ethernet ports. However, to access the iO web interface for the first time, it is recommended to use the ETH-2 100 Mbps port.

Table 4: iO Network Factory Settings

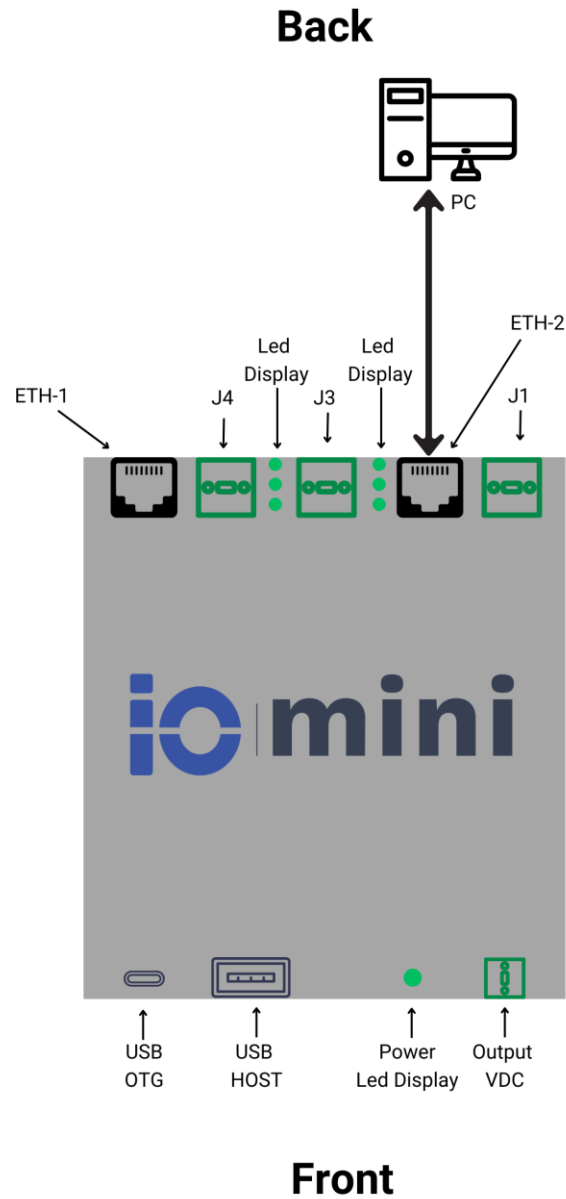
Connectors	Ethernet Ports	IP Address	Subnet Mask	Gateway
J5	ETH-1 1 Gbps		DCHP	
J2	ETH-2 100 Mbps	192.168.1.2	255.255.255.0	192.168.1.1



## 2.2 LAN CONFIGURATION

The first step is to configure a Local Area Network (LAN) between the iO mini and the user's PC.

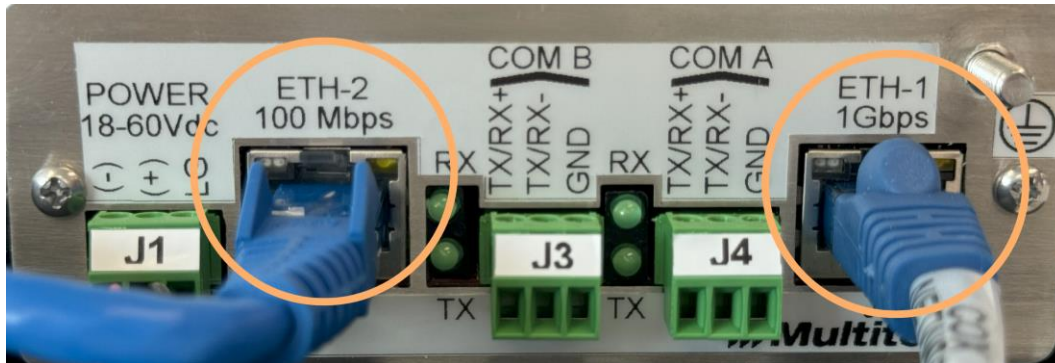
Figure 5: LAN Connection





To create a LAN connection between a PC and the iO mini, the user needs to connect an Ethernet cable (CAT-5, CAT-6, or CAT-5e) between the iO ETH-2 (J2) and the user's PC Ethernet port.

Figure 6: iO mini Back Ethernet Port



Once the Ethernet cable is connected to both ends, activity lights should blink on the iO mini ETH-2 port. If there is no activity, please check the connection and the cable.

