PUMPLOGIC

User Guide

Automated Relay Controller

Temperature-triggered | Schedule-based | Voltage-protected

Web-based control panel accessible via WiFi Access Point at 192.168.4.1

Version 1.0

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Automated Relay Controller Version 2.0

Introduction

PumpLogic is an automated pump controller designed for solar-powered, battery-powered, or constant-power installations where a pump must run on a schedule with flexible control options.

PumpLogic uses a modular control system where features can be independently enabled or disabled to match your installation:

Feature	Enable/Disable	What It Does
Temperature	Always active	Activates the pump when temperature crosses the trigger threshold. Supports **Trigger High** (cooling — pump ON when hot) and **Trigger Low** (freeze protection — pump ON when cold) with configurable temperature buffer to prevent rapid cycling.
Schedule	Always active	Restricts pump operation to configured time windows (separate weekday/weekend schedules).
On/Off Timer Mode	Configurable	When enabled, the pump cycles between ON and OFF durations. When disabled, the pump runs continuously as long as conditions are met.
Voltage Monitoring	Configurable	When enabled, blocks the pump if battery voltage drops below the cutoff and manages charge recovery. When disabled, voltage is ignored (for constant-power installations).
Pressure Sensor	Configurable	When enabled, adds PSI-triggered pump override — the pump starts immediately when pressure drops below the trigger.

Temperature and **Schedule** are always active. On/Off Timer Mode, Voltage Monitoring, and the Pressure Sensor can each be independently enabled or disabled, giving you full control over how PumpLogic operates.

Key capabilities:

- **Flexible temperature control** — Trigger High (cooling) or Trigger Low (freeze protection) with configurable buffer (minimum 3°F) to prevent rapid cycling
- **On/Off Timer Mode** — enable for timed cycling or disable for continuous pump operation driven by conditions

- **Voltage monitoring** — enable for battery-powered installations or disable for constant-power setups
- Separate weekday and weekend operating schedules with midnight wrapping support
- Optional quiet hours window to block pump operation during specific hours
- Optional pressure sensor with PSI-triggered pump override and 24-hour PSI graph
- Low voltage lockout with accumulated charge recovery (pause/resume)
- Stale sensor data fail-safe — blocks pump if temperature, voltage, or pressure data stops updating
- Automatic temperature sensor recovery if disconnected
- Daily min/max temperature, voltage, and PSI tracking
- Daily and lifetime pump runtime counters
- Battery percentage estimation for Lead-Acid and LiFePO4 batteries
- 24-hour graphs for battery charge/discharge, temperature, and PSI with 15-minute intervals
- Voltage trend indicator (rising, falling, stable)
- Event log with up to 100 entries and automatic pruning of entries older than 7 days
- Serial Monitor Log — view internal system messages wirelessly with export capability; boot logs (first 10 minutes) are preserved separately and never overwritten
- Time is saved to device memory and automatically restored after a reboot, so the pump schedule works even without a browser connection
- Set Time — manually set the device clock when no WiFi-capable device is available; auto-disables when a browser sync occurs
- Boot/reboot event tracking with 48-hour history on the Detailed Cumulative Report
- Time sync warning banner when device clock is not yet synced
- Automatic reboot protection for unattended reliability
- Web-based control panel accessible from any device with a browser
- **Settings management** — save/restore defaults, export/import settings files, automatic hourly backups
- **Settings change tracking** — configuration changes logged to the event log with category details
- **WiFi credential safety** — 180-second auto-revert on SSID/password changes, plus a physical reset button for WiFi recovery

PumpLogic hosts its own WiFi network and serves a complete control panel from the device itself — no internet connection or external server required.

Getting Started

Connecting to WiFi

1. On your phone, tablet, or computer, open **WiFi settings**

2. Look for the network named **PumpLogic-XXXX** where XXXX is the last 4 hex characters of the device's MAC address (this is the default; the name may differ if changed in settings)

3. Connect to the network (no password by default)

4. Open a web browser and navigate to:

• **http://192.168.4.1** (always works), or

• **http://pumplogic.local** (works on iPhones, Macs, and most computers)

The PumpLogic control panel will load in your browser.

Important Notes

• PumpLogic creates its **own WiFi network**. It does not join your home or office WiFi.

• Only devices connected to PumpLogic's WiFi network can access the control panel.

• **You will not have internet access** while connected to PumpLogic's network. Your device may display a warning about this — see below.

• The IP address is always **192.168.4.1**.

• **Shortcut URL:** iPhones, iPads, Macs, Windows, and most Linux computers support **http://pumplogic.local** as an easy-to-remember alternative to the IP address. Android devices may not support this — use the IP address instead.

• **Range:** PumpLogic's WiFi typically covers 10–30 meters (30–100 feet) indoors. Move closer if you have trouble connecting.

WiFi "No Internet" Warning

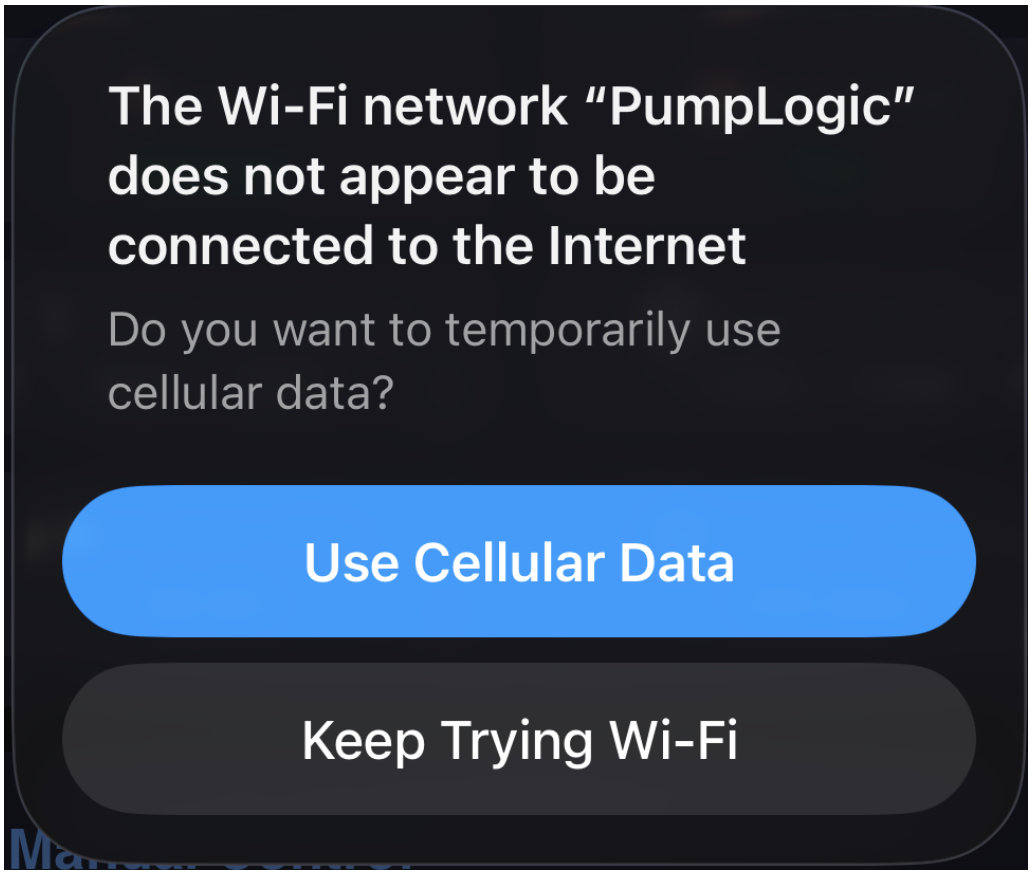

Figure: iPhone WiFi warning — select "Keep Wi-Fi" to stay connected

Because PumpLogic runs its own local network with no internet connection, your phone may display a warning after connecting. On iPhones and iPads, you will typically see a prompt with two options: **Use Cellular Data** or **Keep Wi-Fi (Without Internet)**.

Always select "Keep Wi-Fi (Without Internet)" (or the equivalent option to stay on the network). If you select "Use Cellular Data," your device will disconnect from PumpLogic's WiFi and you will not be able to access the control panel.

Android devices may show a similar notification such as "This network has no internet access — stay connected?" Select **Yes** or **Keep Connection** to remain on PumpLogic's network. Some Android devices may silently switch back to mobile data — if the control panel stops loading, check that you are still connected to the PumpLogic WiFi network in your device's WiFi settings.

Setting the Time (First Use)

PumpLogic requires an accurate clock for scheduling to work correctly. On first use, the time must be synced before the pump schedule can operate.

Automatic sync: When you load the PumpLogic webpage, your browser automatically sends the current date and time to the device. Check the **Network** card — if **Last Sync** shows a recent timestamp, the clock is set and scheduling is ready.

If the time shows "Not synced": Simply reload the webpage. Your browser will sync the time automatically.

If you do not have a WiFi-capable device with the correct time, or if automatic sync is not working, you can set the time manually:

1. Expand the **Network** card
2. Set the **Set Time** toggle to **Enabled**
3. Enter the current date and time in the fields that appear
4. Press **Save Network Settings**

The time is saved to device memory and persists across reboots. Once the clock is set, PumpLogic's schedule, event log timestamps, and all time-dependent features will operate correctly. See Time Synchronization for full details.

WiFi Credential Recovery

If you forget the WiFi password or change the SSID to something you can't connect to, PumpLogic provides two recovery mechanisms:

Automatic Revert (180 seconds)

When you change the WiFi SSID or password, PumpLogic starts a 180-second countdown. If no device connects to the new network within 3 minutes, the credentials automatically revert to the previous values. This prevents being locked out by a mistyped password or SSID.

