WhatsNext Systems

PRELIMINARY DATASHEET

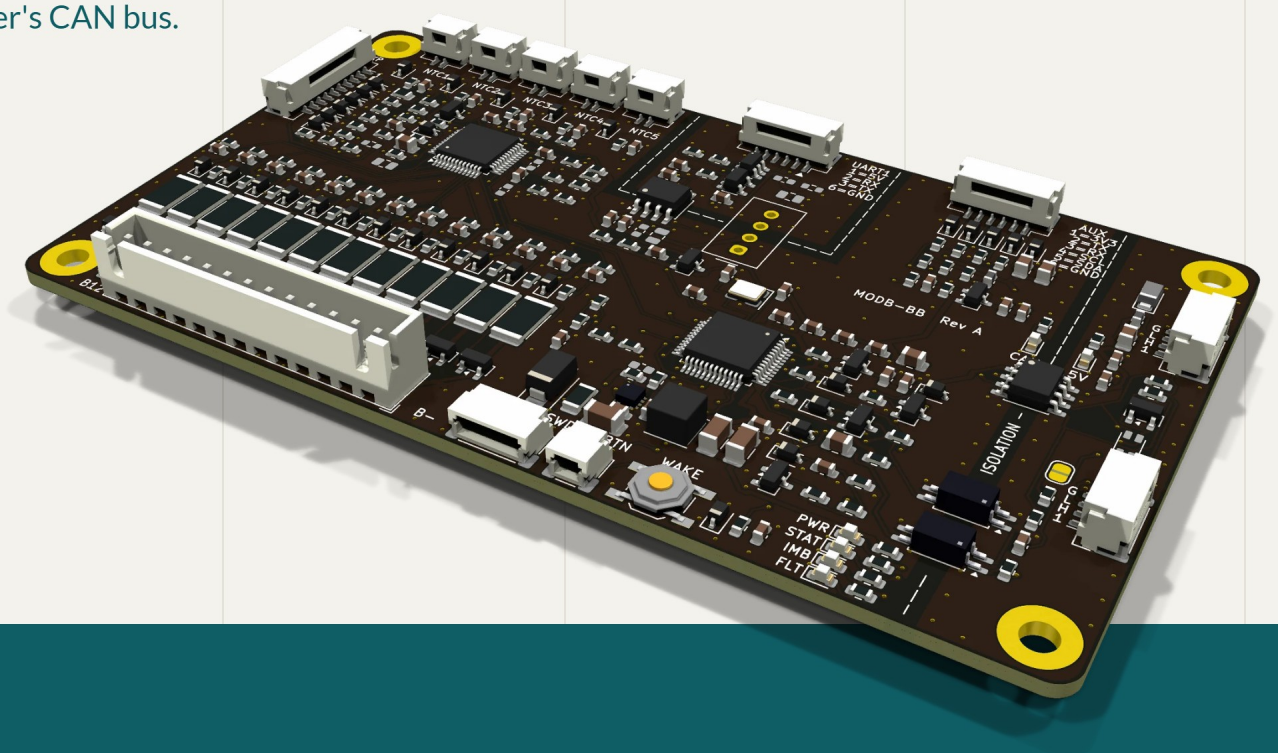
Rev 0.1 · September 2026

MODB-BB · BASE BOARD · REV A

Modular Drone BMS

6S–12S · Isolated CAN · Pixhawk-native

A monitor-and-report battery management system for 6S–12S drone packs. It measures every cell, balances the pack on its own, estimates state of charge and health, and puts all of it on the flight controller's CAN bus.



6–12S
SERIES CELLS · LIPO, LIHV, LI-ION

±5 mV
CELL ACCURACY AT 25 °C (MONITOR IC)

100 mA
BALANCING PER CELL, AUTONOMOUS

5 Mbit/s
ISOLATED CAN FD HARDWARE · 2 PASS-THROUGH PORTS

2–5 µA
SHIP MODE · DESIGN ESTIMATE

–20…85 °C
OPERATING AMBIENT · DESIGN TARGET

> 02 — OVERVIEW

Every cell on the bus.

