Nine Fives Programmable Attenuator

Reference Manual

Nine Fives

None

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1. Introduction

The Nine Fives Programmable SPDT Switch, Programmable SP4T Switch, and Programmable Attenuator are network-controlled RF instruments. Each device provides three communication interfaces for monitoring and control:

- **Web UI** (Port 80) — Browser-based graphical interface for configuration and control
- **REST API** (Port 80) — JSON API for integration with custom applications and automation scripts
- **SCPI over TCP** (Port 5025) — Industry-standard text protocol for test and measurement applications
- **SCPI over HiSLIP** (Port 4880) — High-Speed LAN Instrument Protocol (IVI-6.1) for VISA-compatible instrument communication

All interfaces provide equivalent control over the device. Choose the interface that best fits your application.

1.1 Device Variants

Nine Fives produces the following device variants:

VARIANT	DESCRIPTION
Programmable SPDT Switch	RF switch with two throws (RF0 / RF1)
Programmable SP4T Switch	RF switch with four throws (RF0–RF3)
Programmable Attenuator	Variable RF attenuator (0–95.25 dB in 0.25 dB steps)

See the SPDT, SP4T, or attenuator product specifications for RF performance, power limits, environmental ratings, and connector details.

All variants share common system, network, and firmware management capabilities. The variant-specific commands and endpoints are documented in their respective sections.

1.2 About This Manual

This manual covers all available commands and endpoints for your device variant. Each section includes complete syntax, parameters, examples, and error codes.

2. Getting Started

2.1 Physical Connections

The device has two network interfaces:

INTERFACE	CONNECTOR	DEFAULT IP	DESCRIPTION
Ethernet	RJ-45	Assigned by DHCP (fallback: 192.168.0.95)	Primary network connection
USB-C	USB-C port	192.168.42.95	Direct connection to a host computer

Connect to the device using either interface. The USB-C connection is useful for initial setup or when no Ethernet network is available.

2.2 Available Ports

PORT	PROTOCOL	DESCRIPTION
80	HTTP	Web UI and REST API
5025	TCP	SCPI raw socket
4880	TCP	SCPI over HiSLIP (IVI-6.1)

2.3 Accessing the Web UI

Open a web browser and navigate to the device's IP address:

```
http://192.168.0.95
```

Or, if connected via USB-C:

```
http://192.168.42.95
```

The web UI provides a graphical interface for all device functions including system monitoring, network configuration, firmware updates, and device control.

2.4 Connecting via SCPI

2.4.1 Raw TCP

Use any TCP client to connect to port 5025:

```
telnet <device-ip> 5025
```

Send a command to verify the connection:

```
*IDN?
```

The device responds with its identification string.

2.4.2 HiSLIP (VISA)

Use a VISA library (such as PyVISA) with the following resource string:

```
TCPIP::<device-ip>::hislip0::INSTR
```

Example using Python:

```
import pyvisa
rm = pyvisa.ResourceManager()
inst = rm.open_resource("TCPIP::192.168.0.95::hislip0::INSTR")
print(inst.query("*IDN?"))
```

2.5 Using the REST API

The REST API accepts JSON requests on port 80. Example using `curl`:

```
curl http://192.168.0.95/api/system/status
```

See the REST API section for complete endpoint documentation.

2.6 Default Network Configuration

SETTING	ETHERNET	USB-C
Mode	DHCP Client with Static Fallback	DHCP Host
IP Address	192.168.0.95 (fallback)	192.168.42.95
Subnet Mask	255.255.0.0	255.255.255.0
DHCP Timeout	30 seconds	—

In the default Ethernet mode (`DHCP Client with Static Fallback`), the device first attempts to obtain an IP address from a DHCP server. If no DHCP server responds within 30 seconds, it falls back to the configured static IP address.

The USB-C interface runs a DHCP server by default, automatically assigning an IP address to the connected host computer.