The next step is to create the actual LAN configuration between the iO and the user's PC. This can be done on a Windows PC:


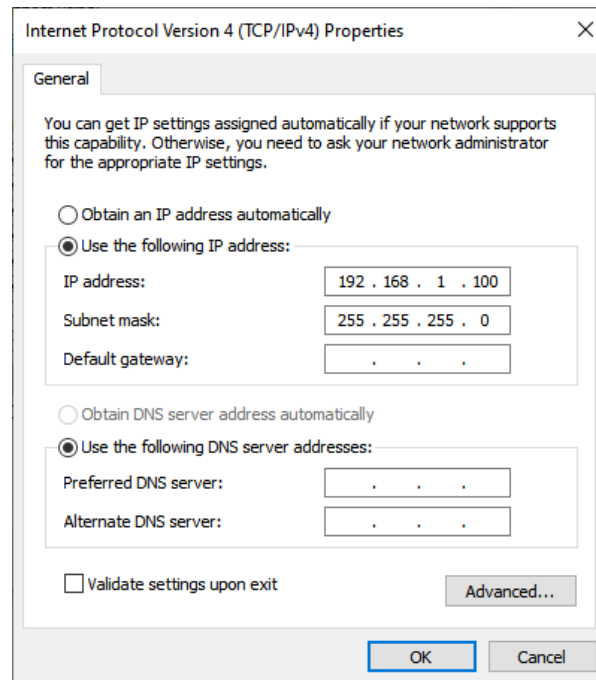
1. Go to the control panel;
2. View by: Large icons; View by: [Large icons](#) ▼
3. Click on Network and Sharing Center;  Network and Sharing Center
4. Change adapters settings;
5. Identify the Ethernet port connected to the iO;
6. Optional: Disable any other connections (Wi-Fi);
7. Right click on the Ethernet port;
8. Click on properties;
9. Click on Internet Protocol Version 4 (TCP/IPv4);
10. Click on properties;
11. Click on "Use the following IP address";
12. Change the IP address and Subnet mask to 192.168.1.100 & 255.255.255.0; and
13. Click on OK.



Figure 7: Changing IPv4 Properties on PC

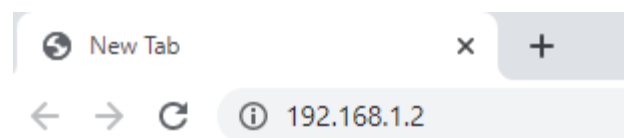


By changing the IPv4 of the PC to 192.168.1.100, a LAN connection is created between the user's PC and the iO mini front Ethernet port (192.168.1.2).

To validate the LAN connection:

1. Open Google Chrome (or your preferred browser); and
2. Input 192.168.1.2 in the address bar.

Figure 8: IP Address in Google Chrome

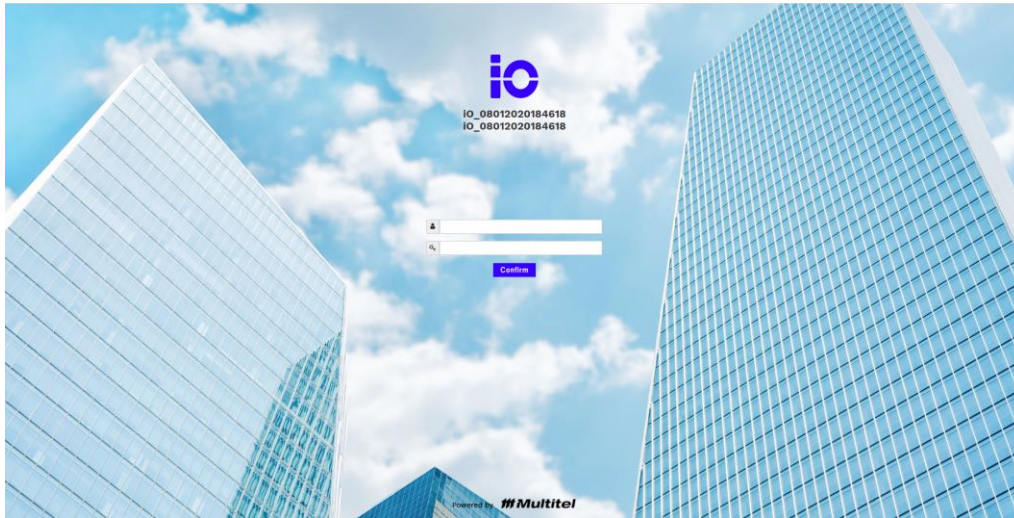




## 2.3 LOGIN

Once the default IP address is entered in the address bar and the LAN configuration has been properly configured, the user can access the iO mini login page.