MODB-BB sits on the pack's balance lead and reports what the flight controller cannot see: every cell voltage, five temperatures, balance state, state of charge and health. It speaks standard DroneCAN over an isolated bus, so the FC needs no custom driver.

01 Stackable

Plug-on modules add current sensing, BLE and a pack switch through the expansion and AUX ports. Several packs share one CAN bus, each under its own battery ID.

02 Isolated CAN, FD-capable

Two latching pass-through ports on one galvanically isolated bus. DroneCAN on classic CAN at 1 Mbit/s; transceiver and MCU support CAN FD to 5 Mbit/s. Cyphal follows.

03 SoC, SoH and history

State of charge from rest voltage per chemistry, or by coulomb counting with the current module. State of health, cycle count, over-discharge count and a fault log in non-volatile memory.

04 Balances on its own

About 100 mA per cell through external FETs, during charge, at rest and in sleep, with no host command. Up to 4 cells at once; firmware stops it above ~75 °C.

05 Protection in silicon

Cell over- and under-voltage, over- and under-temperature on all 5 NTCs and open-wire detection run in the BQ76952. The MCU loads the thresholds at wake; detection then runs without it.

06 Pixhawk-native

JST-GH connectors in Pixhawk DS-009 pin order, so standard 1:1 cables fit. Standard DroneCAN battery messages, so ArduPilot and PX4 need only stock parameters.

07 Micro-amp ship mode

Ship mode draws 2–5 µA (design estimate): the BMS is never why a stored pack runs flat. It wakes on a button press or when the CAN bus powers up.

08 Built for airframes

Latching JST-GH on every data port, 4-point M3 mounting, designed for −20 to +85 °C. Built toward RTCA DO-160G practice; not certified.

> WHAT IT IS

A monitor, balancer, fuel gauge and CAN node for 6S–12S packs. It mounts inside the pack as a smart-battery board, or on the airframe on the balance lead.

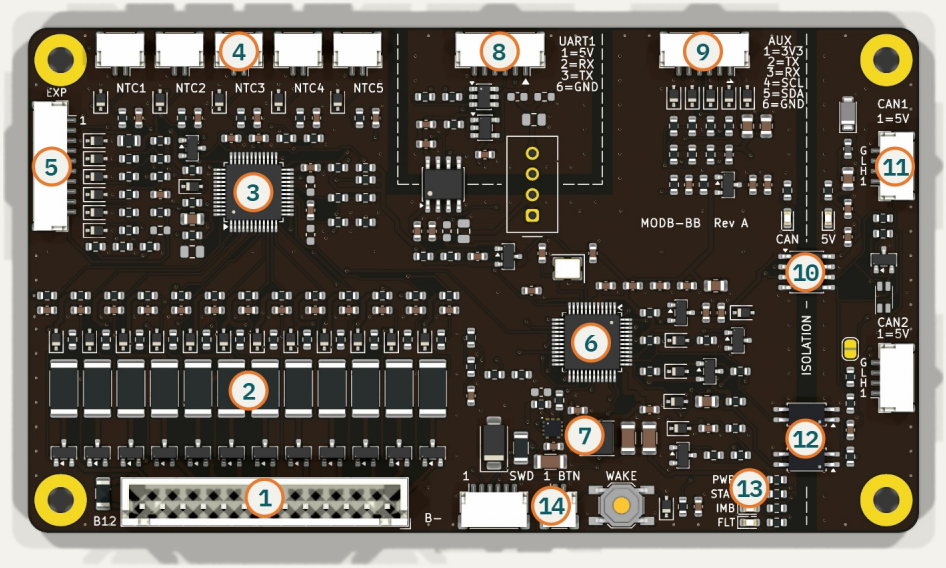
> WHAT IT ISN'T

A power switch. No power MOSFETs and no main-current path on the board, so it cannot cut power in flight. It detects, reports and alarms; switching and current sensing are plug-on modules.