3. Web UI

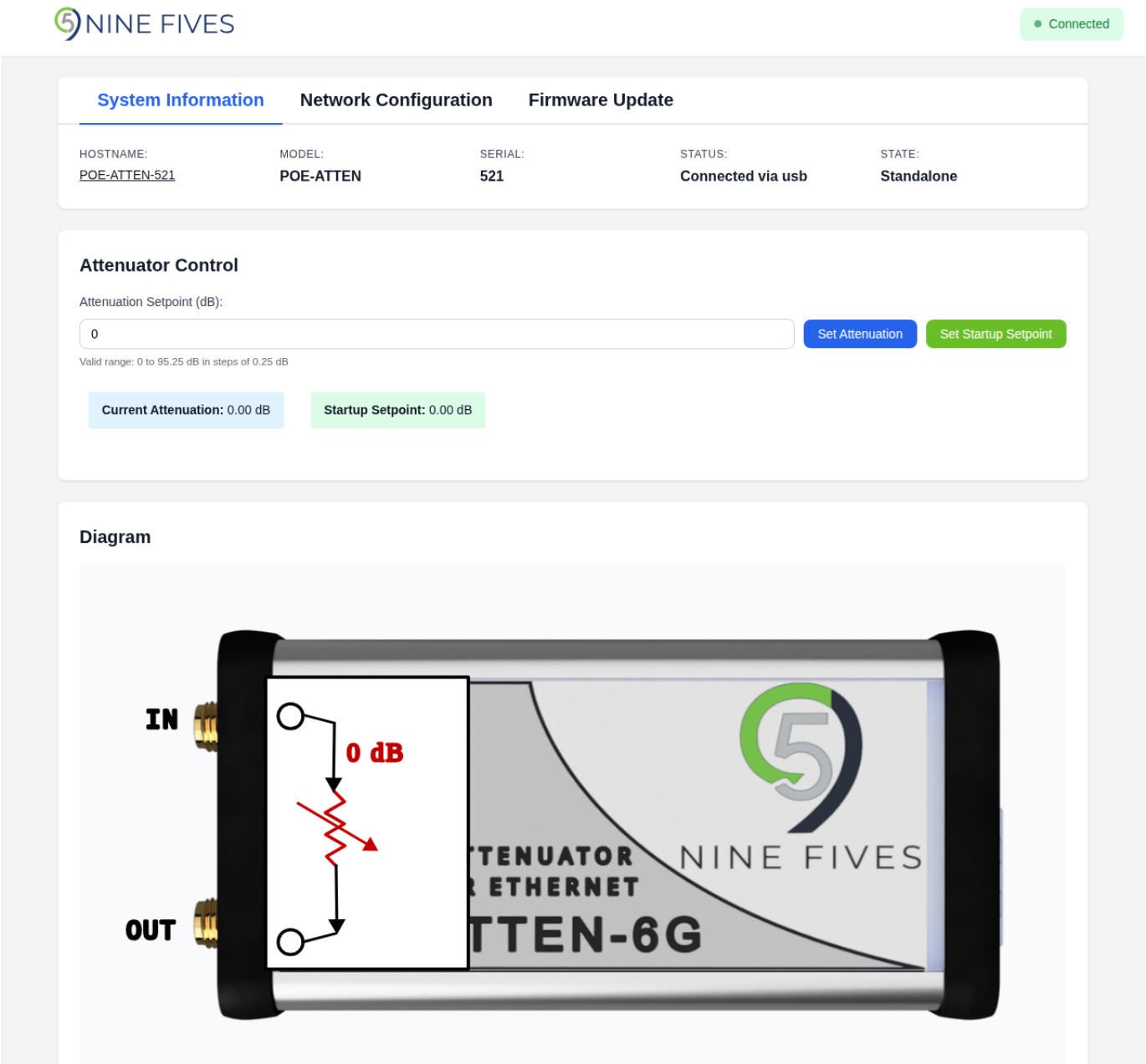
3.1 Web UI Overview

The Nine Fives web interface is accessible at `http://<device-ip>` on port 80. It provides a browser-based graphical interface for monitoring and controlling the device.

3.1.1 Layout

The interface consists of:

- **Header** — Nine Fives logo and connection status indicator
- **Tab bar** — Switches between System Information, Network Configuration, and Firmware Update views
- **Device control card** — Variant-specific controls (switch state or attenuation setpoint)
- **Notifications** — Success and error messages appear at the bottom of the page and auto-dismiss after a few seconds



3.1.2 Connection Status

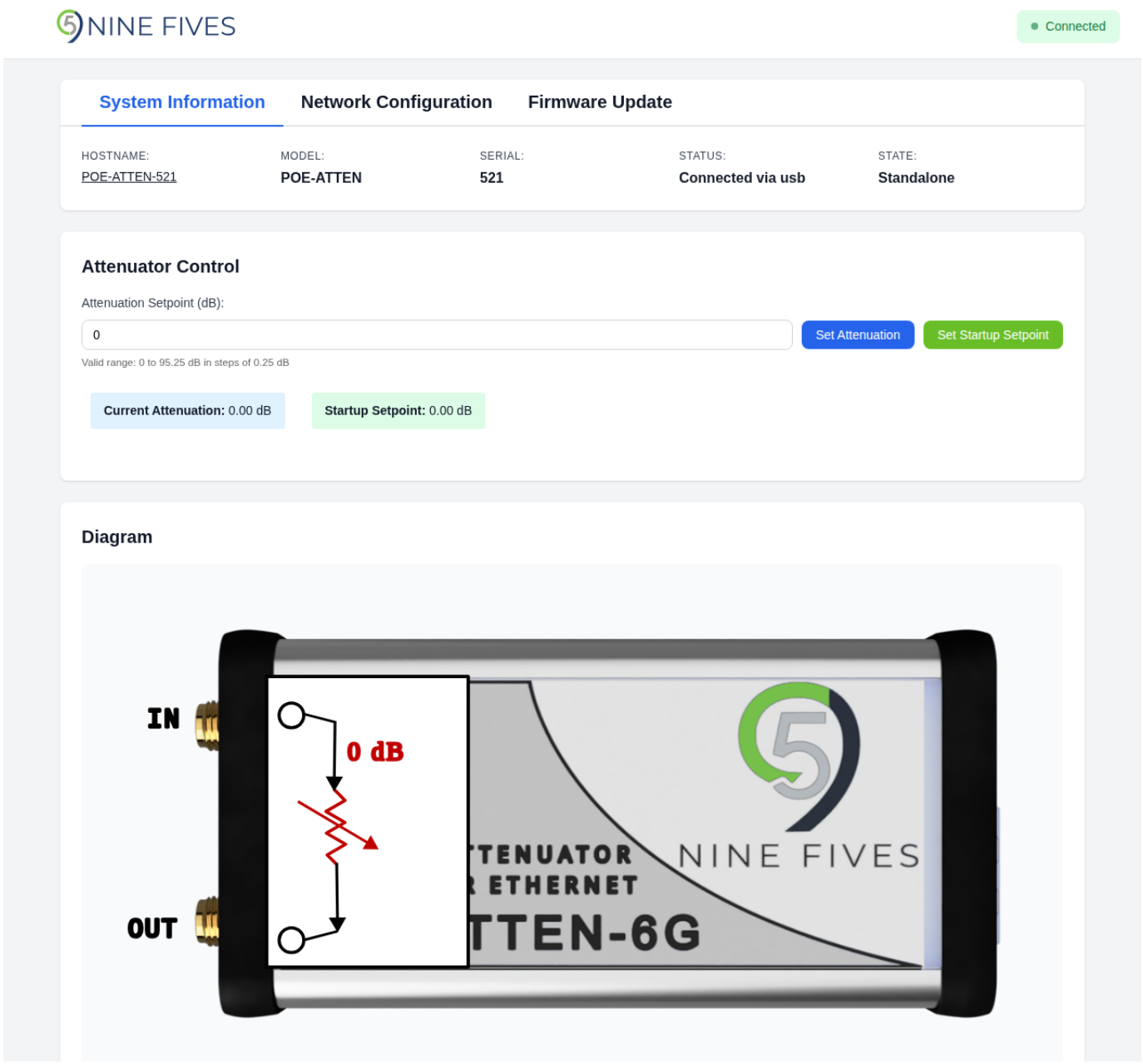
The header displays a connection status badge:

- **Connected** (green) — The browser is communicating with the device
- **Disconnected** (red) — Communication with the device has been lost

The interface polls the device every second to update the displayed state. If communication is lost, the status indicator turns red and controls are disabled until the connection is restored.

3.2 System Information

The **System Information** tab displays the current status of the device.



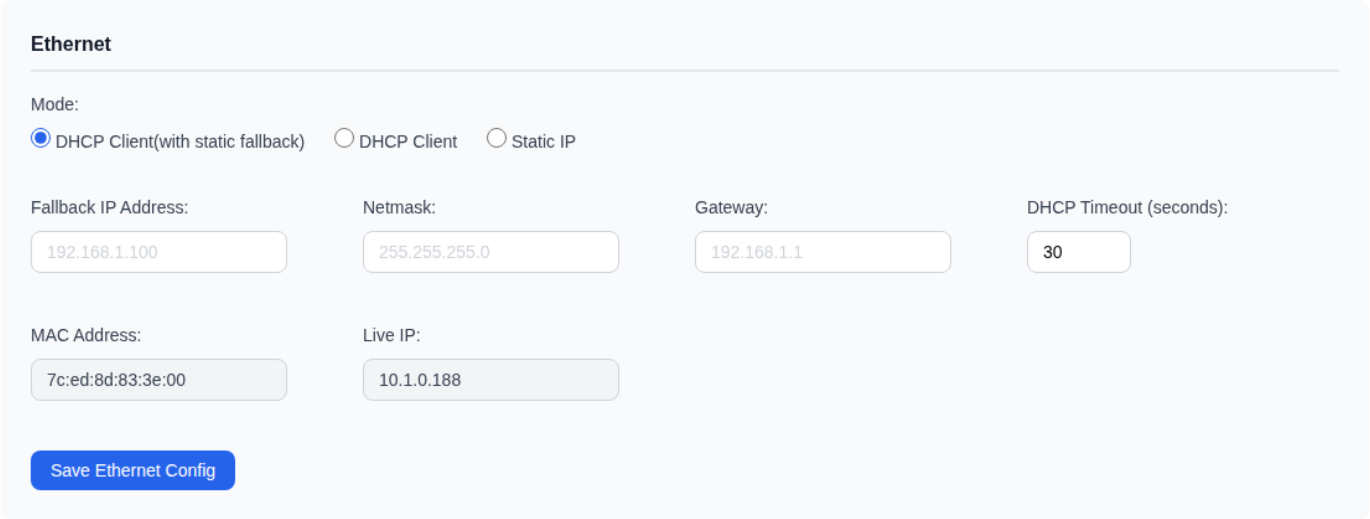
3.2.1 Displayed Fields

FIELD	DESCRIPTION
Hostname	The device hostname, displayed as a clickable link to `http://<hostname>.local`
Model	The device model identifier
Serial	The device serial number
Status	Connection type — "Connected via eth", "Connected via usb", "Connected via dock", or "Disconnected"
State	"Docked" when the module is in its dock, otherwise "Standalone"

3.3 Network Configuration

The **Network Configuration** tab allows you to view and modify the network settings for both the Ethernet and USB-C interfaces.

