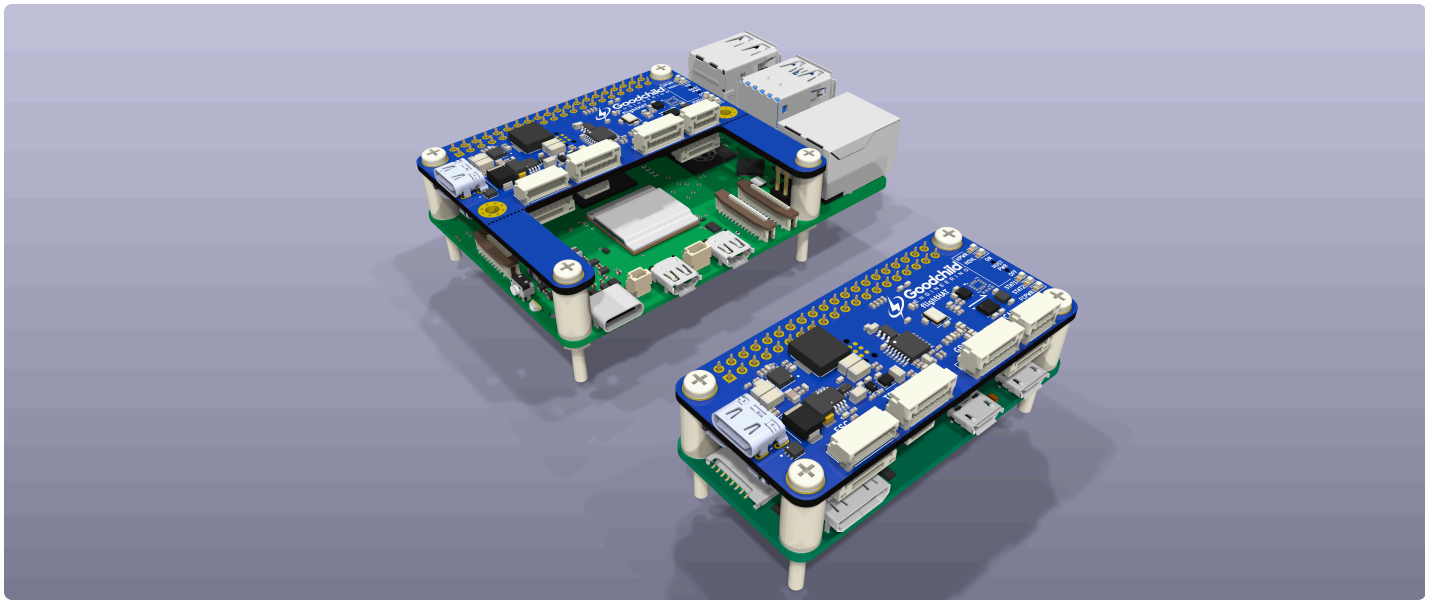
flightHAT

STM32H743 flight controller HAT for Raspberry Pi and compatible single-board computers



flightHAT on a Raspberry Pi 5 (breakaway tabs fitted, left) and on a Raspberry Pi Zero 2 W (tabs removed, right)

Features

- STM32H743 flight controller: Arm Cortex-M7, 480 MHz, 2 MB flash, 1 MB RAM; Pixhawk FMUv6C-based pin map
- ST LSM6DSV16X IMU, ST LPS22HB barometer, ST LIS2MDL magnetometer
- PX4, ArduPilot and Betaflight, each with a flightHAT board target
- Host link on the 40-pin header: UART with RTS/CTS flow control (MAVLink or MSP)
- Host can reflash the flight controller (STM32 ROM bootloader via BOOT0 / NRST)
- 4 × DShot on an 8-pin JST-SH 4-in-1 ESC connector with current and telemetry inputs
- DroneCAN, GPS and TELEM1 on Pixhawk DS-009 JST-GH; RC IN on the Betaflight JST-SH serial connector
- flightHAT and host both run from the ESC connector (2S–6S), like any flight controller
- Input overload switches the host off; the flight controller keeps flying to failsafe
- microSD logging, USB-C, Raspberry Pi HAT+ ID EEPROM
- Pi Zero footprint with breakaway tabs for Pi 4 / 5 mounting; designed for NDAA compliance

