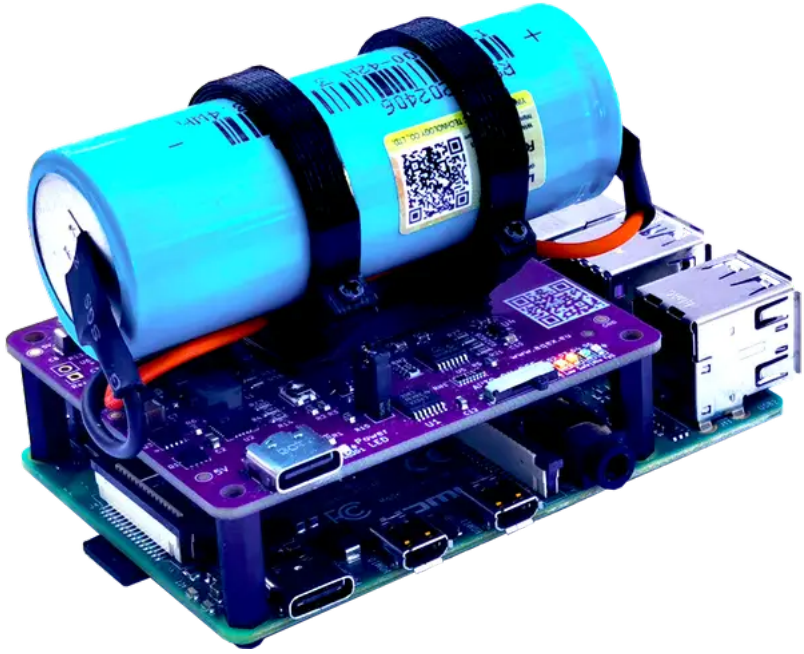
Technical Data Sheet: Stubborn Stamina LF v1.0

Ultra-Durable Industrial LiFePo4 UPS HAT for Raspberry Pi

Official Product Page: https://aqex.eu/stubborn-stamina-lf-raspberry-pi-lfp-ups-hat.html



1. Product Concept & Strategic Advantages

The **Stubborn Stamina LF** is a high-reliability uninterruptible power supply specifically engineered for long-term industrial deployments. By utilizing **LiFePo4 (Lithium Iron Phosphate)** technology, it offers superior thermal stability and significantly higher cycle life compared to standard Li-ion solutions.

The device is available for purchase **with or without a battery cell**, allowing integrators to select the specific capacity required for their application.

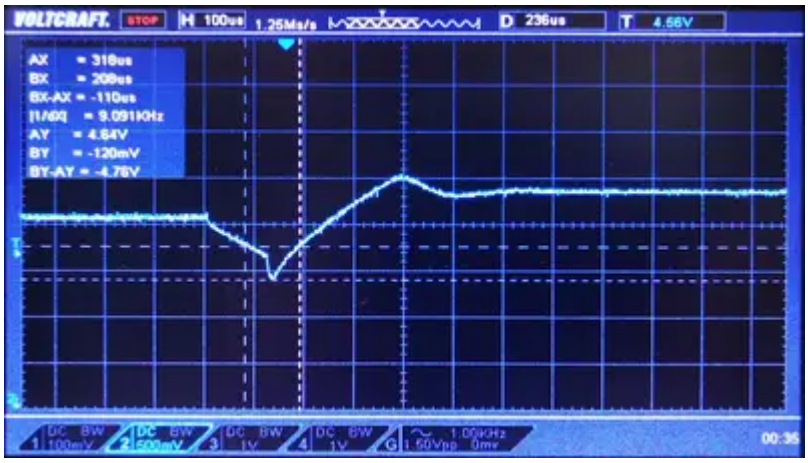
Strategic advantages:

- **Industrial Longevity:** LiFePo4 chemistry ensures thousands of charge cycles and superior thermal stability.
- **Universal Battery Compatibility:** Supports various single-cell (1S) form factors. The modular design allows the use of **18650, 26650, or 32700** cells with matching holders.
- **Flexible Purchasing Options:** Available as a standalone unit or bundled with a **26650 LiFePo4 battery** as the current standard configuration.
- **High Power Delivery:** Specifically designed to handle the peak power demands of the Raspberry Pi 5 (up to 3.5A).
- **Extreme Reliability:** Hardware protection including reverse polarity, deep discharge, and overcharge management.

