ENERCOMP ELECTRONICS

Sarathi V1.2

UAV Flight Controller

User Manual

Hardware revision V1.2 · Manual revision 1.0 · November 2026

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This manual covers the Sarathi V1.2 hardware: what the board is, how to mount, power and wire it, and how to get it flying with PX4 or ArduPilot. Read section 1 before powering the board for the first time.

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1. Safety

- **Remove propellers** whenever the aircraft is powered on the bench, and during setup, calibration and firmware updates.
- **5 V input only.** Supply the board with 4.5–5.5 V on the power-module connector (J1) or USB-C. Never connect a flight battery directly to any connector.
- **J1 pin order is reversed** compared with the common Pixhawk power-module convention: GND is on pins 1–2 and +5 V on pins 5–6. Use the EEPL power module or a cable made for this pinout. A Pixhawk power-module cable will apply reverse polarity.
- **Do not back-feed 5 V.** The board supplies +5 V on pin 1 of the ESC (J5, J14) and CAN (J15) connectors. Leave the +5 V/BEC wire of the mating ESC or CAN device unconnected.
- **3.3 V logic.** All signal pins are 3.3 V. The analogue inputs (J1 pins 3–4, J13) accept 0–3.3 V only and are not 5 V tolerant.
- Handle the board with normal ESD precautions and keep it away from carbon dust, metal debris and moisture.

2. Overview

Sarathi V1.2 is a 4-layer UAV flight controller designed and manufactured in India. It is built around the STMicroelectronics STM32H743 (Cortex-M7, 480 MHz) and carries a 6-axis IMU, a barometer and a magnetometer on board. It drives up to ten PWM outputs, logs to a microSD card, and brings out GPS, telemetry, RC, CAN, I²C and spare UART and ADC ports on JST GH connectors. It is designed to work with EEPL ESCs and the EEPL power module.

Feature	Sarathi V1.2
Processor	STM32H743ZIT6, Cortex-M7, 480 MHz, 2 MB flash, 1 MB RAM
Sensors	TDK ICM-40609-D 6-axis IMU (SPI) · Bosch BMP390 barometer · ST IIS2MDC magnetometer
Outputs	10 PWM: ESC 1–8 (DShot-capable) plus 2 auxiliary
Interfaces	5 UARTs, 1 CAN (FDCAN), external I²C, USB-C, 3 spare ADC, 3 GPIO
Logging	microSD card, 4-bit SDMMC
Power	5 V from USB-C or power module, automatic switch-over

3. Specifications

Parameter	Value
MCU	STMicroelectronics STM32H743ZIT6, LQFP144, 480 MHz, 16 MHz crystal
IMU	TDK InvenSense ICM-40609-D, 6-axis, SPI
Barometer	Bosch BMP390, I²C
Magnetometer	ST IIS2MDC, I²C
PWM outputs	10 (ESC 1–4 on J5; ESC 5–8 and 2 auxiliary on J14). ESC 1–8 support DShot.
Serial ports	5: GPS, telemetry (with RTS/CTS), RC, spare UART, pad-out UART
CAN	1 × FDCAN with NXP TJA1051 transceiver, 120 Ω termination on board
I²C	1 external bus on J9 and on the J10 pad-out (shared)
Analogue inputs	Battery voltage and battery current (J1), 3 spare (J13), 0–3.3 V
GPIO	3 (2 shared with the auxiliary PWM outputs), plus safety switch and buzzer driver
USB	USB-C, USB 2.0 device, ESD protected
Storage	microSD (logs and parameters)
Supply voltage	4.5–5.5 V on J1 (power module) or USB-C; automatic source selection

Parameter	Value
Board current	Budget up to about 0.5 A for the board itself, plus the current of devices powered from its 5 V outputs
Connectors	JST GH, 1.25 mm pitch
Dimensions	58.7 × 49.4 mm, about 1.6 mm thick, 4-layer PCB
Mounting	4 × M3 holes (3.2 mm) on a 48.0 × 39.1 mm pattern
Operating temperature	−40 °C to +85 °C (limited by the sensors)
Ground control software	QGroundControl, Mission Planner