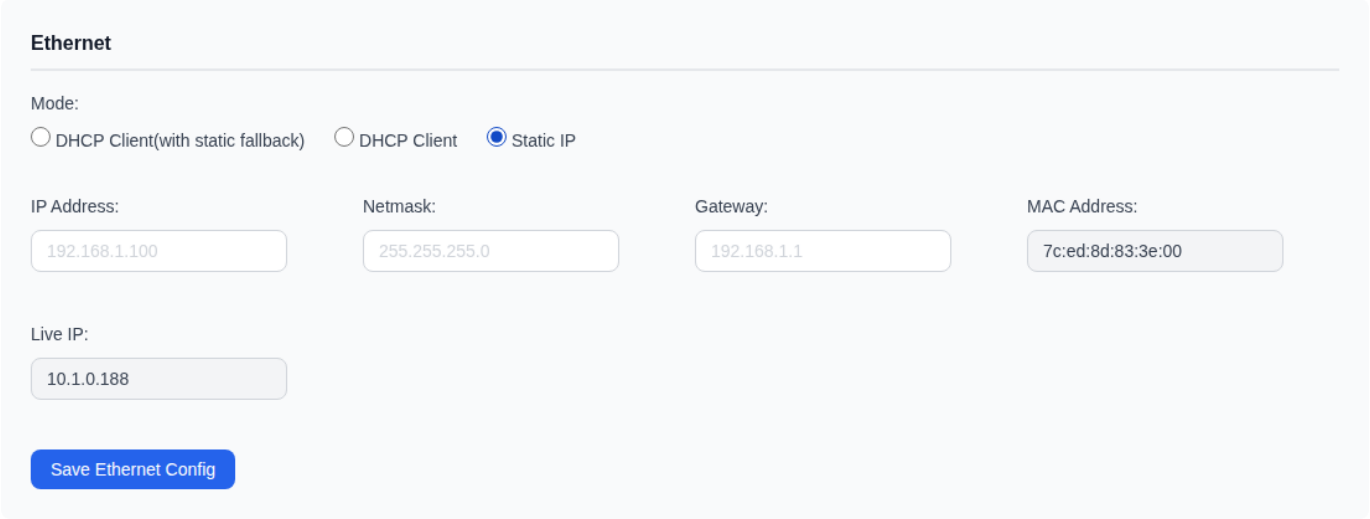
3.3.1 Ethernet Settings



Mode Selection

Select the Ethernet operating mode using the radio buttons:

MODE	DESCRIPTION
DHCP Client (with static fallback)	Attempts DHCP; falls back to the configured static IP address after a timeout. This is the factory default.
DHCP Client	Obtains an IP address from a DHCP server on the network. The IP address and netmask fields are disabled in this mode.
Static IP	Uses the configured IP address, netmask, and gateway.



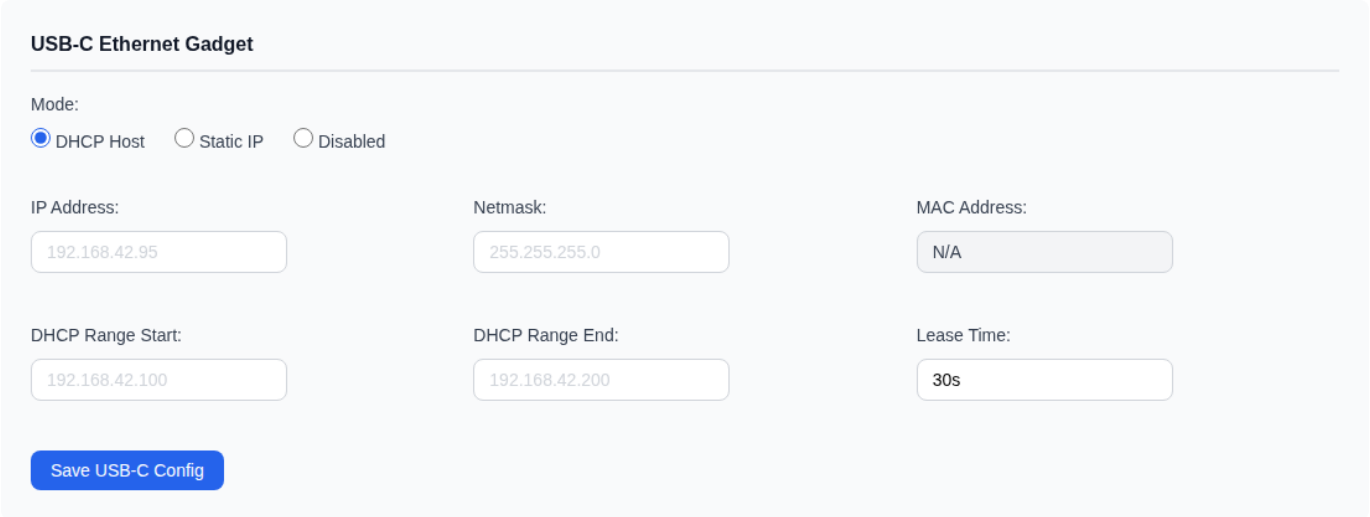
Configuration Fields

FIELD	DESCRIPTION	EDITABLE
IP Address / Fallback IP Address	The configured IP address. Label changes based on mode.	Yes (except in DHCP Client mode)
Netmask	The subnet mask	Yes (except in DHCP Client mode)
Gateway	The default gateway	Yes (except in DHCP Client mode)
DHCP Timeout	Seconds to wait for DHCP before falling back to static. Only shown in DHCP Client (with static fallback) mode.	Yes
MAC Address	The Ethernet interface MAC address	No (read-only)
Live IP	The currently active IP address on the interface	No (read-only)

Click **Save Ethernet Config** to apply changes. Settings take effect immediately.

> **WARNING**
>
> Changing network settings while connected via Ethernet may result in loss of connectivity. Ensure you have an alternative way to reach the device (e.g., via USB-C) before making changes.