Figure 9: Login



The factory credentials are the following:

Table 5: Factory Credentials

Credentials	
Administrator	Username administrator
	Password admin



## 2.4 ETH-1 CONFIGURATION

Once the Login process is completed:

1. Click on Settings; 
2. Click on Connections; 
3. Go to ETH 1 – 1 Gbps;
4. Change the Mode from DHCP to Static;
5. Change the network configuration to the desired IP address:

Table 6: New IP Configuration (ETH-1)

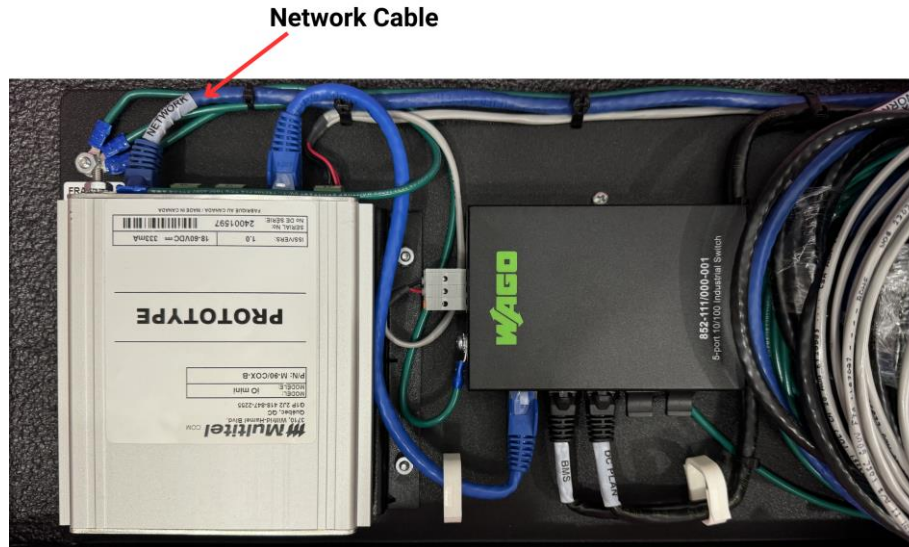
IP CONFIG	OLD	NEW
IP Address		XXX.XXX.XXX.XXX
Subnet Mask	DHCP	255.255.255.XXX
Default Gateway		XXX.XXX.XXX.XXX

6. Click on “Save”;
7. Save a screen capture of the new ETH-1 configuration;
8. Click on “Reboot”; 
9. Reboot process will take around 90 seconds; and
10. Wait until the Login Page appears.



## 2.5 NETWORK VALIDATION

1. Connect the blue cable to your switch (see blue network cable in photo);
2. Connect to your Network;
3. Open your web browser;
4. Input the new IP address in the address bar; and
5. The iO login page should appear.



## 2.6 DEVICE CONFIGURATION

1. Change the IP addresses of the DC Plant Controller and BMS devices according to Table 7.

Table 7: OSP Cabinets LAN Devices

Category	Name	Model	Manufacturer	IP Address
DC Plant	NetSure NCU	NetSure NCU	Vertiv	192.168.1.100
DC Plant	Cordex	Cordex CXCM1	Alpha	192.168.1.104
DC Plant	Lineage	Lineage SPS	GE	192.168.1.103
BMS	Servato BMS	Servato	Servato	192.168.1.101
BMS	String 1/2	PBT SC4 Controller	PBT	192.168.1.102



2. Connect the black cable labeled “BMS” to the Servato or PBT unit Ethernet port. Validate that Ethernet port LED activity is present at the device and at the iO mini switch.



BMS Cable

DC Plant Cable

3. Connect the black cable labeled “DC Plant” to the corresponding DC Plant controller Ethernet port. Validate that Ethernet port LED activity is present at both the device and the iO mini switch.
4. Open a supported web browser.
5. Input the iO ETH-1 IP address in the address bar.
6. Log in to the unit.





Figure 10: iO mini OSP Configuration

The screenshot shows the 'DATA SOURCES | Dashboard' interface for 'ATL Lab-1 (OSP) iO mini'. The main content is a table of equipment with the following columns: Status, Equipment Name, Equipment Category, Equipment Model, Communication Protocol, Manufacturer, Equipment IP Address, and Actions. The table contains 8 rows of equipment data.