4. Mechanical and mounting

- Board outline 58.7 × 49.4 mm. Four M3 mounting holes (3.2 mm, plated) on a **48.0 × 39.1 mm** pattern. This is not the common 30.5 × 30.5 mm or 45 × 45 mm stack, so plan a matching tray or adapter plate.
- All four mounting holes are connected to GND. Use nylon hardware if the frame must stay isolated from ground.
- **Use soft mounts.** The board has no on-board vibration isolation, so mount it on damping grommets or a damped plate, away from motor and propeller vibration.
- Mount the board flat and close to the aircraft centre of gravity. If it is not mounted in the default orientation, set the board-orientation parameter in the firmware (AHRS_ORIENTATION in ArduPilot, SENS_BOARD_ROT in PX4).
- Keep the magnetometer away from power wiring and motors. If the internal compass is disturbed, use an external GPS/compass on J8 and J9.

5. Power

The board runs from a regulated 5 V supply. It can be powered from the power-module connector J1, from USB-C, or from both at once: an automatic power multiplexer selects the source, so USB can stay connected during setup. An on-board buck regulator produces the 5 V rail and a low-noise LDO the 3.3 V rail for the MCU and sensors.

- For flight, power the board from a power module on J1 that supplies 5 V and reports battery voltage (pin 3) and current (pin 4). Set the voltage and current scaling for your module in the firmware.
- USB-C power is for configuration and firmware loading on the bench. Do not power servos or high-current peripherals from USB.
- GPS, telemetry radio, RC receiver and I²C devices are powered from the board's 5 V outputs. Add their current to the board budget when sizing the power module.

Caution: J1 uses GND on pins 1–2 and +5 V on pins 5–6, the reverse of the Pixhawk power-module convention. Check the cable before connecting.

6. Connector reference

All connectors are JST GH 1.25 mm (mating housings GHR-xxV-S). Pin 1 is marked on the board silkscreen. MCU pin names are given for firmware developers.

Top side

J1 – Power module (6-pin)

Pin	Signal	MCU / function
1	GND	—
2	GND	—
3	BAT_VOLTAGE	PF11, ADC (0–3.3 V)
4	BAT_CURRENT	PA6, ADC (0–3.3 V)
5	+5 V in	supply input
6	+5 V in	supply input

Pin order is reversed compared with the Pixhawk power-module convention.

J7 – Telemetry (6-pin)

Pin	Signal	MCU / function
1	+5 V out	—
2	TELEM_TX	PD1, UART4 TX
3	TELEM_RX	PB8, UART4 RX
4	TELEM_CTS	PB0, UART4 CTS
5	TELEM_RTS	PB14, UART4 RTS
6	GND	—

J5 – ESC outputs 1–4 (6-pin)

Pin	Signal	MCU / function
1	+5 V out	do not back-feed
2	ESC_PWM1	PE9, TIM1 CH1
3	ESC_PWM2	PE11, TIM1 CH2
4	ESC_PWM3	PE13, TIM1 CH3
5	ESC_PWM4	PE14, TIM1 CH4
6	GND	—

J8 – GPS (4-pin)

Pin	Signal	MCU / function
1	+5 V out	—
2	GPS_TX	PE1, UART8 TX
3	GPS_RX	PE0, UART8 RX
4	GND	—

J6 – RC input (4-pin)

Pin	Signal	MCU / function
1	+5 V out	—
2	RC_TX	PC6, USART6 TX
3	RC_RX	PC7, USART6 RX
4	GND	—

J9 – External I²C (4-pin)

Pin	Signal	MCU / function
1	+5 V out	—
2	I2C_SCL	PB6, I2C1 SCL (4.7 kΩ pull-up)
3	I2C_SDA	PB7, I2C1 SDA (4.7 kΩ pull-up)
4	GND	—

