PCE-FM

RTD Temperature Monitor/Logger With PoE

USER GUIDE

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TABLE OF CONTENTS

1. Description 4
   1.1 Key Features 4
2. Physical Dimensions 5
   2.1 Grounding/Shielding 5
3. Technical Specification 6
4. Configuration 7
   4.1 Connections. 7
   4.2 Indication LED'S. 7
5. Connecting to the device for the first time 8
   5.1 Direct PC Connection 8
   5.2 Access by Hostname (mDNS) 8
   5.3 Logging In 8
   5.4 Dashboard 9
      5.4.1 Status Sidebar 9
      5.4.2 Live Status 9
      5.4.3 Temperature Trend Graph 10
      5.4.4 Data Logging & Archive 10
   5.5 Changing the Password 11
   5.6 Network Configuration 11
      5.6.1 IP Address Settings 11
      5.6.2 Time Synchronization settings 11
      5.6.3 Applying Network Changes 12
6. MQTT Configuration 12
   6.1 Broker Settings 13
   6.2 Telemetry 13
   6.3 DI Edge Events 13
   6.4 RTD Alarms 13
   6.5 Input Alarms 14
   6.6 MQTT Topics Reference 14
7. Modbus TCP 15
   7.1 Supported Function Codes 15
   7.2 Register Map 16
8. Firmware Update 17
9. Factory Reset 17
10. Updating Webpages 17
   10.1 Updating/replacing Webpages 17
   10.2 Deleting Webpages 19

1. Description

The PCE-FM is a dual-channel RTD temperature monitor/logger with four digital inputs, designed for industrial monitoring applications. The module provides Ethernet connectivity with a built-in web interface, Modbus TCP server, and optional MQTT publishing, enabling integration with SCADA, BMS, and IoT platforms without additional software.

The PCE-FM can be powered using PoE or from a separate 12-24Vdc power source.

1.1 Key Features

- Two independently configurable RTD input channels (PT100, Ni120, PT1000, Ni1000-DIN, Ni1000-Landis&Gyr, Ohms)
- Four digital inputs with edge-event detection and counter accumulation
- 10/100 PoE interface
- Embedded web server — no software installation required
- Modbus TCP server (FC01, FC02, FC03, FC04, FC05, FC06, FC15, FC16)
- MQTT client with configurable broker, QoS 1 telemetry and alarm topics
- On-board flash data logging with CSV export and historical graph
- Secure login with configurable password
- OTA firmware update via web browser

2. Physical Dimensions

The PCE-FM enclosure is shown below.

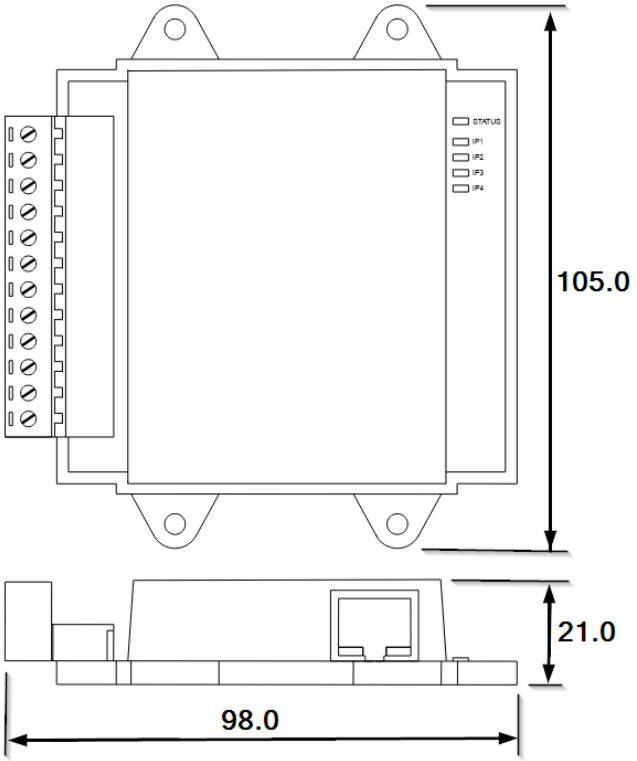

Figure 1: Enclosure Top/Side View

Parameter	Value
Enclosure Width	98 mm
Enclosure Height	105 mm
Enclosure Depth	21 mm
Mounting	4x mounting tabs
Weight	105g
Protection Class	IP20

Table 1: Enclosure Specifications

2.1 Grounding/Shielding

In most cases the PCE-FM will be installed in an enclosure alongside other devices that generate electromagnetic radiation — relays, contactors, transformers, motor controllers, etc. This radiation can induce electrical noise into power and signal lines. Appropriate grounding, shielding, and protective steps must be taken during installation to prevent these effects.

- Ensure the control cabinet is properly earthed.
- Route RTD and signal cables away from high-voltage or high-current conductors.
- Use screened/shielded cable where applicable.
- Fit suppression components (varistors, snubbers) across inductive loads switching near the module.

Warning: Failure to follow earthing suggestion in electrically noisy environments may result in incorrect temperature readings or instability.

3. Technical Specification

External Power Input	Logic Supply Voltage		12 -24 Vdc	
	Logic Supply Current		78mA @ 12V / 42mA @ 24V	
RTD Inputs	Input Points		2	
	RTD Configuration		2 or 3 Wire	
	Resolution		0.1°C	
	Drift		100ppm/°C Typ.	
	Line resistance effect		< 0.1°C balanced	
	Max. line resistance		100ohms	
RTD Type	**Number**	**Type**	**Range**	**Accuracy**
	1	PT100	-200 to 850°C	0.3°CIEC 751:1983
	2	Ni120	-80 to 320°C	0.3°C
	3	PT1000	-200 to 850°C	0.3°C
	4	Ni1000-DIN	-200 to 850°C	0.3°C
	5	Ni1000-Landys&Gyr	-200 to 850°C	0.3°C
	6	Ohms	10 - 400 ohms	
	7	Ohms	100-4000ohms	
Digital Inputs	Input Points		4	
	Input Logic		Active-LOW (pulled high when inactive)	
Counters	Inputs		1 to 4	
	Resolution		32 Bits	
	Frequency		25Hz (max)	
	Pulse Width		40ms (min)	
Data Logging	On-board Flash		128MB	
	Log Interval		1, 5, 10, 15, 30, 60 minutes (configurable)	
	Export Format		JSON (per-day), CSV (per-day or all-logs)	
PoE/Ethernet	10/100BASE-T		Twisted pair	
	PD Class		PoE Class 1 (IEEE 802.3af) — Max 3.84 W	
	PoE Input Voltage		37 – 57V	
Temperature	Operating Temperature.		-40°C to + 80°C	
	Storage Temperature		-40°C to + 85°C	
	Relative Humidity		5 % to 95 % (non-condensing)	
Connectors	Power and Inputs		12 Pin Pluggable Connector	
	Ethernet		RJ45	

4. Configuration

4.1 Connections.

The following diagram shows the wiring for the power, digital inputs and RTD's.