Status	Equipment Name	Equipment Category	Equipment Model	Communication Protocol	Manufacturer	Equipment IP Address	Actions
●	NetSure NCU	DC Plant	NetSure NCU	SNMP	Vertiv	192.168.1.100	Web Access ***
●	Cordex	DC Plant	Cordex CXCM1	SNMP	Alpha	192.168.1.104	Web Access ***
●	Lineage	DC Plant	Lineage SP5	SNMP	OE	192.168.1.103	Web Access ***
●	Servato BMS	BMS	Servato	SNMP	Servato	192.168.1.101	Web Access ***
●	String 1	BMS	PBT SC4 Controller	SNMP	Phoenix Broadband Technologies	192.168.1.102	Web Access ***
●	String 2	BMS	PBT SC4 Controller	SNMP	Phoenix Broadband Technologies	192.168.1.102	Web Access ***
●	NetSure NCU 2100	DC Plant	NetSure NCU	SNMP	Vertiv	192.168.1.105	Web Access ***

- Click on Web Access on the right of the DC Plant Controller and BMS

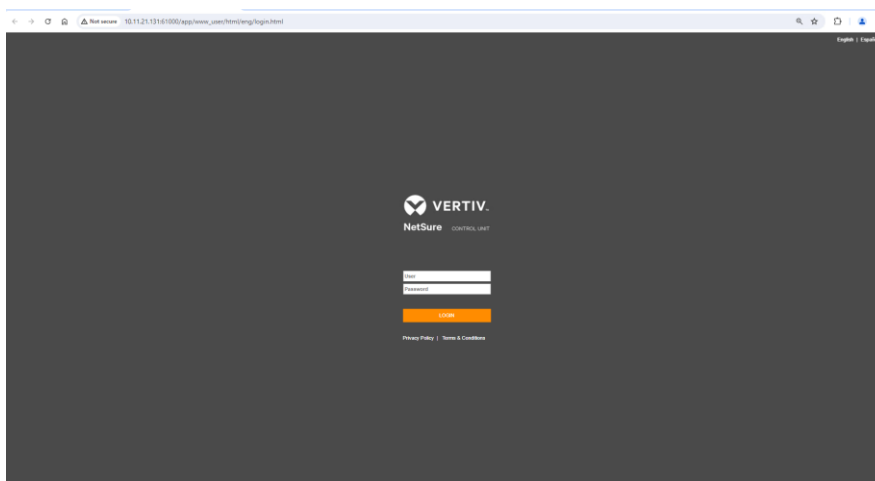
Figure 11: DC Plant Controller and BMS Web Access

This screenshot is a zoomed-in view of the 'Actions' column for the 'NetSure NCU' row in the table from Figure 10. A yellow box highlights the 'Web Access' button and the three dots below it.

Status	Equipment Name	Equipment Category	Equipment Model	Communication Protocol	Manufacturer	Equipment IP Address	Actions
●	NetSure NCU	DC Plant	NetSure NCU	SNMP	Vertiv	192.168.1.100	Web Access ***

- The web interfaces of the DC Plant Controller or BMS should appear in a new tab of the web browser.

Figure 12: DC Plant Controller and BMS Web Interfaces



- Confirm that the web interfaces of both the BMS and DC Plant controller are reachable.



## 3 MONITORING AND TRAP FORWARDING

### 3.1 MONITORING

1. Make sure the cables are connected correctly to the device indicated per the labels.
2. Log into the iO interface and, on the homepage, click on the three dots located in the Actions column (upper right side of the dashboard), then click on “edit”.

The screenshot shows the iO interface with a table of equipment. The table has the following columns: Status, Equipment Name, Equipment Category, Equipment Model, Communication Protocol, Manufacturer, Equipment IP Address, and Actions. The first row is highlighted, and the 'Actions' column for that row contains a 'Web Access' button and three dots, which are circled in red in the original image.