Physical Reset Button

If the automatic revert period has passed and you are locked out:

1. Locate the **BOOT button** on the device (a small button labeled **B1** on the circuit board inside the enclosure)
2. **Hold the BOOT button** while powering on the device (or press the RESET button while holding BOOT)
3. **Keep holding for 3 seconds**
4. WiFi credentials reset to the default: **PumpLogic-XXXX** (where XXXX is unique to your device) with **no password**
5. Connect to the default network and set a new password if desired

The reset only affects WiFi SSID and password — all other settings are preserved.

Understanding the Web Interface

Interface Layout and Navigation

The web interface is organized into **eight cards** stacked vertically. Each card serves a distinct purpose:

Card	Purpose	Collapsible?	Default State
Status	Real-time monitoring dashboard	No	Always visible
Charge Recovery	Charge progress during lockout	No	Hidden (appears only during lockout)
Manual Control	Direct relay and system controls	Yes	Collapsed
Network	WiFi, connectivity, uptime, and clock info	Yes	Collapsed
Battery Charge/Discharge	24-hour battery percentage graph	Yes	Collapsed
Temperature Over Time	24-hour temperature graph	Yes	Collapsed
PSI Over Time	24-hour pressure graph (when enabled)	Yes	Collapsed
Settings	All configurable parameters	Yes	Collapsed
Event Log	History of pump runs and events	Yes	Collapsed

Expanding and collapsing cards: Click the **arrow button** in the upper-right corner of any collapsible card header to toggle it open or closed.

Expand/Close All: Inside the Settings card, an **Expand All Cards** button lets you expand or collapse all collapsible cards at once.

Refreshing data: The Status card auto-refreshes every 30 seconds. The **Battery %** is displayed in the Status card header for quick reference.

Status Card — The Main Dashboard

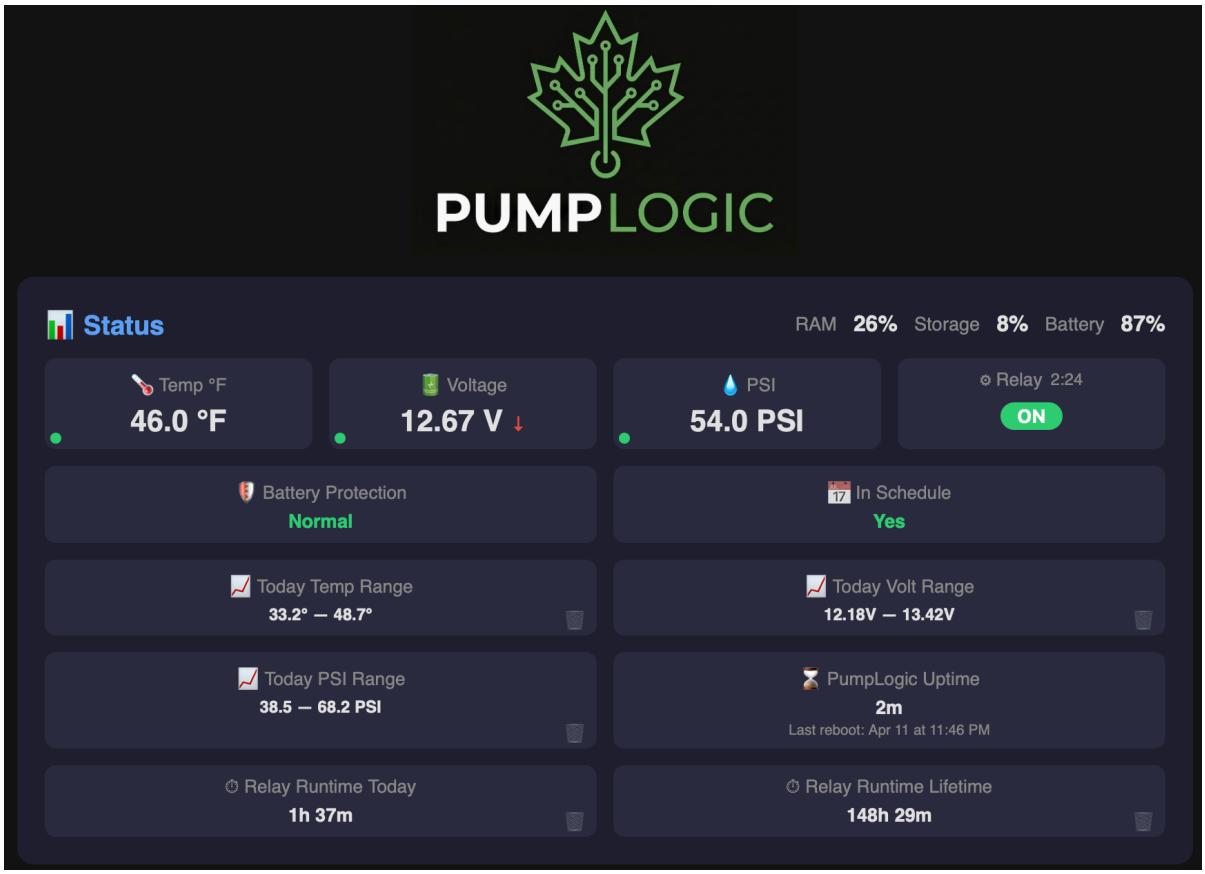

Figure: Status card showing sensor readings and system state

The Status card is the primary monitoring view. It is always visible and organized into four rows.

Row 1 — Sensor Readings and Relay State

Four equally spaced indicators across the full width:

Temperature (Temp °F)

Element	What It Means
Number (e.g., "45.0 °F")	The current temperature reading
Green dot	Temperature condition is met — **at or above** the trigger (Trigger High mode) or **at or below** the trigger (Trigger Low mode)
Red dot	Temperature condition is not met
"Error"	The sensor is disconnected or unresponsive

Voltage

Element	What It Means
Number (e.g., "12.80 V")	The current battery voltage reading
Green dot	Voltage is **above** the low voltage cutoff — condition met
Red dot	Voltage is **at or below** the cutoff — lockout may trigger
Gray dot	Voltage monitoring is **disabled** — voltage is not used as a condition
Trend arrow ↑ (green)	Voltage is **rising** (increased by more than 0.1V since the last reading)
Trend arrow ↓ (red)	Voltage is **falling** (decreased by more than 0.1V since the last reading)
Trend arrow → (gray)	Voltage is **stable** (within ±0.1V of the last reading)

PSI (Pressure)

Element	What It Means
Number (e.g., "52.3 PSI")	The current pressure reading from the transducer
Green dot	Pressure is **at or above** the PSI trigger — no override needed
Red dot	Pressure is **below** the PSI trigger — PSI override may activate
Gray dot / "Disabled"	Pressure sensor is not enabled in Settings

When the pressure sensor is disabled, the PSI column displays "Disabled" in gray text. If pressure data becomes stale (no update in over 2 minutes), the value is highlighted in amber as a warning.

Relay

Element	What It Means
Green **ON** badge	Relay is energized — the pump is running
Red **OFF** badge	Relay is de-energized — the pump is stopped
Countdown timer (e.g., "8:32")	Time remaining in the current ON or OFF cycle
Empty countdown (0:00)	On/Off Timer Mode is disabled — the pump runs continuously based on conditions

When the countdown reaches zero, the status card automatically refreshes to show the new cycle state. When On/Off Timer Mode is disabled, the countdown is not used.

Row 2 — Battery Protection and Schedule Status

Two equally spaced indicators:

Battery Protection

Display	Meaning
Green **"Normal"**	System is operating normally — no voltage issues
Red **"LOW BATTERY"**	Pump is disabled due to low battery voltage. The Charge Recovery card will appear.

In Schedule

Display	Meaning
Green **"Yes"**	Current time is within the active operating schedule
Red **"No"**	Current time is outside the operating schedule
Yellow **"Quiet Hours"**	Current time is within the quiet hours window — pump blocked

The system automatically uses the weekend schedule on Saturdays and Sundays.

Row 3 — Daily Min/Max Tracking

Indicator	Description
Today Temp Range	The lowest and highest temperature readings recorded today (e.g., "28.5° — 47.2°")
Today Volt Range	The lowest and highest voltage readings recorded today (e.g., "11.92V — 13.45V")
Today PSI Range	The lowest and highest pressure readings recorded today (e.g., "38.5 — 68.2 PSI"). Only visible when the pressure sensor is enabled.
PumpLogic Uptime	Time since last reboot (days/hours/minutes). Below the uptime value, **Last reboot** shows the date and time of the most recent boot.

All ranges reset automatically at midnight. A small reset button (trash icon) in the bottom-right corner of each stat lets you manually reset the range.

Row 4 — Runtime Counters

Indicator	Description
Runtime Today	Total pump-on time today, displayed as hours and minutes (e.g., "2h 15m"). Resets at midnight.
Runtime Lifetime	Total cumulative pump-on time since first use (e.g., "148h 32m"). Persists across reboots. Saved to device memory.

Each counter has a small reset button (trash icon) in the bottom-right corner for manual reset.