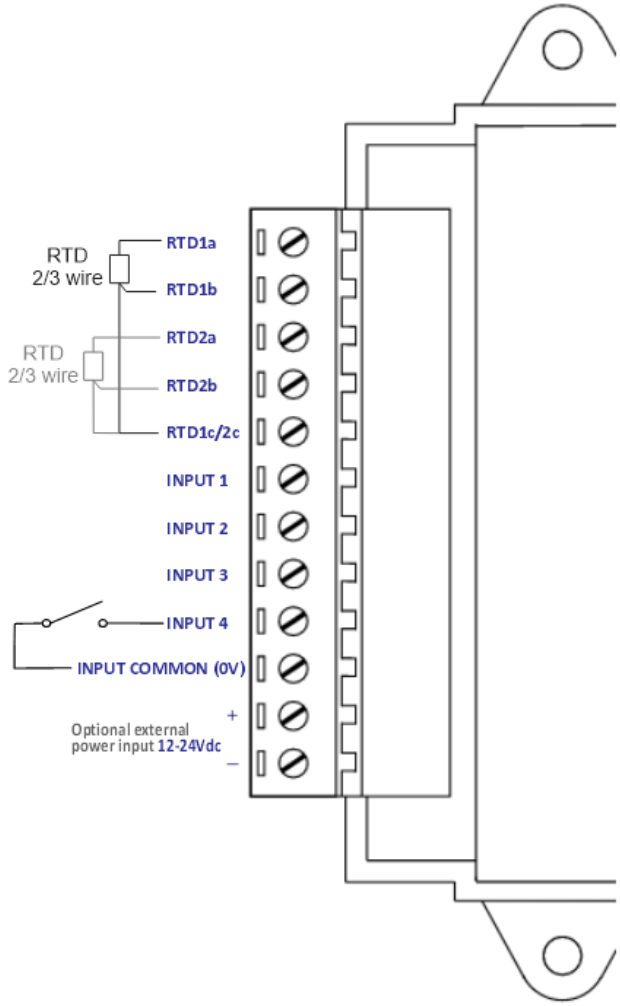

Figure 2: Wiring connections

Note: When using 2 wire RTD's bridge terminals RTD1b and RTD1c/2c for channel 1 and RTD2b and RTD1c/2c for channel 2.

4.2 Indication LED'S.

LED	Colour	Behavior	Meaning
Status	Blue	Fast blink	Starting up – no network connection yet
		Solid on, flicker every second	Normal operation – network up, no faults
		Slow blink	Fault – RTD error or MQTT disconnected
IP1	Red	On	Digital input 1 is active (input pulled to 0V)
IP2	Red	On	Digital input 2 is active
IP3	Red	On	Digital input 3 is active
IP4	Red	On	Digital input 4 is active

Table 2: Led descriptions

5. Connecting to the device for the first time

The PCE-FM ships with a static IP address of 169.254.111.111. This is a link-local address (similar to APIPA) and can be used for direct PC-to-device communication without a router or DHCP server.

5.1 Direct PC Connection

Step 1: Connect the PCE-FM and PC with an Ethernet patch cable.
Step 2: On the PC: Settings → Network & Internet → Change Adapter Options → right-click your Ethernet adapter → Properties → Internet Protocol Version 4 (TCP/IPv4) → Properties.
Step 3: Select 'Use the following IP address' and enter:

Field	Enter This Value
IP address	169.254.111.100
Subnet mask	255.255.255.0
Default gateway	(leave blank)

Table 3: Recommended PC network settings

Step 4: Click OK, close the Properties dialogs.
Step 5: Open a browser and navigate to: http://169.254.111.111
Step 6: The PCE-FM login page should appear.

TIP: Windows may automatically assign a 169.254.x.x address (APIPA) if the adapter is set to DHCP and no DHCP server is found. If so you may be able to skip steps 2–4 and go directly to step 5.

5.2 Access by Hostname (mDNS)

On any network that supports mDNS (all modern Windows, macOS, and Linux systems), the PCE-FM is accessible by hostname:

http://Procon-IO.local

If you have changed the device name from the default, use that name followed by .local — for example, http://refrigerator-12.local

5.3 Logging In

Credential	Factory Default	Notes
Password	ADMIN	Case-sensitive. Change immediately after installation — see Section 5.4.

Table 4: Default Password

After login you are taken to the Dashboard page. The session remains active while you are using the interface. After 5 minutes of inactivity the session expires automatically and you will be redirected to the login page.

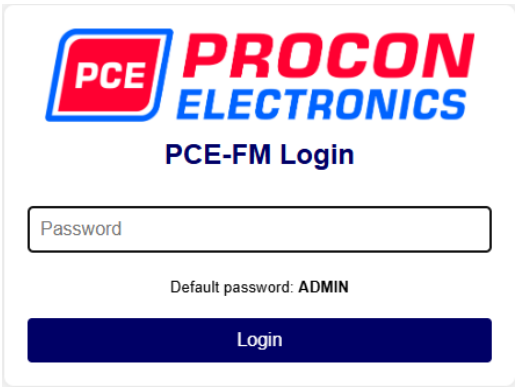

Figure 2 - Login Page

NOTE: There is no username — only a password is required.

5.4 Dashboard

The Dashboard is the main operating screen. It shows live temperature readings, RTD fault status, digital input states, system uptime, IP address, and MQTT connection status.