Applications

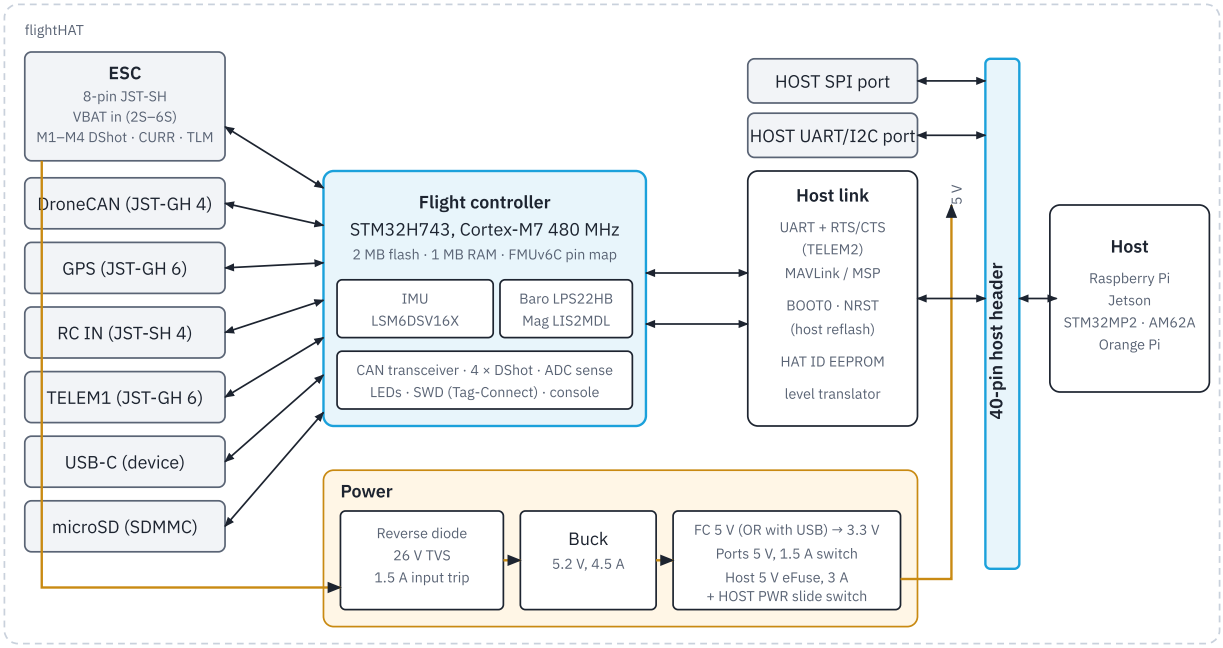
- Autonomous and vision-guided multirotors with a Linux companion computer
- FPV aircraft with HD video, telemetry and networking on the host
- Research, education and prototyping on a Pixhawk-compatible stack
- Ground robots and other vehicles run by PX4 or ArduPilot

Description

flightHAT puts a complete Pixhawk-class flight controller on a Raspberry Pi HAT. The STM32H743 runs PX4, ArduPilot or Betaflight with its own sensors and timing, so flight control never depends on the Linux host, while the host (Raspberry Pi, NVIDIA Jetson, ST or TI dev kit) runs the companion software: vision, autonomy, video and networking.

The two processors share the 40-pin header: a flow-controlled UART carries MAVLink or MSP, and two host GPIOs drive BOOT0 and NRST so the host can update the flight controller firmware in the field. One battery feeds both: the 2S–6S input on the ESC connector supplies a 5.2 V regulator that powers the flight controller, its ports and, through an eFuse and slide switch, the host. Connectors follow the Pixhawk DS-009 standard.

1 Block diagram



2 Specifications

Values apply to hardware revision X1.