Status Card During Lockout

When a low-voltage lockout is active, the Status card layout changes:

- **Row 1** expands to show Temp, Voltage, PSI (if enabled), Relay, Battery Protection, and In Schedule — all critical indicators at a glance
- **Rows 3–4** (min/max tracking and runtime) are hidden to keep the display focused on the lockout situation

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Charge Recovery Card

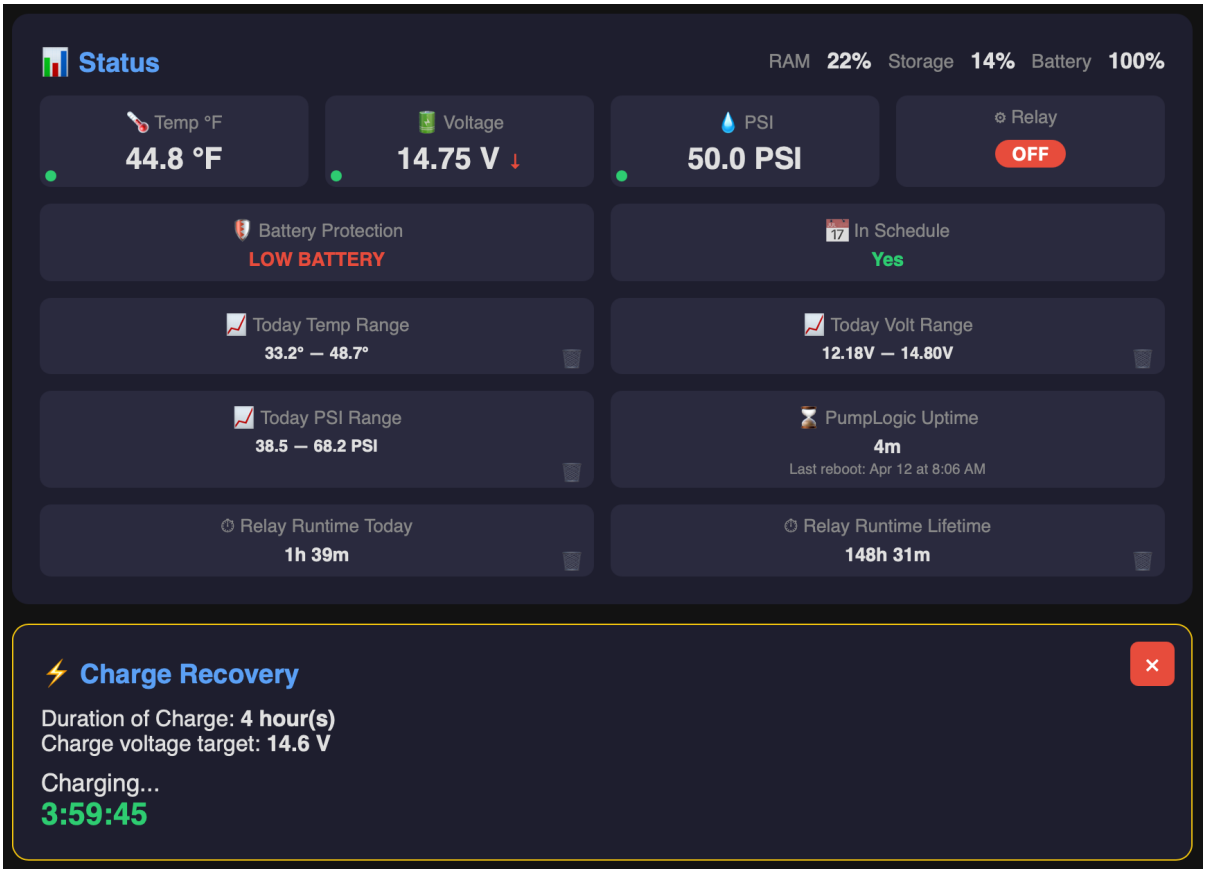
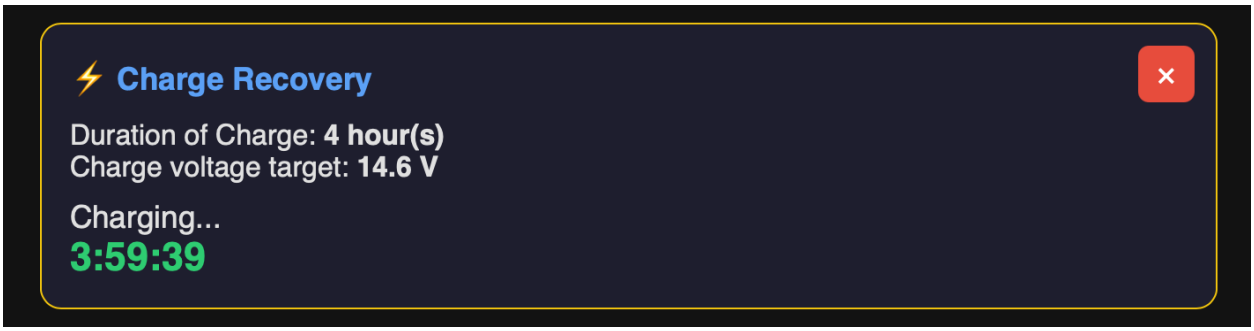


Figure: Charge Recovery card with battery protection progress

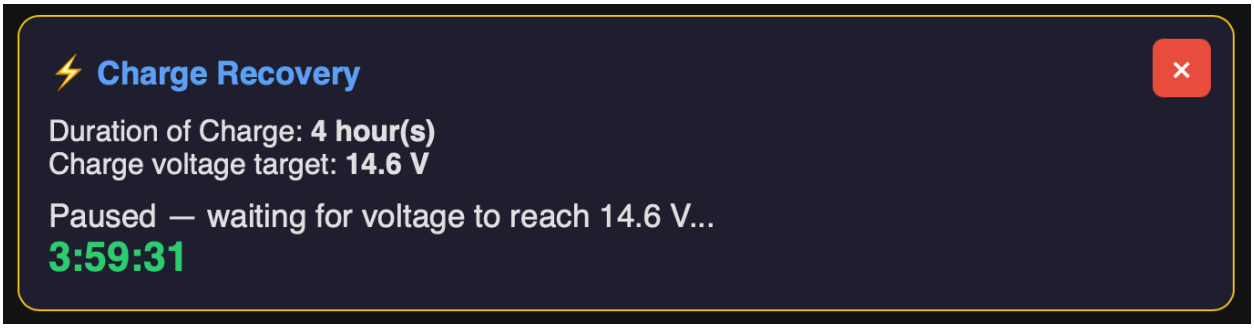
This card **only appears** when a low-voltage lockout is active. It provides real-time progress of the charge recovery process.

Field	Description
Duration of Charge	Total hours required at or above the charge voltage (e.g., "4 hour(s)")

Field	Description
Charge voltage target	The minimum voltage required to count toward charge recovery (e.g., "14.6 V")
Status	Shows "Waiting for voltage to reach XX.X V..." until voltage meets the target, then shows "Charging..." with a countdown timer. If voltage drops below the target, shows "Paused — waiting for voltage to reach XX.X V..." with the countdown frozen at its current position.
Countdown timer	Displays remaining time in H:MM:SS format. Counts down in real time while charging. Pauses if voltage drops below the charge target and resumes from where it left off when voltage returns.



Charge Recovery Activated with Timer



Charge Recovery Paused Timer

A red **X** button in the upper-right corner cancels the charge recovery and immediately resumes normal operation. See the Charge Recovery section for full details.

Manual Control Card

Figure: Manual Control buttons

A collapsible card providing direct control over the pump and system. A brief description of each action is displayed at the top, followed by four buttons in a 2x2 grid:

Button	What It Does
Force ON	Immediately turns the pump ON for the configured ON Duration, regardless of conditions. After the ON duration elapses, PumpLogic logs the run and resumes automatic cycling.
Force OFF	Immediately turns the pump OFF and resumes automatic cycling. The OFF duration timer begins counting down.
Charge Recovery	Manually initiates charge recovery. A confirmation dialog appears first. The pump is disabled until the charge recovery requirements are met. The event is logged.
Reboot	Restarts the device. A confirmation dialog appears first. After rebooting, reconnect to WiFi and reload the page.

Network Card

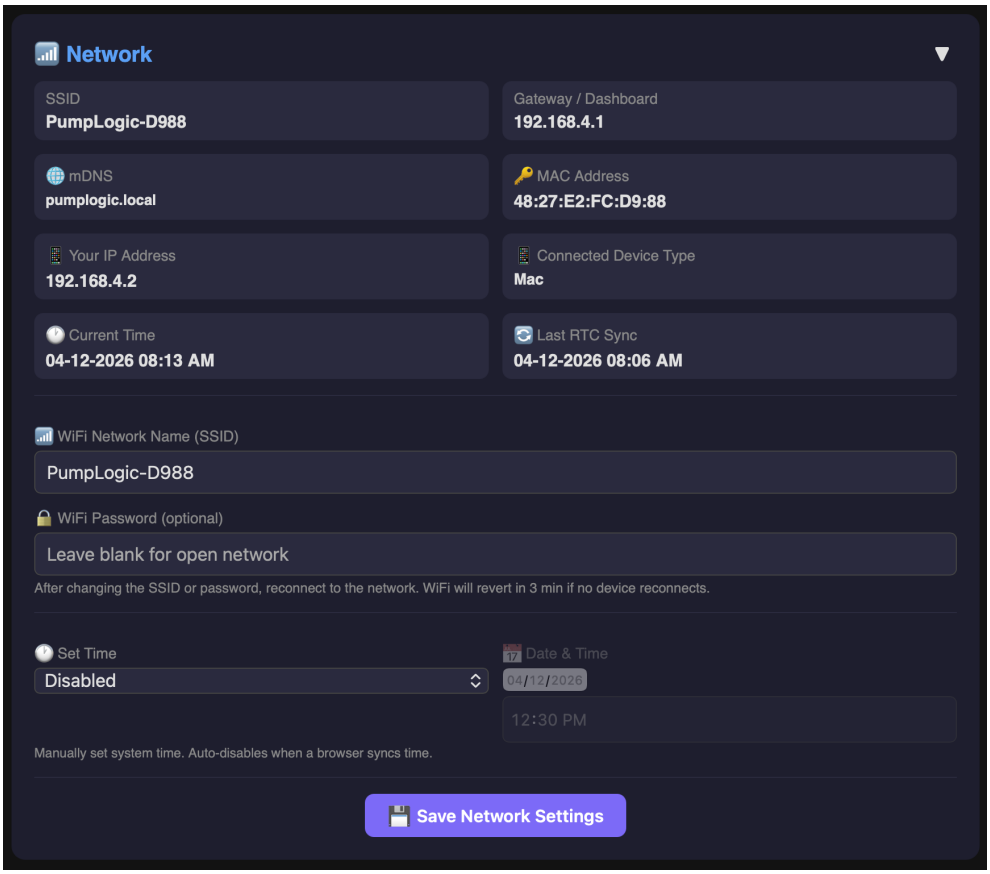


Figure: Network card showing connectivity and time info

A collapsible card displaying connectivity, system, time information, WiFi configuration, and Set Time controls. The card is organized into informational rows followed by editable fields:

Informational rows:

	Fields	
	SSID — the WiFi network name being broadcast	**IP Address** — always 192.168.4.1
	mDNS — the shortcut URL (pumplogic.local)	**Uptime** — time since last reboot (days/hours/r with **Last reboot** timestamp shown below
	MAC Address — the device's unique identifier	**Device Type** — the device model
	Current Time — live date and time from the synced clock	**Last Sync** — timestamp of the most recent tir synchronization. If Set Time is enabled, the lab changes to **Last Sync (Forced)**

WiFi configuration fields:

Field	Description
WiFi SSID	Editable input for the WiFi network name. Max 32 characters.
WiFi Password	Editable input for the WiFi password. Leave blank for an open network. 8–63 characters if set.