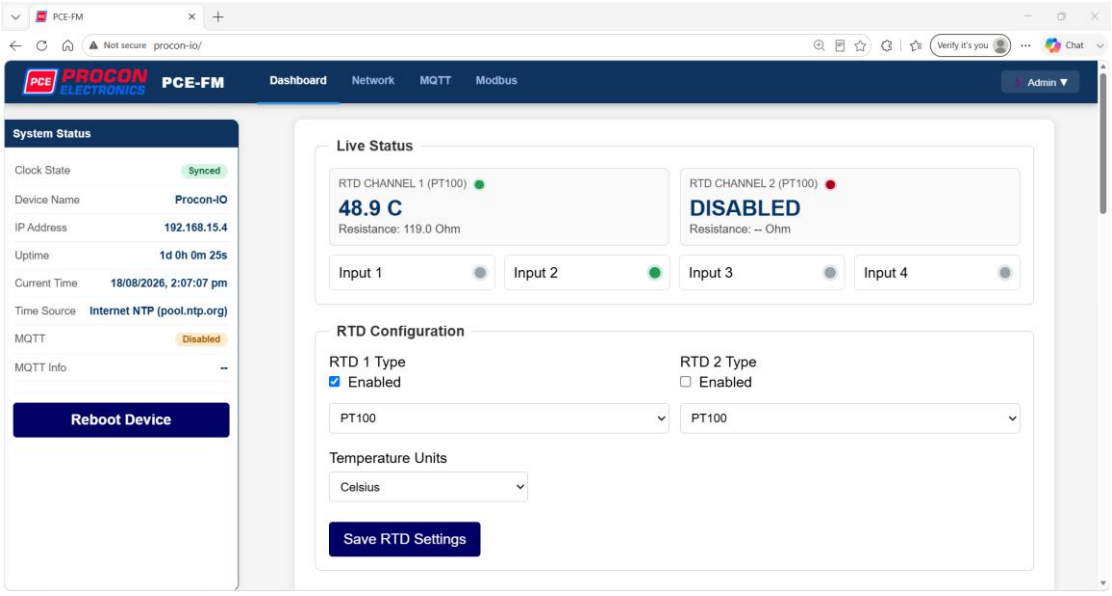

Figure 3: Dashboard Landing Page

5.4.1 Status Sidebar

The right-hand sidebar shows device status at a glance:

- **Clock State** — Synced (green) or Waiting (amber) for NTP time synchronisation.
- **Device Name** — Configured mDNS hostname.
- **IP Address** — Current IP address.
- **Uptime** — Time since last power-on or reboot.
- **MQTT** — Connection status of the MQTT client (Connected / Disconnected / Disabled).

5.4.2 Live Status

The Live status section shows the current Live temperature readings and input status. The RTD's can be enabled/disabled and the type/units can be set.

Note that changes made here will be reflected in the internal Modbus server.

5.4.3 Temperature Trend Graph

The temperature trend graph displays historical temperature readings directly from the on-board data log. The window can be set to 15 minutes, 1 hour, 4 hours, or 24 hours. Hover the mouse over the graph to see the exact value and timestamp at any point.

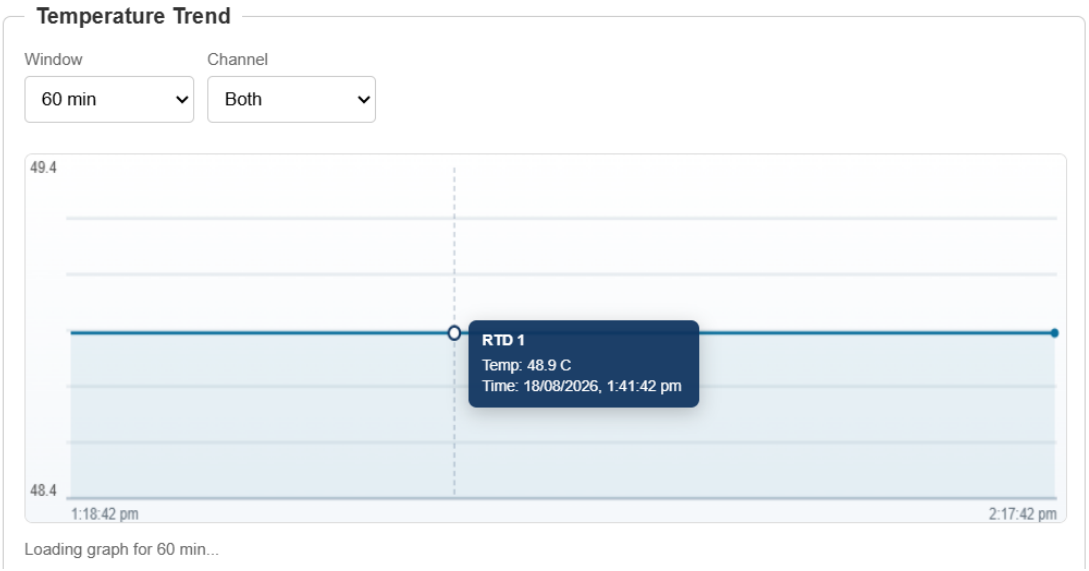

Figure 4: Temperature Trend Window

To view a historical day, use the **Browse Logged Data** section below the graph, select the year, month and day, then click **Load Day into Graph**. The graph window is automatically set to 24 hours. Click ← **Return to Live View** to resume live display.

5.4.4 Data Logging & Archive

The PCE-FM logs RTD temperatures and digital input statistics to on-board flash at a configurable interval. Logged data can be downloaded as CSV for use in spreadsheet applications.

