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The groov® Edge Appliance (groov Box) is an Opto 22 internet of things (IoT) and operator interface appliance that provides visualization, data handling, and connectivity to automation systems, software, databases, and devices of all kinds—all in a compact, industrially hardened box suited to the edge of the network.

**Visualization:** From pumps and processes, to production data, to the weather, your world is full of things you need to view, monitor, or control. With browser-based groov View, you can easily build an operator interface to see and interact with exactly what you need. Show data from sensors and automation systems, cloud applications, databases, web services, and more. Securely view the interface you build on any brand device, from a smartphone to a computer to a web-enabled big-screen TV.

To build your interface, just drag, drop, and tag. No tag limits; no user licenses required. Set up authorized users and groups. Define events based on one or more conditions, and automatically alert selected personnel anywhere when events occur. groov View can augment existing human-machine interfaces (HMI) and SCADA systems by making specific data visible to authorized users at any time and in any location.

**Data Handling:** The key to IoT usefulness is getting the data out of where it’s trapped and into the systems and software where it’s needed. With the groov Edge Appliance, you can use standard internet and IT-compatible tools to manipulate and move data between things in the real world and computer systems and software on premises or in the cloud.

Key tools are built into the groov Box and ready for use: Node-RED, an IoT rapid application development environment; RESTful APIs to groov View Data Stores; and Ignition Edge® from Inductive Automation®, with OPC UA and MQTT. You can place the secure groov Box at the network’s edge in harsh industrial environments and know you have the tools right there to acquire data, move it, and act on it.

**Connectivity:** The groov Box simplifies the connections you need to accomplish your IoT goals. Connect to all kinds of devices and systems to monitor and control them and move data between them.
SYSTEM REQUIREMENTS

- Connect directly to Modbus/TCP devices, Opto 22 groov EPIC® processors, groov RIO units, SNAP PAC controllers, and SNAP PAC I/O units to access their data.
- Use Node-RED (included) to create logical flows for data. Exchange data with cloud applications, IoT platforms, on-premises databases, and external web services. Also connect to serial devices—Modbus RTU/ASCII, weigh scales, and more—via a USB-to-serial converter and Node-RED.
- Use our secure RESTful API from your database, cloud service, or business application to place data in or read data from a groov Data Store, where you can access it for your use.
- Connect to PLCs and PACs from other automation manufacturers using OPC UA:
  - With the internal Ignition Edge server and drivers, connect to Allen-Bradley® and Siemens® PLC systems, plus others (requires Ignition Edge license, GROOV-LIC-EDGE).
  - With an external OPC-UA server such as Kepware Technologies’ KepServerEX®, connect to any system or database your server and drivers support.
- Publish and subscribe data from devices connected to the groov Box to brokers, using the lightweight MQTT transport protocol. MQTT creates a high-performance communications architecture ideal for getting the data that’s trapped behind firewalls into SCADA software like Ignition Enterprise (requires Ignition Edge license, GROOV-LIC-EDGE).

The groov Box brings data from process control, OEM machines, manufacturing and building systems, and the internet of things (IoT) to the people and systems that need it.

NOTE: If you need real-time control as well as connectivity, data handling, and visualization, see the groov EPIC (Edge Programmable Industrial Controller) System. The groov Box is compatible with groov EPIC, groov RIO, and the SNAP PAC System, and all can be used in combination to meet the needs of your application.

SYSTEM REQUIREMENTS

To build operator interfaces with groov View, you’ll need:

- Any computer with a web browser (does not have to be a Windows PC)
- One of the following:
  - groov EPIC
  - groov Edge Appliance
  - groov Server for Windows

You can connect to any of the following devices or services to get and send data:

- A Modbus/TCP device
- A database, online service, or software program to get data from or put data into a Data Store using the groov API
- An Opto 22 groov EPIC processor or SNAP PAC controller (SNAP PAC S-series, R-series, or SoftPAC, with firmware R9.2a or newer), running a PAC Control strategy
- An Opto 22 groov EPIC I/O unit
- An Opto 22 groov RIO unit
- An Opto 22 SNAP PAC I/O unit
- (groov EPIC or groov Box only) A database, cloud application, API, or serial device accessible via a Node-RED node. (Serial device with a groov Box requires a USB-to-serial converter with FTDI chipset, groov Admin R1.570.46 or higher, and Node-RED for groov Box version 3 or higher.)
- OPC UA-compatible automation system or equipment. Ignition Edge supplies an internal server and drivers for groov EPIC or a groov Box. Additional drivers or an external OPC-UA server may be required for your equipment.

NOTE: Browser-based groov View software works on a large number of device/operating system/browser combinations, including HDTVs, smartphones and tablets, and computers. If one browser is causing problems for you, however, try another one and let us know what issues you’ve seen. For Product Support, see page 6.
EVERYTHING YOU CAN DO WITH THE groov BOX

Congratulations on choosing the groov Box! This compact industrial box is designed for harsh environments and is ideal for industrial internet of things applications at the edge of the network. Because it includes not only groov View but also Node-RED and Ignition Edge with MQTT, the groov Box gives you the modern tools you need to make your IoT projects a reality.

The diagram below illustrates how data can move easily between the devices and software at the top, and the industrial systems and equipment at the bottom. You can use the open standards and methods that work best for your skills and situation: groov devices and tags, tags in Ignition Edge, and nodes in Node-RED flows. (You’ll need a groov Edge license to fully use Ignition Edge for OPC UA and MQTT.) With all these tools in the same box, configuration and security are simplified.
groov BOX COMMUNICATIONS

groov uses standard computer networks and protocols. The unit communicates with computer networks over a standard 10/100/1000 Mbps Ethernet network. For use on a wireless network, you must purchase and install a USB WiFi adapter that has been tested and approved by Opto 22. For more information, see Appendix C: Installing an Approved USB WiFi Adapter.

With two independent wired Ethernet network interfaces plus an optional independent wireless interface, the unit gives you the flexibility to monitor devices in hard-to-reach areas and to set up networking suited to your business.

In addition, you can use your groov Box as an access point in order to create a private wireless network with WPA2-PSK security. This is particularly useful for connecting a phone or tablet to groov View when there is no other wireless network available. SoftAP can be used by any WiFi-capable device. Your groov Box can be connected to either a wireless or Ethernet network. See “Using an AR1 as a Wireless Access Point” on page 29.

Using a USB-to-serial converter and Node-RED in the groov Box, you can also connect to serial devices. You can use data from these devices in your groov View operator interface or anything with a Node-RED node, for example a database or a cloud-based service such as IBM Watson IoT. See “Connecting with serial devices” on page 51 for more information.

SYSTEM ARCHITECTURE

When you first set up your groov Box, the PC you use must reside on the same network (broadcast domain) as the Box. In a quick and easy setup, the development PC and smartphone or tablet running groov View all reside within the same domain as the Box. The controller or other device that supplies data to the groov Box can also be on the same network, or it can be on a separate control network as shown below. For more information, see form 2161, the Guide to Networking groov.

The following illustration shows the groov Box connected to control systems from other manufacturers as well as an Opto 22 controller and I/O units. (The illustration shows a SNAP PAC controller, but the groov Box is also compatible with groov EPIC and groov RIO.) When accessing the groov Box outside the Box’s network, over the internet, we recommend a VPN (Virtual Private Network) connection for security. The HTTPS (HTTP plus TLS/SSL) in your browser shows that all data exchanged between your browser and the groov Box is encrypted.
ABOUT THIS GUIDE

This user’s guide shows you how to install and set up your groov Box, how to get started with Node-RED and Ignition Edge, and how to use the groov Admin and Node-RED Admin software. groov Admin provides the tools to back up and restore your project, update groov and Ignition Edge, set up wired and wireless networking, and more. Node-RED Admin includes tools for debugging, backing up, and restoring Node-RED flows, nodes, and credentials. For other information:

- For information about building and viewing groov View interfaces, see form 2027, the groov View User’s Guide. You can also find groov View videos and other resources on our website.
- For information about Node-RED, visit nodered.org. Also see Node-RED videos on our website.
- For Ignition Edge, see inductiveautomation.com.
What’s In This Guide

Chapter 1: Welcome (this chapter) introduces this user’s guide and the groov Box.

Chapter 2: Getting Started describes how to get your groov Box up and running quickly.

Chapter 3: Using groov Admin describes how to use groov Admin to back up and restore groov, manage the network connections, access system information, and more.

Chapter 4: Using Node-RED introduces the open-source tool Node-RED (included in the groov Box) and shows you how to use Node-RED Admin to manage your nodes and flows.

Chapter 5: Using Ignition Edge gets you started with the OPC UA server and MQTT communications option included in your groov Box.

Chapter 6: Using an SSL Certificate describes using an SSL certificate that is digitally signed either by a certificate authority (CA) or self-signed.

Chapter 7: Maintenance and Troubleshooting provides troubleshooting information and answers questions you might have about the groov Box.

Chapter A: Specifications and Dimensions provides technical specifications and dimensions.

Chapter B: Connectors, Ports, and LEDs describes connector and LED functions.

Chapter C: Installing an Approved USB WiFi Adapter provides a list of USB WiFi adapters Opto 22 has tested and approved for use with GROOV-AR1-BASE, and installation instructions.

PRODUCT SUPPORT

If you have any questions about your groov Box, you can call, fax, or e-mail Opto 22 Product Support.

Phone: 800-TEK-OPTO (800-835-6786 toll-free in the U.S. and Canada)
         951-695-3080
         Monday through Friday,
         7 a.m. to 5 p.m. Pacific Time

Fax: 951-695-3017

Email: support@opto22.com

Opto 22 website: www.opto22.com

NOTE: Email messages and phone calls to Opto 22 Product Support are grouped together and answered in the order received.

When calling for technical support, be prepared to provide the following information about your system to the Product Support engineer:

- groov Image version and groov Admin version. Click the System Information icon in the Admin Quick Start (see page 39).
- A description of your system equipment:
  - Computer type, speed, memory, and operating system
  - Browser type and version
  - OPC UA server type and configuration
- A description of the network
- Specific error messages or other diagnostic indications
2: Getting Started

This chapter shows you how to install the groov Box and set up the groov Admin software.

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WHAT YOU WILL NEED

In order to set up your groov Box and do the activities in this chapter, you will need a computer with a web browser on the same network you’ll use for the groov Box. You’ll need a recent web browser: Chrome, Firefox, Edge, Safari, or Internet Explorer 11.

IN THE BOX

These items are included in the box:

- groov Quick Start for GROOV-AR1, form 2103
- groov Box (GROOV-AR1)
- Ethernet cable
- Power supply unit
- One DIN clip and one flat surface mounting bracket (includes four screws)
- Drill template for the mounting bracket
- Activation key certificate
STEP 1. GET TO KNOW THE groov BOX

To set up the groov Box, you’ll use the components shown below. Make sure to put the activation key certificate in a safe place. You’ll need the activation key later when you activate your groov Box.

STEP 2. CHOOSE A LOCATION

The groov Box is a fanless industrial appliance made to operate in tough environments (see specs on page 107 for temperature and humidity). Some location considerations:

- Make sure there is room around the front, top, and sides of the groov Box to allow air to flow freely around the device. Also, you need to be able to see the information on the bottom.
- If you plan to use the two Ethernet network interfaces on the groov Box to separate your control network from an untrusted network (for example, a network with internet access), place it where you can connect to both networks. (For more on networking, see the Guide to Networking groov, form 2161).
- If you’re connecting to a wireless LAN through a WiFi adapter in the top USB port, choose a location where the signal is constant and strong. Wireless networks can be unreliable unless carefully designed and periodically checked.
- If you’re a machine builder or OEM and including a groov Box in your machine, the same basic ideas apply: check specs, check security, and then install. Make sure you have network access to the Box for updates.

**STEP 3. MOUNT THE groov BOX**

Mounting brackets are provided for you to attach the groov Box to a flat surface or a DIN rail. If there will be vibration at the groov Box installation site, make sure to mount the device to a flat surface for a secure installation.

**Mounting on a flat surface:**

1. Using the screws provided, install the surface mounting bracket on the back of the groov Box.

![Surface mounting bracket](image)

2. Using the hole template provided, drill holes for #6 or #8 screws in the mounting surface.

![Drill template](image)

3. Secure the device to a flat surface with #6 or #8 screws.

**Mounting on a DIN rail:**

1. Using the screws provided, install the DIN rail clip on the back of the groov Box.
2. Attach the groov Box to the DIN rail.

STEP 4. CONNECT TO THE NETWORK

1. Connect an Ethernet cable from ETH0 to your computer’s network.
   
   *NOTE: Opto 22 recommends connecting ETH0 to a network with DHCP and DNS services. If you do not have these services, you’ll need to manually configure networking.*

2. The two independent Ethernet connectors (ETH0 and ETH1) have separate IP addresses that can be used to segment a control system’s network from the company LAN. If your Opto 22 controller, OPC UA server, or Modbus/TCP device is on a different network from your computer, connect ETH0 to your computer’s network and ETH1 to the other network.
   
   If you are using both ETH0 and ETH1, make sure they have IP addresses on different subnets. In some situations, this may require configuring a static IP address for the groov Box to avoid communication errors. For more information, see “Assigning a Static IP Address” on page 24.
STEP 5. CONNECT THE POWER SUPPLY

Your groov Box requires a power supply with an output of 8–36 VDC, 24 VDC @ 500 mA. You can use the power supply that comes with the groov Box, or provide your own. In either case, we recommend using a UPS (uninterruptible power supply) for backup power and surge protection.

If you are using the power supply that came with the groov Box, do the following:

Plug the small connector on the power supply into the power terminal on the bottom of the groov Box, and tighten the screws. Plug the other end into a standard 120 or 240 VAC outlet.

If you are using your own power supply, do the following:

1. With the power supply off or unplugged, connect the + (positive) lead from the power supply (normally red) to the + (positive) terminal on the power connector.

   **CAUTION:** Reversing wire polarity may cause damage to your groov Box. This damage is not covered by Opto 22's warranty. If you are not certain about the polarity of the wires on your power supply, check with a meter.

2. Connect the COM wire from the power supply (normally black) to the – (negative) terminal on the power connector.

3. Plug the power supply into a standard 120 or 240 VAC outlet.

STEP 6. TURN ON THE groov BOX

Firmly press the On/Off button only until the SYS LED lights up (in about one second), then release. Take a look at the LNK ACT light for ETH0; if the cable is properly connected, the LNK ACT light should be on or blinking.
STEP 7. ACTIVATE THE GROOV BOX AND GET THE LICENSE FILE

1. Open a web browser. Log into manage.groov.com using your email address and your My.Opto22 password. You may have set up your free My.Opto22 account when you purchased your groov Box. If you don’t have a My.Opto22 account, enter your email address and other information, and the account will be created.

2. Click the Activate button.
3. Follow the on-screen instructions to activate your groov Box. The activation key is printed on the activation key certificate included with the groov Box. When asked to enter the serial number, you’ll find it on the label on the bottom of the device.
4. If you also purchased a groov Edge license for OPC UA or MQTT use, activate the Edge license in the same way, applying it to the groov Box.

5. From the groov Profile page, click the Download license file button and save the file to your computer. If you activated an Edge license, copy the license number and save it.

6. After activating the groov Box and downloading the license file, return to this guide and continue with step 8.

**STEP 8. OPEN groov VIEW**

In most cases you’ll open groov View using your web browser. If your network does not have DNS, use groov Find from a Windows computer (see page 14).