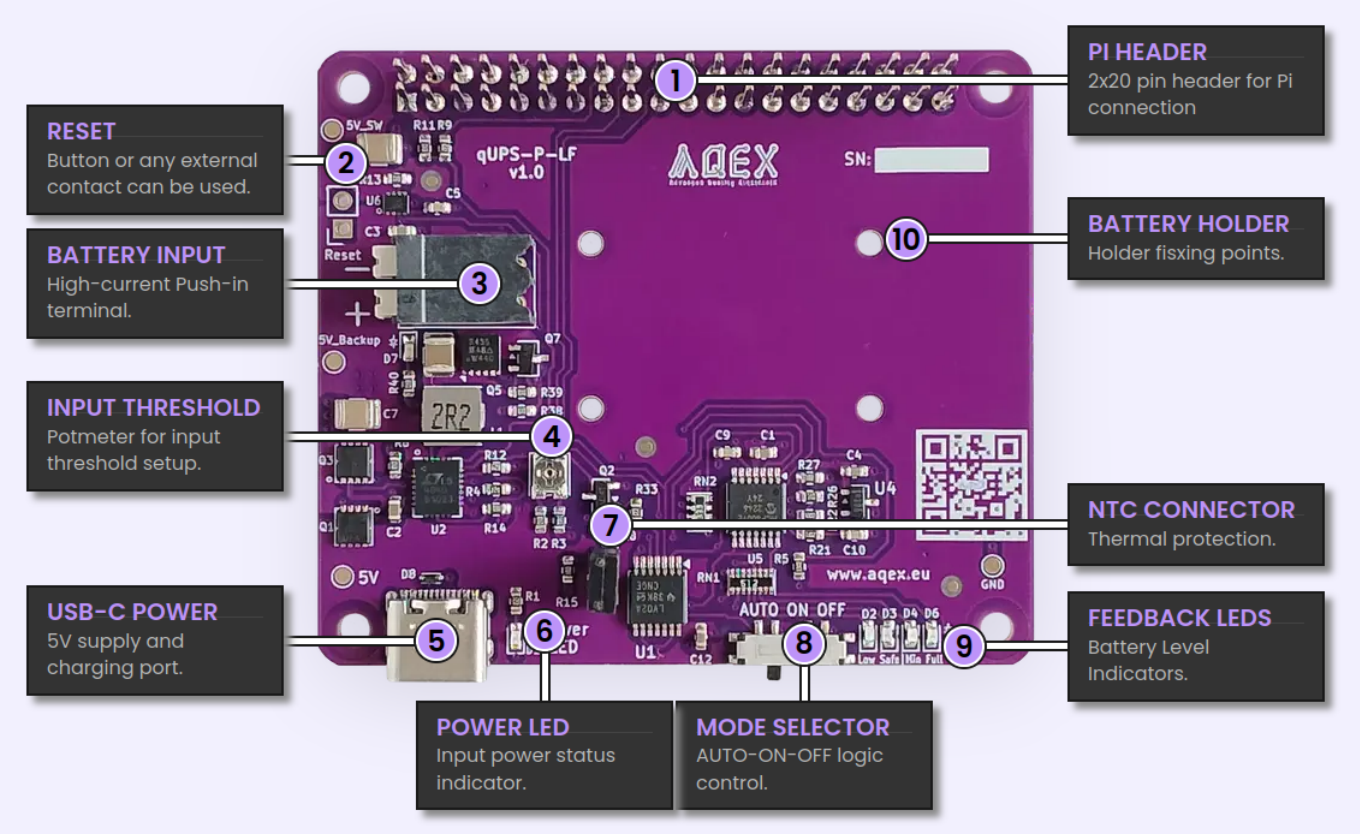
2. Comprehensive Technical Specifications