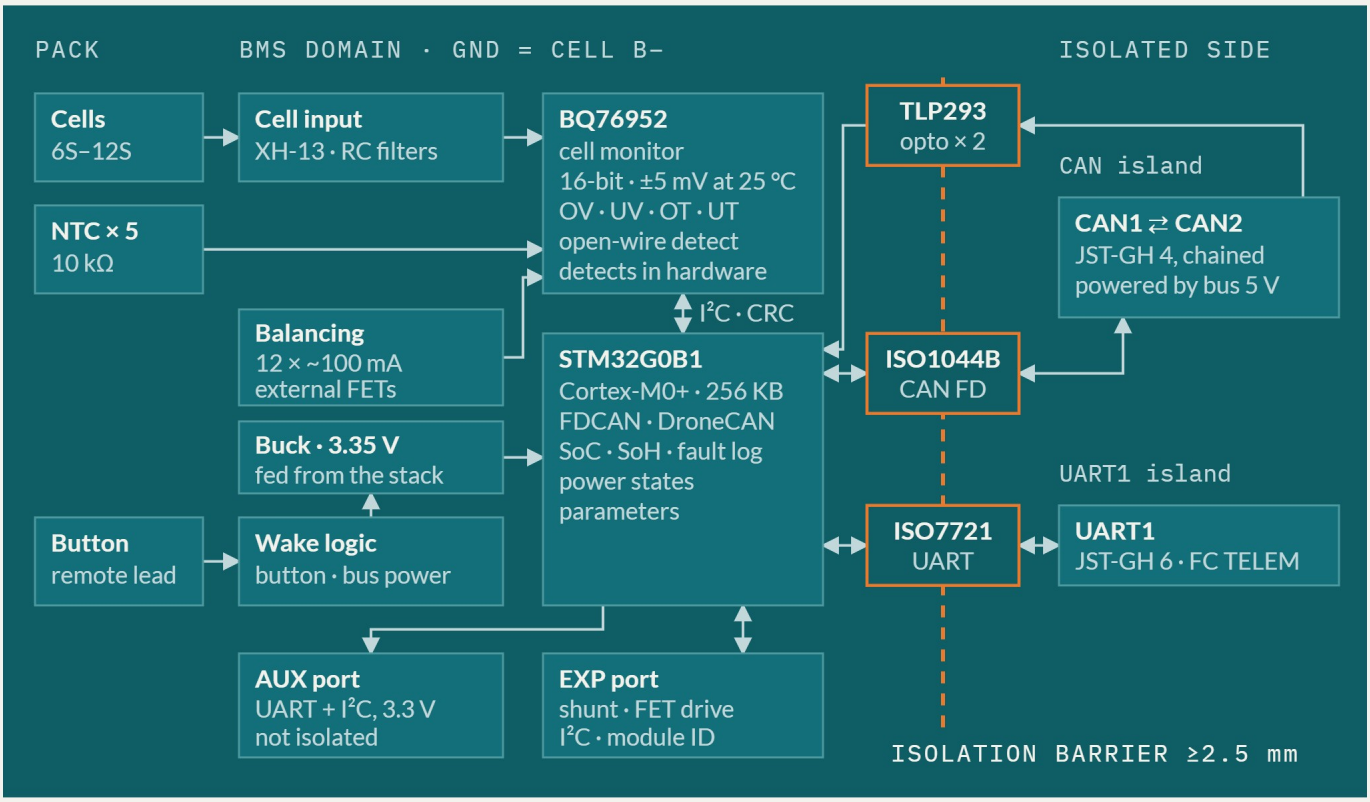
> 03 — ARCHITECTURE

One board. Three ground domains.

The BMS side is referenced to the pack's cell negative. CAN and UART1 each sit on their own isolated island, so no ground current can flow between the pack and the flight controller through a data cable.