**Opening groov View using your web browser**

1. Make sure the SYS LED on the groov Box has stopped blinking.
2. On your computer, open a web browser (like Firefox, Chrome, Safari, Edge, or Internet Explorer 11).
3. Enter https:// and your groov Box’s hostname as the URL. The hostname is printed on the bottom of the groov Box.
   For example, if the hostname is opto-00-d2-dc, you type https://opto-00-d2-dc

Make sure you type https. The s indicates it is a secure (encrypted) connection.
STEP 8. OPEN GROOV VIEW

NOTE: If you’ve assigned a static IP address to the groov Box, or if your network doesn’t provide DHCP and DNS services, use the IP address instead of the hostname to open groov View.

4. Accept the security warning as described below.

   For Chrome:
   – Click “Advanced” to expand the initial screen.
   – Click “Proceed to <hostname> (unsafe).”

   For Firefox:
   – Expand “I Understand the Risks.”
   – Click Add Exception to open the Add Security Exception dialog box.
   – Select “Permanently store this exception.”
   – Click Confirm Security Exception.

   For Internet Explorer 10 or newer: Click “Continue to this website (not recommended).”
    For Safari: Click Continue.

The Welcome to groov window opens in your web browser. Now go to “Step 10. Install the License File” on page 16.

Opening groov View using groov Find

If your network does not have DNS, use a Windows computer with groov Find to locate the groov Box on your network.

1. Download groov Find from our website (click the link or go to www.opto22.com and search on groov Find). Save the file to your computer.
2. Open the Find application file.
   If you have User Account Control (UAC) turned on, a message appears asking if you want Find to be allowed to make changes to your computer.

   NOTE 1: If you are using a Windows account that does not have Administrator privileges (such as Guest), you will need to enter the Administrator User Name and Password in order to use groov Find. If you do not have this information, contact your IT department.

   NOTE 2: Clicking Yes permits Find to have temporary administrative privileges to create an additional temporary IP address for each network interface on the computer. This enables Find to locate a groov device on a network that does not have DNS and DHCP. If the network does not have DNS and DHCP, you will need to assign a static IP address to the groov device in order to maintain communication. (See “Assigning a Static IP Address” on page 24.) If the network does have DNS and DHCP, the temporary IP address is not used and is removed when you exit Find.
3. Click Yes. 
   *groov* Find opens and automatically searches for *groov* devices on the network, including *groov* Boxes, *groov* EPICS, and *groov* RIO units.

4. Find the serial number on the bottom of the *groov* Box.

5. Locate the matching serial number in Find.

6. Click the link for *groov* View. 
   When your browser connects to *groov* View for the first time, the browser will display a security warning. This is normal behavior.

7. Accept the security warning as described below.

   **For Chrome:** Click “Proceed anyway.”

   **For Firefox:**
   - Expand “I Understand the Risks.”
   - Click Add Exception to open the Add Security Exception dialog box.
   - Select “Permanently store this exception.”
   - Click Confirm Security Exception.
STEP 9. CREATE A GROOV ADMIN ACCOUNT

Follow the on-screen instructions to create a username and password for groov Admin. (Do not include spaces in the username or password.) The groov Admin account is for administrative tasks such as changing or editing the network connections and updating the groov Box. (You will create a different account for your groov View project.)

**CAUTION:** Write down your Username and Password, and keep them in a safe place. You will need this information each time you log in. If you lose your login information, you will have to reset the groov Box to factory defaults, which will erase your project. For security, there is no password recovery option.

STEP 10. INSTALL THE LICENSE FILE

Make sure to install your license file. Without an installed license, groov will work for only two hours.

1. When prompted to add a license file to groov, click Install License.

2. Browse to the license file you downloaded in Step 7 (page 12), and then click Open. Your license is now installed.

STEP 11. CREATE A groov VIEW ACCOUNT

A groov View account lets you use groov View to create, edit, and use an operator interface. (Remember, your groov View account is different from the groov Admin account you created in Step 9.)

1. When prompted, enter a new username and password. Enter the password again to confirm.

   **IMPORTANT:** Remember your username and password! There is no way to recover it if you lose it.

2. Click Create groov View Account.

3. Click Go to Build mode. Build mode opens in your browser.

   If you have any trouble opening groov View, see Troubleshooting in the groov View User’s Guide, form 2027. To create and view your mobile operator interface, see instructions in the groov View User’s Guide.
3: Using *groov* Admin

With *groov* Admin, you can back up and restore your projects and project settings, update software and firmware, set up wired and wireless networking, and more.

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**OPENING *groov* ADMIN**

You can open *groov* Admin in three ways:
- From Build mode—see below
- Using the *groov* Admin URL—page 17
- From *groov* Find (only on a Windows computer)—page 18

**Open *groov* Admin from Build mode**

In Build mode, choose Configure > *groov* Admin. To log in, see page 20.

**Open *groov* Admin using the URL**

1. In your web browser, enter https://hostname:10000
2. When groov Admin opens, log in (see page 20).

Open groov Admin using groov Find (Windows only)

groov Find is a utility that locates your groov Box on the network and provides a link so that you can access the groov applications. It is useful if you have multiple groov Boxes, because it finds and lists them all. (It also finds all groov EPICs and groov RIO units.) You can easily switch from one Box to another, for example when updating.

NOTE: You need to have Administrator privileges on your Windows account to use groov Find. If you do not have this information, contact your IT department.

1. Download groov Find from our website (go to www.opto22.com and search on groov Find). Save the file to your computer.

2. Open the Find application file.
   If you have User Account Control (UAC) turned on, a message appears asking if you want Find to be allowed to make changes to your computer.

   ![User Account Control](https://opto-00-d2-dc:10000/hostname:port 10000)

   Hostname

   GROOV-AR1
   Serial Number: 888888
   Default Hostname: opto-00-d2-dc
   ETH0: 00-A0-3D-00-D2-DC ETH1: 00-A0-3D-00-D2-DD

NOTE 1: If you are using a Windows account that does not have Administrator privileges (such as Guest), you will need to enter the Administrator User Name and Password.
NOTE 2: Clicking Yes permits Find to have temporary administrative privileges to create an additional temporary IP address for each network interface on the computer. This enables Find to locate a groov device on a network that does not have DNS and DHCP. If the network does not have DNS and DHCP, you will need to assign a static IP address to the groov Box in order to maintain communication. (See “Assigning a Static IP Address” on page 24.) If the network does have DNS and DHCP, the temporary IP address is not used and is removed when you exit Find.

3. Click Yes.
   groov Find opens and automatically searches for groov devices on the network.

4. Locate the serial number on the bottom of the groov Box.

5. Locate the matching serial number in Find.

   If you do not see the serial number right away, wait 60 seconds and click Search For Devices.

6. Click the groov Admin link. (If it isn’t there, click the link “Click to start groov” to start the initial setup on the groov Box. See “Step 8. Open groov View” on page 13.)
   A security warning appears in your web browser.

7. Accept the security warning (if you need help, see the next section).

8. Log in (see page 20).
Accept the Security Warning

groov uses the TLS/SSL (Transport Layer Security/Secure Sockets Layer) to protect your data by encrypting data exchanged between your browser and the groov Box. When a computer or mobile device attempts to access groov, your browser will issue a security warning unless the appropriate SSL security certificate is installed on the device.

If your computer resides in the same domain as the groov Box, you can safely accept the warning because your data is protected by the 256-bit encryption. However, if you want to avoid seeing the security warning, you can install the self-signed certificate on your computer and other devices that access groov. See “Using a Self-Signed Certificate” on page 90.

If your computer or other device will access groov from outside groov’s network or over the Internet, Opto 22 strongly recommends you obtain an SSL Certificate from a third-party company that is authorized to confirm your user’s ID. See “Using a CA-Signed Certificate on the groov Box” on page 95.

To accept the security warning, see the section below for your browser.

For Chrome
- Click “Advanced” to expand the initial screen.
- Click “Proceed to <hostname> (unsafe).”

For Firefox
1. Expand “I Understand the Risks.”
2. Click Add Exception to open the Add Security Exception dialog box.
3. Select Permanently store this exception.
4. Click Confirm Security Exception.

For Safari
Click Continue.

For Internet Explorer
Click “Continue to this website (not recommended).”

Log in

CAUTION: There is no password recovery option. Write down your Username and Password, and keep it in a safe place. You will need this information each time you log in. If you lose your login information, you will have to reset the groov Box back to factory defaults, which will erase your project.

1. Enter the groov Admin account Username and Password.
2. Click Sign in to open groov Admin.
NOTE: There is a session timer of 10 minutes. If you don’t do anything for 10 minutes, you will be logged out and have to log in again.

QUICK START MENU

groov Admin opens at the Quick Start menu.

The quick start buttons take you directly to some of the more common actions in groov Admin.

- **View System Information**
  Check system information and see usage statistics. “Checking System Information” on page 39.

- **Update groov View**
  Update groov View. See “Updating groov View” on page 30.

- **Update groov Admin**
  Update groov Admin itself with the latest version. See “Updating groov Admin” on page 34.

- **Update Node-RED**
  Update Node-RED software running on the groov Box. See “Updating Node-RED” on page 36.

- **Configure Network Interfaces**
  Configure IP settings for the wired and optional wireless Ethernet interfaces: ETH0, ETH1, and WLAN0. See “Configuring Network Connections” on page 23.

To return to the Quick Start menu, in the left navigation bar, click Quick Start.

OPENING groov VIEW FROM groov ADMIN

To go to groov View, in the left navigation bar, click groov View.
OPENING NODE-RED ADMIN FROM groov ADMIN

To go to Node-RED Admin (or Node-RED), in the left navigation bar, click Node-RED.

Node-RED Admin opens. You’ll need to log in; use your groov Admin username and password.

For more information on Node-RED and Node-RED Admin, see Chapter 4: Using Node-RED.

OPENING IGNITION EDGE FROM groov ADMIN

1. To go to Ignition Edge, in the left navigation bar, click Ignition Edge.
2. If Edge is already running, click Open Ignition Edge.
3. If Edge is not running, check Enable and run Ignition Edge. Wait for the message that all changes are done, and then click Back. Return to the screen shown above and click Open Ignition Edge.

For more information, see Chapter 5: Using Ignition Edge.

CONFIGURING IGNITION EDGE

See the following sections for more information about configuring Ignition Edge:
- “License Ignition Edge” on page 76
- “Use Ignition Edge Designer or Edge Panel” on page 82.

CONFIGURING NETWORK CONNECTIONS

groov is designed to work with a network that has a Dynamic Host Configuration Protocol (DHCP) server and a Domain Name Server (DNS). If your network has DHCP and DNS, you do not need to assign an IP address to the groov Box; you just plug it in and the IP address is assigned automatically. This is the recommended method for setting up the groov Box.

However, if you need to customize your network connections for groov after the initial setup, groov Admin provides the tools to do that.

This section includes the following topics:
- “Assigning a Static IP Address” on page 24
- “Changing the Hostname, DNS Servers, or IPv4 Gateway” on page 25
- “Configuring ETH1 for the Control Network” on page 25
- “Configuring Wireless Communications” on page 26
- “Using an AR1 as a Wireless Access Point” on page 29

To set up your network, see form 2161, the Guide to Networking groov. This guide provides detailed information on how to make your groov network more secure. It also describes how to directly communicate with groov over the Internet using a virtual private network (VPN) or with port forwarding (PF). A VPN is recommended because it is more secure.
Assigning a Static IP Address

If you do not have a DHCP server, you’ll need to configure a static address to either ETH0 or ETH1. Otherwise there may be communication errors.

**NOTE:** If you are using a laptop computer to assign a static IP address, make sure you disable Windows’ Internet Connection Sharing (ICS). If you don’t, the laptop will act like a DHCP server and assign a dynamic address.

You’ll need to get the following networking information from your IT department:

- **IPv4 address**—A unique, fixed (static) IP address.
  - For example: 172.18.234.1
- **Netmask**—Identifies the subnetwork.
  - For example: 255.255.0.0
- **Gateway** (optional)—Identifies the route to the Internet.
  - For example: 172.18.1.1

1. In the left navigation bar choose Networking > Network Configuration, or click the Configure Network Interfaces button in Quick Start.

   OR:

2. Click the wired Ethernet connection you want to configure.

   **NOTE:** Use ETH0 as the main network connection. Only use ETH1 if you have segmented networks.

3. Select Static configuration. Enter the static IP Address and Netmask.
4. Click Save.
Changing the Hostname, DNS Servers, or IPv4 Gateway

In order to identify the groov Box more easily on the network, you might want to change the hostname from the default. And, depending on your network setup, you might need to change the DNS Servers or IPv4 Gateway.

*NOTE: Keep in mind that any changes to this interface may make your system inaccessible via your current wired or wireless connection. Be sure to write down the new hostname or other changes.*

1. In the left navigation bar choose Networking > Network Configuration, or click the Configure Network Interfaces button in Quick Start.

OR:

The Network Configuration page opens.

2. In the Client Options are, change the hostname, DNS servers, or IPv4 Gateway as necessary.

*NOTE 1: A hostname cannot have spaces or special characters.*

*NOTE 2: Any changes to this interface may make your system inaccessible via your current wired or wireless connection. Be sure to write down the new hostname or other changes.*

3. Click Save.

Configuring ETH1 for the Control Network

If your computer is on a different network than the control network, you need to configure ETH1 by assigning it an IP address and subnet appropriate for the control network.

1. In the left navigation bar choose Networking > Network Configuration, or click the Configure Network Interfaces button in Quick Start.
2. Click ETH1.

3. If the network has DNS and DHCP, select “From DHCP.” If it doesn’t, enter a static IP Address and Netmask. 

   NOTE: If you are using static addresses, ETH1 must be on a different subnet than ETH0.

4. Click Save.

Configuring Wireless Communications

If you want to use your groov Box on a wireless network, you must purchase and install a USB WiFi adapter that has been tested and approved by Opto 22. See Appendix C: Installing an Approved USB WiFi Adapter.

You can configure the groov Box to connect to a wireless network through an access point using the 802.11b, 802.11g, and 802.11n protocols.

Before you begin, get the following information from your IT Department:

SSID—Name of the wireless network access point you want the groov Box to join

Security—Encryption type (WPA or WPA2), network key input type (hex or ASCII), and password

Password—To access the wireless network

1. With the groov Box connected via ETH0, in groov Admin’s left navigation bar choose Networking > Network Configuration, or click the Configure Network Interfaces button in Quick Start.
2. Click WLAN0.

3. Enter the Network Name (SSID).
   The SSID is a text string from 1 to 32 characters used to uniquely identify the wireless network. This should match the SSID of the access point you want to connect to.
   
   **NOTE:** If the SSID contains one or more spaces, enclose the SSID with quotation marks. For example, enter “Opto 22” instead of Opto 22.
   
4. Select the Encryption Type.
   This is the type of encryption used to encrypt any packet sent or received between the access point and the groov Box.
   - **None**—No encryption used.
   - **WEP64**—Use WEP encryption with a 5 digit ASCII or 10 digit hexadecimal key. WEP has been deprecated by IEEE and should not be used in new installations.
   - **WEP128**—Use WEP encryption with a 13 digit ASCII or 26 digit hexadecimal key.

   **NOTE:** WEP is not secure and has been deprecated by the Institute of Electrical and Electronics Engineers (IEEE). Do not use WEP in new installations unless it is the only option available. Use WPA or WPA2 instead.
   
   - **WPA**—Use TKIP encryption (RC4) with an 8 to 63 digit ASCII or 64 digit hexadecimal key.
   - **WPA2**—Use CCMP encryption (AES) with an 8 to 63 digit ASCII or 64 digit hexadecimal key.