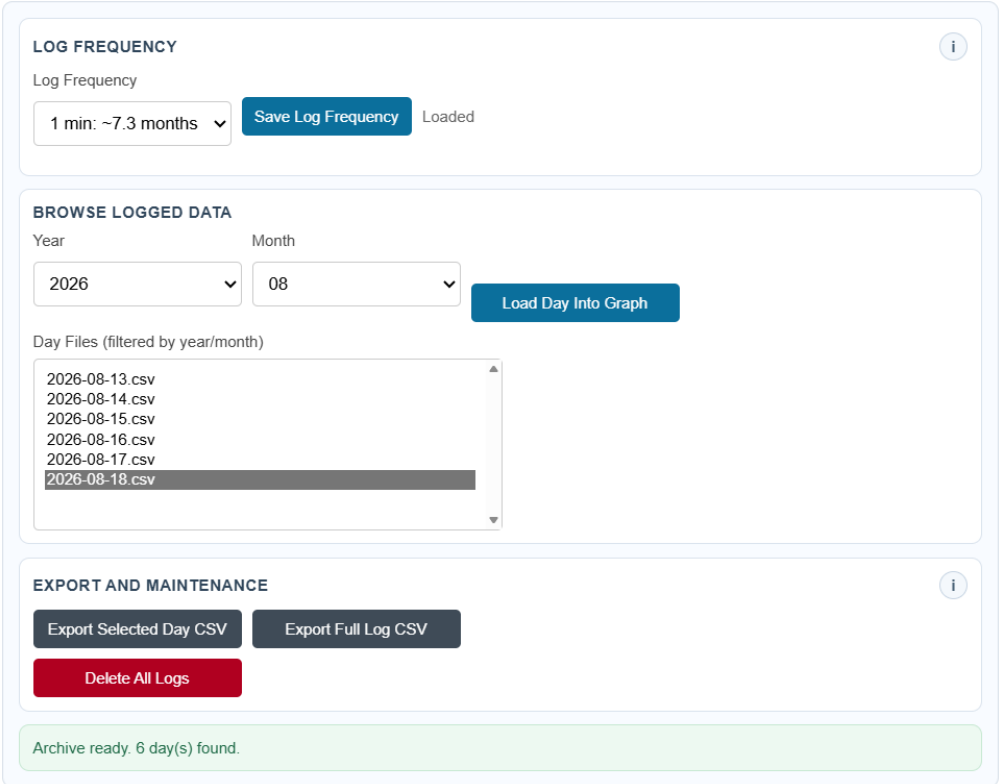

Figure 5: Log Settings and Records

Export Option	Description
Download Day CSV	Downloads one day of log records in CSV format
Download All Logs CSV	Downloads the entire log archive in a single CSV file
Delete All Logs	Erases all stored log records (irreversible)

Table 5: Log Options

CSV columns include: timestamp (Unix and local), window duration, DI toggle counts, DI on-percent, RTD1 temperature, RTD2 temperature, RTD1 resistance, RTD2 resistance.

NOTE: The digital input counts and on-percentage are for that log period window only.

5.5 Changing the Password

Step 1: From the Dashboard, open the Admin menu (top right of the page) and select Change Password.
Step 2: Enter the current password.
Step 3: Enter and confirm a new password. The password is case-sensitive.
Step 4: Click Save. The new password is active immediately.

NOTE: If the password is forgotten the only recovery is to reset the network settings using the reset button.

5.6 Network Configuration

Network settings are located on the Network page. The MODE can be changed from **Static IP** to **DHCP** as required.

5.6.1 IP Address Settings

Setting	Description	Default	Range / Options
DHCP	Request IP automatically from a network DHCP server	Other	Enabled / Disabled
IP Address	Device static IPv4 address (used when DHCP is disabled)	169.254.111.111	Any valid IPv4
Gateway	Default gateway address	169.254.111.1	Any valid IPv4
Subnet Mask	Network subnet mask	255.255.255.0	Any valid mask
Device Name	Hostname used for mDNS (.local) access	Procon-IO	1–63 alphanumeric / hyphen

Table 6: IP Address Settings

NOTE: It is advised to always use a static IP address in production installations. DHCP addresses can change after a router restart.

5.6.2 Time Synchronization settings

The time server, UTC offset, and DST settings can be configured on the Network page. By Default, the device synchronizes time via local server NTP, if internet is available it is recommended to enable Internet NTP Fallback. If no NTP server is reachable, the browser's time is used as a fallback for timestamping log records.

The device will synchronize time on power up and again once every hour, if the device cannot re-synchronize the time, it will continue logging using its internal time (Internal drift is approximately 10s a day).

If the device is initially powered on without a network connection, logs will be written to a buffer, the buffer can hold approximately 8 hours of logs at 1 log a minute. When time is synchronized, the buffered logs will have their times amended and will be written into the flash storage.

In order for logs to have the correct date/time, the correct UTC offset will need to be set (This will be set automatically using your browsers current offset).

Daylight savings can be enabled if required, you will need to enable it and select the region and UTC offset.

5.6.3 Applying Network Changes

To apply any changes made to network settings or device identity click the corresponding **SAVE** button, a reboot will be required to save any settings changes, follow the prompt to reboot the device, the PCE-FM will reboot and apply the new settings. The reboot takes approximately 5–10 seconds. Update your browser address bar to the new IP address/mDNS host name as required.

NOTE: After changing network settings to DHCP, the local PC connection will stop working, please move the device to your local network.

6. MQTT Configuration

Navigate to the **MQTT** page to configure MQTT publishing. The PCE-FM supports MQTT v3.1.1 over TCP or TLS.