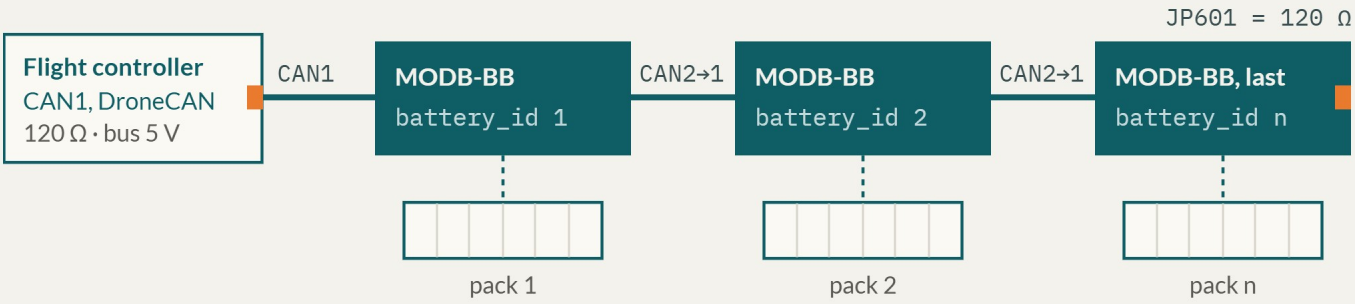
1 Cell input, JST-XH 13
2 Balancing, 12 × 100 mA
3 BQ76952 monitor
4 NTC1–NTC5 ports
5 Expansion port (modules)
6 STM32G0B1 MCU
7 3.35 V buck, stack-fed
8 UART1, isolated island
9 AUX port, not isolated
10 ISO1044B, on the barrier
11 CAN1 / CAN2, isolated
12 Bus-power wake optos
13 PWR · STAT · IMB · FLT
14 SWD, button, WAKE



04 — INTEGRATION

Plugs into the aircraft you fly.

Standard connectors, standard messages. The flight controller treats each MODB-BB as a DroneCAN smart battery; a dock or ground station on the same bus reads the same data.



CAN1 and CAN2 pass straight through: one JST-GH 4 cable per hop. Terminate only the two ends (orange), the FC and the last pack (close JP601). The FC's bus 5 V powers each isolated CAN side and wakes the packs.

INSIDE THE PACK

Smart-battery build: the cell harness is crimped to the BMS and the board travels with the pack. Only the CAN lead and wake-button lead leave the wrap.

ON THE AIRFRAME

The BMS stays on the frame and plugs into the pack's balance plug through an adapter lead matched to the cell count. Packs stay stock.

WHAT THE FLIGHT CONTROLLER SEES

DroneCAN message	Content
`BatteryInfo · 1092`	Pack voltage, current[1], temperature, SoC, SoH, capacity, status flags, battery_id
`BatteryInfoAux · 20004`	Every cell voltage, cycle and over-discharge counts, is_powering_off
`NodeStatus, NodeInfo`	Health, uptime, firmware version, board revision
`param.*`	Cell count, capacity, chemistry, battery_id, thresholds, NTC map

[1] No current module: reported as not available (NaN), never 0 A. Firmware is in development; this is the design specification, to be validated with ArduPilot and PX4 on Alpha units.

ARDUPILOT

```
CAN_P1_DRIVER = 1
CAN_D1_PROTOCOL = 1
BATT_MONITOR = 8
BATT_SERIAL_NUM = battery_id
```

Next pack: BATT2_MONITOR = 8 and BATT2_SERIAL_NUM.

PX4

```
UAVCAN_ENABLE = 2
UAVCAN_SUB_BAT = 1
```

FOR DOCK BUILDERS

- **Wake on contact.** Powering the dock's CAN bus wakes the pack. No button press.
- **Charge on cell data.** Every cell voltage and temperature is live on the bus. Terminate on the highest cell, not on pack voltage.
- **Balance while docked.** Balancing runs on its own during charge and at rest; the dock sends no command.
- **The dock owns the charger.** The base board does not switch or limit charge current.

> 05 — SPECIFICATIONS

Electrical characteristics

MODB-BB Rev A, variant V01. Monitor figures are from the TI BQ76952 datasheet. Values marked "design estimate" are calculated and will be confirmed on Alpha hardware.