2.1 Flight controller

Parameter	Value
MCU	STMicroelectronics STM32H743VIT6, Arm Cortex-M7 with FPU, 480 MHz
Memory	2 MB flash, 1 MB RAM
Reference design	Pixhawk FMUv6C (DS-018), no-IO variant
IMU	ST LSM6DSV16X, SPI
Barometer	ST LPS22HB, I2C
Magnetometer	ST LIS2MDL, I2C
Logging	microSD, 4-bit SDMMC
Motor outputs	4 × DShot
Serial ports	GPS, RC IN, TELEM1 (flow control), host link (flow control), ESC telemetry, console
CAN	1 × CAN (DroneCAN), TCAN1044AV transceiver, 120 Ω termination
USB	USB 2.0 full-speed device, USB-C connector
Real-time clock	None; time from GPS or from the host

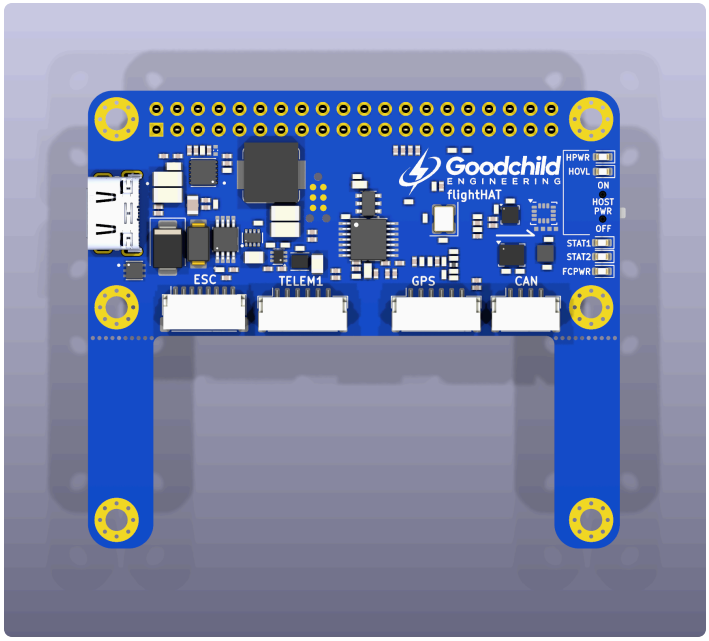
2.2 Power and electrical

Parameter	Min	Typ	Max	Unit
Battery input (ESC VBAT), 2S–6S	6.0		26.1	V
Input current (trip threshold)		1.5		A
Regulator output (+5V2)		5.20		V
Regulator output current, total			4.5	A
Host 5 V output current (eFuse limit)		3.0		A
Peripheral port 5 V, total (current limit)		1.5		A
USB-C input (bench, FC only)		5.0		V
Battery voltage sense range	0		36.3	V
Input current sense range	0		3.2	A
Logic level, ports and host link		3.3		V