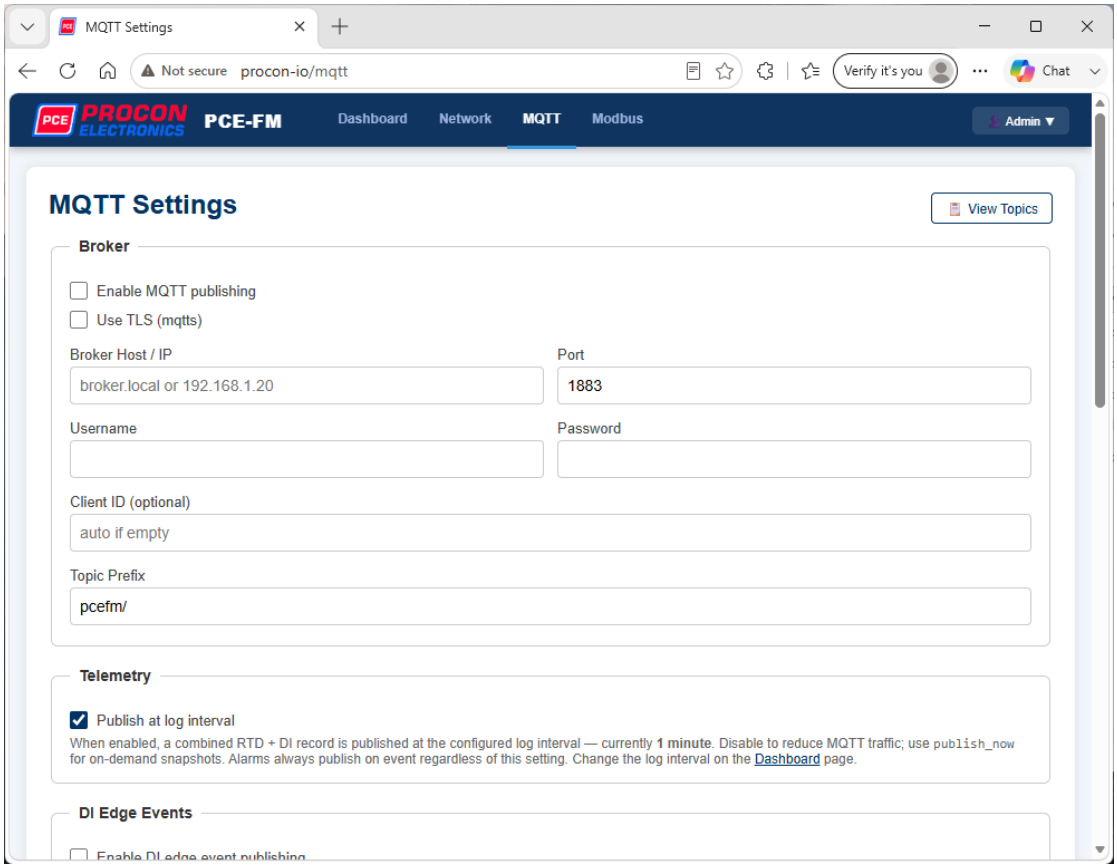

Figure 6: MQTT Page

6.1 Broker Settings

Setting	Description
Enable MQTT publishing	Master enable switch for all MQTT publishing.
Broker Host/IP	Hostname or IP address of the MQTT broker.
Port	Broker port. Default: 1883 (TCP) or 8883 (TLS).
Use TLS	Enable encrypted connection to the broker.
Username/Password	Broker authentication credentials (leave blank if not required).
Client ID	MQTT client identifier. Leave blank to auto-generate from device MAC address.
Topic Prefix	All published topics are prefixed with this string (e.g. *pcefm/site1/device01*).

Table 7: Broker Settings

6.2 Telemetry

When enabled, a combined RTD and digital input record is published at the configured log interval. Use the *publish_now* command on the command topic for an immediate on-demand snapshot.

6.3 DI Edge Events

When enabled, a message is published immediately on every digital input state change. The trigger direction can be set to: *Both edges*, *Input active (on)*, or *Input inactive (off)*.

6.4 RTD Alarms

Independent high and low temperature alarms can be configured for each RTD channel. When a threshold is crossed the device publishes an active alarm message (retained, QoS 1). When the temperature recovers past a 1 °C hysteresis band a cleared message is published.

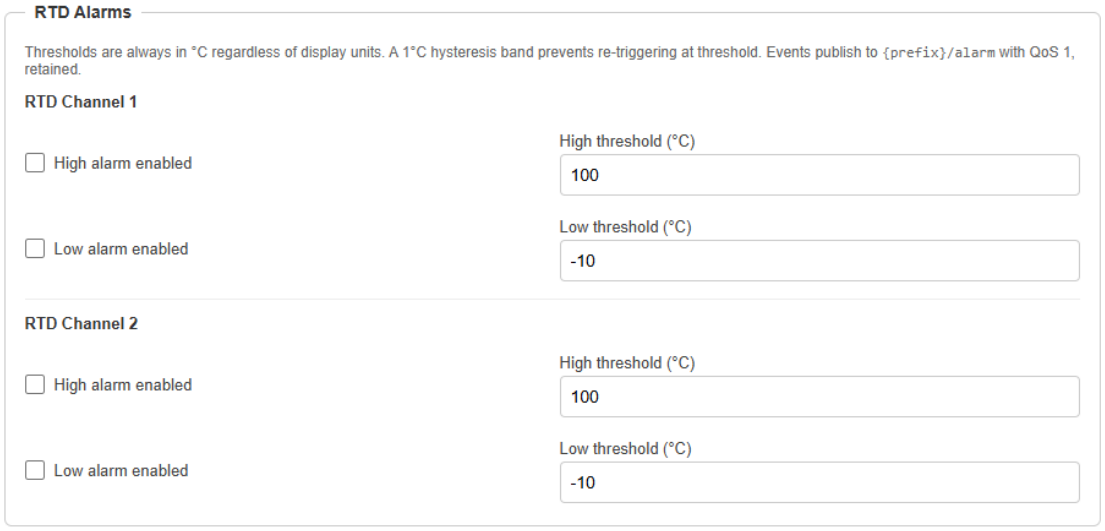

Figure 7: RTD Alarms

6.5 Input Alarms

Each digital input channel can be configured with an on-time alarm. The alarm fires when the input has been continuously in the monitored state for longer than the configured threshold. The monitored state can be inverted (alarm when input is OFF rather than ON).

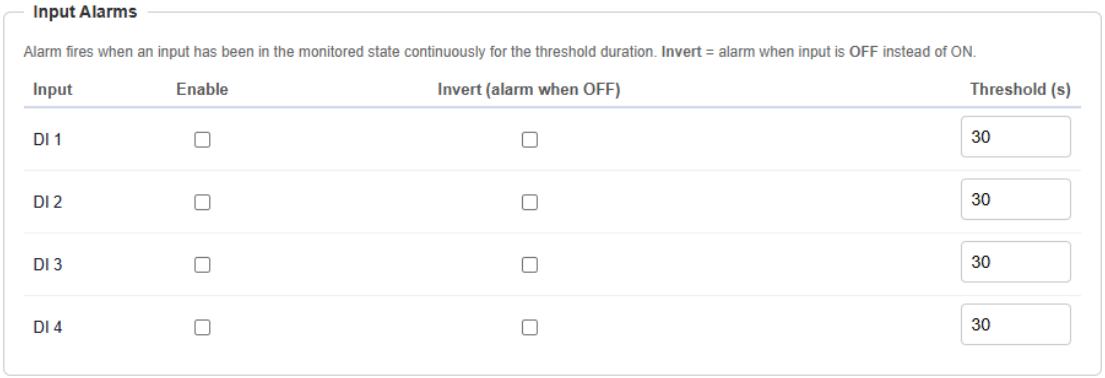

Figure 8: Input Alarms

6.6 MQTT Topics Reference

All topics use the configured topic prefix. Click the **View Topics** button on the MQTT settings page for the full topic reference with example payloads.