Set Time section:

Field	Description
Set Time toggle	Enable/disable toggle. When enabled, date and time input fields appear for manually setting the device clock.
Date and Time inputs	Appear when Set Time is enabled. Enter the current date and time to manually set the device clock.

Save Network Settings button:

A **Save Network Settings** button at the bottom saves all settings (equivalent to the Save Settings button in the Settings card).

After changing the SSID or password, reconnect to the new network. WiFi credentials will automatically revert in 3 minutes if no device reconnects to the new network.

All timestamps are displayed in **MM-DD-YYYY HH:MM AM/PM** format.

Time is synced automatically when you load the page if the device has not been synced yet or if the last sync was more than 30 seconds ago. See Time Synchronization for details.

Battery Charge/Discharge Card

Figure: Battery Charge/Discharge card showing 24-hour battery percentage graph

A collapsible card displaying a 24-hour battery percentage line graph. The graph plots battery charge percentage (0–100%) at 15-minute intervals, providing a visual overview of charge and discharge patterns throughout the day.

Element	Description
Battery%	Current battery charge percentage displayed in the card header
Line graph	Green line plotting battery percentage over 24 hours at 15-minute intervals
X-axis labels	Time labels from 12a (midnight) through 12p to 11:45p, shown every 3 hours
Y-axis labels	Percentage scale: 0%, 25%, 50%, 75%, 100%
Current slot dot	Accent-colored dot highlighting the most recent reading on the graph
Sample indicator	Text below graph indicating sample data is displayed (clears after first real reading)
Open Full View	Button that opens the graph in a dedicated full-page view at /battgraph

On initial boot, the graph displays sample data showing a realistic 24-hour charge/discharge cycle. Once the first real battery reading is recorded (after 15 minutes), all sample data is cleared and replaced with actual readings.

The graph is horizontally scrollable within the card — swipe or scroll left/right to see the full 24-hour timeline. Readings are every 15 minutes for a maximum of 24 hours and reset on reboot.

The **Open Full View** button opens the graph in a dedicated full-page view that is optimized for both portrait and landscape viewing on mobile devices.

Temperature Over Time Card

Figure: Temperature Over Time card showing 24-hour temperature graph

A collapsible card displaying a 24-hour temperature line graph. The graph plots temperature readings (in °F) at 15-minute intervals, providing a visual overview of temperature changes throughout the day.

Element	Description
Line graph	Orange line plotting temperature over 24 hours at 15-minute intervals
X-axis labels	Time labels from 12a (midnight) through 12p to 11:45p, shown every 3 hours
Y-axis labels	Temperature scale in °F, auto-scaled to the data range
Current slot dot	Accent-colored dot highlighting the most recent reading on the graph
Sample indicator	Text below graph indicating sample data is displayed (clears after first real reading)
Open Full View	Button that opens the graph in a dedicated full-page view at /tempgraph

On initial boot, the graph displays sample data showing a realistic 24-hour temperature cycle. Once the first real temperature reading is recorded (at the next 15-minute boundary after boot), all sample data is

cleared and replaced with actual readings.

The graph is horizontally scrollable within the card — swipe or scroll left/right to see the full 24-hour timeline. The **Open Full View** button opens the graph in a dedicated full-page view optimized for both portrait and landscape viewing on mobile devices.

PSI Over Time Card

Figure: PSI Over Time card showing 24-hour pressure graph

A collapsible card displaying a 24-hour pressure line graph. This card is only visible when the pressure sensor is enabled in Settings. The graph plots PSI readings (0–100 PSI) at 15-minute intervals, providing a visual overview of pressure changes throughout the day.

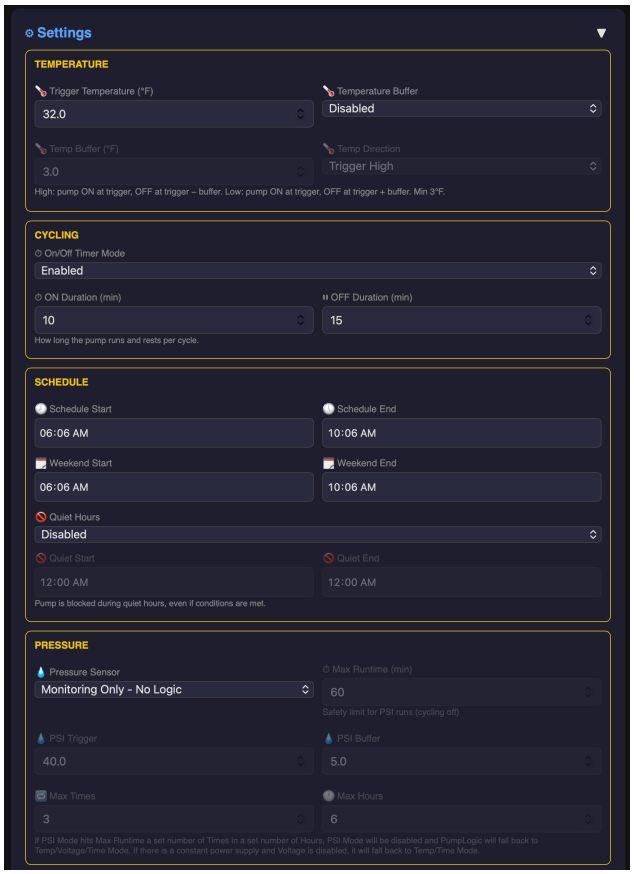
Element	Description
Line graph	Blue line plotting PSI over 24 hours at 15-minute intervals
X-axis labels	Time labels from 12a (midnight) through 12p to 11:45p, shown every 3 hours
Y-axis labels	Pressure scale: 0, 25, 50, 75, 100 PSI
Current slot dot	Accent-colored dot highlighting the most recent reading on the graph
Sample indicator	Text below graph indicating sample data is displayed (clears after first real reading)
Open Full View	Button that opens the graph in a dedicated full-page view at /psigraph

On initial boot with the pressure sensor enabled, the graph displays sample data showing a realistic 24-hour pressure cycle. Once the first real pressure reading is recorded (at the next 15-minute boundary after boot), all sample data is cleared and replaced with actual readings.

The graph is horizontally scrollable within the card — swipe or scroll left/right to see the full 24-hour timeline. The **Open Full View** button opens the graph in a dedicated full-page view optimized for both portrait and landscape viewing on mobile devices.

When the pressure sensor is disabled in Settings, this card is hidden from the interface.

Settings Card

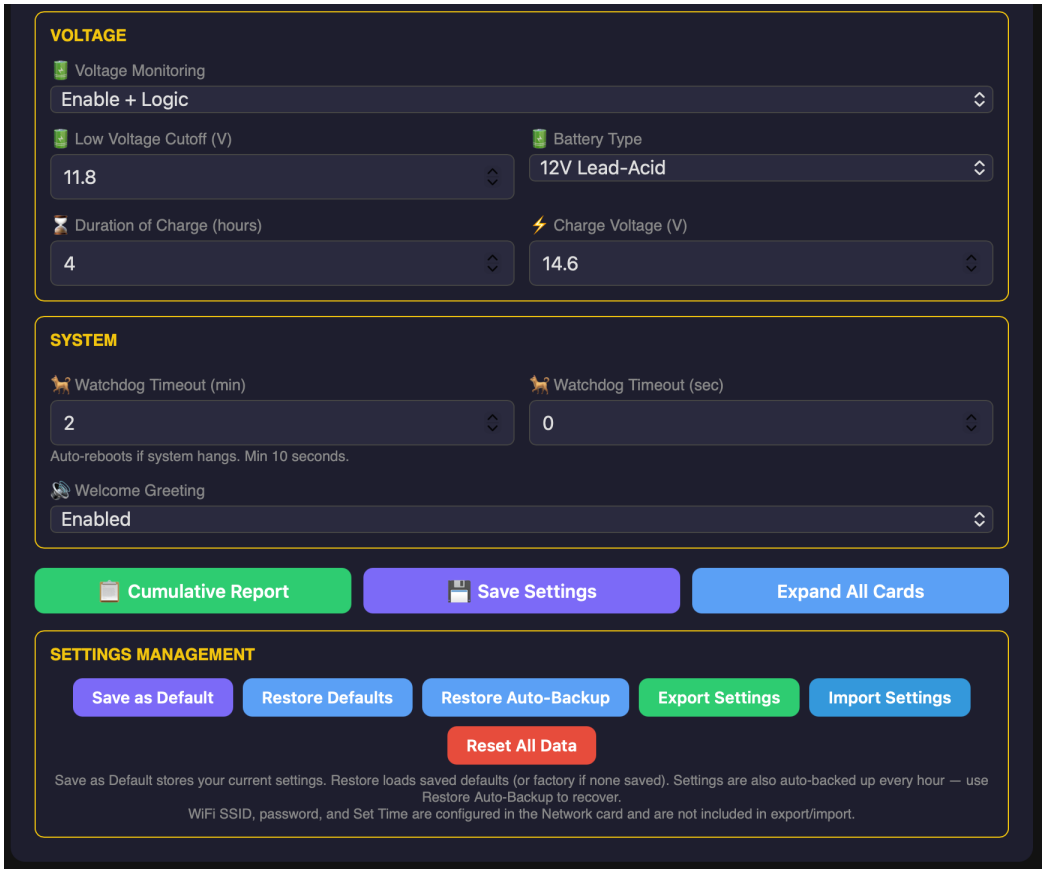


Settings Card — Temperature, Cycling, Schedule, Pressure

A collapsible card containing all configurable parameters, organized into yellow-bordered subsections. Expand the card, adjust values, and press **Save Settings** to apply changes. Most changes take effect immediately — no reboot required. WiFi SSID/password and Set Time are configured in the Network card.