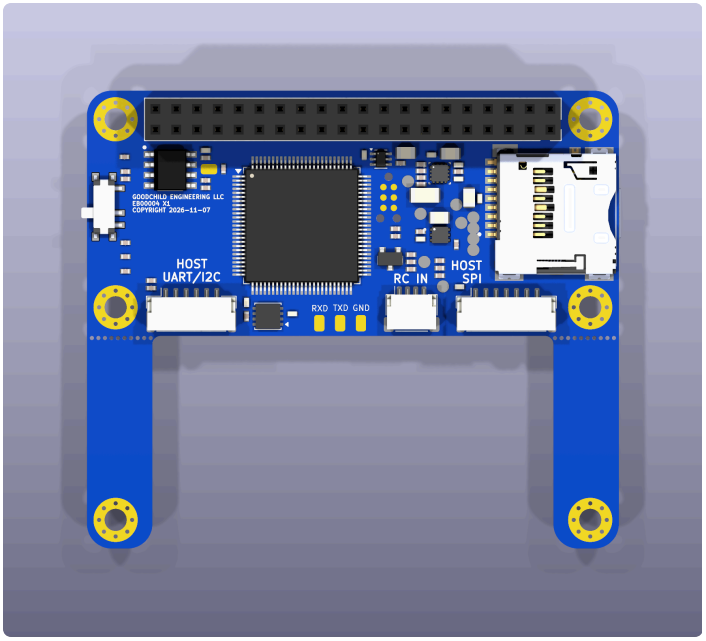
2.3 Mechanical and environmental

Parameter	Value
Board size	65 × 30 mm core; 65 × 56 mm with breakaway tabs
PCB	4 layers, 1.6 mm, ENIG, blue solder mask, IPC Class 2
Mounting	M2.5, Pi Zero pattern (58 × 23 mm) + Pi 4 / 5 pattern (58 × 49 mm)
Stack height	11.1 mm between host and HAT
Weight	TBD
Operating temperature	−20 to +50 °C ambient

3 Board layout



Top side



Bottom side (faces the host)

Item	Side	Location	Section
ESC, TELEM1, GPS, CAN (JST)	Top	Lower edge of the core, left to right, mating faces at the board edge	4.1–4.4
USB-C	Top	Left edge	4.8
LEDs (HPWR, HOVL, STAT1, STAT2, FCPWR)	Top	Right edge	6
HOST UART/I2C, RC IN, HOST SPI (JST)	Bottom	Lower edge of the core	4.5–4.7
Console pads (RXD, TXD, GND)	Bottom	Lower edge, between HOST UART/I2C and RC IN	4.10
microSD	Bottom	Right side	4.9
HOST PWR slide switch	Bottom	Left edge	6
40-pin host header (female)	Bottom	Top edge	5
SWD (Tag-Connect TC2030-NL)	Top and bottom	Two footprints, mirrored	4.11

4 Connectors

The JST-GH ports follow the Pixhawk Connector Standard (DS-009); the ESC and RC IN ports (JST-SH) follow the Betaflight Connector Standard, since DS-009 defines neither. Pin 1 is listed first. Signal directions are seen from the flightHAT. Logic levels are 3.3 V. The 5 V pins of GPS, TELEM1, CAN and RC IN share a 1.5 A current-limited supply that the flight controller can switch off.

4.1 ESC: 8-pin JST-SH (SM08B-SRSS-TB)

Pin	Signal	Dir	Description
1	VBAT	Power in	Battery, 2S–6S. The board's only battery input
2	GND		Ground
3	CURR	In	ESC current sensor (analog)
4	TLM	In	ESC telemetry (UART RX)
5–8	M1–M4	Out	Motor signals, DShot

Betaflight 4-in-1 pin order. ESCs with another order (for example Holybro Kakute / Tekko32, ARK 4IN1) need a re-pinned cable. Contacts are rated 1 A; the input is limited to 1.5 A by the trip.

4.2 TELEM1: 6-pin JST-GH

Pin	Signal	Dir	Description
1	5V	Power out	Port 5 V
2	TX	Out	UART transmit
3	RX	In	UART receive
4	CTS	In	Clear to send
5	RTS	Out	Request to send
6	GND		Ground

Telemetry radio, rangefinder, second GPS, gimbal or other serial device.

4.3 GPS: 6-pin JST-GH (DS-009 Basic GPS)

Pin	Signal	Dir	Description
1	5V	Power out	Port 5 V
2	TX	Out	UART transmit
3	RX	In	UART receive
4	SCL	I/O	I2C clock (external compass)
5	SDA	I/O	I2C data
6	GND		Ground

4.4 CAN: 4-pin JST-GH (DS-009 CAN)

Pin	Signal	Dir	Description
1	5V	Power out	Port 5 V
2	CAN_H	I/O	CAN high
3	CAN_L	I/O	CAN low
4	GND		Ground

DroneCAN; the flight controller is the bus master (node ID allocation). 120 Ω termination on board.

4.5 RC IN: 4-pin JST-SH (SM04B-SRSS-TB)

Pin	Signal	Dir	Description
1	5V	Power out	Port 5 V
2	GND		Ground
3	RX	In	UART receive (from the receiver)
4	TX	Out	UART transmit (receiver telemetry)

Betaflight serial (RX) connector pinout. Serial receivers: CRSF / ExpressLRS, S.BUS.