OPERATING CONDITIONS		
Series cells	6 to 12	Solder jumpers plus a parameter; supplied as 12S
Cell chemistry	LiPo · LiHV · Li-ion	4.20 V · 4.35 V · down to 2.5 V per cell
Stack voltage	15.0 to 52.2 V	6S × 2.5 V to 12S × 4.35 V
Input protection	58 V TVS, fuse	SMAJ58A behind 10 Ω; 0.5 A, 63 V fuse
Operating temperature	−20 to +85 °C	Design target, not yet tested; WAKE switch SW401 rated +70 °C
Storage temperature	−40 to +85 °C	

MEASUREMENT		
Cell voltage accuracy[1]	±5 mV	25 °C, 2 to 5 V, after offset calibration
	±10 mV	0 to 60 °C
	±15 mV	−40 to +85 °C
Cell ADC	16 bit	2.93 ms per conversion (1.46 ms fast mode)
Temperature inputs	5 × NTC	10 kΩ, B ≈ 3435 K; OT and UT on all 5 in hardware
Board temperature	2 sensors	Balancer NTC and monitor die
Pack current	with MODB-CS	Shunt into SRP/SRN, ±200 mV; not on the base board

CELL BALANCING		
Method	External N-FET	51 Ω, 1 W resistor per cell (TI SLUAA81 topology)
Balance current	≈100 mA	Per cell at 4.2 V: ≈82 mA external + ≈18 mA internal
Cells at once	up to 4	Default limit; 0.35 W each, ≈1.5 W total
Active in	charge, rest, sleep	Autonomous in the monitor; no host command
Thermal stop	≈75 °C	Firmware, from the balancer NTC (MCU ADC)

SUPPLY AND CURRENT CONSUMPTION		
Supply	From the cell stack	Loads all cells equally; LMR36506 buck to 3.35 V, 0.6 A
ACTIVE, 3.3 V load	≈23 mA	Design estimate; excludes any AUX module
STANDBY	35–50 µA + MCU	Design estimate + MCU STOP; PWR LED +60–120 µA
SHIP	2–5 µA	Design estimate at 25 °C; rises with temperature
AUX 3.3 V output	150 mA max	Switched, off in STANDBY and SHIP; ≈100 mA on V02
EXP 3.3 V output	100 mA	PTC-protected, always on

[1] Monitor IC specification. Board-level accuracy, including harness resistance, will be characterised on Alpha units.

> 06 — FUNCTIONAL DESCRIPTION

How it behaves

STATE	Monitor	MCU · ports	Balancing	Draw	Leaves on
ACTIVE	NORMAL	Running, CAN on	Charge, rest	≈23 mA at 3.3 V	Bus off, then idle time-out
STANDBY	SLEEP	STOP, ports off	Continues	35–50 µA + MCU + LED	Button, bus, alert, timer
SHIP	SHUTDOWN	Unpowered	Off	2–5 µA	Button, bus power

Stays ACTIVE while the CAN bus is powered. SHIP follows a 5 s button press, a CAN command, a long idle or a low-cell storage limit, after publishing is_powering_off. Currents are design estimates; the PWR LED adds 60–120 µA in STANDBY.

ISOLATED INTERFACES		
CAN transceiver	**ISO1044B**	3 kVrms part rating; functional, not safety, isolation
CAN data rate	**1 Mbit/s**	Classic CAN at launch; hardware is CAN FD-capable to 5 Mbit/s
CAN bus-side supply	**4.5–5.5 V**	From the bus 5 V pin; up to ≈70 mA while transmitting
CAN bus protection	**±58 V fault**	±12 V common mode, TXD time-out, TVS per line
UART1 isolator	**ISO7721**	3.3 V logic on the isolated side, powered from pin 1 (5 V)
Barrier spacing	**≥2.5 mm**	Copper to copper, every layer (V01)

DETECTION	Enforced by
Cell over- and under-voltage	Monitor hardware
Over- and under-temp, NTC1–5	Monitor hardware
Open cell tap	Monitor hardware
Over-current, short circuit	Monitor, with MODB-CS
NTC open or shorted	Firmware, sensor fault
Cell count vs setting	Firmware, every boot
Config, stale data, hang	Read-back, CRC, watchdog
CAN bus lock-up	Transceiver time-out

The MCU loads thresholds at every wake and verifies them. No power FETs on board: faults go to CAN and the FLT LED.

STATE OF CHARGE AND HEALTH

Base board alone
SoC from rest voltage and a per-chemistry table. The uncertainty is published with it.

With MODB-CS
Coulomb counting with voltage correction. SoH from capacity fade, cycles and internal resistance.

Always
Cycle count, over-discharge count and fault log in flash.