Topic	Direction	Description
{prefix}/telemetry/log	Publish	Combined RTD + DI record at log interval
{prefix}/telemetry/di_event	Publish	Immediate DI edge event (when enabled)
{prefix}/alarm	Publish (retained)	RTD and DI alarm state changes
{prefix}/status	Publish (retained)	Device online / offline (LWT)
{prefix}/cmd	Subscribe	Inbound commands: publish_now, reboot, backfill
{prefix}/backfill/status	Publish	Backfill start/done envelope
{prefix}/backfill/record	Publish	Individual historical records (backfill)

Table 8: MQTT Topics

HINT: use backfill to request historical data from the device's onboard logs. Replays historical records for a time range. Requires from and to Unix timestamps. Maximum range: 7 days.

7. Modbus TCP

The PCE-FM acts as a Modbus TCP server on port 502. The device supports up to four simultaneous Modbus TCP connections.

The webpage shows the current Modbus register values, as well as the connected device status.

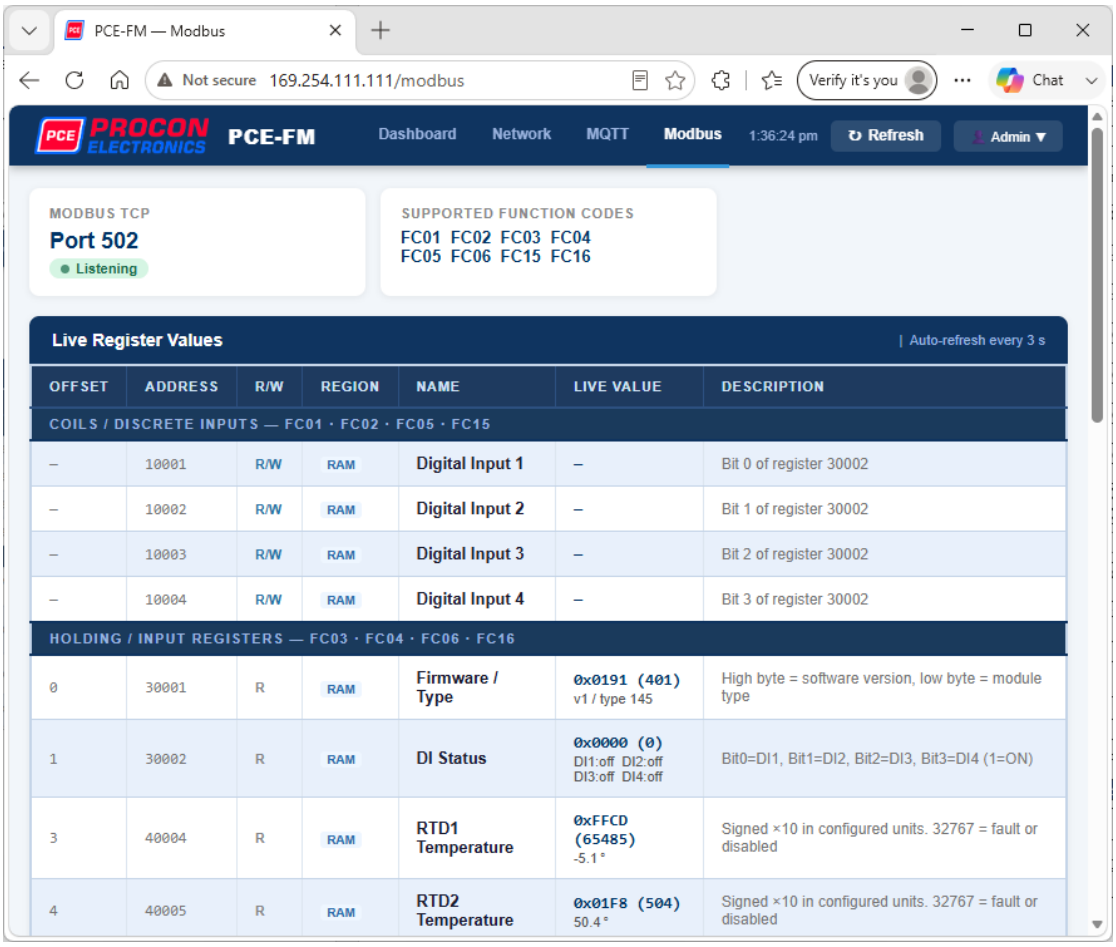

Figure 9: Modbus TCP Page

7.1 Supported Function Codes

Function Code	Description
FC01	Read Coils
FC02	Read Discrete Inputs
FC03	Read Holding Registers
FC04	Read Input Registers
FC05	Write Single Coil
FC06	Write Single Register
FC15	Write Multiple Coils
FC16	Write Multiple Registers