5. Choose the Network Key Type.
   Select ASCII or Hexadecimal keys. Typically, WEP uses hexadecimal keys and WPA uses ASCII keys.
6. Enter the Network Key.
   Use the key for the Encryption Type selected above. This is a write-only field.

7. Scroll down to the Boot Time Interface Parameters section.

![Boot Time Interface Parameters](image)

8. Select From DHCP.
   If the wireless network does not have a DHCP server, assign a static IP address and netmask.

9. Click Save.
   Wait till you see the following message.

   Congratulations. You're connected!

10. IF ETH0 and WLAN are on the same subnet, disconnect the cable from ETH0.
    You need to disable ETH0 because the groov Box will continue to communicate over ETH0 as long as it is connected on the same subnet and enabled.

    **NOTE:** If you are using a control network and an enterprise network, and ETH0 is on a different subnet, you can leave it connected.

    a. In the Network Configuration page, click ETH0.

    ![Edit Interface](image)

    b. Select Disabled, then click Save.
c. Click the Back button, and notice that in the Network Configuration page, ETH0 is disabled (Down) and WLAN0 is enabled (Up).

### Using an AR1 as a Wireless Access Point

groov's SoftAP (Software Access Point) feature allows you to use your groov Box as an access point in order to create a private wireless network with WPA2-PSK security. This is particularly useful for connecting a phone or tablet to the groov Box when there is no other wireless network available. SoftAP can be used by any WiFi-capable device. Your groov Box can be connected to either a wireless or Ethernet network.

In order to use SoftAP, you will need one of the following WiFi adapters:

- Netis WF2119S
- Netis WF2116

These are the only WiFi adapters tested and approved for this feature.

1. Follow the instructions on page 113 to install your Netis WiFi adapter.
2. With the groov Box connected via ETH0, in groov Admin’s left navigation bar choose Networking > Network Configuration, or click the Configure Network Interfaces button in Quick Start.

3. In the Network Configuration page, click WLAN0.
4. Scroll down to Boot Time Interface Parameters and make sure that WLAN0 is Disabled.
5. Scroll back up and click the Wireless Access Point tab.
6. Next to **Enable?**, choose Yes.
7. Edit the following parameters as necessary:
   - **Static IPv4 Address**—Use an IP address that is not on the same subnet as ETH0 or ETH1.
   - **Network Name (SSID)**—Enter a name between 1 and 32 characters.
   - **Network Key**—Enter a key between 8 and 63 characters.
   - **Channel**—The WiFi Channel should be between 1 and 14, depending on the geographic region.
     Click **Execute WiFi Sight Survey** to display a table of detectable WiFi access points and populate the Channel field with the quietest channel available.
8. Click Save.

Now you’re ready to connect your wireless device to your new wireless network using the Network Name and Network Key. For information about using a mobile device with groov, see form 2105, the *Setting Up groov Mobile Apps Technical Note*.

**UPDATING groov VIEW**

1. Before updating groov View, back up your project (see page 32).
2. Make sure the groov Box is activated. See “Step 7. Activate the groov Box and Get the License File” on page 12.
3. Go to manage.groov.com and follow directions to download the latest groov View update file and save it to your computer.
4. Open groov Admin.
5. Click Quick Start and then the Update groov View button.
6. Click Choose File, navigate to the update file you downloaded, and then click Open.
7. Click Update.
   Wait while the application is installed and restarted automatically, which may take several minutes. When the operation is complete, a success message appears.
BACKING UP groov VIEW AND NETWORK SETTINGS

During backup, project components are saved to a file on your computer or a USB flash drive. You should back up groov View frequently. There is no automatic backup.

NOTE: To back up Node-RED, see page 57. To back up Ignition Edge, see page 81.

groov View project backups are interchangeable among the groov Box, groov EPIC, and groov Server. So you can restore to groov EPIC a project you backed up from a groov Box, and vice versa.

If you have two groov Boxes, EPICs, or Servers at different versions of groov View and you want to move a project to the older version, it will usually work only between lettered versions. For example, moving a project from a product running groov View at R3.3b to one running groov View at R3.3a should be OK, but moving from R3.3 to R3.2 is not likely to work. As much as possible, it’s safest to keep your groov products at the same release.

To restore from the backup file, see “Restoring groov View and Network Settings” on page 33.

IMPORTANT: Your groov View project files are not encrypted or masked in any way. This means that most of the project information in them (except for the groov View user passwords) can be read, including the following:

- SMTP account info (including password)
- User email accounts (does not include the groov View user passwords, which are securely encrypted before being stored)
- Device addresses
- Tag address information (PAC tag names, Modbus addresses, OPC node-id, etc.)

Opto 22 recommends that you secure your backup files using file- or disk-based encryption provided either by the operating system or other software/hardware.

Also, be aware that if you send project files to Opto 22, our personnel will have access to the information listed above.

Follow these steps to back up:
1. In the left navigation bar, choose System > Backup and Restore.
2. Click the Back up tab.
3. Select the components you want to back up.
   
   **groov (Build, View, projects)** saves groov View, Build mode, and your project.

   **Ethernet/Wireless Settings** saves any settings you’ve configured for ETH0, ETH1, and the wireless network, including IP, Subnet, Gateway, Hostname, SSID, Wireless Network Key, etc.

4. Do one of the following:
   
   – Select Download to PC.
   – Insert a USB drive into a USB slot on the front of the groov Box. Select Save to USB Flash Drive. (The option is not available until you insert the USB drive. If necessary, refresh the page.)

5. Click Back up.
   
   – If saving to the PC, save the file (don’t open it).
   – If saving to a USB flash drive, the file is downloaded to your USB drive. When you see the prompt to Eject the USB drive, click Eject. Wait for the prompt that says it’s OK to remove the flash drive before you take it out of the groov Box.

---

**RESTORING groov VIEW AND NETWORK SETTINGS**

Use the following instructions to restore groov View components and network settings from a backup file saved on a computer or USB flash drive (see “Backing Up groov View and Network Settings” on page 32).

**NOTE:** To restore Node-RED, see page 57. To restore Ignition Edge, see page 81.

1. In the menu tree, click System, and then click Backup and Restore.

2. Click the Restore tab.
3. Select the components you want to restore. If you choose a component that isn’t included in the backup file, it won’t be restored.

   *groov (Build, View, projects)* restores the groov View software and the project you built in groov View.

   *Ethernet/Wireless Settings* restores any settings you’ve configured for ETH0, ETH1, and the wireless network, including IP, Subnet, Gateway, Hostname, SSID, Wireless Network Key, etc.

4. Do one of the following:
   - To restore from your PC, select Upload from PC, then click Choose File and locate your backup file.
   - To restore from a USB flash drive, insert the drive with the backup file into a slot on the front of the groov Box. (The option is not available until you insert the USB drive. If necessary, refresh the page.) Click Load from USB Flash Drive, then click the browse button and select your backup file.

5. Click Restore, and then wait while the files are uploaded. It may take several minutes.

**UPDATING groov ADMIN**

When you update groov Admin, your groov View configuration settings are kept. Updates for Ignition Edge software are included in groov Admin updates.

1. **IMPORTANT:** If you are using Ignition Edge, before you update groov Admin, do two things:
   - a. Back up your Ignition Edge project following the steps on page 81.
   - b. Deactivate your Ignition Edge license following the steps in “Unactivate Ignition Edge license” on page 80.

2. Log into manage.groov.com, click Manage, locate your groov Box in the list, and click Manage.
3. In Latest Releases, click the Filename for groov Admin to download and save the latest groov Admin update file to your computer.
4. If the Quick Start menu is not open, in the left navigation bar, click Quick Start.
5. Click Update groov Admin.

6. Click Choose File and locate the update file you downloaded. Highlight the file, and click Open.

7. Click Update.

The application file is downloaded and installed. The update process may take several minutes. It may not look like anything is happening, but it is. A small note in the lower-left corner of the screen shows progress while the file is loaded to the groov Box. Be patient and don’t click away from this page until you see the success message.

NOTE: If you have reset your groov Box to factory defaults and your original groov Admin version is 1.570.41 or lower, your Update groov Admin page may become blank for awhile and later show an “updating” message. Continue to wait. It can take as long as 15 minutes to completely update on an older Box.

8. When the success message appears, click “Click here to restart now” or click Back to restart later. (To restart later, see “Restarting the groov Box” on page 36.) Wait while it restarts, which may take several minutes.

During the restart, if you can see the groov Box, you’ll notice its LED lights go off and then come back on, and the SYS LED flash in different colors. Wait until the SYS LED has completely stopped flashing. At that point the groov Box has fully restarted, and you and your users will be able to use groov View.

9. Refresh the page to see the new groov Admin version.
10. If you are using Ignition Edge, restore your Edge project following steps on page 82, and reactivate your license as shown in “License Ignition Edge” on page 76.

UPDATING NODE-RED

1. Before updating, back up your Node-RED project using Node-RED Admin (see “Backing up and restoring your Node-RED project” on page 57).
2. Log into manage.groov.com, click Manage, locate your groov Box in the list, and click Manage.
3. In Latest Releases, click the Filename for Node-RED to download and save the latest Node-RED update file to your computer.
4. Open groov Admin.
5. Click Quick Start and then the Update Node-RED button.

![Update Node-RED](image)

6. Click Choose File, navigate to the update file you downloaded, and then click Update. Wait while Node-RED is updated, which may take several minutes.

   The groov Box must be restarted in order for updates to take effect. While it is restarting, all users are disconnected, and you won’t be able to work in groov View.

7. To restart, click the message “Click here to restart now.” Wait until the Box is fully restarted before continuing.

   If you can see the groov Box, you’ll see its LED lights go off and then come back on, and the SYS LED flash in different colors. Wait until the SYS LED has completely stopped flashing. At that point the groov Box has fully restarted, and you and your users will be able to use groov View.

RESTARTING THE groov BOX

While the groov Box is restarting, all users are disconnected, and you won’t be able to continue working in groov View. The groov Box must be restarted in order for updates to take effect.

To restart the groov Box, do one of the following:

- **After updating** groov Admin, click the message “Click here to restart now.”
In the left navigation bar, choose System > Restart groov and then click the Restart groov Box button.

If you’ve updated but not restarted the Box, click System Information, and then click “Click here to restart now.”

Hardware restart: Press the On/Off button briefly and wait for the groov Box to turn off. Then briefly press the On/Off button again to power it back up.

During a restart, if you can see the groov Box, you’ll notice that its LED lights go off and then come back on. You and your users will be able to use groov View once the groov Box has fully restarted and the SYS LED has stopped flashing.

CHANGING USERNAME AND PASSWORD

For groov Admin there is only one user; you cannot add more than one username. However, you can change the username or password for the groov Admin user. This change does not affect any usernames or passwords in groov View.

1. In the left navigation bar, choose System > Change Username/Password.
2. Enter your current username and password to verify your identity, and click Apply.

3. Enter the new username and the password in both boxes. Do not include spaces in the username or password.

   **CAUTION:** Write down your new Username and Password, and keep it in a safe place. You will need this information each time you log in. If you lose your login information, you will have to restore the groov Box back to factory defaults, erasing your project. There is no password recovery option.

4. Click Save.
   The login dialog box appears.

5. Log in using the new username and password.
CHECKING SYSTEM INFORMATION

In the left navigation bar, choose System Information in the menu tree, or click the System Information icon in Quick Start.

The following information is provided.
CHECKING HARDWARE STATUS

1. To check the status of the internal components in the groov Box, in the left navigation bar, choose System > Hardware Status.

![System Menu](image)

The following information is provided:

<table>
<thead>
<tr>
<th>Hardware Status</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Temp 1</td>
<td>36.7°C</td>
</tr>
<tr>
<td>Internal Temp 2</td>
<td>35.0°C</td>
</tr>
<tr>
<td>CPU Temp</td>
<td>35.0°C</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>15.12 V</td>
</tr>
<tr>
<td>Battery Voltage</td>
<td>3.18 V</td>
</tr>
</tbody>
</table>

If any value is out of range, it is displayed in red and a message appears. Here are the values:

- **Internal Temperature 1**: Temperature of the internal PCB located near the battery
- **Internal Temperature 2**: Temperature of the internal PCB located near the power supply
- **CPU Temperature**: Temperature of the CPU
- **Input Voltage**: Main power supply for the groov Box
- **Battery Voltage**: Voltage of the battery that maintains the date and time

2. To change the temperature units (Fahrenheit or Celsius) shown in Hardware Status, click Module Config under Help on the left-hand side.

![Module Config](image)

3. Select either Fahrenheit or Celsius.
4. Click Save.

### SETTING THE SYSTEM TIME

You can set the time and time zone used by the groov Box. You can also set the Box to synchronize with a specific time server.

1. In the left navigation bar, choose System > System Time.

2. Set the time and date and then click Apply.

3. To change the time zone from the default of UTC (Coordinated Universal Time), click the Change timezone tab.
4. In the drop-down list, select a time zone, and then click Save. Restart the groov Box to use the new time zone.

5. To set up the groov Box to automatically synchronize the time with a remote server, click the Time server sync tab. Synchronization uses the Unix time protocol or NTP, depending on the remote system.

6. Enter the hostnames or addresses of the time server(s). Separate servers by a space.

7. Click Yes next to “Synchronize once per day.”

8. Click Sync and Apply.
Included in your groov Box is Node-RED, an open-source, multi-platform software program that lets you wire together devices, databases, cloud applications, and APIs (application program interfaces) with simple logic flows.

Because Node-RED is included in the groov Box, you do not have to download and install it on a computer or embedded device. You can just log in and start using it. A tool called Node-RED Admin is included for easier debugging, backups, and certificate administration.

Node-RED nodes are available for groov View and for Opto 22 groov EPIC and SNAP PAC controllers. These are reliable industrial-grade controllers used in thousands of applications worldwide. The Node-RED nodes provide access to data in groov View Data Stores and controllers. For more information on nodes, see developer.opto22.com.

NOTE: Node-RED is not included in the original GROOV-AT1 groov Box nor on groov Server for Windows. It is included only with GROOV-AR1 Boxes.

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- Getting Started ............................................................................................................ 44
- Connecting with serial devices ............................................................................. 51
- Working with nodes ................................................................................................. 53
- Working with flows ................................................................................................... 54
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- Managing security certificates ............................................................................. 57
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WHAT IS NODE-RED?

Node-RED is a visual tool originally designed at IBM® Emerging Technologies to connect hardware devices, APIs, and online services. Many people use it for Internet of Things (IoT) applications.

In Node-RED you connect prebuilt nodes (provided by device manufacturers or software developers) together to make a flow. The flow provides the logic to accomplish your goal. You can also add function nodes containing JavaScript.
Node-RED in the groov Box

Node-RED Editor. You can include one or many flows in your Node-RED project, which you build in the standard Node-RED Editor. You can access the editor directly or from Node-RED Admin.

Because Node-RED is a general-purpose programming environment, you have the freedom to create the flows you like using any nodes you choose. Opto 22 control nodes (for groov EPIC or SNAP PAC controllers), groov View Data Store nodes, and a wide variety of other nodes are easy to install.

Serial nodes are available for Node-RED. Using an FTDI USB-to-serial adapter, you can connect one or more serial devices to the groov Box and use their data in your flows. See “Connecting with serial devices” on page 51 for more information.

Debugging. With few programming restraints, it's easy to write bugs into your flow. The Node-RED Admin tool can help you debug flows. If Node-RED crashes, it is automatically restarted. You can also start and stop Node-RED yourself from within the Node-RED Admin tool.

Files. Your Node-RED project consists of two files: the main file with all your flows, and a separate file containing all the sensitive credential information used by some nodes, such as usernames and passwords for an email node. In the groov Box these files are treated separately to maintain security, and the Node-RED Admin tool provides ways to work with them.