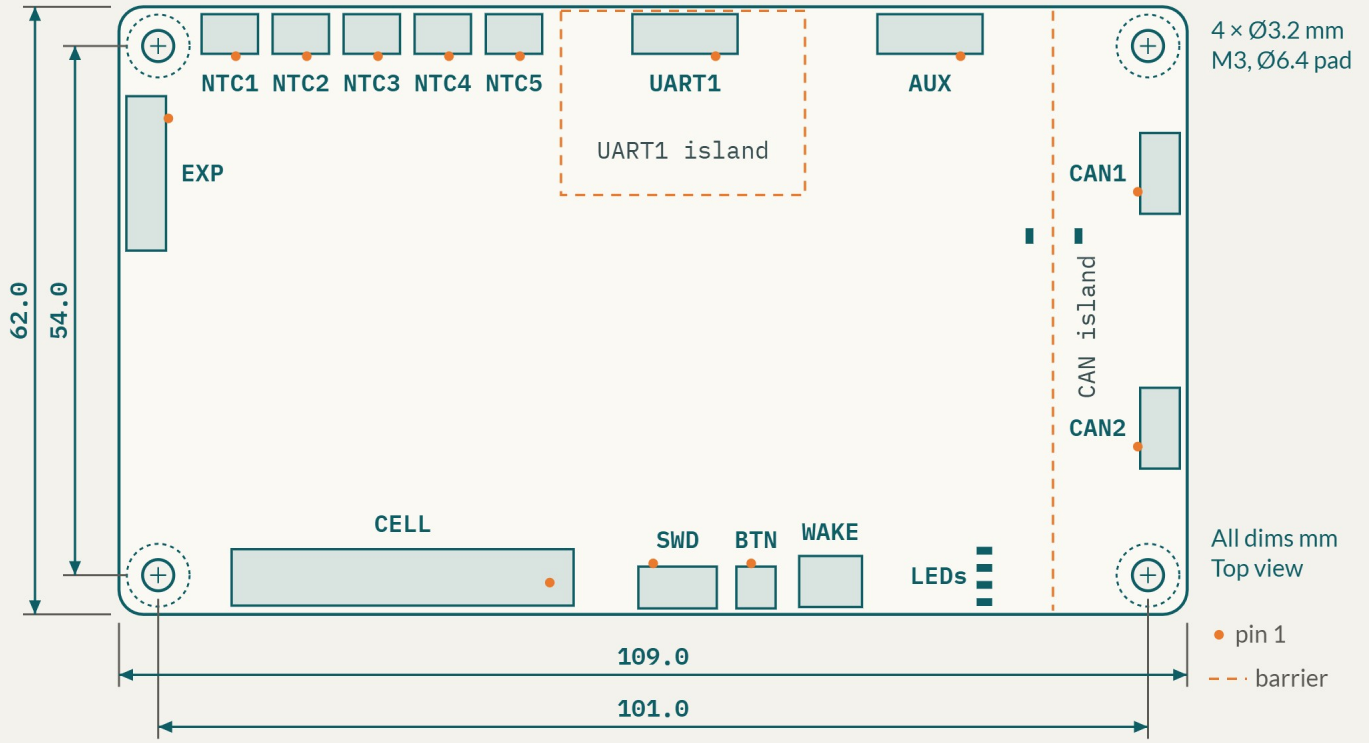
LED	Shows
PWR green	3.3 V rail on
STAT green	1 Hz heartbeat in ACTIVE
IMB amber	On: imbalance over limit. Blink: balancing
FLT red	On: latched fault. Blink code: fault class
CAN orange	Frame traffic
5V blue	CAN bus 5 V present

CELLS	Close (bottom side)	Source
6S	JP205–JP210	JP220
7S	JP206–JP210	JP221
8S	JP207–JP210	JP222
9S	JP208–JP210	JP223
10S	JP209, JP210	JP224
11S	JP210	JP225
12S	none	JP226 •

• JP226 is bridged at the factory (12S). For 6S–11S: cut JP226, close the listed jumpers and set the cell-count parameter; balance resistors for positions N−1 to 10 stay unfitted.