3.3.2 USB-C Ethernet Gadget Settings



Mode Selection

MODE	DESCRIPTION
DHCP Host	Runs a DHCP server, automatically assigning an IP address to the connected computer. This is the factory default.
Static IP	Uses the configured IP address and netmask.
Disabled	Brings down the USB-C network interface. All fields are hidden.

Configuration Fields

FIELD	DESCRIPTION	EDITABLE
IP Address	The device IP address on the USB-C interface	Yes
Netmask	The subnet mask	Yes
MAC Address	The USB-C interface MAC address	No (read-only)
Live IP	The currently active IP address on the interface	No (read-only)

When **DHCP Host** mode is selected, additional fields appear:

FIELD	DESCRIPTION
DHCP Range Start	First IP address in the DHCP pool
DHCP Range End	Last IP address in the DHCP pool
Lease Time	DHCP lease duration (e.g., `30s`, `1h`, `24h`)

Click **Save USB-C Config** to apply changes.

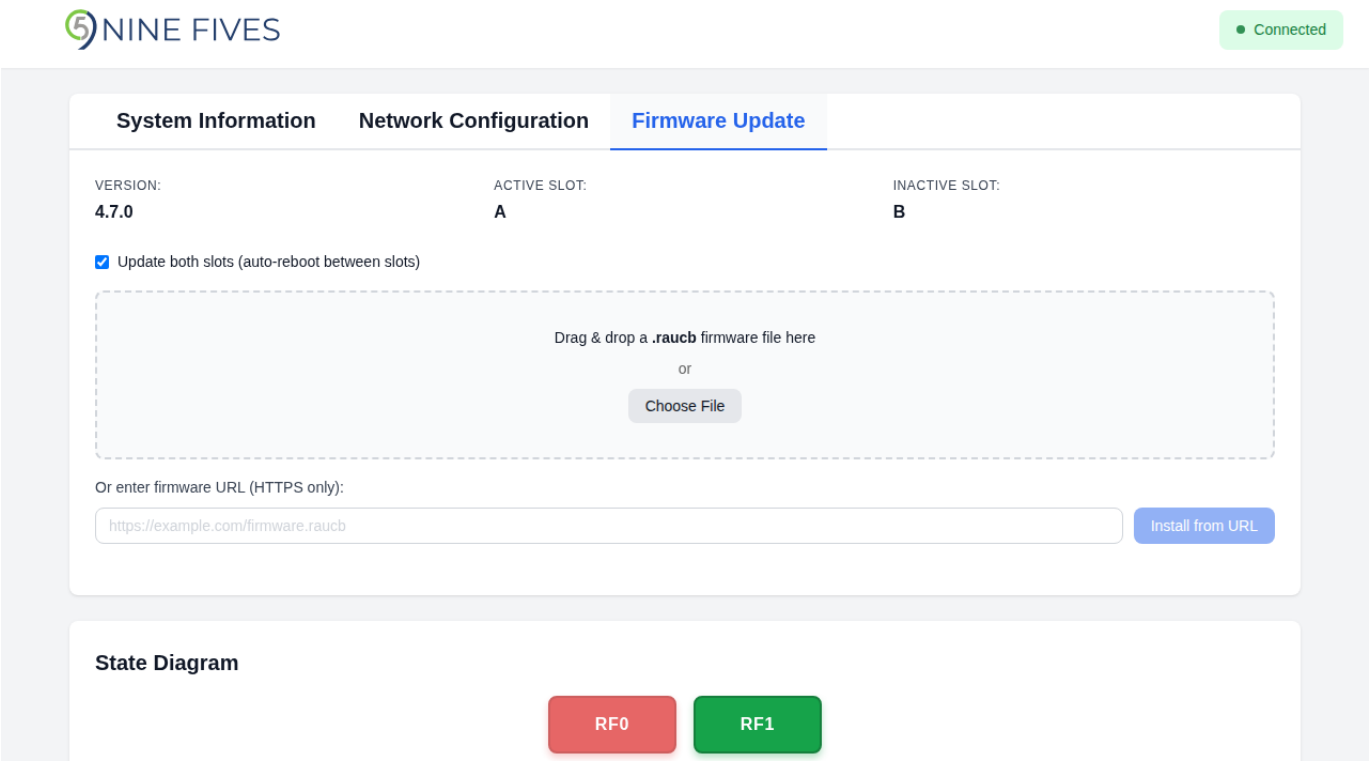
3.3.3 Factory Reset

Click **Reset Networking Settings to Factory Defaults** at the bottom of the network configuration panel to restore all network settings to their factory defaults. A confirmation dialog appears before the reset is applied.

> **WARNING**
>
> The device will briefly be unreachable while factory default settings are applied. The default configuration uses DHCP Client with Static Fallback mode on Ethernet (fallback IP: 192.168.0.95) and DHCP Host mode on USB-C (IP: 192.168.42.95).

3.4 Firmware Update

The **Firmware Update** tab displays the current firmware version and provides tools for updating the device firmware.



3.4.1 Firmware Information

FIELD	DESCRIPTION
Version	The currently running firmware version
Active Slot	The firmware slot currently booted (A or B)
Inactive Slot	The alternate (not booted) firmware slot (A or B)

The device uses an A/B slot scheme. Firmware is always installed to the inactive slot, so the running firmware is never modified while it is in use. A both-slots update replaces the previous firmware in both slots, so no copy of it remains to fall back to.