GETTING STARTED

The included Node-RED Admin tool provides access to Node-RED as well as debugging, security certificate processing, and backups.

Requirements

- A GROOV-AR1 Box with groov Admin v1.570.44 or higher (Updates are available at manage.groov.com.)
- A computer that can communicate with the groov Box
- For real-world communication with an industrial controller, an Opto 22 groov EPIC processor running a PAC Control strategy, or a SNAP PAC R-series or S-series controller with firmware R9.5 or higher, with its built-in RESTful API configured (see Quick Start steps on developer.opto22.com).

Open Node-RED

1. Open a web browser and enter: https://[your groov Box’s hostname]:3000
   Don’t forget the “s” in https. Example: https://opto-00-d2-da:3000
   
   NOTE: This URL using port 3000 takes you to Node-RED Admin. In the future, if you want to go directly to the Node-RED Editor, use port 1880: https://[hostname]:1880
   You can also open Node-RED Admin from within groov Admin. See page 22.

2. Log in using your username and password for groov Admin.
   The Node-RED Admin homepage appears. Status for your Node-RED project appears in the middle column, and status for the groov Box appears in the right-hand column:
3. Click the Node-RED Editor button to open Node-RED.

Create a flow

1. In the Nodes palette on the left, locate the inject node. Drag it to the workspace. The inject node lets you inject messages into a flow, either by clicking the button on the node or by setting a time interval between injects.

2. Open the right sidebar (click Ctrl-Space, or click Menu > View > Show sidebar) and select the info tab. Click the inject node to see information about its properties and a description of what it does:
3. Scroll down in the Nodes palette and locate the debug node. Drag it to the workspace.
4. Wire the inject and debug nodes together by dragging from the output port of inject to the input port of debug.

**Deploy the flow and test**

The nodes exist only in the editor and must be deployed to the server.
1. Click the Deploy button in the upper right.
2. In the sidebar, select the debug tab. Click the button on the inject node.
   Numbers appear in the sidebar:

   ![Sidebar with numbers](image)

   This number is a timestamp representing the number of milliseconds since January 1, 1970. This is the default payload of the Inject node.

**Add a Function node**

Let’s make the timestamp more readable by using a Function node. Function nodes let you pass each message though a JavaScript function. If you don’t know JavaScript, you may be able to find code you need using an Internet search.
1. Drag the Function node to the workspace between the Inject and Debug nodes. If you need to delete the existing wire, select it and press Delete on the keyboard. Add new wires if necessary to link the three nodes.
2. Double-click the Function node to edit it.
3. In the Name field, type Human Date.
4. Copy the following code into the Function field:
   // Create a Date object from the payload
   var date = new Date(msg.payload);
   // Change the payload to be a formatted Date string
   msg.payload = date.toString();
5. Leave this code in place at the end:
   return msg;
6. Click Done to close the edit dialog box and then click the Deploy button.
   Now when you click the Inject button, the message in the sidebar shows a more readable time stamp:

Install groov View nodes

Your groov Box must have access to the internet in order to install nodes.
1. Choose Menu > Manage palette.
2. Click the Install tab.
3. In the search field, enter groov.
4. Find `node-red-contrib-groov` in the list and click the Install button next to it.
5. Click Install. When installation is finished and the button changes to read Installed, click Done.

The new groov View nodes appear at the top of the nodes palette:

If you have a groov View Data Store, you can use a groov View node to read or write data in the Store. For help, see “Adding a Data Store” in the groov View User’s Guide. For complete instructions to use the node, see “groov Nodes” on developer.opto22.com.

Add an Opto 22 PAC Control node

For this section, you’ll need to have an Opto 22 groov EPIC processor running a PAC Control strategy, or a SNAP PAC S-series or R-series industrial controller with firmware R9.5 or higher, running a PAC Control R9.5 or higher control strategy. Make sure the RESTful API is configured. On developer.opto22.com, see the PAC Control REST API instructions for groov EPIC or the SNAP PAC REST API Quick Start instructions.

1. Install Node-RED for PAC Control nodes just as you installed the groov node. (Menu > Manage palette > Install tab. Search for `node-red-contrib-pac`.)
2. Make sure you have an inject and a debug node in the workspace.
3. Near the top of the Nodes palette, click the pac read node and drag it to the workspace, in between inject and debug (msg.payload).
   The pac read node lets you read I/O and variable data in the PAC Control strategy.
4. Wire the pac node to the other nodes in the flow.
5. Click the node and click the info tab to see helpful information about using it.
6. Double-click the Opto 22 node to edit it.

![Edit pac read node](image1)

7. Click the pencil at the right of the Controller field.

![Add new pac-device config node](image2)

8. Complete the fields:
   a. For PAC Address, choose the protocol (HTTPS is strongly recommended because it is secure) and enter the EPIC’s or PAC’s IP address.
   b. Enter the API Key ID and Value to allow access to the PAC Control API. (You must have already set this up for the controller. See steps on developer.opto22.com.)
   c. If you are using HTTPS as recommended, enter the SSL certificate information. (You must have already created the certificates. See “Managing security certificates” on page 57 to add the certificates to the groov Box.)
   d. Click Add.

You return to the edit box, where your controller is now configured:

![Edit pac read node](image3)

9. Choose the Data Type from the dropdown list.
The data type determines what other fields appear. In this example we chose Analog Input, so a field appears for Tag Name.

![Edit pac read node](image)

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller</td>
<td>10.192.55.67</td>
</tr>
<tr>
<td>Data Type</td>
<td>Analog Input</td>
</tr>
<tr>
<td>Tag Name</td>
<td>aiOvenTemperature</td>
</tr>
<tr>
<td>Node Name</td>
<td>Name</td>
</tr>
</tbody>
</table>

a. **Tag Name**—Enter the exact I/O point or variable name from the PAC Control strategy running on this controller. If you leave this field blank, you’ll receive values for all tags of this type (in this example, all analog inputs).

b. **Start Index** and **Length**—For a table, enter the starting index and length of the data you want to use.

c. **Node Name**—(Optional) By default, the tag name is used for this node. If you want to give it a different name, enter it here.

d. Click Done.

10. Click the down arrow next to Deploy to see your choices.

![Deploy](image)

You can deploy everything, or if you don’t want to disturb running flows, you can choose to deploy only the changed flows or changed nodes.

The gray box around the icon shows what will happen when you click the Deploy button. In this example, everything is deployed (Full).

11. Click Deploy. Now click the inject button and see what message appears in the debug tab. You should see the data from your Opto 22 controller. Here’s how our example looks:
CONNECTING WITH SERIAL DEVICES

Several serial nodes are available for Node-RED. You can attach one or more serial devices to the groov Box and use serial nodes to communicate with them. You can connect to RS-232, RS-485, or RS-422 serial devices (2-wire or 4-wire). Three USB ports are available on the groov Box. If you need to connect to additional devices, use a USB hub.

Data from connected serial devices can be used in your flows and can also be included in your groov View operator interface. For example, you can:

- Get data from a Modbus RTU device, reformat it if necessary in your flow, put it in a groov View Data Store, and use it in your groov View operator interface for technicians to monitor.
- Log data from weigh scales in your company database for tracking.
- Send data from legacy serial manufacturing equipment to a cognitive computing application, such as IBM Watson IoT, to analyze for predictive maintenance.
- Monitor facility energy usage through serial devices, correlate it with temperature data from local sensors, and project future usage based on forecasts from an online weather service.
- Write data from a company database to serial devices.

**Requirements**

To use serial devices with the groov Box, you will need:

- groov Admin 1.570.46 or higher
- Node-RED for groov Box version 3 or higher
- An RS-232, RS-485, or RS-422 serial device (2-wire or 4-wire)
- A USB-to-serial converter with FTDI chipset, appropriate for the serial device you want to connect to. We recommend single-port adapters.
- If you use a USB hub, use a powered hub.

*NOTE: FTDI-compatible adapters are not likely to work. Use an adapter with a genuine FTDI chip, for example B&B Electronics model USOPTL4 or Gearmo US-485422.*
**Setting up the serial device**

1. Connect the converter from the serial device to one of the USB ports on the front or top of the groov Box (diagram on page 110).
2. In Node-RED, drag your serial node to the workspace and double-click it to edit it.

3. Click the pencil at the right of the Serial Port field.
4. In the Add New dialog box, click the magnifying glass to discover the serial devices you have connected to your groov Box.
   In this example, two serial devices are connected, both to the front of the Box:

   ![Add New dialog box](image)

   - `/dev/ttySer0` is the top USB port on the front of the groov Box.
   - `/dev/ttySer1` is the bottom USB port on the front of the Box.
   See diagram on page 110.

   For serial devices connected through a USB hub, see address information on page 110.

5. Choose the device you want, and then enter the Settings (baud rate, data bits, and so on) that apply to it. Make any other changes necessary for the node and then click Add.
6. Back in the Edit dialog box, give the new serial port a name and click Done.
   Your serial device is ready to use in Node-RED.

**IMPORTANT:** Remember that the address of the port you added in the node is the address of the USB connector on the groov Box or hub, not the address of the serial device. If you unplug a device from one connector and plug it into a different one, you will need to change the device’s address in the node.
WORKING WITH NODES

In the nodes palette on the left side of the workspace, you see all the nodes built into the program. You can scroll down to find the one you want or search for it by typing into the search box at the top.

Managing nodes

You can remove or disable nodes you don’t want and install additional nodes you want to use.

To manage nodes, choose Menu > Manage palette. You see a list of the nodes built into Node-RED:

Installing nodes

Many Node-RED nodes are available, and you can easily install the ones you want. For example, you may want to use nodes for a weather service or for mysql.

To install nodes, choose Menu > Manage palette. Click the Install tab.

In the search box, enter the node you’re looking for. In this example we entered: weather
WORKING WITH FLOWS

You can have one or many flows in your Node-RED project.

- **To name a flow**, choose Menu > Flows > Rename.
- **To add a new flow**, click the plus sign in the upper-right corner of the workspace.
- **To delete a flow**, choose Menu > Flows > Delete.

**Exporting a flow**

It’s easy to export flows or nodes. Exporting lets you share a flow you’ve built with others or store it for future use.

1. With the flow open in the workspace, highlight one or more nodes (to export just part of a flow, highlight only the nodes to export).
2. To store, choose Menu > Export > Library. Give the file a name so you can find it later.
3. To save to a text file for sharing, choose Menu > Export > Clipboard.
4. Choose whether to export only the highlighted nodes, the current flow, or all flows in the project.
5. Click Export to clipboard.
6. Paste the contents of the clipboard into a text file and save it.

Importing a flow

Importing lets you use flows or nodes you’ve saved or other people have built, so you can build what you needs faster. (A good source of flows is the OptoForum, where Opto 22 customers ask and answer questions and share code samples and tips.)

Import from the Library

If you’ve already saved flows or nodes, open the flow you want to import to. Choose Menu > Import > Library and choose the filename you want.

The saved flow or node immediately appears in the workspace.

Import from a file

1. Make sure the data you want to import is in a text file. Copy the contents of the file.
2. In the workspace, choose Menu > Import > Clipboard.

3. Paste the data into the field. Choose whether to import into the flow that’s open on the workspace or to create a new flow.
4. Click Import.
In the Editor

Within the Node-RED Editor, the debug tab helps you debug your flow.

In this example, we forgot to configure the SNAP PAC controller in the middle node. When we injected, an error was returned in the debug tab:

To see which node the error occurred in, hover over the error or click it to highlight the node (the node is surrounded with a dotted orange line).

Note: If the problem node is in another flow, hovering won’t highlight the node; but if you click the error you’ll be taken to the flow and the node highlighted.

In Node-RED Admin

Node-RED Admin keeps a running log of events that you can view or download to help debug problems.

1. In the left nav bar in Node-RED Admin, select Diagnostics.

2. To save a copy of the log, click Download Console Log. To view only the log in a separate browser tab, click View Console Log.
MANAGING SECURITY CERTIFICATES

SSL security certificates must exist on the groov Box before you can connect to Opto 22 controllers using Node-RED. You can upload and manage these certificates from within Node-RED Admin.

1. In the left nav bar in Node-RED Admin, select Certificates.

   ![SSL Certificates](image)

   If you’ve already added one or more certificates, you’ll see a list of those installed.

2. Click Add/Update. Navigate to the location of your Opto 22 controller’s public key certificate. Click Open. The certificate appears in the list of Installed Certificates.

BACKING UP AND RESTORING YOUR NODE-RED PROJECT

You’ll want to back up your Node-RED project to make sure you have a copy. Backing up just means downloading the files to your computer, so you can upload them later if you need to.

The project consists of two files: one for all your flows and the other for sensitive credential information like the username and password required for some nodes. We recommend you back up both.

1. In the left nav bar in Node-RED Admin, select Project.

   ![Project Management](image)

   To see what each file looks like, click the View button under Flows or Credentials.

2. To back up your Node-RED project, click Download under Flows or Credentials and save the file in a safe place on your computer.
4. To restore your project, click *Upload flows* or *Upload flow credentials*. Navigate to the location of the backed-up file and click Open.
   Backing up and restoring can take several minutes. Wait until the process is finished.

   *NOTE:* If you have updated Node-RED since your last Node-RED backup, restoring will take you back to a previous version. Update Node-RED again after restoring (see “Updating Node-RED” on page 36.)

**STARTING A NEW NODE-RED PROJECT**

You can only have one Node-RED project at a time, although that project can contain multiple flows. If you decide to start over and create a new project, you can delete all flows and credentials in the existing project.

1. In the left nav bar in Node-RED Admin, select Project.

2. Scroll down and click the red Delete Project button.

3. To verify that you really want to start over, click Delete and Restart.
Chapter 7

5: Using Ignition Edge

This chapter introduces Ignition Edge, available in the groov Box and designed so you can use OPC UA and MQTT at the edge of the network for your IoT applications.

NOTE: Ignition Edge is not included in the original GROOV-AT1 groov Box nor in groov Server for Windows. It is included only with GROOV-AR1 Boxes.

WHAT IS IGNITION EDGE?

Available in your groov Box is Ignition Edge, an internet of things (IoT) software application developed by Inductive Automation for the network’s edge, with OPC-UA drivers for Allen-Bradley and Siemens PLCs, SNAP PACs, and other automation equipment.

Because Ignition Edge is included in the groov Box, you can use its tags—in your groov View operator interface, Node-RED flows, and MQTT communications—for your IoT projects:
- Without having to purchase a separate OPC-UA server
- Without requiring a PC at the network’s edge

Note that the OPC-UA server in Ignition Edge is used by Ignition applications and by groov View. The server is available only to internal applications.

Ignition Edge in the groov Box

In the Opto 22 groov Box, Ignition Edge provides two key connectivity tools for IoT applications—OPC UA and MQTT:
- Ignition Edge includes an internal OPC-UA server and drivers for a number of commonly used PLCs, plus Modbus devices communicating over TCP. (See “OPC UA drivers included with Ignition Edge in the groov Box” on page 60.) Additional drivers may be available for purchase from Inductive Automation and their partners.
- Ignition Edge also includes an MQTT Transmission module. MQTT is a transport protocol highly useful in IoT applications because of its architecture. For more information, see “Using MQTT” on page 73.

You can use Ignition Edge in the groov Box for two-hour trial periods and reset the trial as often as you wish. To use Ignition Edge fully, you will need to purchase an Ignition Edge license, part number GROOV-LIC-EDGE.
The groov Box with Ignition Edge is especially useful for the plant floor, geographically dispersed locations, and OEMs, because everything is included in one compact, secure, industrial appliance.