Status	Equipment Name	Equipment Category	Equipment Model	Communication Protocol	Manufacturer	Equipment IP Address	Actions
●	NetSure NCU	DC Plant	NetSure NCU	SNMP	Vertiv	192.168.1.100	Web Access ...
●	Cordex	DC Plant	Cordex CXCM1	SNMP	Alpha	10.11.21.139	Web Access ...
●	Lineage	DC Plant	Lineage SPS	SNMP	GE	192.168.1.103	Web Access ...
●	Servato BMS	BMS	Servato	SNMP	Servato	192.168.1.101	Web Access ...
●	String 1	BMS	PBT SC4 Controller	SNMP	Phoenix Broadband Technologies	192.168.1.102	Web Access ...
●	String 2	BMS	PBT SC4 Controller	SNMP	Phoenix Broadband Technologies	10.11.21.141	Web Access ...



- Click first on the Disable/Enable toggle in the upper right side of the screen, and then click on the “Save” button located on the lower left side of the screen to save the Enable/Disable configuration of your device.

The screenshot shows the configuration page for a NetSure NCU. The 'State' toggle is set to 'Disabled' and is circled in red. The 'Save' button at the bottom left is also circled in red. The configuration includes fields for Equipment Name, Smart Equipment, Communication Protocol, Equipment IP Address, Equipment Hostname, SNMP Version, SNMP V2C, SNMP Device Community Name, Equipment Category, Equipment Model, Manufacturer, Equipment Time Out, Time Out After Retry, Number Of Retry, Total Iteration Number, and Multi-Road.

The iO mini units provided to Cox Communication were already uploaded with a configuration file. Thus, the specified data points from the DC plants and the BMSs should automatically be polled by the iO mini. In order to validate that the iO mini is correctly polling your data points:

- Click on the button located on the left side of each piece of equipment.

The screenshot shows the dashboard with a table of equipment. A red arrow points to the 'Web Access' button for the first equipment item, NetSure NCU. The table has columns for Status, Equipment Name, Equipment Category, Equipment Model, Communication Protocol, Manufacturer, Equipment IP Address, and Actions.

Status	Equipment Name	Equipment Category	Equipment Model	Communication Protocol	Manufacturer	Equipment IP Address	Actions
<input type="checkbox"/>	NetSure NCU	DC Plant	NetSure NCU	SNMP	Vertiv	192.168.1.100	Web Access ***
<input type="checkbox"/>	Cordex	DC Plant	Cordex CXCM1	SNMP	Alpha	10.11.21.139	Web Access ***
<input type="checkbox"/>	Lineage	DC Plant	Lineage SPS	SNMP	GE	192.168.1.103	Web Access ***
<input type="checkbox"/>	Servato BMS	BMS	Servato	SNMP	Servato	192.168.1.101	Web Access ***
<input type="checkbox"/>	String 1	BMS	PBT SC4 Controller	SNMP	Phoenix Broadband Technologies	192.168.1.102	Web Access ***
<input type="checkbox"/>	String 2	BMS	PBT SC4 Controller	SNMP	Phoenix Broadband Technologies	10.11.21.141	Web Access ***



Once this is completed, the available data points for the equipment will be displayed.

The screenshot shows the 'DATA SOURCES | Dashboard' interface. The 'Equipment' tab is selected, displaying a table of equipment. The table has columns for Status, Equipment Name, Equipment Category, Equipment Model, Communication Protocol, Manufacturer, Equipment IP Address, and Actions. The status of each equipment is indicated by a green dot.

Status	Equipment Name	Equipment Category	Equipment Model	Communication Protocol	Manufacturer	Equipment IP Address	Actions
●	NetSure NCU	DC Plant	NetSure NCU	SNMP	Vertiv	192.168.1.100	Web Access
●	Cordex	DC Plant	Cordex CXCM1	SNMP	Alpha	192.168.1.104	Web Access
●	Lineage	DC Plant	Lineage SP5	SNMP	GE	192.168.1.103	Web Access
●	Servato BMS	BMS	Servato	SNMP	Servato	192.168.1.101	Web Access
●	String 1	BMS	PBT SC4 Controller	SNMP	Phoenix Broadband Technologies	192.168.1.102	Web Access
●	String 2	BMS	PBT SC4 Controller	SNMP	Phoenix Broadband Technologies	192.168.1.102	Web Access
●	NetSure NCU 2100	DC Plant	NetSure NCU	SNMP	Vertiv	192.168.1.105	Web Access

2. In the next screen, you should see the data points in green.

The screenshot shows the 'DATA SOURCES | Dashboard' interface with a modal window open for the 'NetSure NCU 2100' equipment. The modal displays a table of data points with columns for Mnemonic, Data Point Description, Value, Status, Binary Status, Actions, and Last Update. All data points are shown with a green status indicator.