Table 9: Supported Modbus Function Codes

7.2 Register Map

Address	Name	R/W	Description
10001	Digital Input 1	R/W	Bit 0 of register 30002. 1 = active
10002	Digital Input 2	R/W	Bit 1 of register 30002
10003	Digital Input 3	R/W	Bit 2 of register 30002
10004	Digital Input 4	R/W	Bit 3 of register 30002
30001	Firmware/Type	R	High byte = software version, low byte = module type
30002	DI Status	R	Bit0=DI1, Bit1=DI2, Bit2=DI3, Bit3=DI4 (1=ON)
40004	RTD1 Temperature	R	Signed ×10 in configured units. 32767 = fault or disabled
40005	RTD2 Temperature	R	Signed ×10 in configured units. 32767 = fault or disabled
40009	Counter 1 – High	R/W	Upper 16 bits of 32-bit DI 1 counter
40010	Counter 1 – Low	R/W	Lower 16 bits
40011	Counter 2 – High	R/W	Upper 16 bits of 32-bit DI 2 counter
40012	Counter 2 – Low	R/W	Lower 16 bits
40013	Counter 3 – High	R/W	Upper 16 bits of 32-bit DI 3 counter
40014	Counter 3 – Low	R/W	Lower 16 bits
40015	Counter 4 – High	R/W	Upper 16 bits of 32-bit DI 4 counter
40016	Counter 4 – Low	R/W	Lower 16 bits
30017	RTD Status	R	Bit0=RTD1 error, Bit1=RTD1 disabled, Bit2=RTD2 error, Bit3=RTD2 disabled
30100	Reset	R/W	Read: 1 when reset button pressed. Write 1: reset network config and reboot
40101	Watchdog Timer	R/W	0 = disabled; 1–255 = watchdog period in seconds
40102	Counter Mode	R/W	0 = disabled, 1 = all up, 2 = up/down pairs
40103	Input Filter	R/W	0 = none; ×10 ms per unit
40104	RTD1 Type	R/W	1=PT100, 2=Ni120, 3=PT1000, 4=Ni1000-DIN, 5=Ni1000-LG, 6=Ohms 10–400, 7=Ohms 100–4000
40105	RTD2 Type	R/W	Same type map as RTD1
40106	RTD Enable	R/W	Bit0=RTD1 enabled, Bit1=RTD2 enabled
40110	Temperature Units	R/W	1 = Celsius, 2 = Fahrenheit
Calibration Warning: Changing the settings below will effect RTD calibration			
30091	Raw Resistance x10	R	Uncalibrated raw reading for channel in 30092
30092	Cal Channel	R/W	1 = RTD1, 2 = RTD2
30093	Cal Control	W	Write 1 = store low point, 2 = store high point. Returns to 0

Table 10: Register Map

8. Firmware Update

To Update the Firmware, Navigate to the Software Update option in the Dashboard Admin Menu. The Firmware update page displays the current firmware version. To upload new firmware, choose the device firmware file .encsig from your computer and click Upload Firmware. When the Firmware update reaches 100%, the device will now reboot. After the device Reboots, it will be necessary to Login again at http://Device_Name.local

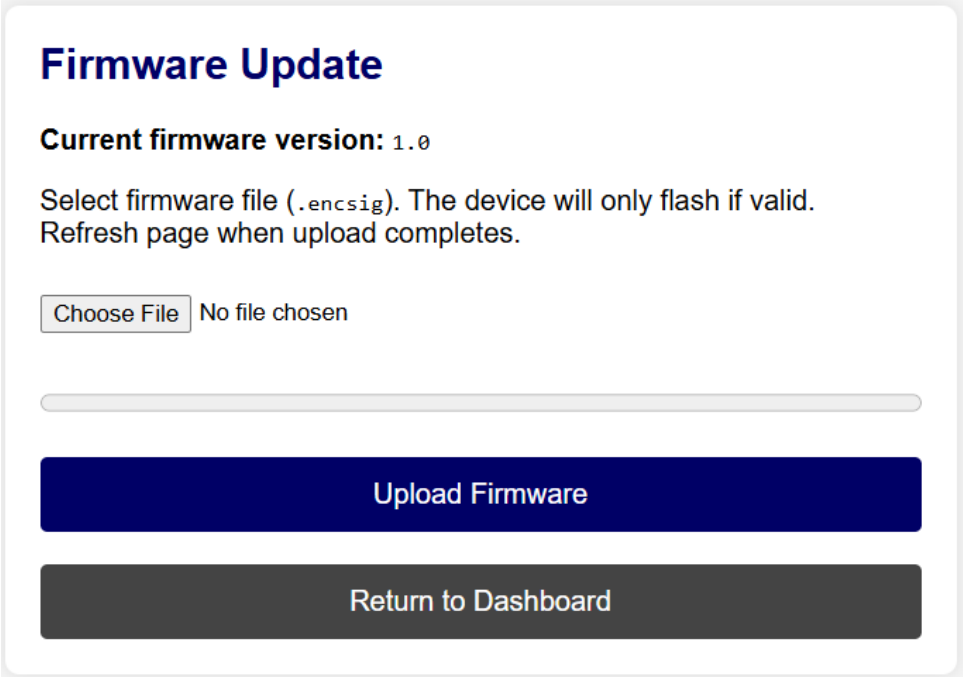

Figure 10: Firmware Update Page

9. Factory Reset

To Recover a forgotten password or to add/remove web pages, you will need to reset the network settings. This can be done by holding in the reset button on the device for 10 seconds while the device is powered on.

To Factory reset the device, navigate to the Network page and click Factory Reset Device, please note that this is not reversable, all settings will be restored to their factory defaults.

Note: Factory Reset will not delete Log entries. To delete log entries use ***Delete All Logs*** in the ***EXPORT AND MAINTANANCE*** section on the dashboard page.

10. Updating Webpages

10.1 Updating/replacing Webpages

All web pages can be modified by the user to change branding/remove features.

New pages can only be uploaded while the device has its link local IP 169.254.111.111 and is connected directly to a PC.

Whilst connected to the **link local network**, run the windows batch uploader, upload_web.bat. The batch file uploads all compatible files from within the same folder into the flash storage on the device. The batch file can be downloaded from the module: http://169.254.111.111/upload_web.bat.