With Ignition Edge in the groov Box:
- Data from many PLCs becomes easier to access for IoT applications.
- Authorized operators can monitor and control these PLC systems from your groov View operator interface.
- All data in Ignition Edge can be published and subscribed to via MQTT.
- Node-RED flows can use tags from the Ignition Edge tag database.
- It’s easy to add other Inductive Automation products:
  - Other Ignition Edge-compatible modules
  - Additional drivers like DNP3, Omron®, and TCP/UDP
  - Ignition Edge Panel or Enterprise

**OPC UA drivers included with Ignition Edge in the groov Box**

<table>
<thead>
<tr>
<th>Opto 22 controllers:</th>
<th>Allen-Bradley PLCs:</th>
<th>Siemens PLCs:</th>
<th>Other drivers:</th>
</tr>
</thead>
<tbody>
<tr>
<td>groov EPIC</td>
<td>Logix: ControlLogix® and CompactLogix™ firmware v21 and higher</td>
<td>S7-300</td>
<td>Modbus/TCP devices</td>
</tr>
<tr>
<td>SNAP PAC</td>
<td>ControlLogix firmware v20 and lower</td>
<td>S7-400</td>
<td>Devices that support Modbus RTU over TCP</td>
</tr>
<tr>
<td></td>
<td>CompactLogix firmware v20 and lower</td>
<td>S7-1200</td>
<td>Other drivers you have purchased</td>
</tr>
<tr>
<td></td>
<td>SLC™ 5/05</td>
<td>S7-1500</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PLC-5®</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MicroLogix™ 1100, 1200, 1400, 1500</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**groov EPIC and SNAP PAC drivers**

Ignition Edge in the groov Box includes drivers for Opto 22 groov EPIC and SNAP PAC systems, which help you:
- Publish EPIC and SNAP PAC system data via MQTT.
- Connect other Inductive Automation applications to groov EPIC and SNAP PAC systems.

You can add drivers to the groov EPIC system by downloading and installing the Opto 22 groov EPIC and SNAP PAC Driver module, which is a product of Cirrus Link Solutions. For details, see the Cirrus Link Documentation webpage (https://docs.chariot.io/display/CLD/Opto+22+groov-EPIC+and+SNAP+PAC+Driver). However, note that you don’t need to use this driver to use groov EPIC or SNAP PAC controller tags in your groov View operator interface. Instead, configure the groov EPIC or SNAP PAC controller in groov View, so groov View communicates with the groov EPIC or SNAP PAC system directly.

**GETTING STARTED**

This section gives you basic steps to get started using Ignition Edge. For a lot more information on using Ignition Edge, visit Inductive University.

**Requirements**
- A GROOV-AR1 Box with groov Admin v1.570.47 or higher (Updates are available at manage.groov.com.)
- A computer that can communicate with the groov Box
- One or more devices supported by the drivers included with Ignition Edge in the groov Box (see list on page 60)
NOTE: If you want to read PAC Control R10.0a (or higher) tag names with Ignition Edge or Ignition Designer, be sure to:

- Configure PAC Control Strategy tags with public tag access using PAC Control R10.0a or newer.
- Install version 3.4.2 (or higher) of the Opto 22 groov EPIC and SNAP PAC Driver module.

For details, see KB87534.

To get you started, the following steps use a simulated device that is included in Ignition Edge.

**Configure Ignition Edge**

1. Open a web browser and enter: https://[your groov Box’s hostname]:10000
   Or open groov Admin from within Build mode (Configure > groov Admin).
2. Log in with your groov Admin username and password to open the Quick Start menu.
3. In the left navigation panel, click Ignition Edge.
The Status section on this page shows you whether you already have a groov Enterprise license, which fully enables Ignition Edge. However, you can use Ignition Edge for a two-hour trial without licensing it. You can restart the trial as often as you want. These Getting Started steps use the free trial. This section also shows you whether Ignition Edge is currently running.

4. In the Configuration section, check Enable and run Ignition Edge at startup.
5. For this example, do not check Enable access to Ignition Edge Designer and Edge Panel.
6. Click Save.
7. Read the software license and click Accept to continue. Wait until the message in the image below appears.
8. Click Back and notice that Ignition Edge is now running.

9. Click Open Ignition Edge.

   *NOTE: In the future, you can open Ignition Edge from this page in groov Admin, or you can go directly to Ignition Edge in your web browser by entering as the URL: https://[your groov Box’s hostname]:8043
Don’t forget the “s” in https. Example: https://opto-00-d2-da:8043*

10. Wait while Ignition Edge starts. (It may take a few minutes initially.)
The Ignition Edge gateway webpage appears, showing the trial running.

11. In the top navigation bar, click Configure.
12. Sign in using the default username admin and password password and press Enter. (When you license Ignition Edge for full use, you will change your Ignition Edge password following the steps on page 80.)

13. In the left navigation panel, scroll down and choose OPC-UA Server > Settings.
14. Change only the following:
   a. Under Authentication, check the box to Allow Anonymous Access. Allowing anonymous access does not create a security issue, because the Ignition Edge OPC server is on the same box as groov View.
   b. Under Expose Configured Tags, check the box to Expose Tag Providers (allows the server to get tags automatically for some manufacturers’ devices).

15. Scroll to the bottom of the page and click Save Changes.

16. In the left nav, choose System > Gateway Settings.

17. Scroll down and check the box next to Use SSL:

Because Ignition Edge is in the groov Box and it includes a self-signed certificate, a purchased certificate may not be necessary. See Chapter 6: Using an SSL Certificate for more information on certificates.
18. Scroll to the bottom of the page and click Save Changes.

**Configure a device in Ignition Edge**

1. In the left nav, choose OPC-UA Server > Devices.

   ![Devices Table](image)

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
<th>Enabled</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Devices</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
   ![Create new Device](image)

2. Click Create New Device.
   You see all the device types whose drivers are included in Ignition Edge in the groov Box. If your application requires a device type not listed, you can contact Inductive Automation to see if a driver is available for it. For this example, we’ll use one of the demo devices.

   ![Add Device Step 1: Choose Type](image)

3. For this example, scroll down and choose the Simulators Dairy Demo Simulator. Click Next.

   ![New Device](image)
4. Give the demo a name and optional description, and click Create New Device.

![Device](image)

The DairySim device is listed and its status shows as Connected.

5. Back up your Ignition Edge project: in the left navigation panel, choose System > Backup/Restore.

![System Backup](image)

6. Click Download Backup and save the file to your computer.

7. Continue with the next section.

**Add the internal OPC-UA server to groov View**

For help in using groov View, see the *groov View User’s Guide*.

1. Open a new tab in your browser and open groov: https://[your groov Box’s hostname]
2. Click the gear icon in the upper right and choose Switch to Build mode.
3. Choose Configure > Devices and Tags. Click Add New Device (upper right) and click OPC UA Server.

![Add OPC UA Server](image)

4. Enter a name for your Ignition Edge server. For the Server URL, enter: 127.0.0.1:4096

   The URL uses the loopback address, because groov View and the server are in the same box. The 4096 specifies the port groov View uses to communicate with the server.

5. Click Add Server.
Your new server is added to groov View’s list of devices:

6. Click Close.
7. Back in Build mode, find your new server in the Gadget Palette (lower right corner, in the Tags tab). Click the plus sign next to the server’s name to see the tags in this device. Keep opening the tree by clicking the plus signs next to Static Tags > Devices > [Dairy Demo] > Refrigeration.

You can configure multiple devices in the server. Devices and their tags appear in the tree, but their location depends on how their tags are created.

Server tags show the status of the Ignition Edge OPC-UA server itself. Under Configured tags you’ll find tags you manually configured in the server (from devices whose tags were not imported automatically).

The Dairy Demo is the device you configured in the Ignition Edge server. The server automatically imported its tags, so all of them are shown here. You’ll find a folder under Devices for each device whose tags were imported by the server.

Add a gadget connected to an Ignition Edge tag
1. Add a new page to your groovView project, or open an existing page to add new gadgets.
2. In the Gadget Palette, under Refrigeration, select dischargePressure. Highlight the Value gadget.

3. Drag the Value gadget onto your page. 

   NOTE: If you receive an error, the Ignition Edge trial period may have expired. Open another browser tab, go to https://[your groov Box’s hostname]:8043 and restart the trial. (See page 75 for help.)

4. Expand the gadget’s width so you can see the full tagname.

5. Choose File > Save All Changes and Switch to groov View. Watch the value change in groov View.

   groov View updates data from OPC-UA servers (or from any source) at a fixed rate of once per second.

   NOTE: If you see a yellow triangle on the gadget and no value is shown, click the yellow triangle to see what’s wrong. Some possibilities:

   • Your groov View trial period may have expired. Unless your groov Box has an Edge license, you are using a free trial for OPC UA, and that trial expires two hours after you first look at your operator interface in groov View. To restart the trial, just restart the Box. (See page 36 for steps.)

   • Your Ignition Edge trial period may have expired. Open another browser tab, go to https://[your groov Box’s hostname]:8043 and restart the trial. (See page 75 for help.)

Add other devices (Allen-Bradley, Siemens, Modbus)

Take another look at the list of OPC UA drivers included with Ignition Edge in the groov Box. If you have any of this equipment, you can use their tags in your groov View operator interface, Node-RED flows, and MQTT communications.

Tags for these devices are brought into Ignition Edge in two different ways:
Some, like Opto 22 controllers and most Allen-Bradley devices, support tag browsing. That means all tags on the device are automatically pulled into the server and available immediately in groov View.

Others, like Siemens and Modbus devices, do not support tag browsing. You manually add each tag you want to use to the server.

To add another device:
1. Go back to the tab with the Ignition Edge gateway webpage. Or open a new browser tab and enter: https://[your groov Box’s hostname]:8043
2. Make sure the Trial Version is still running (to restart, click the Reset Trial button).
3. In the left nav, choose OPC-UA Server > Devices.
4. Click Create new Device. Choose the appropriate driver for your hardware. Scroll down and click Next.
5. Give your new device a name and optional description. Make sure Enabled is checked. Fill in the hostname or IP address of your device and then click Create New Device.
   Your device appears in the list.
6. If your device is an A-B PLC, go back to Build mode and test the new device by adding a gadget, just as you did with the Dairy Demo.
7. If your device is Siemens or Modbus, follow steps in “Configure tags manually,” next.

Configure tags manually

You need to manually add tags using Ignition Edge Designer if any of the following applies:
- You are using MQTT.
- You are using Ignition Edge OPC-UA tags in Node-RED flows.
- Your device does not support tag browsing.
- You want to reduce the number of tags you see for Opto 22 controllers and Allen-Bradley PLCs when building your groov View interface.

CAUTION: To configure tags manually, you must temporarily open an insecure TCP port on the groov Box. Before opening it, make sure that:
- The groov Box is connected only to a trusted network that blocks external connection requests to TCP port 8088
- You have checked the “Use SSL” box in the Ignition Edge Gateway Settings (see step 16 on page 65).

1. Open a web browser and enter: https://[your groov Box’s hostname]:10000
   Or open groov Admin from within Build mode (Configure > groov Admin).
2. Log in with your groov Admin username and password.
3. In the left navigation panel, click Ignition Edge.
4. Make sure Ignition Edge is running. Under Configuration, click Enable access to Ignition Edge Designer and Edge Panel. Then click Save.

5. When the changes are marked as done, click Back. Click Open Ignition Edge.

6. When the Ignition Edge gateway page opens, click the Launch Designer button in the upper right.

NOTE: Ignition Edge Designer is not web-based software, but a program you download from the gateway page to your computer and run locally. It requires Java to run. If you don’t have Java, you can install it from the Java website.

7. Save the file to your computer. Double-click it to open it. At the security warning, click Continue.
8. Log into Ignition Edge Designer using your Ignition Edge credentials. (If you have not changed them, the defaults are: admin and password)

9. To add tags for a device, follow the instructions provided by Inductive Automation:
   - Instructions for Siemens
   - Instructions for Modbus

10. For MQTT tags, set up folders for topics and put tags in them, following instructions in documentation from Cirrus Link.

11. When you have finished adding tags, choose File > Save and Publish.

12. IMPORTANT: When you have finished configuring tags and saved them, go back to groov Admin. In the left navigation panel, click Ignition Edge. Uncheck "Enable access to Ignition Edge Designer and Edge Panel" and click Save to close the insecure port.

13. Remember to back up your Ignition Edge project to make sure all your tags are saved (see page 81).
USING MQTT

One of the advantages of having Ignition Edge in the groov Box is that you can use the Message Queue Telemetry Transport (MQTT) in your IoT application. MQTT is a publish/subscribe (pub/sub) protocol that’s suited to many IoT applications because of its architecture.

In a pub/sub architecture, a central source, called a broker, stores all data. MQTT clients can publish data to the broker or subscribe to get data from it (or both). Clients who publish data send it only when the data changes. Clients who subscribe to data automatically receive it from the broker only when it changes.

Contrast this with a client/server architecture. There the client and server must be connected, because the client requests data directly from the server. The client doesn’t know when the data changes, so it must request it at regular intervals.

MQTT pub/sub offers three main advantages over client/server for IoT applications:

- Network traffic is reduced overall, because data is published and sent only when it changes, rather than at regular intervals.
- Because the broker is a central source with stored data, servers don’t have to strain to serve multiple clients. And even remote devices with irregular connections or low bandwidth can publish or subscribe to data. If a subscriber is offline, for example, the broker buffers the data and sends it at a later time.
- For data publishers, there’s another important advantage: data is published using an outbound connection. Most firewalls block inbound traffic (for example, an external OPC client requesting data from an internal OPC server), but they allow outbound connections over secure TCP ports.

See mqtt.org for more information about the protocol.

MQTT and the groov Box

Ignition Edge in the groov Box gives you access to an MQTT Transmission module built by a third party, Cirrus Link Solutions. This module uses the Sparkplug open MQTT client specification. More information and documentation are available on the Cirrus Link website.

You will also need an MQTT broker, which you can locate on your premises or in the cloud; information is available online to set one up.

Install the MQTT Transmission module

1. Open the Ignition Edge gateway page: https://[your groov Box’s hostname]:8043
2. In the top navigation, click Configure. Scroll down till you see the MQTT plugin.

3. Click Install. In the next page, scroll down to find Quarantined modules and click the install button for MQTT Transmission. Then follow directions on the screen to accept the license.

4. Check “I want to add this certificate to my trusted certificates and install the module” and then click the button to install.

When the success message appears, you can scroll down and see the MQTT Transmission module listed under Cirrus Link Solutions.

5. To see documentation for the module, click More > documentation.

Configure the MQTT broker

You will need an MQTT broker to handle published data and send it to subscribers. The broker can reside either locally or in the cloud. If you don’t have a broker, check online for instructions to set one up. These steps show you how to configure a broker you’ve already set up.

1. In the Ignition Edge gateway page left navigation, choose MQTT Transmission > Settings.

2. Follow instructions from Cirrus Link to enter the URL and credentials for the MQTT broker.

Configure MQTT tags

1. Configure tags for MQTT following the steps in “Configure tags manually” on page 70.

   NOTE: The MQTT tags you create are individually configured tags. When you look for them in groov View, they'll appear in the Configured Tags folder.
2. When you have finished configuring your MQTT broker and tags, remember to back up your Ignition Edge project (see page 81.)