Mnemonic	Data Point Description	Value	Status	Binary Status	Actions	Last Update
STA11	DC Plant Voltage	54.49 V	●	<input checked="" type="checkbox"/>		01:47:01 PM 07/09/24
STA12	DC Plant Current	0.76 A	●	<input checked="" type="checkbox"/>		12:47:01 PM 07/09/24
STA13	DC Plant Temp #1	84.46 F	●	<input checked="" type="checkbox"/>		01:47:34 PM 07/09/24
STA14	DC Plant Temp #2	71.12 F	●	<input checked="" type="checkbox"/>		01:48:03 PM 07/09/24



### 3.2 TRAP FORWARDING

1. Log into the iO interface and, on the homepage, click on the “Trap Forwarding” icon.
2. In the Destination tab, make sure that the destination IP and SNMP configurations are correct. Click on “Test” to send an SNMP TRAP to the NOC to validate the communication between the iO and the NOC.
3. In the Source tab, create the source (BMS and DC Plant Controller) and make sure that the TRAPs are sent to the correct destinations.
4. Use the BMS or DC Plant Controller to generate a test trap to validate that the Trap Forwarding is working.



## 4 LDAP CONFIGURATION

### 4.1 LDAP

1. Log into the iO interface and, on the homepage, click on the “Settings” icon followed by clicking on “Security.”
2. In the LDAP tab, click on “test connection” in the Hosts section. The LDAP server current host should be green, which means that the iO was able to successfully establish a connection between the iO and the LDAP Server.

The screenshot shows the iO Settings Security page. At the top, there is a navigation bar with the iO logo, 'SETTINGS | Security', and the user 'ATL Lab-1 (OSP) iO mini' with a timestamp of '03:55:47 PM 07/08/24'. Below the navigation bar, there is a 'BEGIN CERTIFICATE' section with a warning message: 'The connection to the LDAP will now be encrypted with the provided key'. The main content area is divided into several sections: 'User Search Settings' with fields for 'User Search Base DN' (OU=CCLDC-CORP,DC=COX,DC=com) and 'Username Attribute' (UserPrincipalName); 'Service Account Settings' with fields for 'Login' and 'Password'; 'Hosts' section with an 'Add Host' field and a 'Current Host' field containing 'atl2 ldap.cox.com' which is highlighted in green, with a 'TEST CONNECTION' button below it; and 'Groups' section with a table listing local and distant group DNs.

Local	Distant Group DN
Contractor	CN=CATL0-IOGateway-Contractors,OU=Groups,OU=Atlanta Corporate,OU=CCL
Supervisor	CN=CATL0-IOGateway-Supervisors,OU=Groups,OU=Atlanta Corporate,OU=CCL
User	CN=CATL0-IOGateway-Users,OU=Groups,OU=Atlanta Corporate,OU=CCL,DC=C

Software Version: 1.8.8.636 / OS Version: 2.8.3.202406193 / Backend is Ready

3. Click on the iO icon at the top right and log out.

The screenshot shows the iO login page. At the top, there is a navigation bar with the text 'ATL Lab-1 (OSP) iO mini', the time '10:38:17 AM 07/11/24', and the iO logo. Below the navigation bar, there is a blue box containing the iO logo, the text 'Administrator ATL Lab-1 (OSP) iO mini', and three buttons: 'USER PROFILE' and 'LOG OUT'.

4. On the login page, use LDAP credentials to login to the iO web interfaces.



Table 7: LDAP Username Attribute

Username Attribute Type	Nomenclature
sAMAccountName	Firstname.Lastname Ex. John.Doe
userPrincipalName	<a href="#">EmailAddress@domain.com</a> Ex. John.Doe@johndoe.com
name	Firstname Lastname Ex. John Doe

5. Validate the access level for the different user groups.



## 5 INSTALLATION AND COMMISSIONING CHECKLIST

You can test the installation of the iO mini with the following checklist:

QUESTIONS	Y/N
Are the frame grounds connected?	
Is the power feed connected?	
Were the cables prepared to ensure there are no bare-ended power cables?	
Are there any loose cables and are all cables attached or tie-wrapped together?	
Are all mounting screws tightened?	
Is the iO mini POWER/FAIL LED on the front panel solid green?	
Are the cable designations clear and self-explanatory?	
Is the unit's IP address labeled?	
Have the distribution fuse locations been assigned and designated?	
Are all measurement readings calibrated?	
Is the polarity for each input signal correct?	