3.4.2 Update Methods

File Upload

Drag and drop a `.raucb` firmware bundle onto the upload area, or click **Choose File** to select one from your computer.

URL Install

Enter an HTTPS URL pointing to a `.raucb` firmware bundle and click **Install from URL**. The device downloads and installs the firmware directly. The server must present a valid TLS certificate.

Either way, the browser asks you to confirm before the install starts.

3.4.3 Update Modes

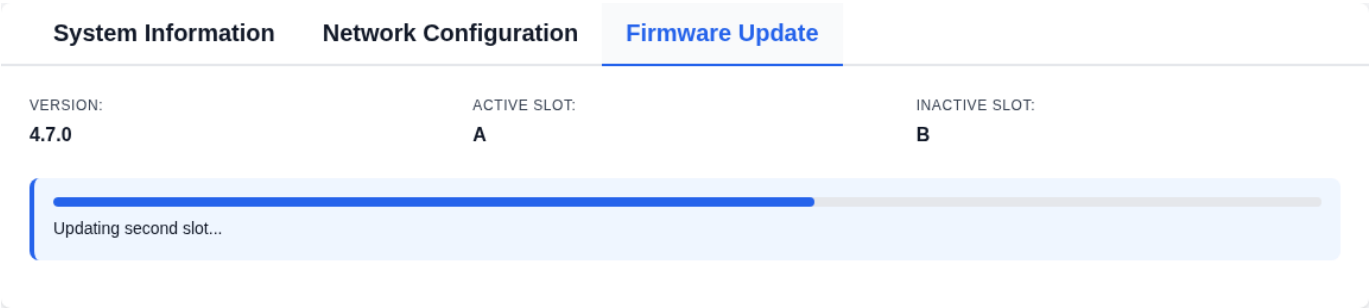
The **Update both slots (auto-reboot between slots)** checkbox selects the mode. It is checked each time the page loads.

MODE	DESCRIPTION
Both slots (default)	The device installs the firmware to the inactive slot, reboots automatically into it, then installs it to the second slot.
Single slot	Uncheck **Update both slots** before uploading *or* installing from a URL. The device installs the firmware to the inactive slot only. After installation, click **Reboot to Activate New Firmware** to boot into the new firmware. The previous firmware stays in the other slot.

3.4.4 Both-Slots Updates

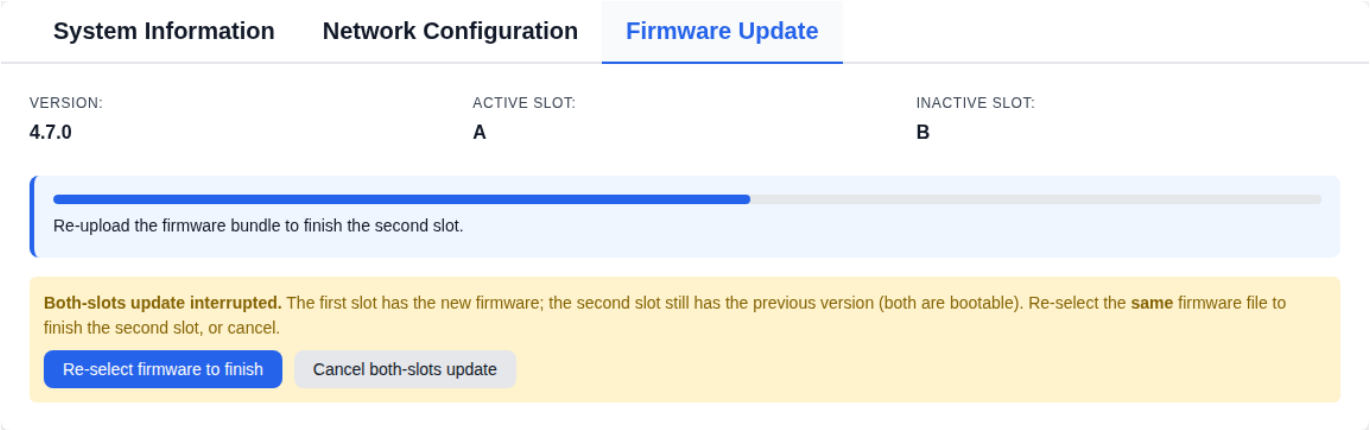
The firmware bundle is too large to stage on the device's persistent storage, so it must be re-supplied for the second slot after the mid-cycle reboot. How that happens depends on how you started the update:

- **File upload:** keep the browser tab open. The page holds the bundle in memory and re-uploads it automatically once the device comes back up to finish the second slot.
- **URL install:** the device re-downloads the bundle from the URL on its own, so there is no need to keep the tab open.