3. To use the MQTT module, see documentation from Cirrus Link.

**MANAGING IGNITION EDGE**

In this section:
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- License Ignition Edge ............................................................... 76
- Unactivate Ignition Edge license ............................................ 80
- Change Ignition Edge password ........................................... 80
- Back up and restore Ignition Edge project ............................ 81
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- Ignition Edge Plugins ............................................................. 84
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**Restart the Trial**

If your groov interface stops reporting values on gadgets you’ve attached to Ignition Edge, your two-hour trial may have expired. You can reset it as often as you want.

If the trial has expired, the banner color in the Ignition Edge gateway webpage changes from green to orange:

1. Click Activate Ignition to start the trial period again. Enter the username and password if asked. (If you’ve changed it, enter your credentials. If you haven’t changed it, enter the defaults admin and password and press Enter.)
2. To start the two-hour trial again, click Reset Trial.
3. To enter your Ignition Edge license now, see “License Ignition Edge,” next.

License Ignition Edge

You can use Ignition Edge for a two-hour trial without licensing it, and you can repeat the trial. But to use Ignition Edge fully, you must license it.

1. Purchase a groov Ignition Edge license (GROOV-LIC-EDGE).
   You’ll receive a certificate with an Activation Key for the license.
2. Log into manage.groov.com with your MyOpto username and password.
3. Click Activate, enter your activation key, and follow instructions to apply it to your groov Box. Make sure you choose the correct Box!
4. Copy the Ignition Edge License number shown on the groov Box profile page.
5. Open the Ignition Edge gateway page: https://[your groov Box’s hostname]:8043
6. If you have not already changed your username and password from the defaults (admin and password), do so now:
   a. In the Ignition Edge gateway webpage, click the Configure tab.
   b. In the left navigation panel, choose Security > Users, Roles.
c. For the default user, click the manage users button.

![Manage Users and Roles for Profile 'default'](image)

- Username: enter new username
- Check Change Password?
- Password/Password: enter new password
- (Optional) First Name/Last Name and Language: enter or change as necessary

e. Scroll to the bottom of the screen and click Save Changes.

f. In the top right corner of the page, click Sign Out. Then sign back in using your new username and password.

7. Click Activate Ignition (upper right).

![Activate Ignition](image)

8. Under License Management at the right, if your groov Box has internet access, click Activate Online. If your groov Box does not have internet access, go to “Activate Offline” on page 78.
9. To activate online, enter the Ignition Edge license key you copied in step 4, and click Activate. A confirmation message appears, stating that your license was successfully activated.

**Activate Offline**

Use these steps if your groov Box does not have internet access.

1. In the Ignition Edge gateway page, click Activate Ignition. Scroll down and find No Internet Connection?

2. Click Activate Offline.
3. Under 1, enter the Ignition Edge license key you copied. Click Download Activation Request.

4. Save the Request (a text file) to your computer.
   If your computer is not online, you can save the file to a flash drive and take it to a computer that does have an internet connection. The next few steps require internet access.

5. Under 2, click the link to Inductive Automation.

6. In the Activate Ignition section, click Choose File, find the text file you just downloaded, and open it. Then click Upload Activation File. A license file is downloaded; save it to your computer.

7. Go back to the gateway page. Under 3, click Choose File, find the license file, and open it. Click Activate.
A confirmation message appears, stating that your license was successfully activated.

Unactivate Ignition Edge license

Before you update groov Admin or reset your groov Box to factory defaults, be sure to deactivate your Ignition Edge license. Then when the update or reset is finished, activate the license again. By deactivating and then reactivating, you avoid having to contact Ignition Edge to have the license reinstated.

1. Open the Ignition Edge gateway page: https://[your groov Box’s hostname]:8043
2. Click the Configure tab. In the left navigation panel, choose System > Licensing.

3. **IMPORTANT**: Make sure you have a record of your license number, so you can reactivate it later.
4. To deactivate, click the trash can button next to your license number.
5. To confirm, click Yes, Unactivate.

When you’re ready to activate your license again, follow steps in "License Ignition Edge" on page 76.

Change Ignition Edge password

You can change your username and password for Ignition Edge whenever you want to. Be sure you change them when you license Ignition Edge (see page 76).

1. In the Ignition Edge gateway webpage, click the Configure tab.
2. In the left navigation panel, choose Security > Users, Roles.
3. For the default user, click the manage users button.

![Manage Users and Roles for Profile 'default'](image)

4. Click Edit and complete the following fields:
   - Username: enter new username
   - Check Change Password?
   - Password/Password: enter new password
   - (Optional) First Name/Last Name and Language: enter or change as necessary

5. Scroll to the bottom of the screen and click Save Changes.

6. In the top right corner of the page, locate Sign Out.

7. Click Sign Out. Then sign back in using your new username and password.

**Back up and restore Ignition Edge project**

Remember to back up your Ignition Edge project when you first configure Ignition Edge, devices, and tags, and also when you change configurations.

1. Open the Ignition Edge gateway page: `https://[your groov Box’s hostname]:8043`
2. Click the Configure tab.
3. In the left nav, choose System > Backup/Restore.

![System Backup / Restore](image)

4. Click Download Backup and save the file to your computer.
**Restore Ignition Edge project**

1. Open the Ignition Edge gateway page: https://[your groov Box’s hostname]:8043
2. Click the Configure tab.
3. In the left nav, choose System > Backup/Restore.
4. Click the Restore tab.
5. Click Choose File and locate the backup file you saved to your computer. Then click Restore.

**Use Ignition Edge Designer or Edge Panel**

You can access Ignition Edge Designer from the Ignition Edge gateway page if you need to use it. Designer is **not** needed to configure Allen-Bradley and SNAP PAC drivers and use their data in groov View.

Designer is needed to:
- Configure tags for Siemens PLC and Modbus drivers (see “Configure tags manually” on page 70)
- Create MQTT Transmission tags (see “Using MQTT” on page 73)
- Configure and update MQTT brokers with tag configurations and changes
- Use Ignition Edge OPC-UA tags in Node-RED flows
- Use advanced features of Ignition Edge, including Panel and EAM. Ignition Edge EAM, Panel, and the Vision module are available for separate purchase from Inductive Automation.

**CAUTION:** Ignition Edge Designer and Edge Panel require an insecure TCP port to be exposed by the groov Box firewall. Opto 22 recommends that while you are using Designer or Panel, you:

- Connect the groov Box only to a trusted network that blocks external requests to TCP port 8088.
- Make sure you configure Ignition Edge to use SSL (see step 16 on page 65).

1. Open a web browser and enter: https://[your groov Box’s hostname]:10000
   Or open groov Admin from within Build mode (Configure > groov Admin).
2. Log in with your groov Admin username and password.
3. In the left nav, click Ignition Edge.
4. Make sure Ignition Edge is running. Under Configuration, click Enable access to Ignition Edge Designer and Edge Panel. Then click Save.

5. When the changes are marked as done, click Back. Click Open Ignition Edge.

6. When the Ignition Edge gateway page opens, click the Launch Designer button in the upper right.

NOTE: Designer is not web-based software, but a program you download from the gateway page to your computer and run locally. It requires Java to run. If you don’t have Java, you can install it from the Java website.

7. Log into Designer using your Ignition Edge credentials. (If you have not changed them, use the default username admin and password password.)

8. To use Designer:
   a. If you are configuring tags for Siemens PLC and Modbus drivers, see “Configure tags manually” on page 70.
   b. If you are using MQTT, see “Using MQTT” on page 73.
c. For other uses, follow Ignition’s instructions.

9. When you have finished using Designer or Panel, return to groov Admin and uncheck the box to disable access and close the insecure port.

Ignition Edge Plugins

The Ignition Edge gateway Configure page shows plugin options you may be interested in:

- Ignition Panel (free trial included; to purchase, contact Inductive Automation)
- Ignition Enterprise (free trial included; to purchase, contact Inductive Automation)
- Ignition Edge MQTT by Cirrus Link—if you plan to use the MQTT protocol, you’ll want this module.
  See “Using MQTT” on page 73

Check Ignition Edge license and modules

You can see which Ignition Edge modules you have licensed, and which are available.

1. Open the Ignition Edge gateway page: https://{your groov Box’s hostname}:8043
2. Click the Status tab.
3. In the left nav under Systems, click Modules.

You see all the modules you have. In the License column, the modules that show “Activated” are licensed, and those that show “Trial” are not. The Status column shows which modules are currently running.

At the bottom are modules that are available to license. See “Add Quarantined Modules” on page 85.
Add Quarantined Modules

Two modules are included in Ignition Edge on the groov Box but not enabled until you install them:

- MQTT Transmission—for using the MQTT protocol with Sparkplug messaging. See “Using MQTT” on page 73.
- Opto 22 groov EPIC and SNAP PAC Driver—for using groov EPIC or SNAP PAC programmable automation controller tags with MQTT or with other Ignition software.

To install a quarantined module:

1. In the Ignition Edge gateway webpage, click the Configure tab. In the left navigation bar under System, click Modules.

2. Scroll down till you see Quarantined Modules.

3. Click the Install button next to the module you want to add. Click confirm when asked.

4. Read the license and check the box at the bottom of the page. Click Accept License.
5. Check the box to add the certificate and install the module, and then click the button. You see a success message, and when you scroll down you find the installed module is no longer quarantined. It’s ready to use.
6: Using an SSL Certificate

UNDERSTANDING CERTIFICATES

Like other web servers that contain sensitive data—for example, your bank—the groov Box uses an SSL/TLS certificate to (1) encrypt communications and (2) prove the Box’s identity to client browsers. This certificate contains the server name, the name of the organization that controls the server, and digital signatures of organizations that vouch for the authenticity of the certificate. The certificate is digitally signed either by a certificate authority (CA) or it is self-signed.

The default certificate type (a self-signed certificate) and configuration will cause your web browser to issue an untrusted site warning when accessing the groov Box. To avoid the warning you can install the self-signed certificate in all the browser certificate stores used to access the Box. However, whether or not the certificate is installed in the certificate stores, communication between the Box and client browsers is always encrypted.

Here’s a comparison of the certificate types:

<table>
<thead>
<tr>
<th></th>
<th>Self-Signed Certificate (default)</th>
<th>Self-Signed Certificate installed on all browser certificate stores</th>
<th>CA-Signed Certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best Use</td>
<td>For one or two groov products and a small set of client browsers that remain pretty much the same, and users who trust that your certificate is valid</td>
<td>Same as default, plus it avoids seeing the untrusted site warning from the browser</td>
<td>Use with a system with many groov products or where the set of browsers that will access them is unknown or changes frequently, or for users who will not trust your self-signed certificate</td>
</tr>
<tr>
<td>Cost</td>
<td>Free</td>
<td>Free</td>
<td>Public CA-signed certificates cost anywhere from $9 to $100 or more per year</td>
</tr>
<tr>
<td>Ease of Configuration</td>
<td>Easiest configuration</td>
<td>Must install in the browser certificate store for every browser that accesses the server</td>
<td>More complex initial configuration because a certificate authority signature must be obtained</td>
</tr>
<tr>
<td>Untrusted Site Warning</td>
<td>Browser raises untrusted site warning. (But communication is still encrypted.)</td>
<td>No untrusted site warning from browser</td>
<td>No untrusted site warning from browser. Trusted by all major browsers.</td>
</tr>
<tr>
<td>Trust Level</td>
<td>Trusted by those to whom the groov Box administrator has demonstrated the validity of the certificate (e.g. by providing the certificate thumbprints).</td>
<td>Trusted by those who trust the groov Box administrator enough to install or let him or her install the certificate in their browser certificate store</td>
<td>Trusted by everyone</td>
</tr>
</tbody>
</table>
Certificate Structure

Whether you use a self-signed or CA-signed certificate, your certificate contains 3 parts:

**Private Key**—The private key is secret. Put it in a very safe place and make sure it remains secure.

**Server Certificate**—The server or hostname certificate is generated by the self-signed certificate process or is obtained via the CA (Certificate Authority).

**Intermediate Certificate** (chain.cert)—A certificate signed by a CA may or may not include this intermediate certificate as part of a chained certificate path.

### STEP 1: BACK UP YOUR groov VIEW PROJECT

**IMPORTANT:** Before starting any certificate process, back up your groov View project. See “Backing Up groov View and Network Settings” on page 32 for instructions. Certificates can be tricky, and you want to make sure you can recover if needed.

After you’ve backed up your groov View project, follow steps in the next section to create a private key.

### STEP 2: CREATE A PRIVATE KEY

Follow the steps below to generate the following components.

- **Private Key**: This must be kept secret and never shared. Keep a copy of it in a safe and secure place. There is also a **Public Key** included in the signed certificate. You will not handle the public key using groov Admin.

- **Signed Certificate**: Contains identification information, the public key, and a digital signature. Identification information includes the server name and the name of the organization that controls the server. The self-signed certificate is digitally signed by the Private Key to establish authenticity. The Certificate is automatically installed on the groov Box.

- **Certificate Signing Request (CSR)**. If you want to use a CA-signed certificate, you will need this CSR.

To generate a private key:

1. In groov Admin, select Networking > SSL Configuration.

2. Click the Create certificate tab.

3. Fill in the Create SSL key form as follows:
   - **Server name**: Enter the **fully qualified domain name** (or hostname) of this groov Box that client browsers will use to access groov. (Also see “Changing the Hostname, DNS Servers, or IPv4 Gateway” on page 25.) The server name may contain letters a–z (case insensitive), digits 0–9, or a hyphen (-). No other characters are allowed. The server name must not start with a hyphen. For example, if the URL you will use to access groov View in client browsers is https://process1.acme.com, then you enter process1.acme.com
   - **Email address**: (optional) Enter the email address of the person responsible for administering this certificate.
Department: Use this field to differentiate between divisions within an organization. For example, you might enter “Engineering” or “Manufacturing.” If applicable, you can enter the DBA (doing business as) name in this field.

Organization: The legally registered name of your business. This business must be the legally registered owner of the domain name.

City or Locality: Name of the city or locality where your organization is located. Spell out the name of the city or locality. Do not abbreviate.

State: Full name of the state, province, region, territory where your organization is located. Do not abbreviate.

Country code: The two-letter International Organization for Standardization (ISO) format country code for the country in which your organization is legally registered. Click here for a complete list of ISO country codes.

RSA key size: Both the public key and the private key. The recommended key size is 2048 bits. Avoid key sizes smaller than 2048 bits.

Days before expiry: Enter the number of days before the self-signed certificate is expired and has to be replaced. It’s up to the groov Box administrator how many days to enter. For example, if you want the certificate to be valid for 10 years, enter 3650.

4. Click Create Now.

groov Admin creates the following and displays them all in the same window:
- New private key
- Self-signed certificate
- Certificate signing request (CSR) to obtain a CA-signed certificate

At this point, the new self-signed certificate is installed on the groov Box and network services restarts.

5. Copy the private key portion of text in its entirety, including the title portion "-----BEGIN PRIVATE KEY-----" and paste it to a file named <server name>-key.pem (where <server name> is replaced by the server name value you entered on the Create SSL key form.) Save this file in a secure place and do not share it with anyone.

IMPORTANT: Do not lose the private key! You will need it if you are using a CA-signed certificate. Also, you must keep a copy of it to restore later in case you commission a replacement groov Box or have to restore the Box to factory defaults. You cannot go back and get it again.
6. Continue with the next section.

**STEP 3: GET AND USE THE CERTIFICATE**


For a **CA-signed certificate**, see "Using a CA-Signed Certificate on the groov Box" on page 95.

**Using a Self-Signed Certificate**

A self-signed certificate encrypts communications, but does not include a digital signature from a commercial CA. It is free and easy to configure, but if you want to avoid having your users see an untrusted site warning every time they use groov, you must install the self-signed certificate in the browser certificate store for every browser that will access groov. This type of certificate is a good solution for a small set of groovs and a small set of client browsers that you can configure.