Bottom side

J14 – ESC outputs 5–8 and auxiliary (8-pin)

Pin	Signal	MCU / function
1	+5 V out	do not back-feed
2	ESC_PWM5	PA0, TIM5 CH1
3	ESC_PWM6	PA1, TIM5 CH2
4	ESC_PWM7	PA2, TIM5 CH3
5	ESC_PWM8	PA3, TIM5 CH4
6	AUX 9 / GPIO	PB10, TIM2 CH3
7	AUX 10 / GPIO	PB11, TIM2 CH4
8	GND	—

J15 – CAN (4-pin)

Pin	Signal	MCU / function
1	+5 V out	do not back-feed
2	CANL	FDCAN1 via TJA1051
3	CANH	FDCAN1 via TJA1051
4	GND	—

CANL is on pin 2 and CANH on pin 3, the opposite of several Pixhawk-family pinouts. Check the cable.

J12 – Spare UART (4-pin)

Pin	Signal	MCU / function
1	GND	—
2	UART5_RX	PB12
3	UART5_TX	PB13
4	GPIO	PE15

J13 – Spare ADC (4-pin)

Pin	Signal	MCU / function
1	ADC_IN2	PC4 (0–3.3 V)
2	ADC_IN3	PB1 (0–3.3 V)
3	ADC_IN1	PF13 (0–3.3 V)
4	GND	—

Solder pads and service connectors

J11 – Safety switch and buzzer pads

Pin	Signal	MCU / function
1	+3.3 V	—
2	GND	—
3	+5 V	buzzer supply
4	BUZZER−	low-side switched buzzer output (PC3)
5	SWITCH	safety switch input, PE3 (10 kΩ pull-up)
6	GND	—

J10 – Auxiliary pads

Pin	Signal	MCU / function
1	GND	—
2	+5 V	—
3	PO_TX	PE8, UART7 TX
4	PO_RX	PE7, UART7 RX
5	I2C_SCL	PB6, same I²C bus as J9
6	I2C_SDA	PB7, same I²C bus as J9

Other connectors

Ref	Connector	Use
J3	USB-C (USB 2.0 device)	Configuration, firmware loading, MAVLink over USB
J2	microSD socket	Flight logs and parameters (see section 9)
J4	Tag-Connect TC2030-NL	SWD debug for developers: SWDIO, SWCLK, SWO, NRST, 3.3 V, GND
SW1	Slide switch	BOOT0 select for the STM32 USB (DFU) bootloader (see section 10)

7. Motor and servo outputs

Output	Connector / pin	Timer	Typical use
1–4	J5 pins 2–5	TIM1 CH1–4	Motors 1–4 (PWM, OneShot or DShot)
5–8	J14 pins 2–5	TIM5 CH1–4	Motors 5–8 (PWM, OneShot or DShot)
9–10	J14 pins 6–7	TIM2 CH3–4	Servos or auxiliary functions (PWM)

- Outputs 1–4 and 5–8 form two timer groups. All outputs in a group run at the same rate and protocol, so keep motors (DShot) and servos (PWM) in separate groups.
- All outputs have 33 Ω series resistors and are 3.3 V logic, which ESCs and servos accept.
- Outputs 9–10 share pins with GPIO. Their availability as PWM outputs depends on the firmware build; check with Enercomp for your firmware.

- With DShot, ESC throttle calibration is not needed. With PWM ESCs, calibrate the ESCs from the ground control software.