If a file-upload both-slots update is interrupted (for example the tab is closed or reloaded before the second slot finishes), the device is left running the new firmware on the first slot with the previous firmware still on the second slot. Both remain bootable. When you next open the firmware page, a **Both-slots update interrupted** banner offers two choices:

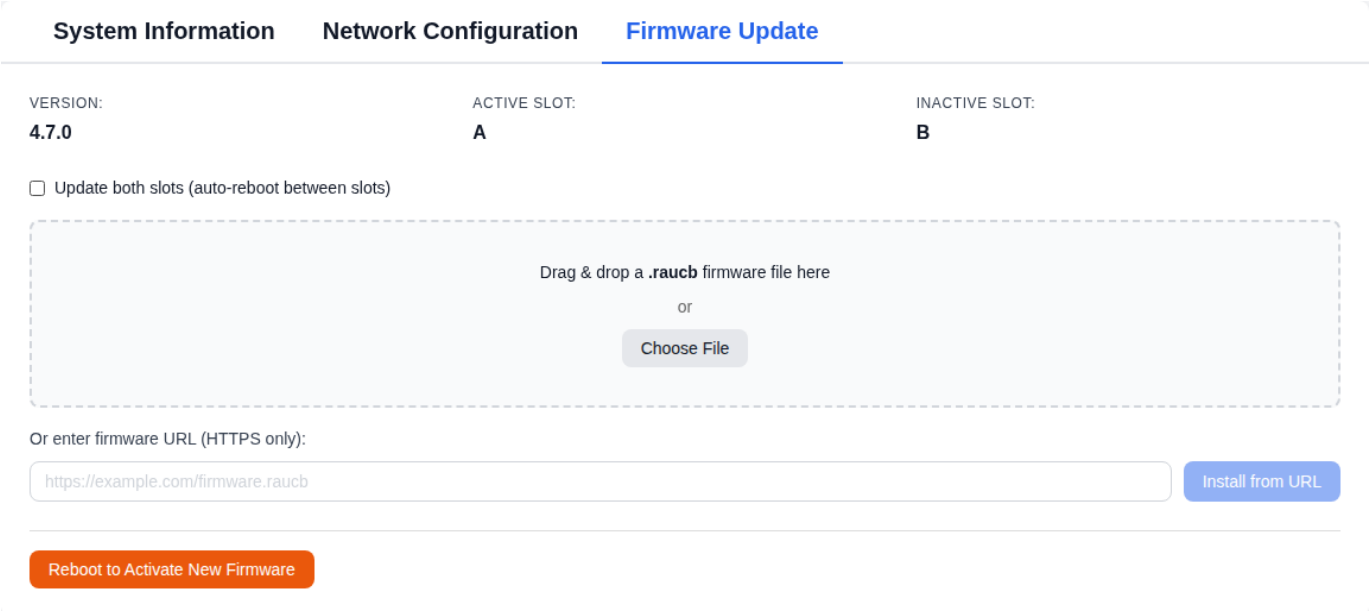
- **Re-select firmware to finish:** choose the *same* `.raucb` file to install it to the second slot. A file with a different version is rejected and the banner stays.
- **Cancel both-slots update:** leave the second slot on the previous firmware.



3.4.5 Update Progress

During an update, the checkbox, upload area and URL field are replaced by a progress bar and status message. The page polls for status every 2 seconds, and keeps polling across the automatic reboot during a both-slots update.

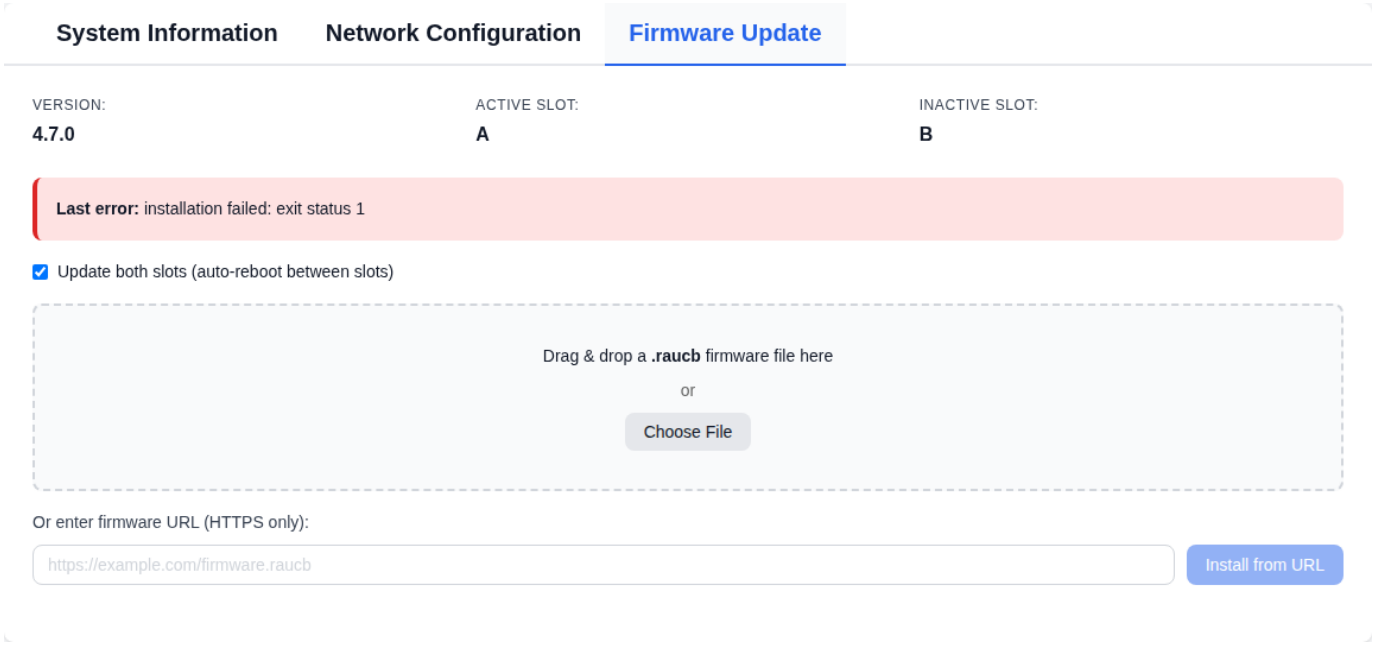
After a successful single-slot update, a **Reboot to Activate New Firmware** button appears. Clicking it (and confirming) reboots the device. The page reloads 30 seconds later.