Follow these steps to use a self-signed certificate:

- "Finish the Self-Signed Certificate" on page 90
- "Add the Self-Signed Certificate to a Browser Trust Store on a Computer" on page 91
- "Install an SSL Certificate on Mobile Devices" on page 94

**Finish the Self-Signed Certificate**

When you created the private key ("Step 2: Create a Private Key" on page 88), you also created a self-signed certificate. Continue with these steps to finish.

1. **IMPORTANT:** Before proceeding, wait for the SYS LED on the groov Box to stop blinking green, then make sure to refresh your browser.

   It might take some time, but eventually you should see the security warning. (The security warning appears because the new certificate that was just installed on the groov Box is not trusted by the browser.)

2. Accept the security warning as described below.

   - **For Chrome**: Click “Proceed anyway.”
   - **For Firefox**:
     - Expand “I Understand the Risks.”
     - Click Add Exception to open the Add Security Exception dialog box.
     - Select “Permanently store this exception.”
     - Click Confirm Security Exception.
   - **For Internet Explorer 10**: Click “Continue to this website (not recommended).”
   - **For Safari**: Click Continue.

3. When groov Admin returns, select Networking> SSL Configuration.

4. Click the Current Certificate tab, then select “PEM format.”
The certificate’s text appears.

```
-----BEGIN CERTIFICATE-----
MIIEVzCCAbawAgEoJ3MoAwIBAgIjYWx5CMZnXyQzANBgssBAHg EAQQDmEwMBQAwGg
eFw0DQYJKoZIhvcNAQEBBQADgY0GMUwEwUQJAwOg==
-----END CERTIFICATE-----
```

If you have multiple certificates and have any doubt about whether this is the right one, open up the certificate in Windows. When the certificate wizard/explorer opens, you can see the hostname the certificate was created for.

5. Copy the certificate text and paste it to a file named `<server name>.cer` (where `<server name>` is replaced by the server name value you entered on the Create SSL key form in step 3 on page 88.)

Add the Self-Signed Certificate to a Browser Trust Store on a Computer

To prevent the untrusted site warning in browsers, the self-signed certificate must be added to the trust store for each browser used to access the groov Box or groov View. This section describes how to add a self-signed certificate on a computer. Step 3 describes how add a self-signed certificate on a mobile device.

See the section below for the client computer’s operating system.

“Windows” on page 91

“OS X” on page 93

Windows

Internet Explorer & Chrome.

1. In Windows file explorer, locate the `<server name>.cer` file you created in the previous step.
STEP 3: GET AND USE THE CERTIFICATE


Windows 8

3. (Windows 8 only) If you are administrator of local machine, choose the Local Machine certificate store so this certificate will be trusted by all user accounts. Otherwise it will only be trusted by the current user account.

4. Click Next.
5. Select “Place all certificates in the following store.”
6. Click Browse to open the Select Certificate Store dialog box.
7. Select Trusted Root Certification Authorities, and then click OK.
8. Click Next.
9. Click Finish.
10. A security warning alerts you that certificate installation is a risk if you don’t trust the certificate.
11. Click Yes to affirm that you trust the self-signed certificate.
12. To verify the certificate was installed correctly, open Internet Explorer or Chrome and enter the hostname specified on the certificate. If the browser does not generate an untrusted site warning, the certificate was installed correctly.

Firefox.

The self-signed certificate is added to the certificate store by adding a security exception. Firefox will present several warnings about creating a security exception for a self-signed certificate, but because you created and control the private key and certificate and installed the private key on the server, you can trust that the certificate identifies your server.

1. Open Firefox and enter https://<server name>
   A warning appears that says, “This Connection is Untrusted.”
2. Expand “I Understand the Risks.”
3. Click Add Exception to open the Add Security Exception dialog box.
4. Select “Permanently store this exception.”
5. Click Confirm Security Exception.

6. To verify the certificate was installed correctly, open Firefox and enter the hostname specified on the certificate. If the browser does not generate an untrusted site warning, the certificate was installed correctly.

**OS X**

*Safari and Chrome.*

1. Open Safari and enter `https://<server name>` to open this dialog box:

2. Click Show Certificate to reveal the full details:
STEP 3: GET AND USE THE CERTIFICATE

3. If the certificate looks good to you, check the “Always trust <server name> when connecting to <server name>” and click Continue. You will be asked to provide your password to authorize the addition of this certificate to your keychain, after which the browser and the Hosted Projects window will accept the SSL certificate as valid.

4. To verify the certificate was installed correctly, open a browser and enter the hostname specified on the certificate. If the browser does not generate an untrusted site warning, the certificate was installed correctly.

Install an SSL Certificate on Mobile Devices

When you open the operator interface in a browser on a smart phone or tablet, a security warning will appear unless you have installed a self-signed SSL certificate. See the section below for the device's operating system.

- “iOS Devices” on page 94
- “Android Devices” on page 94

iOS Devices.

1. Email the <server name>.cer file you created previously (see “Step 2: Create a Private Key” on page 88) to an email account accessible from iOS.
2. On the iOS device, open the email message containing <server name>.cer.
3. Tap on <server name>.cer
4. A message appears, “The authenticity of <server name> cannot be verified...”
5. Click Install.
6. Click Install Now.
7. Click Done.
8. To verify the certificate was installed correctly, open a browser and enter the hostname specified on the certificate. If the browser does not generate an untrusted site warning, the certificate was installed correctly.

Android Devices.

1. Email the <server name>.cer file you created previously (see “Step 2: Create a Private Key” on page 88) to an email account accessible from Android.
2. On the Android device, open the email and click the <server name>.cer file to install the certificate.
3. When prompted for a certificate name, type in a name. Make sure “Credential use:” is set to “VPN and apps.”
4. Click OK.
5. To verify the certificate was installed correctly, open a browser and enter the hostname specified on the certificate. If the browser does not generate an untrusted site warning, the certificate was installed correctly.

**Using a CA-Signed Certificate on the groov Box**

A **CA-signed certificate** contains identification information, the public key, and a digital signature. Identification information includes the server name and the name of the organization that controls the server. The certificate is digitally signed by a CA to establish authenticity. The Certificate is installed on the groov Box or Server.

To obtain the certificate, you send the certificate signing request (CSR) to the Certificate Authority (CA) of your choice. The CA verifies the identification information and signs the CSR, which then becomes a CA-signed Certificate. Follow these steps to obtain and use the certificate.

“**Finish the CSR**”  (see page 95)

“**Obtain a CA-Signed Certificate**”  (see page 96)

“**Install the CA-Signed Certificate on the groov Box**”  (see page 97)

**Finish the CSR**

When you created the private key (“**Step 2: Create a Private Key**” on page 88), you also created a certificate signing request (CSR). Continue with these steps to finish.

1. **IMPORTANT:** Before proceeding, wait for the SYS LED on the groov Box to stop blinking green, then make sure to refresh your browser.
   
   It might take some time, but eventually you should see the security warning. (The security warning appears because the new self-signed certificate that was just installed on the groov Box is not trusted by the browser.)

2. Accept the security warning as described below.

   - **For Chrome:** Click “Proceed anyway.”
   - **For Firefox:**
     - Expand “I Understand the Risks.”
     - Click Add Exception to open the Add Security Exception dialog box.
     - Select “Permanently store this exception.”
     - Click Confirm Security Exception.
   - **For Internet Explorer 10:** Click “Continue to this website (not recommended).”
   - **For Safari:** Click Continue.

3. Select the Current Certificate tab, then click the CSR hyperlink at the bottom of the dialog box.
4. Copy and paste the entire text to a file named `<server name>.csr` (where `<server name>` is replaced by the server name value you entered on the Create SSL key form in step 3 on page 88.)

Obtain a CA-Signed Certificate

When filling out a form for a certificate authority, keep in mind that an SSL certificate can be used with any operating system. If you are asked to select an operating system, you can select "other" if that is an option, but it’s OK to select some other operating system.

1. Open the .csr file you created in the previous section.

2. Provide the text of the CSR to the certificate authority in whatever form they require, whether it’s a text file or just text pasted into a text field.

To paste the text into a text field on the CA’s website, open your .csr file in a text editor such as Notepad, select all of the text and press Ctrl+C to copy the text to the clipboard.
3. Finish the transaction with the certificate authority and receive your new SSL certificate.

**Install the CA-Signed Certificate on the groov Box**

1. In groov Admin, select Networking > SSL Configuration.

   ![groov Admin SSL Configuration](image)

2. Click the Upload certificate tab on the SSL Encryption page.

   ![SSL Encryption Page](image)

3. Under "Private key," click Choose File and specify the `<server name>.key` file that you created and saved in “Step 2: Create a Private Key” on page 88. If you are running groov Admin v1.570.50 or later and the certificate you are uploading was created with the private key that is already installed on the groov Box, then you can skip this step.

   **IMPORTANT:** Remember to keep the Private Key private. If it is compromised, security is no longer guaranteed.

4. Under “Public Certificate”, click Choose File and specify the file you received from the CA.

5. If the SSL certificate you received from the CA included an Intermediate Certificate (chain.cert), under “Intermediate Certificate”, click Choose file and specify the file you received from the CA.

6. Click Save to complete the process.

   The browser pauses for a few seconds while the certificates are applied to the groov Box. When the certificates have been installed successfully, a confirmation message appears.

7. To verify the certificate was installed correctly, use a browser to access the groov Box using the hostname specified on the certificate. If the browser does not generate an untrusted site warning, the certificate was installed correctly.
STEP 3: GET AND USE THE CERTIFICATE
MAINTENANCE

Turning the groov Box On and Off

Turning the Box On
1. Check to make sure that the groov Box is plugged in and receiving power.
2. Firmly press the On/Off button only until the SYS LED lights up (in about one second), then release.
   Take a look at the LNK ACT light for ETH0; if the cable is properly connected, the LNK ACT light should be on or blinking.
   
   **CAUTION**: If you press the button for longer than eight seconds, the groov Box will be reset to default settings.
   Your project and all passwords will be erased.

   **NOTE**: Always wait until the SYS LED has stopped blinking before you try to log into the groov Box Otherwise, you may not be able to use the hostname to log in. If this happens, see page 102.

Turning the Box Off
With the groov Box on, press the On/Off button. The SYS LED will blink blue and then turn off. Always allow the groov Box to turn off completely before removing power.
Resetting the groov Box to Factory Defaults

Resetting the groov Box returns the Box to its default network settings and erases all your data, including your groov View, Node-RED, and Ignition Edge projects.

**CAUTION:** When the groov Box is reset to factory default settings, your projects and all passwords are erased.

1. **IMPORTANT:** Back up your groov View project (page 32), your Node-RED project (page 57), and your Ignition Edge project (page 81). Also, unactivate your Ignition Edge license following steps on page 80.

2. Turn the groov Box off by pressing the On/Off button briefly (the SYS LED blinks blue and then turns off). Make sure the Box is still plugged in and receiving power.

3. Press and hold the On/Off button for at least eight seconds, until the SYS LED is blinking red and green. Then release the button. The reset defaults operation can last several minutes. When the process is complete, the groov Box powers off.

   *NOTE:* Do not remove power from the groov Box or turn it off while the SYS LED is blinking red and green. If you do, you'll need to repeat the reset defaults operation from step 1.

4. Firmly press and release the On/Off button to turn on the groov Box. groov is now in the same state it was in when shipped from the factory.

   *NOTE:* Always wait until the SYS LED has stopped blinking before you try to log into the groov Box. Otherwise, you may not be able to use the hostname to log in. If this happens, see page 102.

5. Wait until the SYS LED has stopped blinking, and then open your web browser and type https:// plus the groov Box’s hostname (find it on the bottom of the Box).

   Example: https://opto-01-d2-cd

6. Accept the security warnings. When groov View opens, follow the onscreen instructions to create a groov Admin account. Remember your username and password! They cannot be retrieved.

7. When prompted, install your license.

8. Follow instructions to create a groov View account. Remember this username and password, too; login information cannot be recovered if lost.

9. Click Go to Build mode. When Build opens, choose Help > Check for Updates. Log into manage.groov.com using your My.Opto22 credentials, click Manage, and locate your Box in the list. Click Manage next to its name.

10. From the Box’s profile page, download updates for groov Admin, groov View, and Node-RED (if you use it), and then install them (see “Updating groov Admin” on page 34, “Updating groov View” on page 30, and “Updating Node-RED” on page 36).

11. Restore your groov View project (page 33), your Node-RED project (page 57), and your Ignition Edge project (page 81), and reactivate your Ignition Edge license (page 76).

Applying a groov Edge license option

A groov Edge license is required for:

- Using the Ignition Edge internal OPC-UA server & drivers in the groov Box
- Using MQTT in Ignition Edge

You can purchase the groov Edge license, part number GROOV-LIC-EDGE, at the same time you buy the groov Box, or you can buy it later. Then follow the steps in "License Ignition Edge" on page 76 to activate and apply it.
Transferring a groov Box to someone else

In some situations, you may need to transfer ownership of a groov Box to someone else. For example, if you are a system integrator or OEM, you may need to transfer groov Boxes to your customers so they can install updates or licenses.

**IMPORTANT:** When you transfer the groov Box to someone else, you will no longer be able to see or manage it in your list of groov products on manage.groov.com. Only the new owner will be able to do that.

To transfer a groov Box:
1. Log into manage.groov.com with your MyOpto username and password.
2. Click Manage.
3. In your list of groov products, find the Box you want to transfer and click the Manage button next to it.
4. At the bottom of the Box's Profile page, click Transfers.
5. Enter the email address of the person you are transferring the Box to (the transferee) and double-check to make sure it is the correct address. Then click Transfer groov.

You receive a confirmation email. If you’ve made an error, you can cancel the transfer unless the transferee has already accepted it.

The transferee receives an email asking them to accept or decline the transfer at manage.groov.com. If they don’t already have a free My.Opto account, they will need to register for an account.

When the transferee accepts the transfer, the groov Box disappears from your list and appears in their list.

If you have any problems with the transfer, contact Opto 22 Product Support (see page 6).

Replacing the battery

If the power LED blinks red and power to the groov Box is adequate, replace the battery. The battery maintains the Date and Time. You’ll need a BR2032 button cell lithium battery with a nominal voltage of 2.8 volts.

1. On the top of the groov Box, unscrew the captive screw, and pull out the battery holder.

2. Using your fingers, pop out the old battery.
3. Put in the new battery, push in the holder, and secure the captive screw.

TROUBLESHOOTING

**groov Box is not receiving power**

- Make sure you are using either the power supply that came with groov Box or else a power supply with the appropriate specifications. See Appendix A: Specifications and Dimensions on page 107.
- Check that the power supply is securely attached to the groov Box and that the power supply is receiving power.

**Cannot log into groov Box using its hostname**

When starting a groov Box, always wait until the SYS LED has stopped blinking before you try to access groov. Otherwise, you might not be able to log in using the hostname. If this happens, try one of the following methods to log in:

**Method 1:** Open groov Find (see page 18) and locate the IP address of the groov Box you want to log into. Log in using the Box's IP address. After some time passes, you should be able to log in again using the hostname.