8. Connecting peripherals

Device	Connect to	Notes
GPS / GNSS	J8 (UART8)	Use the Enercomp Pathik GPS or any UBX/NMEA receiver. Connect the GPS compass to J9 (I²C).
Telemetry radio	J7 (UART4)	Full RTS/CTS flow control, suitable for high baud rates. Enable flow control in firmware if your radio uses it.
RC receiver	J6 (USART6)	SBUS, CRSF, DSM and SRXL2 are supported. SBUS works without an external inverter. Select the protocol in firmware.
DroneCAN devices	J15 (CAN)	GPS, ESCs, power monitors and other DroneCAN nodes. The board has 120 Ω termination on board, so place it at one end of the bus and terminate the other end.
I²C sensors	J9 or J10 pads	Both share one bus. Devices must have unique addresses. Run the bus at 100 kHz.
Extra serial device	J12 (UART5) or J10 pads (UART7)	Companion computer, rangefinder, ADS-B receiver and similar.
Analogue sensor	J13	0–3.3 V only, for example an analogue airspeed sensor or RSSI.
Safety switch and buzzer	J11 pads	Switch between SWITCH (pad 5) and GND. Buzzer between +5 V (pad 3) and BUZZER− (pad 4).

9. microSD card

- Insert a microSD card before first use. The board has no on-board flash: **flight logs and parameters are stored on the card**, so the board needs a card to save settings.
- Use a good-quality card (industrial grade recommended) formatted as FAT32.
- If the card fails, both logs and parameters are lost. Save a copy of your parameters from the ground control software after setup.

10. Firmware and first-time setup

Sarathi V1.2 runs PX4 or ArduPilot. All on-board sensors are supported by the standard PX4 and ArduPilot drivers, and the board needs a firmware build made for Sarathi V1.2. Contact Enercomp at sales@enercomp.in for the current build for your autopilot stack.

Loading firmware over USB (DFU)

- Disconnect the flight battery and remove propellers.
- Set the BOOT0 slide switch (SW1) to the boot position and connect USB-C. The board starts in the STM32 USB (DFU) bootloader.
- Load the firmware with QGroundControl, Mission Planner or STM32CubeProgrammer, as directed for your firmware build.
- Set SW1 back to the normal position and re-power the board.

First-time setup checklist

- Set the airframe type and board orientation.
- Calibrate the accelerometer, gyro and compass. The board has no IMU heater, so calibrate at a temperature close to your operating conditions.
- Calibrate the RC transmitter and set flight modes.
- Configure the battery monitor (voltage and current scaling for your power module).
- Set up the outputs: motor order, protocol (DShot or PWM) and servo functions.
- Set failsafes for RC loss, telemetry loss and low battery.

- Check GPS lock outdoors and clear all pre-arm checks before the first flight.

Note: Sarathi V1.2 has a single IMU, a single barometer and a single magnetometer, so there is no automatic sensor failover. Mount the board carefully and keep the calibration current.

11. Status LEDs

LED	Meaning
RGB status LED	Driven by the firmware: arming state, GPS status and warnings, using the standard PX4 or ArduPilot colour patterns
PWR	Board is powered
USB	USB power is present
MUX	Shows which 5 V source the power multiplexer has selected
SYS	System indicator controlled by the firmware

12. Troubleshooting

Symptom	Check
Board not detected on USB	Use a data-capable USB-C cable. Check that SW1 is in the normal position (not boot) unless you are loading firmware.
No power from the power module	Check the J1 cable pin order (GND on pins 1–2, +5 V on pins 5–6) and that the supply is 4.5–5.5 V.
Settings not saved after reboot	A microSD card must be fitted and readable. Re-seat or replace the card.
No GPS data	Confirm the GPS is on J8 with TX and RX the right way round and the baud rate matches. Test outdoors with a clear sky.
DroneCAN devices not found	Check CANL/CANH order on J15 (CANL on pin 2), termination at the far end of the bus, and that CAN is enabled in firmware.
I²C sensor not detected	Check for address clashes between devices on J9 and J10, and that the bus runs at 100 kHz.
Compass errors or poor heading	Move power wiring away from the board, use an external GPS/compass and recalibrate.
ESCs do not arm or respond	Check output protocol and motor order in firmware, ESC ground connection, and that the ESC 5 V wire is not connected to pin 1.

13. Support and revision history

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Specifications may change without notice. Check enercompelec.com for the latest version of this manual.