4.6 HOST SPI: 7-pin JST-GH (DS-009 SPI)

Pin	Signal	Header pin	Description
1	5V	2 / 4	Host 5 V, switched by host 3.3 V
2	SCK	23	Host SPI clock
3	MISO	21	Host SPI data in
4	MOSI	19	Host SPI data out
5	nSS1	24 (CE0)	Chip select 1
6	nSS2	26 (CE1)	Chip select 2
7	GND		Ground

4.7 HOST UART/I2C: 6-pin JST-GH (DS-009 Basic GPS)

Pin	Signal	Header pin	Description
1	5V	2 / 4	Host 5 V, switched by host 3.3 V
2	TX	32	Host UART TX (Raspberry Pi 4 / 5)
3	RX	33	Host UART RX (Raspberry Pi 4 / 5)
4	SCL	5	Host I2C clock
5	SDA	3	Host I2C data
6	GND		Ground

The HOST ports connect to the host only, not to the flight controller. Pull-ups are fitted for the Jetson's unpulled I2C.

4.8 USB-C (Hirose CX90B-16P1)

USB 2.0 device of the flight controller: configuration, firmware update, logs. Sink only: it powers the flight controller for bench work and never powers the host.

4.9 microSD (Yamaichi PJS008-2003-1)

Push-push socket on the 4-bit SDMMC bus for flight logs.

4.10 Console: 3 solder pads, 2.54 mm

RXD, TXD, GND: flight controller debug console (USART3, 3.3 V).

4.11 SWD: Tag-Connect TC2030-NL

Two footprints in parallel (top and bottom): 1 VTref, 2 SWDIO, 3 NRST, 4 SWCLK, 5 GND, 6 SWO (not connected).

5 Host interface (40-pin header)

The 2 × 20 female header mates with a Raspberry Pi-compatible male header. Pins not listed are not connected. Pin 30 is left open because it is a signal on the SK-AM62A-LP.

Pin	Signal	flightHAT function	Pin	Signal	flightHAT function
1, 17	3V3	Host 3.3 V: level translator host side, HAT EEPROM, HOST port enable	2, 4	5V	Host 5 V from the flightHAT eFuse (or from the host); HOST port 5 V
3	GPIO2	HOST UART/I2C: SDA	5	GPIO3	HOST UART/I2C: SCL
8	GPIO14	Host link: flight controller RX (host TX)	10	GPIO15	Host link: flight controller TX (host RX)
11	GPIO17	Host link RTS (optional flow control)	36	GPIO16	Host link CTS (optional flow control)
18	GPIO24	Flight controller BOOT0	29	GPIO5	Flight controller NRST
19	GPIO10	HOST SPI: MOSI	21	GPIO9	HOST SPI: MISO
23	GPIO11	HOST SPI: SCK	24	GPIO8	HOST SPI: nSS1
26	GPIO7	HOST SPI: nSS2	27, 28	ID_SD / ID_SC	HAT ID EEPROM
32	GPIO12	HOST UART/I2C: TX (Pi 4 / 5)	33	GPIO13	HOST UART/I2C: RX (Pi 4 / 5)
GND: 6, 9, 14, 20, 25, 34, 39. Pin numbers and GPIO names are the Raspberry Pi's.					

5.1 Host link

- Flight controller UART5 (TELEM2 in PX4) through a TXU0204 level translator powered by the host's 3.3 V, so an unpowered host is isolated from the flight controller.
- MAVLink for PX4 and ArduPilot, MSP for Betaflight. RTS / CTS flow control where the host supports it.
- Firmware update from the host: the host drives BOOT0 and NRST to start the STM32 ROM bootloader on the same UART.
- The HAT+ ID EEPROM lets Raspberry Pi OS identify the board and load its overlay at boot.