The Settings card is organized into the following yellow-bordered subsections:

Subsection	Contents
TEMPERATURE	Trigger temperature, temperature buffer toggle, buffer value, temperature direction
CYCLING	On/Off Timer Mode toggle, ON duration, OFF duration
SCHEDULE	Weekday start/end, weekend start/end, quiet hours toggle and quiet hours times
PRESSURE	PSI mode, max runtime, PSI trigger, PSI buffer, failsafe fields
VOLTAGE	Voltage mode, low voltage cutoff, battery type, charge hours, charge voltage
SYSTEM	Watchdog timeout, Welcome Greeting, Detailed Cumulative Report button (green, opens report in a new tab)



Settings Card — Voltage, System, Buttons, Settings Management

Below the subsections, three evenly-spaced buttons:

Button	Action
Cumulative Report (green)	Opens the Detailed Cumulative Report in a new browser tab.
Save Settings	Saves all current values to device memory. A green toast notification confirms the save.
Expand All Cards (blue)	Toggles all collapsible cards open or closed at once.

SETTINGS MANAGEMENT subsection (outside the form, yellow border):

Button	Action
Save as Default	Saves current settings as user defaults.
Restore Defaults	Restores user-saved defaults, or factory defaults if none saved.
Restore Auto-Backup	Restores settings from the last hourly auto-backup.
Export Settings	Downloads settings as a `.pumplogic_settings` JSON file.
Import Settings	Uploads a `.pumplogic_settings` file to restore settings.
Reset All Data	Clears graphs, event log, serial log, and daily stats. Requires double confirmation.

Save as Default stores your current settings. Restore loads saved defaults (or factory if none saved). Settings are also auto-backed up every hour — use Restore Auto-Backup to recover. WiFi SSID, password, and Set Time are configured in the Network card and are not included in export/import.

See the Settings Reference section for a detailed description of every setting.

Event Log Card

Figure: Event Log showing run history

A collapsible card showing a scrollable table of recorded events. Each row includes five columns:

Column	Description
Event	The event type — "Successful Run", "Charge Recovery", "Max PSI", "PSI Disabled", "Boot", or "Config"
Time	When the event occurred (MM-DD-YYYY HH:MM AM/PM)
Temp	Temperature at the time of the event (for non-Config events)
Voltage	Battery voltage at the time of the event (for non-Config events)
In Sched	Whether the event occurred within the configured schedule window (Yes/No)

Color coding:

Event Type	Color
Successful Run	Green badge
Charge Recovery	Yellow badge
Max PSI	Orange badge

Event Type	Color
PSI Disabled	Red badge
Boot	Blue badge — logged each time PumpLogic starts or restarts. Boot events are excluded from the pump cycle count on the dashboard.
Config	Purple badge — logged when settings are changed via the web UI.

Settings Change Log:

When settings are changed, a **Config** event is logged with a purple badge. Instead of temperature and voltage columns, Config events display which setting categories were modified (e.g., "temp,schedule,voltage"). This helps track what was changed and when.

Storage details:

- Up to **100 events** are stored in a rolling list. When full, the oldest entry is overwritten by the newest.
- Entries older than **7 days** are automatically removed at midnight each day to free slots for new events.
- Events are saved to device memory and persist across reboots.
- Event log format changed in Version 2.0 — existing logs are reset on first boot after updating.
- A **Clear All Logs** button at the bottom of the card clears the entire event log.

Serial Monitor Log Card

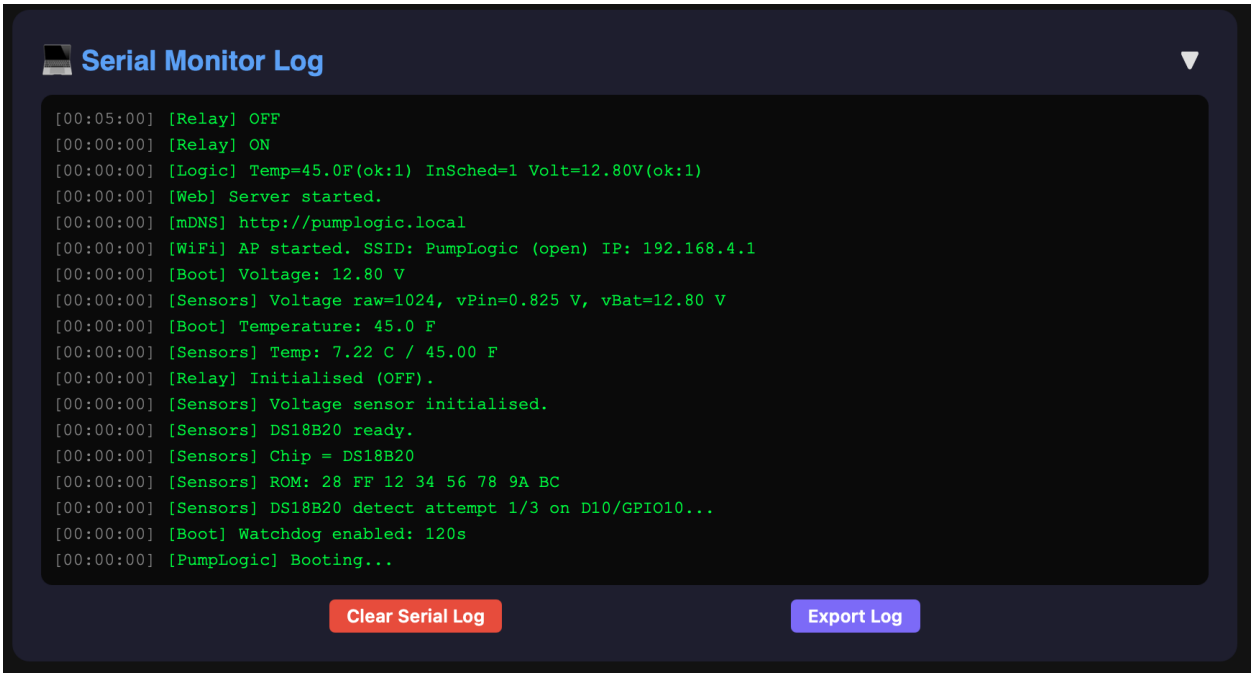


Figure: Serial Monitor Log with terminal-style debug output

A collapsible card with a dark terminal-style display showing internal system messages, accessible wirelessly through the web interface.

Display:

- Dark background with green monospace text, mimicking a serial terminal
- Each line shows an uptime timestamp in `[HH:MM:SS]` format followed by the message
- Messages are displayed newest-first, scrollable up to 100 entries

Adaptive refresh rate:

- When the card is **collapsed** (default), the page refreshes every **30 seconds**
- When the card is **expanded**, the refresh rate increases to every **3 seconds** for near-real-time monitoring

Bottom buttons:

Button	Action
Clear Serial Log	Erases all log entries from memory. A confirmation entry is recorded.
Export Log	Downloads the current log as a text file named `SerialMonitorLog-MM-DD-YYYY.txt`. The log is automatically cleared after download.

Storage details:

- Up to **200 entries** are stored in temporary memory (cleared on reboot)
- The first **50 entries** recorded during the initial 10 minutes after boot are stored in a **protected boot section** that is never overwritten by newer log entries. This ensures boot-time messages are always available for troubleshooting.
- When exported, boot logs appear first, followed by a separator line, then the rotating log entries (newest first)
- **Clear Serial Log** only clears the rotating section — boot logs are always preserved

---

Toast Notifications

All confirmations and status messages appear as brief, non-blocking toast notifications at the bottom of the screen — not as popup dialogs.

Toast Color	Meaning
Green	Success (e.g., "Settings saved!", "Relay forced ON")
Red	Error (e.g., a failed operation)

Toasts automatically disappear after 3 seconds (10 seconds for reboot messages).

How Automatic Pump Cycling Works

PumpLogic continuously evaluates conditions to decide when to turn the pump on and off. The behavior depends on which features are enabled.

Step 1 — Check Manual Override

If a **Force ON** or **Force OFF** is active, automatic logic is skipped:

- **Force ON:** The relay stays on until the ON duration elapses, then normal cycling resumes.
- **Force OFF:** The relay stays off and the OFF duration timer begins.

Step 2 — Periodic Sensor Reads

Sensors are read at fixed intervals. Between reads, the most recent value is cached and used by the decision logic.

Sensor	Interval
Temperature	Every 1 minute
Voltage	Every 30 seconds
Pressure (PSI)	Every 30 seconds (when enabled)

Step 3 — Low Voltage Lockout Check (When Voltage Monitoring Enabled)

If Voltage Monitoring is enabled and the battery voltage drops below the **Low Voltage Cutoff**:

- The relay is immediately turned OFF
- The event is logged in the Event Log
- The pump cannot run until charge recovery completes (see Charge Recovery)
- All other automatic logic is skipped

When Voltage Monitoring is disabled, this check is skipped entirely. The system assumes a constant power supply is in use.

Step 4 — Evaluate Conditions

PumpLogic evaluates the following conditions:

Condition	Requirement
Temperature	Depends on Temperature Direction. **Trigger High:** reading is at or above the trigger. **Trigger Low:** reading is at or below the trigger.