After a successful both-slots update, the message **Both firmware slots updated successfully.** is displayed. No reboot is needed.

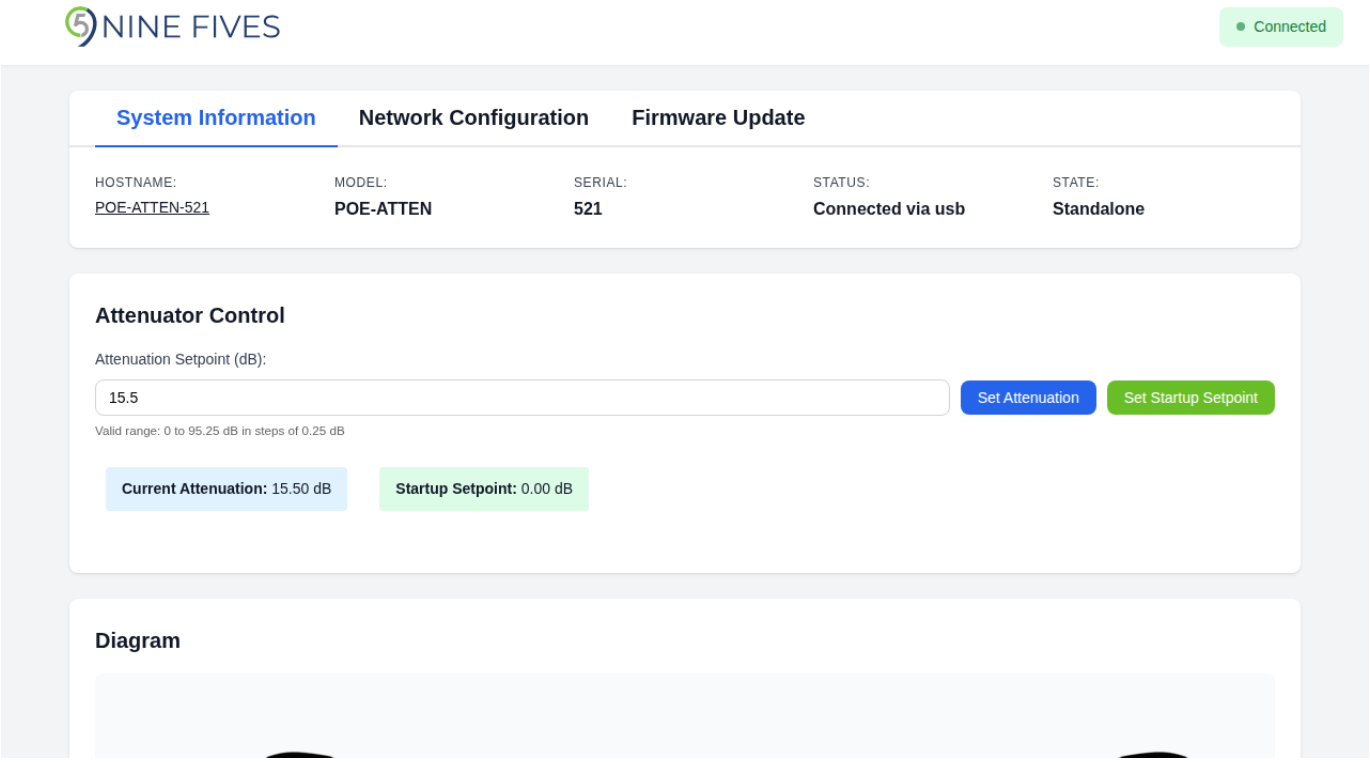
3.4.6 Errors

If an update fails, a **Last error** box below the firmware information shows the reason, and the upload area returns so you can try again. A request the device rejects (for example a non-HTTPS URL) is reported in a notification that disappears after a few seconds.


System Information
Network Configuration
Firmware Update
VERSION:
4.7.0
ACTIVE SLOT:
A
INACTIVE SLOT:
B
Last error: installation failed: exit status 1
Update both slots (auto-reboot between slots)
Drag & drop a .raucb firmware file here
or
Choose File
Or enter firmware URL (HTTPS only):
https://example.com/firmware.raucb
Install from URL

3.5 Attenuator Control

The **Attenuator Control** card provides direct control over the RF attenuation level.



3.5.1 Controls

CONTROL	DESCRIPTION
Attenuation Setpoint (dB)	Numeric input field. Valid range: 0 to 95.25 dB in steps of 0.25 dB.
Set Attenuation	Applies the entered value immediately.
Set Startup Setpoint	Saves the entered value as the power-on default. The device will apply this attenuation every time it boots.

3.5.2 Display

FIELD	DESCRIPTION
Current Attenuation	The attenuation value currently applied to the hardware, updated in real time.
Startup Setpoint	The saved power-on default attenuation value.

3.5.3 Diagram

A block diagram below the controls illustrates the signal path through the attenuator, displaying the current attenuation value.