5.2 Compatible hosts

Host	Mounting	Powered by flightHAT	Notes
Raspberry Pi 5	Tabs on (Pi 4 / 5 holes)	Yes (3S or more recommended)	Primary target
Raspberry Pi 4 Model B	Tabs on	Yes (3S or more recommended)	Primary target
Raspberry Pi Zero 2 W	Tabs off (Pi Zero holes)	Yes, any pack	Primary target; needs a 40-pin header fitted. HOST UART not available
NVIDIA Jetson Orin Nano / NX dev kits	Header only	No (header 5 V is output only)	Own 9–20 V supply; flow control needs a pinmux change
STMicroelectronics STM32MP257F-DK	Header only	Yes	Tall connector near one corner
Texas Instruments SK-AM62A-LP	Header only	No (not allowed by TI)	Host link without flow control
Orange Pi Zero 3W, 5 Pro, 5 Max, 5 Ultra, 5 Plus	Varies	Yes	Not NDAA (Chinese maker and SoC)

6 Power

Battery power enters only through the ESC connector. A Schottky diode blocks reverse polarity and a 26 V TVS clamps transients. A current monitor on a 10 mΩ shunt measures the input; above 1.5 A it switches the host 5 V off while the flight controller keeps running (failsafe or land), and the trip clears when the HOST PWR switch is cycled. A synchronous buck makes 5.2 V for three branches:

- **Flight controller:** 5.2 V or USB-C, whichever is present (ideal-diode OR), then a 3.3 V regulator.
- **Peripheral ports:** 5 V through a 1.5 A current-limited switch to GPS, TELEM1, CAN and RC IN.
- **Host:** 5 V through a 3 A eFuse with reverse blocking and over-voltage clamp to header pins 2 / 4, enabled by the HOST PWR slide switch. A host on its own supply cannot back-feed the flightHAT; USB-C never powers the host.

6.1 Available 5.2 V output by battery (calculated)

Pack	4.35 V/cell (HV full)	4.20 V/cell (full)	3.70 V/cell (nominal)	3.00 V/cell (minimum)
2S	11.1 W / 2.14 A	10.7 W / 2.06 A	9.4 W / 1.80 A	7.5 W / 1.44 A
3S	17.0 W / 3.27 A	16.4 W / 3.15 A	14.4 W / 2.76 A	11.5 W / 2.22 A
4S	22.9 W / 4.40 A	22.1 W / 4.24 A	19.4 W / 3.73 A	15.6 W / 3.00 A
5S	23.4 W / 4.50 A	23.4 W / 4.50 A	23.4 W / 4.50 A	19.6 W / 3.78 A
6S	23.4 W / 4.50 A	23.4 W / 4.50 A	23.4 W / 4.50 A	23.4 W / 4.50 A

Input limited to 1.5 A, 0.45 V diode drop, 90 % buck efficiency, 4.5 A regulator limit. The host receives this minus 0.3–0.5 A for the flight controller and ports, and at most 3 A. A Raspberry Pi Zero 2 W runs from any pack; a Raspberry Pi 4 / 5 needs 3S–4S or more, or its own supply.