Condition	Requirement
Schedule	Current time is within the operating window (weekday or weekend) AND not in the quiet hours window. Always required.
Voltage	When Voltage Monitoring is enabled: battery voltage is at or above the Low Voltage Cutoff. When disabled: always passes.

Step 5 — Relay ON: When to Turn Off

If the relay is currently ON, PumpLogic checks whether to turn it off based on which mode is active:

PSI-triggered run: The relay turns off when pressure reaches the PSI Trigger plus PSI Buffer (e.g., 40 + 5 = 45 PSI). The Max Run Time acts as a safety limit.

On/Off Timer Mode enabled: The relay turns off when the ON duration elapses. The run is logged and the OFF cycle begins.

On/Off Timer Mode disabled (continuous mode): The relay stays on as long as conditions remain met. Temperature uses buffer hysteresis to prevent rapid cycling:

- **Trigger High:** stays on until temperature drops below (trigger - buffer)
- **Trigger Low:** stays on until temperature rises above (trigger + buffer)

The pump also turns off if the schedule window ends, voltage drops below cutoff (when voltage monitoring enabled), or PSI reaches the target plus overshoot (when pressure sensor enabled).

Step 6 — Relay OFF: When to Turn On

If the relay is currently OFF:

PSI Override (when pressure sensor enabled): If all conditions are met AND pressure is below the PSI Trigger, the pump starts immediately — even if the OFF cooldown has not elapsed.

On/Off Timer Mode enabled: PumpLogic waits for the OFF duration to elapse. Once elapsed, if all conditions are met, a new ON cycle begins.

On/Off Timer Mode disabled (continuous mode): The pump starts immediately when all conditions are met — no OFF cooldown. If the pressure sensor is enabled, the pump only starts when PSI is below the trigger.

Operating Modes Summary

Cycling	PSI	Voltage	Behavior
ON	Any	ON	Standard: timed ON/OFF cycling with PSI override and voltage gate

Cycling	PSI	Voltage	Behavior
ON	Any	OFF	Same cycling, no voltage gate (constant power assumed)
OFF	ON	ON	PSI drives pump: ON when PSI < trigger, OFF at trigger + overshoot. Voltage gate applies
OFF	ON	OFF	PSI drives pump, no voltage gate
OFF	OFF	ON	Continuous: pump ON while temp condition + voltage + schedule met
OFF	OFF	OFF	Continuous: pump ON while temp condition + schedule met

Cycle Example — Standard Mode

With default settings (On/Off Timer Mode enabled, 10 min ON, 15 min OFF, Trigger Low 32°F, 10:00–16:00 schedule):

```
10:00 AM — Temperature 28°F (below trigger), voltage 12.5V → conditions met → Relay ON
10:10 AM — ON duration elapses → Relay OFF, run logged, OFF cycle begins
10:25 AM — OFF duration elapses → Conditions re-evaluated
           If all conditions still met → Relay ON for another 10-minute cycle
           ...repeats until 4:00 PM (schedule end), or until temperature
           rises above 32°F, or voltage drops below cutoff
```

Cycle Example — Continuous Mode (Cycling Disabled)

With cycling disabled, Trigger High 80°F, buffer 5°F:

```
Temperature rises to 80°F → conditions met → Relay ON (runs continuously)
Temperature drops to 76°F → below (80 - 5 = 75°F)? No → stays ON
Temperature drops to 74°F → below 75°F? Yes → Relay OFF
Temperature rises back to 80°F → conditions met → Relay ON again
```

Settings Reference

All settings are accessible from the Settings card and the Network card. Changes are saved to device memory and persist across reboots.

Temperature Settings

Setting	Default	Description
Trigger Temperature (°F)	32.0	The temperature threshold that activates the pump. Behavior depends on the Temperature Direction setting.
Temperature Direction	Trigger Low	Controls when the pump activates based on temperature. **Trigger High** (cooling): pump activates when temperature is **at or above** the trigger. **Trigger Low** (freeze protection): pump activates when temperature is **at or below** the trigger.
Temperature Buffer	Enabled	Dropdown selector (Enabled/Disabled). When enabled, the temperature buffer provides hysteresis around the trigger point to prevent rapid on/off cycling. When disabled, no buffer is applied and the pump activates/deactivates exactly at the trigger temperature. The Temp Buffer field is grayed out when disabled.
Temp Buffer (°F)	3.0	The number of degrees past the trigger before the pump deactivates (when On/Off Timer Mode is disabled). Prevents rapid on/off cycling near the trigger point. **Trigger High:** pump stays on until temperature drops below (trigger - buffer). **Trigger Low:** pump stays on until temperature rises above (trigger + buffer). Minimum: 3°F, Maximum: 50°F. Only applies when Temperature Buffer is enabled.

Temperature is read automatically every 1 minute. This interval is fixed and not configurable.

Pump Cycle Timing

Setting	Default	Description
On/Off Timer Mode	Enabled	Dropdown selector (Enabled/Disabled). When enabled, the pump cycles between ON and OFF durations. When disabled, the pump runs continuously as long as conditions are met (temperature buffer hysteresis prevents rapid cycling). The ON/OFF duration fields are grayed out when cycling is disabled.
ON Duration (min)	10	How long the pump runs during each ON cycle. After this time, the relay turns off and the OFF cycle begins. Only applies when On/Off Timer Mode is enabled.
OFF Duration (min)	15	How long the pump rests between ON cycles. After this time, PumpLogic evaluates conditions to decide whether to start a new ON cycle. Only applies when On/Off Timer Mode is enabled.

Schedule Settings

All times use **24-hour format** (e.g., 16:00 = 4:00 PM).

Setting	Default	Description
Schedule Start	10:00	Beginning of the weekday (Mon–Fri) operating window. The pump will not run before this time.
Schedule End	16:00	End of the weekday operating window. The pump will not start a new ON cycle at or after this time.
Weekend Start	10:00	Beginning of the weekend (Sat–Sun) operating window.
Weekend End	16:00	End of the weekend operating window.

Quiet Hours Settings

Setting	Default	Description
Quiet Hours	Disabled	Dropdown selector (Disabled/Enabled). When enabled, defines a time range during which the pump is blocked from running, regardless of the normal schedule.
Quiet Start	00:00	Beginning of the quiet hours window (24-hour format).
Quiet End	00:00	End of the quiet hours window (24-hour format).

The quiet hours window supports **midnight wrapping** — for example, setting Start to 22:00 and End to 06:00 blocks from 10 PM to 6 AM.

Pressure Sensor Settings

Setting	Default	Description
Pressure Sensor	Disabled	Dropdown selector with three options: **Disabled** (PSI-related UI hidden, pressure logic skipped), **Enabled** (full PSI monitoring with pump override logic), or **Monitoring Only - No Logic** (PSI is displayed and graphed but does not affect pump operation). When set to Monitoring Only, the PSI Trigger, PSI Buffer, Max Runtime, Max Times, and Max Hours fields are grayed out.
PSI Trigger	40.0	The pressure threshold below which the PSI override activates. When pressure drops below this value (and all three base conditions are met), the pump starts immediately without waiting for the OFF cooldown. Only applies when set to Enabled (not Monitoring Only).
PSI Buffer	5.0	Additional PSI above the trigger that the pump must reach before stopping a PSI-triggered run. For example, with a trigger of 40 and buffer of 5, the pump runs until pressure reaches 45 PSI. This prevents rapid on/off cycling near the trigger point. Only applies when set to Enabled.

Setting	Default	Description
Max Run Time (min)	60	Safety limit for PSI-triggered runs when On/Off Timer Mode is disabled. If the PSI target is not reached within this time (e.g., due to a leak or sensor failure), the pump stops automatically. Range: 1–1440 minutes. Only applies when set to Enabled.
Max Times	3	The maximum number of Max Runtime hits allowed within the Max Hours window before PSI Mode is automatically disabled as a failsafe. When triggered, PumpLogic falls back to Temp/Voltage/Time Mode (or Temp/Time Mode if Voltage is disabled). Range: 1–20. Only applies when set to Enabled.
Max Hours	6	The rolling time window (in hours) used to count Max Runtime hits for the failsafe. If the Max Times threshold is reached within this window, PSI Mode is disabled. Range: 1–48 hours. Only applies when set to Enabled.

Voltage and Battery Settings

Setting	Default	Description
Voltage Monitoring	Enabled	Dropdown selector with three options: **Enabled** (voltage acts as a gate — the pump is blocked if voltage drops below the cutoff, and low-voltage lockout with charge recovery is active), **Monitoring Only - No Logic** (voltage is displayed and graphed but does not affect pump operation; the warning about constant power is shown), or **Disabled** (voltage is ignored). When set to Monitoring Only or Disabled, the Low Voltage Cutoff, Battery Type, Duration of Charge, and Charge Voltage fields are grayed out, and the constant-power warning is displayed.

Setting	Default	Description
Low Voltage Cutoff (V)	11.8	If voltage drops below this value, PumpLogic enters low-voltage lockout and the pump is disabled until charge recovery completes. Only applies when Voltage Monitoring is enabled.
Battery Type	12V Lead-Acid	Configures the voltage-to-percentage curve. Options: **12V Lead-Acid** (10.5V–12.8V = 0%–100%) or **12V LiFePO4** (10.0V–13.4V = 0%–100%).

Charge Recovery Settings

Setting	Default	Description
Duration of Charge (hours)	4	The total hours of accumulated charge time at or above the Charge Voltage required before the lockout is cleared. A real-time countdown timer tracks the remaining charge time. If voltage drops below the target, the timer pauses and resumes when voltage returns — accumulated time is preserved.
Charge Voltage (V)	14.6	The minimum voltage a reading must reach to count toward charge recovery. Typically set to the voltage indicating active charging.

System Settings

Setting	Default	Description
Watchdog Timeout	2:00 (120s)	Safety timer that automatically reboots the device if it becomes unresponsive. Set in minutes and seconds. Minimum 10 seconds. Under normal operation, the watchdog is never triggered.
Welcome Greeting	Enabled	Dropdown selector (Enabled/Disabled). When enabled, a welcome message appears at the top of the page on first load.