> 07 — CONNECTORS AND MECHANICAL

Outline and pinout



PCB 1.6 mm, 4 layers, FR-4 TG155, ENIG · all parts on top · ≈7 mm tall at the JST-XH header, ≤4.5 mm elsewhere · XH pins ≈1.8 mm below (3D model) · weight: to be measured on Alpha units

CELL · J201 JST-XH 13

1	B0, pack −
2…N−1	B1 … B(N−2)
12	B(N−1)
13	BN, pack top

N-cell harness. 12S uses pins 1–13 in order.

BTN · J401 JST-SH 2

1	WAKE_BTN
2	GND (BMS)

Pin 1 rests near stack voltage: use an insulated switch.

EXP · J806 JST-GH 10

1	SRP, shunt +
2	SRN, shunt −
3	VSS
4	3V3, PTC
5	SDA
6	SCL
7	MOD_ID
8	DCHG
9	DDSG
10	PACK_SENSE

BMS ground. For MODB modules only.

CAN1, CAN2 JST-GH 4

1	5 V from FC
2	CAN_H
3	CAN_L
4	GND, isolated

NTC1–5 JST-GH 2

1	NTC
2	GND (BMS)

NTC1–3 also on bottom pads.

SWD · J501 JST-SH 6

3V3 · CON_TX · CON_RX · SWDIO · SWCLK · GND

Pixhawk Debug Mini. Bench use only.

UART1 · J751 JST-GH 6

1	5 V in (V01)
2	RX, from FC TX
3	TX, to FC RX
4–5	NC
6	GND, isolated

1:1 cable to a Pixhawk TELEM port.

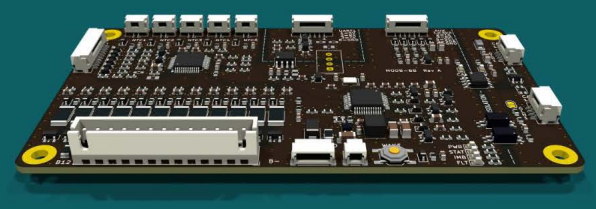
AUX · J701 JST-GH 6

1	3V3 out, 150 mA
2	TX
3	RX
4	SCL
5	SDA
6	GND (BMS)

Not isolated. Modules only, never the FC.

> 08 — MODULES AND ORDERING

Start with the base board. Add what the aircraft needs.



BASE BOARD · REV A ALPHA BUILD

Monitor, balancer, gauge and CAN node. The expansion and AUX ports are reserved for the modules below, so adding one needs no new base board.

MODB-CS on EXP

Current sensor

Low-side Kelvin shunt into the monitor's coulomb counter, planned for 150–200 A packs. Adds coulomb-counted SoC and hardware over-current and short-circuit detection.

MODB-FET on EXP

Pack switch

External MOSFETs driven by the monitor's DCHG/DDSG outputs: a disconnect path that does not depend on the MCU. Planned default in flight: warn only.

MODB-BLE on AUX

Bluetooth link

Configuration and live telemetry from a phone or laptop, using the same parameters as DroneCAN.

All three modules are planned. Their interfaces are already fixed on the Rev A base board.

VARIANTS AND ORDERING

MODB-BB-A-V01	Standard. UART1 is powered by the FC's TELEM 5 V.
MODB-BB-A-V02	Isolated 5 V out on UART1 pin 1 for sensors. Never connect it to an FC.
Cell count	6S to 12S, set at assembly; default 12S.
Firmware	In development: DroneCAN first; CAN bootloader, Cyphal and CAN FD follow.

ENVIRONMENT AND BUILD

Designed for −20 to +85 °C operating, −40 to +85 °C storage; to be tested

Designed toward RTCA DO-160G; not certified

Acrylic conformal coat (IPC-CC-830) for flight builds; Alpha units ship uncoated

Alpha: JST-compatible XUNPU headers on SWD, CAN and NTC ports

COMING NEXT MODB-SB: a compact 6S–10S version, 70 × 70 mm target, in design.

Building a drone and the power layer is in your way? Write to us.

> hello@whatsnext.systems

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Datasheet Rev 0.1, 15 September 2026: first preliminary release for MODB-BB Rev A, layout R3. Preliminary information: specifications are design targets and may change without notice. © 2026 WhatsNext Systems.