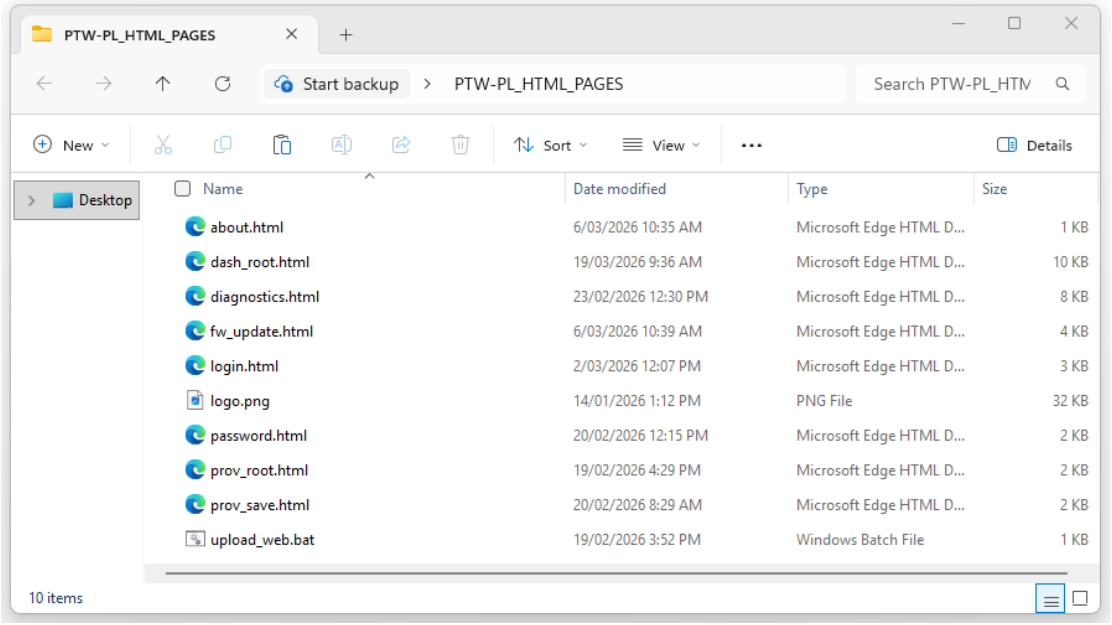

Figure 11: Example Webpage Folder

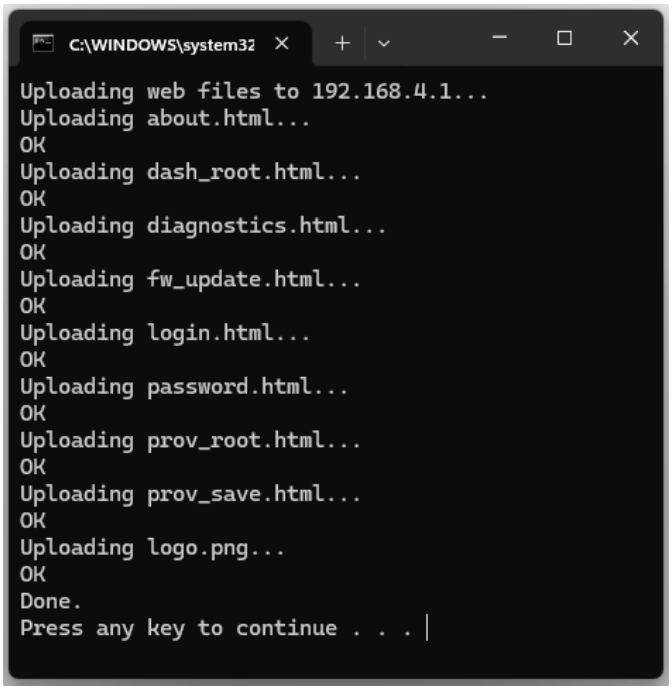

Figure 12: Example Upload Script

If you want to check which files are currently stored on the device, whilst it has its link local IP, type: http://169.254.111.111/list ,this will show a list of all files.

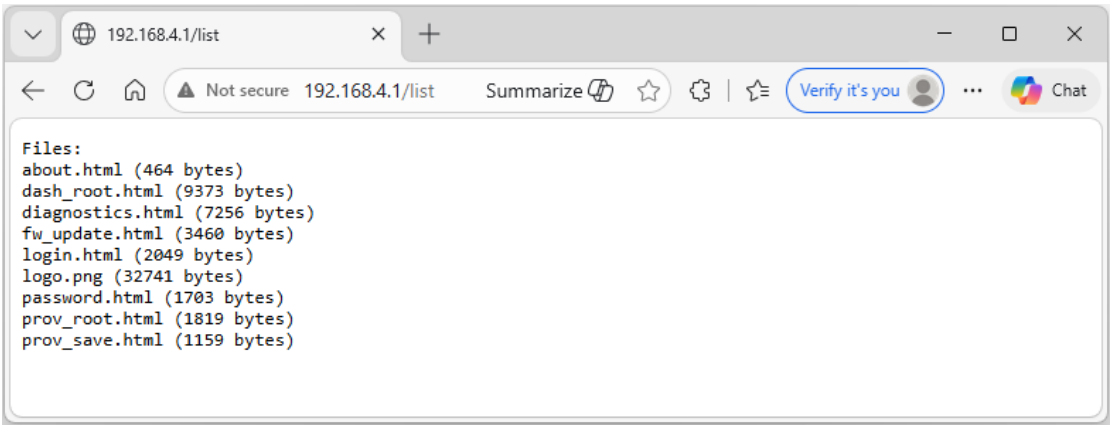

Figure 13: Example File List

10.2 Deleting Webpages

If you want to delete a file from the internal storage, whilst it has its link local IP, type: http://169.254.111.111/delete?file=dash_root.html (Replace with the file name you want to delete out of storage).

Note: Uploading new webpages will only overwrite files already in storage with the same name.

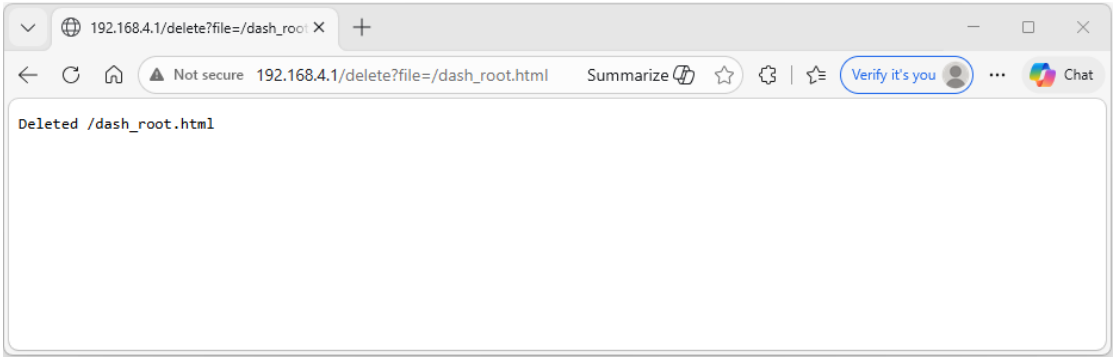

Figure 14: File deletion example