Setting	Default	Description
Detailed Cumulative Report	Button	Opens a comprehensive report in a new browser tab.

Network Settings

These settings are configured in the Network card.

Setting	Default	Description
WiFi Network Name (SSID)	PumpLogic-XXXX	The name of the WiFi network broadcast by the device. XXXX is the last 4 hex characters of the device's MAC address. Maximum 32 characters. Changing this requires reconnecting to the new network name.
WiFi Password	*(empty/open)*	Optional password for the WiFi network. Leave blank for an open network. 8–63 characters if set. Changing this requires reconnecting with the new password.
Set Time	Disabled	Manually set the device clock when no WiFi-capable device is available. Date and time input fields appear when enabled. The time is saved to device memory and persists across reboots. **Auto-disables:** When a browser syncs time via the normal auto-sync mechanism, Set Time is automatically disabled and the label switches back to "Last Sync."

Settings Management

Feature	Description
Save as Default	Saves current settings as user defaults. Does not include WiFi SSID/password.
Restore Defaults	Restores user-saved defaults, or factory defaults if none saved. Does not change WiFi credentials. Preserves lifetime runtime.
Restore Auto-Backup	Restores settings from the last hourly auto-backup. Does not change WiFi credentials.

Feature	Description
Export Settings	Downloads all settings (except WiFi SSID/password) as a `.pumplogic_settings` JSON file. Filename format: MM-dd-YY.pumplogic_settings
Import Settings	Uploads a `.pumplogic_settings` file to restore settings. Does not change WiFi SSID/password.
Reset All Data	Clears graphs, event log, serial log, and daily stats. Does NOT reset settings or lifetime runtime. Requires double confirmation.

Saving Settings

There are two save buttons: **Save Network Settings** in the Network card and **Save Settings** in the Settings card. Both save all settings. Press either button to save all changes. A green toast notification confirms the save.

- **Most settings** take effect immediately — no reboot required.
- **WiFi name/password changes** cause the WiFi network to restart. You will need to disconnect and reconnect to the new network name or with the new password.
- WiFi credential changes include a 3-minute safety net. If no device connects to the new network within 180 seconds, credentials automatically revert to the previous values.
- All settings are stored in **device memory** and persist across reboots.
- Settings are automatically backed up every hour. Use "Restore Auto-Backup" in Settings Management to recover from accidental changes.

Manual Controls

The Manual Control card provides four actions for direct control. Expand the card by clicking its header arrow.

Force ON

Press **Force ON** to immediately energize the relay and run the pump, regardless of whether the three conditions are met.

- **Low-voltage warning:** If the system is currently in low-voltage lockout, a confirmation dialog warns that running the pump may damage the battery. You must confirm to proceed.
- A toast notification confirms: "Relay forced ON (manual mode active)"
- The countdown timer shows the remaining ON time
- When the ON duration elapses, the run is logged and automatic cycling resumes
- Press **Force OFF** at any time to stop a Force ON cycle early

Force OFF

Press **Force OFF** to immediately de-energize the relay and stop the pump.

- A toast notification confirms: "Relay turned OFF, automatic mode resumed"
- The OFF duration timer begins counting down
- After the OFF duration elapses, PumpLogic will start a new ON cycle if all conditions are met

Charge Recovery (Manual)

Press **Charge Recovery** to proactively initiate a charge recovery cycle before the voltage drops below the automatic cutoff.

- A confirmation dialog appears before proceeding
- The relay is immediately turned OFF
- The system enters lockout mode and the event is logged
- The pump cannot run until charge recovery requirements are met (see Charge Recovery)

Reboot

Press **Reboot** to restart the device. A confirmation dialog appears first. After rebooting:

- All saved settings are preserved
- The relay starts in the OFF state
- Temperature and voltage sensors are re-read
- Time will re-sync from your browser when you reload the page
- Wait approximately 10 seconds, then reconnect to WiFi and reload the page

Low Voltage Protection

PumpLogic monitors battery voltage to protect against over-discharge. This is especially important for solar-powered or battery-powered installations where the battery is the sole power source.

Note: Low voltage protection only applies when **Voltage Monitoring** is enabled in Settings. When voltage monitoring is disabled (for constant-power installations), low voltage lockout and charge recovery are inactive.

How It Works

1. Voltage is checked automatically every **30 seconds** for responsive lockout detection

2. If the voltage drops below the **Low Voltage Cutoff** (default: 11.8V):

• The relay is **immediately turned OFF**

• The system enters **LOW BATTERY** mode

• The event is logged in the Event Log

• The pump **cannot run** until charge recovery is complete

• The **Charge Recovery card** appears on the webpage

What Triggers a Lockout

A single voltage reading below the cutoff threshold triggers lockout immediately. This is intentionally aggressive to protect the battery from deep discharge.

Charge Recovery

When a low-voltage lockout occurs, PumpLogic requires the battery to accumulate sufficient charge time before allowing the pump to run again. This prevents rapid cycling between lockout and operation when the battery is marginal.

How It Works

1. The **Charge Recovery card** appears showing status and a countdown timer

2. Voltage is checked every **30 seconds**

3. When voltage reaches or exceeds the **Charge Voltage** (default: 14.6V), the charge countdown timer starts

4. The countdown timer displays the remaining time in **H:MM:SS** format and counts down in real time

5. A **0.5V hysteresis band** prevents rapid toggling when voltage hovers near the threshold:

• If voltage drops **less than 0.5V** below the Charge Voltage, the timer **keeps running** (within the hysteresis band)

• If voltage drops **0.5V or more** below the Charge Voltage, the countdown timer **pauses** — accumulated charge time is preserved. The status changes to "Paused" and the countdown freezes at its current position.

6. When voltage returns to or above the Charge Voltage, the countdown **resumes** from where it left off

7. When the countdown reaches zero (total accumulated time at or above the Charge Voltage equals the **Duration of Charge**), the lockout clears and normal operation resumes

Charge Recovery Example

With defaults (4 hours, 14.6V charge voltage):

1. Low voltage detected → Lockout activates, card shows "Waiting for voltage to reach 14.6 V..."

2. Charger connected, voltage rises to 14.6V → Countdown starts: **4:00:00**

3. Timer counts down in real time: 3:59:59, 3:59:58, ...

4. After 1 hour, voltage drops to 13.9V (0.7V below threshold, exceeds 0.5V hysteresis) → Timer pauses at **3:00:00**, shows "Paused — waiting for voltage to reach 14.6 V..."

5. Voltage returns to 14.6V → Timer resumes from **3:00:00** and continues counting down

6. Timer reaches 0:00:00 → Lockout clears, normal operation resumes

Cancelling Charge Recovery

If you know the battery is sufficiently charged (e.g., you connected a different power source), press the red **X** button on the Charge Recovery card:

1. A confirmation dialog appears

2. If confirmed, the lockout is immediately cleared

3. The Charge Recovery card disappears
4. Normal automatic cycling resumes (subject to the three conditions)
5. If a subsequent voltage reading falls below the Low Voltage Cutoff, lockout will re-engage

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Scheduling

Weekday and Weekend Schedules

PumpLogic supports separate operating windows for weekdays and weekends:

Days	Schedule Used
Monday – Friday	Schedule Start / Schedule End
Saturday – Sunday	Weekend Start / Weekend End

Both schedules work identically: the pump will only start a new ON cycle if the current time falls within the active window. This lets you set different hours for weekdays vs. weekends — for example, a later start on weekends when solar panels begin generating power later in the morning.

Midnight wrapping: Regular schedules support overnight ranges. For example, setting Schedule Start to 22:00 and Schedule End to 06:00 creates an operating window from 10 PM through 6 AM.

Quiet Hours

The quiet hours window is an optional feature that **explicitly blocks** pump operation during a specific time range, regardless of the normal schedule.

Use cases:

- **Quiet hours** — prevent pump noise during sleeping hours
- **Peak demand** — avoid running during times when other devices need the battery
- **Maintenance** — block operation during planned maintenance windows

Behavior when active:

- The "In Schedule" status shows **"Quiet Hours"** in yellow
- The pump will not start new ON cycles
- If the pump is currently running, it will complete its current ON cycle but will not start a new one

Midnight wrapping: The quiet hours window supports overnight ranges. For example, setting Quiet Start to 22:00 and Quiet End to 06:00 blocks operation from 10 PM through 6 AM.

To enable: Set the **Quiet Hours** dropdown to **Enabled** in Settings and configure the start and end times.

Battery Monitoring

Voltage Trend Indicator

The Status card shows a **trend arrow** next to the voltage reading that indicates whether the battery is charging, discharging, or holding steady:

Arrow	Color	Meaning	Threshold
↑	Green	Voltage is rising	Increased by more than 0.1V since last reading
↓	Red	Voltage is falling	Decreased by more than 0.1V since last reading
→	Gray	Voltage is stable	Within ±0.1V of last reading

Battery Percentage Estimation

Below the voltage reading, PumpLogic displays an estimated battery charge percentage based on the configured **Battery Type**:

Battery Type	0%	20%	40%	60%	80%	100%
12V Lead-Acid	≤10.5V	11.8V	12.0V	12.2V	12.6V	12.8V+
12V LiFePO4	≤10.0V	—	—	—	—	13.4V+

The percentage is calculated using linear interpolation between these reference points. When voltage exceeds the top of the table, the display shows **100%**.

Note: Battery percentage estimates from voltage alone are approximate. Factors such as load, temperature, and battery age affect the actual state of charge. Use the percentage as a general guide, not a precise measurement.

Battery Charge/Discharge Graph

The Battery Charge/Discharge card provides a visual timeline of battery charge levels over 24 hours. This helps identify charging patterns, discharge rates, and whether solar panels are adequately replenishing the battery.