6.2 Controls and indicators

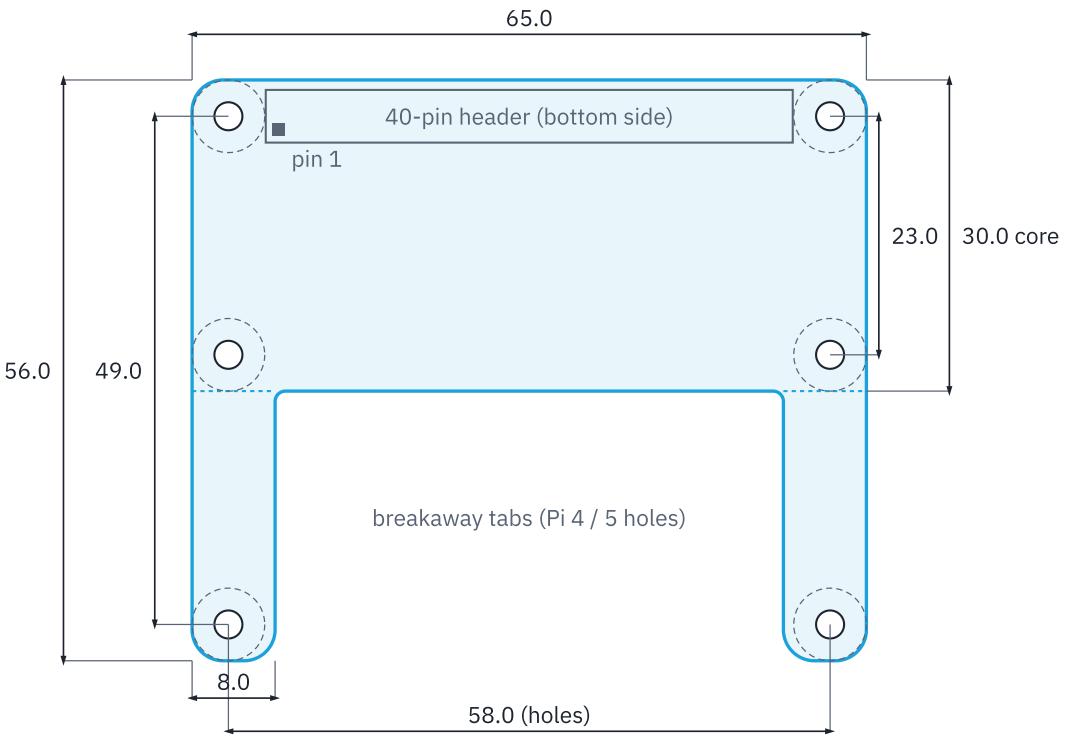
Label	Type	Function
HOST PWR (ON / OFF)	Slide switch	Enables the host 5 V output. Cycling it clears an input over-current trip
FCPWR	LED	Flight controller powered
HPWR	LED	Host 5 V output on
HOVL	LED, red	Input over-current trip: host power switched off
STAT1, STAT2	LEDs	Flight controller status (set by the flight stack)

7 Firmware

Flight stack	Status	Host protocol	Board target
PX4	Primary	MAVLink (TELEM2)	flightHAT target derived from `px4/fmu-v6c`; own bootloader and board ID
ArduPilot	Supported	MAVLink	flightHAT hwdef
Betaflight	Supported	MSP	flightHAT config

- Ground control over the host's network with QGroundControl, Mission Planner or any MAVLink GCS.
- Hardware version and revision are readable by firmware (PX4 HW version: 1 = flightHAT, revision 1 = X1).
- The flight controller has no real-time clock: it takes time from GPS or from the host over MAVLink / MSP.

8 Mechanical



Top view, mm. 6 × Ø2.7 plated holes for M2.5.
Dashed circles: Ø7 keep-out (no parts). Corner radius 3.

Parameter	Value
Core (Pi Zero size)	65.0 × 30.0 mm
With breakaway tabs	65.0 × 56.0 mm
Mounting holes	6 × Ø2.7 mm plated, for M2.5
Hole patterns	58 × 23 mm (Pi Zero), 58 × 49 mm (Pi 4 / 5)
PCB thickness	1.6 mm
Host-to-HAT spacing	11.1 mm (7/16 in)

The tabs snap off along the mouse-bite lines for Pi Zero builds. The female header sits on the bottom side and mates with the host's male header; its body and the host's header base set the 11.1 mm stack, matched by the included spacers.

The Raspberry Pi 5 Active Cooler does not fit under the 11.1 mm stack; use a low-profile passive heatsink.

8.1 Mounting hardware (included)

Qty	Part
4	Nylon round spacer, #4, 3.2 ID × 6.4 OD × 11.1 mm (Bivar 9911-437)
4	M2.5 × 25 mm nylon pan-head screw (Essentra 50M025045P025)
4	M2.5 nylon hex nut (Essentra 04M025045HN)

9 Ordering information

Product	Contents	Order code
flightHAT	flightHAT board and mounting hardware (4 spacers, screws and nuts)	TBD

10 Compliance

- Designed for NDAA compliance
- RoHS compliant
- FCC Part 15 compliant

11 Revision history

Rev	Date	Changes
0.1	2026-11-07	Preliminary release for hardware revision X1

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