**Method 2:** Open a command prompt and enter `ipconfig /flushdns` Then log into the Box using the hostname.

**groov Box is connected to Ethernet network but doesn’t work**

- Make sure the groov Box has been turned on, and the LNK ACT LED for the connected Ethernet interfaces are lit. (See “LEDs” on page 111.)
- Make sure you’ve typed the URL accurately and included the "s": `https://` plus the groov Box hostname or IP address. Check the label on the bottom of the groov Box, where the hostname is printed.
  - `https://opto-06-51-f2`
  - `https://192.168.11.2`
- If you cannot connect to the groov Box on the network, make sure the Ethernet cable is connected to ETH0, which must be used for initial setup and configuration. After that, either ETH0 or ETH1 may be used.
- Make sure that the groov Box and the computer are connected to the same network. If you still can’t reach the Box, your network is set up differently. That’s OK. Find out the following information about your network and your computer:
  - Does your network have a DHCP server? See below.
  - Does your network have a DNS server? See below.
– Does your computer have more than one network interface card (NIC)? See below.

**DHCP (dynamic host configuration protocol) server**

A DHCP server automatically assigns IP addresses to devices on the network, which is what the groov Box expects. If you have no DHCP, work with your IT Department to choose a static IPv4 address for the groov Box.

To assign the fixed IP address, you’ll need:

- a Windows PC on the same network subnet as the groov Box
- groov Find utility (download from www.opto22.com)

Assign the static IP address to the Box. See “Assigning a Static IP Address” on page 24.

Once you’ve assigned the static IP address, open your web browser and for the URL enter https:// plus the IP address you assigned to the Box. For example: https://182.154.1.68

**DNS (domain name server)**

A DNS (domain name server) keeps track of the unique hostname for each device on the network, so you can find it by name even if its IP address changes. If your network has no DNS, you won’t be able to access the groov Box using its hostname, but you can access it using its IP address.

To determine the IP address, you’ll need:

- a Windows PC on the same network subnet as the groov Box

Once you’ve found your groov Box in groov Find, click the link to set up the Box. Also make a note of the IP address shown, so later you can use it in your web browser instead of the hostname: for the URL enter https:// plus the Box’s IP address. For example: https://192.168.1.220

**Computer with more than one NIC**

More than one NIC can cause a problem when you’re trying to communicate with the groov Box using your browser and the groov Box’s hostname.

Each NIC communicates on a separate network subnet. You may have one network subnet set up for your computers and a second one set up for your control system, for example (this is a pretty common scenario, and in fact we recommend it for security).

Make sure you’re trying to reach the groov Box using the NIC for the network subnet it is on. You could unplug the Ethernet cable from your controller network NIC to force the PC to look for the groov Box on the computer network. Then try again using your browser and the groov Box’s hostname.

If your control system and your computers are on separate network subnets, you’ll need to set up ETH1 on the groov Box in order to reach your control system. See the next question.

**Modbus/TCP device, OPC UA server, or Opto 22 SNAP PAC controller can’t be found**

Are your control system and your computers on separate network subnets? We recommend this setup for security reasons, and the groov Box is designed to work this way. Here’s what to do so groov View can find your OPC UA server, Opto 22 SNAP PAC controller, or Modbus/TCP device:

1. Plug the control network into ETH1 on the groov Box. (Remember, your computer network is plugged into ETH0. The two Ethernet network interfaces on the Box are independent, so that keeps the two network subnets separate.)

2. Follow the steps in “Configuring ETH1 for the Control Network” on page 25 to configure the ETH1 connection.
3. Now try configuring your tag server or controller again. This time groov View should be able to find it.

Cannot read from/write to Modbus/TCP device OR Modbus data doesn’t make sense

Modbus/TCP devices, though based on a standard protocol, may be set up differently from one another. Some use zero-based addressing and some use one-based addressing. Some devices don't support all Modbus functions. Modbus/TCP devices also vary in the way they present float data. And device documentation sometimes doesn’t specify how the device is set up.

If you’re having trouble reading or writing to your device, or if the data is clearly wrong, you probably need to change settings for your Modbus device. In groov View, choose Configure > Devices and Tags and locate your device in the list. Follow instructions in the groov View User’s Guide to understand and change settings. You may need to try different combinations of settings to see what works.

"Connection is reset" error in groov Admin

If you see this error, it just means that groov Admin has timed out. For security reasons, if you have not interacted with groov Admin in 10 minutes, you must log in again. Refresh the page and log in.

Power LED is blinking red

If the power LED blinks red, either power to the groov Box is outside normal range, or the Box’s battery needs replacing. Check to make sure the power supply to the groov Box is adequate (see “Step 5. Connect the Power Supply” on page 11). If power is OK, replace the battery (see page 101).

Power outage

If power to the groov Box is removed, such as when there is a power outage, when the power is restored the groov Box may return to the state it was in prior to the power being removed. That is, if it was on, it may power up, and if it was off, it will likely remain off.

However, to avoid potential problems we recommend that you use a UPS (uninterruptible power supply) with the groov Box for backup power and surge protection.

Node-RED flow not working

Node-RED is open-source software, and troubleshooting it is beyond the scope of this user’s guide. But a good thing to try if your flow used to work, but now doesn’t, is to redeploy it.
For example, if you upgrade to a newer version of Node-RED for the groov Box, some nodes you’re using may have changed or been removed. If they’ve been removed, you’ll need to reinstall them, but changes can also affect the way your flow works.

Make sure there are no unwanted changes, and then try doing a full deploy (a partial deploy may not be enough). If the Deploy button is grayed out, move a block or make some other small change to the flow.

**Console Log.** The log can also help with troubleshooting. Open Node-RED Admin and choose Diagnostics in the left navigation bar to see the console log.

**Additional resources** for using Node-RED:
- Node-RED website
- Opto 22 developer website at developer.opto22.com
- Opto 22 Node-RED forum

**Errors in Build mode when using Ignition Edge**

If you’re working in Build mode and receive an error while trying to create a gadget for an Ignition Edge tag, the Ignition Edge trial period may have expired. Here’s an example of an error like this:

To fix it, open another browser tab, go to https://[your groov Box’s hostname]:8043 and restart the trial. (See page 75 for help.)

**No data in groov View for gadgets using Ignition Edge tags**

If you’re in groov View and gadgets for Ignition Edge tags show a yellow triangle and no data, click the yellow triangle to see what’s wrong.

- Your groov View trial period may have expired. Unless your groov Box has an Edge license (see page 100), you are using a free trial for OPC UA, and that trial expires two hours after you first look at your operator interface in groov View. To restart the trial, just restart the Box. (See page 36 for steps.)
- Your Ignition Edge trial period may have expired. If so, go to https://[your groov Box’s hostname]:8043 and restart the trial. (See page 75 for help.)

**Ignition Edge OPC-UA and MQTT documentation**

Instructions for using Ignition Edge, Ignition Edge Designer, and the MQTT Transmission module are beyond the scope of this guide, since these products are owned by other companies. Here are some document links:

- Configure OPC UA tags for Siemens: https://docs.inductiveautomation.com/display/DOC79/Siemens
- Configure OPC-UA tags for Modbus: https://docs.inductiveautomation.com/display/DOC79/Modbus
- Set up folders and configure tags for MQTT: https://docs.chariot.io/display/CLD/Sending+OPC+Tag+Data+with+Transmission
- Using the MQTT Transmission module: https://docs.chariot.io/display/CLD/MT%3A+Configuration
Ignition Edge shows license is temporary and valid for only seven days

If you have updated groov Admin or reset your groov Box to factory defaults, and you did not deactivate your Ignition Edge license before updating or resetting, you may see a message in Ignition Edge that your license was previously activated and is now temporarily valid for a week.

If you see this message, contact Ignition Edge at the number shown in the message and explain the situation, so they will reinstate the license.

To avoid this problem, always deactivate your Edge license before updating groov Admin or resetting the groov Box to factory defaults. See “Unactivate Ignition Edge license” on page 80.

Time zone change not shown in Ignition Edge

You set up your time zone in groov Admin (see page 41). If you are running Ignition Edge and change the time zone, Ignition Edge does not automatically update it. To update it, restart the Ignition Edge Gateway.
## A: Specifications and Dimensions

### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet Communication (wired)</td>
<td>Two independent 10/100/1000 Mbps RJ-45 connectors, each with a separate IP address (separate subnets)</td>
</tr>
<tr>
<td>Ethernet Comm (wireless)</td>
<td>802.11 b/g/n (optional; requires purchase of a third-party commercial USB WiFi adapter that has been tested and approved by Opto 22)</td>
</tr>
<tr>
<td>Security (wireless)</td>
<td>WEP64, WEP128, WPA PSK (also called WPA Personal), WPA2 PSK (also called WPA2 Personal)</td>
</tr>
<tr>
<td>Backup battery</td>
<td>BR2032 button cell lithium battery with a nominal voltage of 2.8 volts. Lasts 8 years at 25 °C. This battery maintains the date and time.</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>8-36 VDC, 24 VDC @ 500mA (Power supply included; input 100-240 VAC. Use international adapter if needed.)</td>
</tr>
<tr>
<td>Housing</td>
<td>Compact and sturdy metal. Fanless operation.</td>
</tr>
<tr>
<td>USB</td>
<td>USB 2.0 (three: used for backing up, restoring, WiFi, and connecting to serial devices via a USB-to-serial converter with an FTDI chipset)</td>
</tr>
<tr>
<td>Indicators</td>
<td>Ethernet interfaces (2): Link/Activity and Speed System: SYS &amp; PWR</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>0 to 70 °C (32 to 158° F)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-20 to +80 °C (-4 to 176° F)</td>
</tr>
<tr>
<td>Operating Humidity</td>
<td>10% to 90% relative humidity, non-condensing</td>
</tr>
<tr>
<td>Storage Humidity</td>
<td>5% to 95% relative humidity, non-condensing</td>
</tr>
<tr>
<td>Agency Approvals</td>
<td>CE, RoHS, DFARS</td>
</tr>
<tr>
<td>Warranty</td>
<td>30 months</td>
</tr>
</tbody>
</table>
DIMENSIONS

[Dimensions diagram with various measurements labeled in both inches and millimeters]
B: Connectors, Ports, and LEDs

CONNECTORS

Independent 10/100/1000 Mbps Ethernet interfaces (RJ-45 connectors)

USB connectors. Can be used for:
- Backing up and restoring. See “Backing Up groov View and Network Settings” on page 32 and “Restoring groov View and Network Settings” on page 33.
- Connecting to serial devices using an FTDI USB-to-serial converter and Node-RED. See “USB connectors for serial devices” on page 110 and “Connecting with serial devices” on page 51.

USB connector, used for:
- WiFi adapter. See Appendix C: Installing an Approved USB WiFi Adapter on page 113 and “Configuring Wireless Communications” on page 26.
- Serial device. See “USB connectors for serial devices” on page 110 and “Connecting with serial devices” on page 51.

Power connector

Top

Bottom
USB connectors for serial devices

When used for connecting to serial devices with a USB-to-serial converter with FTDI chipset, each USB connector on the groov Box shows a specific address in Node-RED. The address is for the connector, not for the serial device. If you unplug a device from one connector and plug it into a different one, you will need to change the device’s address in the node. Connector addresses are shown below.

If you’re using a USB hub, the address looks like this:
```bash
ttySer<connector>.[<tier 1 port number>].[<tier 2 port number>]
```
- `<connector>` indicates the 0, 1, or 2 connector on the groov Box, as shown above.
- `[<tier 1 port number>]` for a USB hub connected to the AR1, indicates the USB hub port number where the converter is plugged in.
- `[<tier 2 port number>]` is for a second USB hub connected to the first hub. You can add additional tiers if needed, using the same pattern.

Examples:

1. USB-to-serial converter is attached to the top USB connector on the front of the groov-AR1: `/dev/ttySer0`
2. Converter is attached to port 2 of a USB hub attached to the bottom connector on the front of the groov-AR1: `/dev/ttySer1.2`
3. Converter is attached to port 4 of a USB hub attached to port 1 of a USB hub attached to the USB connector on the top of the groov-AR1: `/dev/ttySer3.1.4`

Remember that the address indicates the connectors, not the serial device. If you move a device, be sure you change the device’s address in the node.
PORTS

The following ports are used for communication in the groov Box:

<table>
<thead>
<tr>
<th>Port</th>
<th>How used</th>
<th>Example/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>443 or 8443</td>
<td>Basic communication with groov View</td>
<td>Default is 443.</td>
</tr>
<tr>
<td>10000</td>
<td>Open groov Admin</td>
<td>https://[groov Box hostname]:10000</td>
</tr>
<tr>
<td>1880</td>
<td>Open Node-RED Editor</td>
<td>https://[groov Box hostname]:1880</td>
</tr>
<tr>
<td>3000</td>
<td>Open Node-RED Admin</td>
<td>https://[groov Box hostname]:3000</td>
</tr>
<tr>
<td>4096</td>
<td>groov View communication with Edge (inside the Box)</td>
<td>127.0.0.1:4096</td>
</tr>
<tr>
<td>8043</td>
<td>Open Ignition Edge Gateway</td>
<td>CAUTION: This is an insecure port. If you need to open it temporarily for configuring tags, close it as soon as possible. While it is open we strongly recommend that you connect the groov Box only to a trusted network that blocks external connection requests to TCP port 8088. Also, configure Ignition Edge to use SSL for the user interface. See page 82.</td>
</tr>
<tr>
<td>8088</td>
<td>Download Ignition Edge Designer project file</td>
<td></td>
</tr>
</tbody>
</table>

LEDs

The groov Box's LEDs use color and blinking to show status information.

<table>
<thead>
<tr>
<th>LED</th>
<th>What it shows</th>
<th>Color</th>
<th>What it means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>groov Box is turned off</td>
<td></td>
<td>groov Box is turned off</td>
</tr>
<tr>
<td>Green</td>
<td>groov Box is turned on</td>
<td></td>
<td>groov Box is turned on</td>
</tr>
<tr>
<td>Blinking green</td>
<td>groov Box is booting up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blinking blue</td>
<td>groov Box is shutting down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blinking red and green</td>
<td>Default settings are being restored</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blinking red</td>
<td>Restoration to default settings failed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SYS LED On/Off button

Ethernet LEDs
<table>
<thead>
<tr>
<th>LED</th>
<th>What it shows</th>
<th>Color</th>
<th>What it means</th>
</tr>
</thead>
<tbody>
<tr>
<td>On/Off</td>
<td>Power to Box</td>
<td>Green</td>
<td>groov Box is turned on</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blinking red</td>
<td>Input power is outside normal range or battery is low (see “Power LED is blinking red” on page 104)</td>
</tr>
<tr>
<td>SPEED</td>
<td>Ethernet link speed</td>
<td>Off</td>
<td>10 Mbps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Green</td>
<td>100 Mbps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Orange</td>
<td>1000 Mbps</td>
</tr>
<tr>
<td>LINK ACT</td>
<td>Ethernet network activity</td>
<td>Off</td>
<td>No Ethernet link</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Green</td>
<td>There is an Ethernet link, but no activity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blinking green</td>
<td>There is a link and activity</td>
</tr>
</tbody>
</table>
C: Installing an Approved USB WiFi Adapter

If you want to use the groov Box on a wireless network, you must purchase and install one of the following USB WiFi adapters that Opto 22 has tested and approved for use with GROOV-AR1. Unapproved WiFi adapters should not be used.
- Netis WF2119S
- Netis WF2116
- Rosewill RNX-N150UBE
- Patriot Memory PCUSBW1150

Install the WiFi adapter and restart the groov Box as follows:
1. If the groov Box is on, press the On/Off button firmly but briefly to turn it off.
   
   **CAUTION:** If you press the button for longer than eight seconds, the groov Box will be restored to default settings. Your project and all passwords will be erased.

2. Insert the WiFi adapter into the USB connector on the top of the device.

3. Firmly press the On/Off button. The Power LED will turn on. Wait until the SYS LED has stopped blinking and is solid green.

4. Open groov Admin as described on page 17.

5. Configure wireless communications as described on page 26.
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