How it works:

- Every 15 minutes, PumpLogic records the current battery percentage — up to 96 readings (one every 15 minutes over 24 hours)

- The line graph plots these readings with time on the X-axis (midnight to midnight) and battery percentage on the Y-axis (0–100%)
- A green accent dot marks the most recent reading on the graph
- The graph is horizontally scrollable within the card for viewing the full 24 hours on mobile devices
- Graph data is saved to device memory every 15 minutes and **persists across reboots**

Sample data on first boot: When PumpLogic boots for the very first time (or after device memory is reset), the graph displays sample data showing a realistic 24-hour charge/discharge cycle. This demonstrates the graph's appearance before real data is available. Once the first real battery reading is recorded (at the next 15-minute boundary after boot), all sample data is cleared and only actual readings are displayed. On subsequent reboots, the previously recorded real data is restored from memory.

Full-page view: Press the **Open Full View** button to open the graph in a dedicated full-page view at /battgraph. This view displays PumpLogic branding, renders the graph at full viewport width, automatically adapts to portrait and landscape orientations on mobile devices, and auto-refreshes every 30 seconds.

Daily Min/Max Tracking

The Status card tracks the day's highest and lowest temperature, voltage, and PSI readings (PSI only when the pressure sensor is enabled). These ranges reset automatically at midnight and are useful for:

- Seeing how cold it got overnight (was freeze protection needed?)
- Tracking battery voltage swings throughout the day (is the solar panel keeping up?)
- Monitoring pressure trends to verify the pump is maintaining adequate PSI
- Diagnosing issues without being connected to the controller all day

Runtime Counters

Counter	Resets	Stored
Runtime Today	At midnight	Temporary (cleared on reboot)
Lifetime	Never (manual reset only)	Device memory (persists across reboots)

These counters are useful for maintenance scheduling and understanding overall pump usage patterns.

Pressure Monitoring (Optional)

PumpLogic supports an optional pressure sensor for monitoring and controlling system pressure. The pressure sensor is disabled by default and can be enabled in Settings.

How PSI Override Works

When the pressure sensor is enabled, PumpLogic adds a PSI override to the normal pump cycling logic:

1. Pressure is read every **30 seconds**
2. If pressure drops below the **PSI Trigger** (default: 40 PSI) and all three base conditions (temperature, schedule, voltage) are met, the pump starts immediately — even if the OFF cooldown has not elapsed
3. The pump runs until pressure reaches the **PSI Trigger + PSI Buffer** (e.g., 40 + 5 = 45 PSI)
4. If the target PSI is not reached within the ON Duration, the pump stops as a safety measure
5. After a PSI-triggered run completes, the system resumes normal cycling

The PSI override does **not** bypass the three base conditions — temperature, schedule, and voltage must all be met before pressure can trigger a pump start. If pressure data becomes stale (no update in over 2 minutes), the PSI override is blocked as a safety measure.

PSI Over Time Graph

When the pressure sensor is enabled, a 24-hour PSI graph is available in the PSI Over Time card. The graph records pressure readings every 15 minutes (96 data points per day) and displays them as a blue line graph. Graph data is saved to device memory and persists across reboots.

Time Synchronization

PumpLogic syncs its internal clock from your device's browser.

How It Works

1. When you load the PumpLogic webpage, your browser checks if the device needs a time sync
2. A sync is triggered if: the device has **never been synced**, OR the last sync was **more than 30 seconds ago**
3. Your browser sends its current date, time, and timezone offset to the device
4. The device sets its internal clock and saves the sync timestamp
5. The page reloads to reflect the updated time
6. Every 5 minutes, the current time is saved to device memory so it can be restored after a reboot

Time Saved on Device

PumpLogic saves the last synced time to device memory. On reboot, the saved time is automatically restored so the pump schedule can operate immediately — even before a browser connects to sync the clock. The restored time will drift slightly (by the duration of time the device was powered off), but is accurate enough for schedule operation until the next browser sync refreshes it.

Set Time

If you do not have a WiFi-capable phone or tablet available to sync time, you can manually set the device clock using the **Set Time** controls in the Network card:

1. Enable the **Set Time** toggle in the Network card
2. Enter the current date and time in the input fields that appear
3. Press **Save Network Settings**

The device clock is set immediately and the time persists across reboots. The Network card label changes to **Last Sync (Forced)** to indicate the time source.

When a browser later syncs time via the normal auto-sync mechanism, Set Time is **automatically disabled** and the label switches back to **Last Sync**. This ensures the device uses the most accurate time source available.

Important Notes

- **Time accuracy** depends on your browser's clock being correct — ensure your phone or computer has the correct date and time
- **After a reboot**, the last saved time is automatically restored from device memory. The time may drift slightly during the time the device was powered off, but is accurate enough for schedule operation until the next browser sync.
- **Set Time** is available for installations where no WiFi-capable device is available. The forced time auto-disables when a browser sync occurs.

• **Sync status** is shown in the Network card under "Last Sync" (or "Last Sync (Forced)" when Set Time is active)

• **"Not synced"** appears if time has never been set and no saved time exists

• **Warning banner:** When time is not synced, a blinking amber banner appears at the top of the Status card: "Time not synced — Refresh the webpage or use Set Time in the Network card to set the clock." The banner disappears automatically once the clock is set.

• **Boot events** are recorded in the event log each time PumpLogic starts. The Detailed Cumulative Report includes a **Boot/Reboot History (48h)** section listing all boot events from the last 48 hours.

Troubleshooting

Cannot Connect to WiFi

Possible Cause	Solution
Wrong network name	Look for **PumpLogic-XXXX** in your WiFi settings (XXXX is unique to your device). If the name was changed, it may be different.
Forgotten password	Use the physical reset button to restore the default WiFi settings. See WiFi Credential Recovery.
Out of range	Move closer to the device — typical range is 10–30 meters (30–100 feet) indoors.
Phone switched to mobile data	Your phone may have automatically switched back to cellular. Check your WiFi settings and reconnect to the PumpLogic network.

Webpage Does Not Load

Possible Cause	Solution
Not on PumpLogic WiFi	Confirm you are connected to the PumpLogic network, not your home WiFi.
Wrong URL	Navigate to **http://192.168.4.1** (not https). Also try **http://pumplogic.local**.
Browser cache	Try a different browser or clear your cache.
Device is still starting up	After a reboot, wait approximately 10 seconds for the device to finish starting, then reconnect to WiFi and try again.

Time Shows "Not synced"

Possible Cause	Solution
Page not fully loaded	Reload the webpage — time syncs automatically on page load.
First boot	If this is the very first time the device has been powered on, time must be synced from a browser or set manually using Set Time in the Network card.

Possible Cause	Solution
Incorrect phone/computer clock	Ensure your phone or computer has the correct date and time — PumpLogic syncs from your browser's clock.
Browser issue	Try a different browser. Ensure your browser allows scripts to run.
No WiFi-capable device available	Use the **Set Time** controls in the Network card to manually enter the date and time.

Pump Won't Start

Check the Status card to verify all conditions are met:

1. Temperature: Is the colored dot green? Green means the temperature condition is met (at/above trigger for Trigger High, at/below trigger for Trigger Low). If the value appears in **amber**, the reading is **stale** — the sensor has not updated recently and the pump is blocked as a safety measure.

2. Schedule: Does "In Schedule" show "Yes"? The current time must be within the operating schedule window.

3. Voltage: Is the colored dot green? (voltage is above the cutoff). A **gray dot** means voltage monitoring is disabled. An **amber** value means the reading is stale.

4. Battery Protection: Does it show "Normal"? If it shows "LOW BATTERY," the pump is disabled until charge recovery completes.

5. OFF Duration: Is the countdown timer still counting down? If so, the system is in its rest period between cycles. Wait for it to reach zero.

6. PSI (if enabled): Is the PSI value displayed in amber? If so, pressure data is stale and the PSI override is blocked.

Pump Runs Continuously or Won't Stop

Possible Cause	Solution
ON Duration too high	Check and reduce the ON Duration setting in the Settings card.
Immediate stop needed	Press **Force OFF** in the Manual Control card to immediately stop the pump.
Schedule End incorrect	Verify the Schedule End time is set correctly in Settings.
On/Off Timer Mode disabled	When cycling is disabled, the pump runs continuously as long as conditions are met. Enable On/Off Timer Mode in Settings to use timed cycles.

Settings Not Saving

Possible Cause	Solution
Button not pressed	Make sure you press **Save Settings** or **Save Network Settings** after making changes.
No confirmation toast	If the green "Settings saved!" notification does not appear, try reloading the page and saving again.
Browser issue	Try a different browser. Some older browsers may not fully support the interface.
Need to recover previous settings	Use **Restore Auto-Backup** in the Settings Management section to recover the last hourly backup.

WiFi Password Forgotten

If you changed the WiFi password and can no longer connect, see WiFi Credential Recovery in the Getting Started section. PumpLogic provides a 3-minute automatic revert window and a physical reset button for recovery.

Graphs Show No Data

Possible Cause	Solution
Too soon after boot	Graph data is recorded every 15 minutes. Wait at least 15 minutes after startup for the first data point to appear.
Sample data displayed	On first boot, sample data is shown. This is replaced with real data after the first 15-minute reading.
Data was cleared	If someone pressed **Reset All Data**, all graph data is erased. New readings will begin accumulating automatically.

Event Log is Empty After Update

The event log format changed in Version 2.0. Existing log entries are automatically cleared on first boot after updating to the new version. This is expected — new events will be recorded going forward.

Device Rebooted Unexpectedly

If PumpLogic appears to have restarted, the built-in **watchdog timer** likely triggered an automatic reboot due to a system hang. This is a safety feature that ensures the device recovers automatically. Check the **Event Log** for blue **Boot** badges showing when reboots occurred, or view the **Detailed Cumulative Report** for a Boot/Reboot History covering the last 48 hours. The **Serial Monitor Log** preserves boot-time messages for diagnostics. The watchdog timeout is configurable in Settings (default: 2 minutes).

PumpLogic — Automated pump control with flexible temperature triggers, configurable cycling, battery protection, pressure monitoring, settings management, and web-based monitoring.