Parameter	Value	Condition / Detailed Notes
Input Voltage (USB-C)	5.0V – 5.2V	RPi 5 official power adapter compatible
Output Voltage	5.0V DC	Precision regulated for Raspberry Pi
Max Continuous Load	**3.5A**	Enhanced current delivery for RPi 5 + Peripherals
Max Battery Discharge	7.5A	High-rate discharge capability
Charging Current	2A	Fast charging for 18650 LiFePo4 cells
Battery Chemistry	**LiFePo4 ONLY**	Nominal: 3.2V / Charging: 3.6V
Switchover Time	100 – 300 µs	No-reboot guaranteed transition

> **Design Note:** The **Offline topology** ensures almost zero power loss and heat generation during standard operation. A momentary (<1ms) voltage transient occurs during power failure; however, the Raspberry Pi's internal regulation easily filters this, ensuring zero system instability or reboot.



3. qUPS-P-SC User Interfaces and Indicators



4. Battery Management & Protection

Feature	Specification
Protection Circuit	Deep discharge, Overcharge, Reverse Polarity
Thermal Monitoring	Optional NTC connector (5) for temperature-aware charging
Charging Cut-off	Integrated hardware-level voltage monitoring
Low Battery Limit	Automatic load disconnection at critical voltage

> **Warning:** Use only LiFePo4 cells. Connecting standard 3.7V Li-ion batteries may result in incomplete charging or circuit mismatch.

5. User Interfaces & Configuration

5.1 Mode Selection (Switch 4)

- **OFF:** Complete power cut.
- **ON:** Immediate power-up when power (battery or external) is available.
- **AUTO:** Intelligent start-up logic; only boots the Pi when the battery reaches the "Min" energy level.

5.2 GPIO Communication

The system utilizes a 3-pin GPIO interface for OS-level integration. The following pins are used on the 40-pin Raspberry Pi header:

- **PFO (Power Fail): GPIO 23 (Pin 16)** — Signals external power loss (HIGH = OK / LOW = Backup Mode).
- **LIM (Limit): GPIO 24 (Pin 18)** — Signals that the battery has reached the critical low threshold.
- **SHD (Shutdown): GPIO 25 (Pin 22)** — Handshake signal. The UPS cuts power after the OS pulls this pin LOW (or the daemon signals a halt).

6. Visual Diagnostics (LED Indicators)

LED	Color	Status / Meaning
External Power (6)	**Green**	Primary 5V power source detected.
Bad Polarity (9)	**Red**	**CRITICAL:** Battery installed backwards!
Full	Green	Battery fully charged (>3.5V).
Min	Green	Sufficient energy for a safe boot-shutdown cycle.
Safe	Yellow	Sufficient energy for a safe shutdown cycle.
Low	Red	**Critical level.** Immediate shutdown required.

7. Intelligent Power Management (IPM)

- **Safe-Start Logic:** Prevents "brown-out" loops by ensuring the Pi only starts when the battery can support the peak current of the boot process.
- **Shutdown Guard:** Monitors the Pi's state and ensures power is only cut after the operating system has safely unmounted the filesystem.
- **Input Threshold Tuning:** Onboard potentiometer allows adjustment for voltage drops caused by long input cables.

8. Estimated Runtimes (4000mAh LiFePo4)

Raspberry Pi Model	No Load [min]	100% Load [min]
Raspberry Pi 2	535	285
Raspberry Pi 3	428	172
Raspberry Pi 4	413	124
Raspberry Pi 5	**261**	**109**

**Note: Final runtimes are dependent on battery capacity, age, and ambient temperature.*

9. Software Support

- **qups-guard:** Native daemon for automated monitoring and safe shutdown.
- **Compatibility:** Fully compatible with Raspberry Pi OS (Debian-based).
- **Repository:** github.com/aqexhu/qups-guard

HW Version: 1.0 | **Released:** 2026
Manufacturer: AQEX Electronics | aqex.eu