PRODUCT DATASHEET | RELEASE 1.1

# INS / IMU Navigation Module

Enclosed GNSS-aided inertial navigation module with dual DroneCAN buses for vehicle and autopilot integration.




| CAN1 FD | CAN2 | Node ID | HW Rev |
|---|---|---|---|
| 1 / 2 Mbps DroneCAN | Classic CAN 1 Mbps | Default 1 / range 1-125 | INS-CAN R1.1 + IMU-A R1.2 |

Release 1.1 publishes connector, bus protocol and onboard sensor configuration for the V6X000 firmware profile. Electrical ratings, mechanical envelope and navigation-accuracy claims remain outside this datasheet.

SECTION 01

# IMU, Gyro and GNSS Specifications

Configured startup ranges and interface facts from the V6X000 / HBQ_IMU_A firmware profile and INS-CAN carrier design.

### Accelerometer

| Device | Full-scale | ODR / notes |
|---|---|---|
| **ICM-42688-P** | +/-16 g | ODR 8 kHz; FIFO |
| **BMI088** | +/-24 g | 1600 Hz; FIFO |
| **ICM-45686** | +/-32 g | ODR 6.4 kHz; FIFO |
| **IIS3DWBTR** | +/-16 g | ODR 26.7 kHz; 0.488 mg/LSB; all axes |

### Gyroscope

| Device | Full-scale | ODR / notes |
|---|---|---|
| **ICM-42688-P** | +/-2000 deg/s | ODR 8 kHz; FIFO |
| **BMI088** | +/-2000 deg/s | 2000 Hz; bandwidth 532 Hz; FIFO |
| **ICM-45686** | +/-4000 deg/s | ODR 6.4 kHz; FIFO |

### GNSS / GPS

| Item | Specification |
|---|---|
| **Receiver module** | u-blox MAX-M10N (onboard carrier) |
| **Function** | Concurrent multi-GNSS positioning aid |
| **DroneCAN outputs** | uavcan.equipment.gnss.Fix / Fix2 / Auxiliary |
| **Default publish rate** | 5 Hz via DRCANFD_RATE_GNSS (0-20 Hz) |
| **Estimator coupling** | GNSS-aided EKF2 attitude / position when fix is valid |

### Sensor fusion (firmware)

| Item | Specification |
|---|---|
| **Primary estimator** | EKF2 |
| **Estimated states** | Attitude, local/global position, odometry |
| **Monitoring model** | Innovation, status, bias and reset counters |
| **Magnetometer path** | MagneticFieldStrength published at default 50 Hz |

Range and ODR values above are firmware startup configuration. They are not navigation-accuracy, RTK or vibration-qualification claims.

SECTION 02

# Product Identity and Mechanical Form

The module is an enclosed navigation-sensor assembly. Photographs support mechanical recognition and mounting orientation only.




Top view and open enclosure showing carrier board with GNSS module and raised IMU daughterboard.

| Item | Specification |
|---|---|
| **Product name** | INS / IMU Navigation Module |
| **Hardware basis** | INS-CAN Rev1.1 + IMU-A Rev1.2 |
| **Firmware board target** | px4_fmu-v6x-hbq_default |
| **IMU startup profile** | V6X000 / HBQ_IMU_A |
| **External connector** | SP13 female, 9-pin circular |
| **Installation rule** | Wire SP13 per released pin map; keep mounting orientation consistent with firmware |

### CAN1 DOMAIN

dronecan_fd service. DroneCAN CAN FD at 1 Mbps nominal and 2 Mbps data. Node ID DRCANFD_NODE_ID, default 1.

### CAN2 DOMAIN

uavcan service. DroneCAN classic / CAN 2.0B at 1 Mbps with no FD. Node ID UAVCAN_NODE_ID, default 1.

SECTION 03

# Connector Interface

External interface is an SP13 female circular connector. Pin 1 is marked on the connector face. Wire only the signals required by the host.




| Pin | Signal | Description |
|---|---|---|
| 1 | VIN | Power input |
| 2 | CAN1_P | CAN1 High / Positive |
| 3 | CAN1_N | CAN1 Low / Negative |
| 4 | GND | Ground |
| 5 | CAN2_P | CAN2 High / Positive |
| 6 | CAN2_N | CAN2 Low / Negative |
| 7 | UART_TX / I2C_SDA | UART TX or I2C SDA |
| 8 | UART_RX / I2C_SCL | UART RX or I2C SCL |
| 9 | GND | Ground |

SP13 female connector with released 9-pin assignment.

Minimum bring-up wiring: pin 1 VIN, pins 4/9 GND, and the selected CAN pair (CAN1 pins 2/3 or CAN2 pins 5/6). Keep unused UART/I2C pins isolated unless the application uses them.

SECTION 04

# CAN Protocol and Publication Rates

CAN1 provides the released DroneCAN message contract and configurable publication rates. Decode with matching DroneCAN DSDL types.

| Item | Specification |
| --- | --- |
| **Default enable state** | DRCANFD_ENABLE=1; UAVCAN_ENABLE=1 |
| **Node ID range** | 1-125 on each bus; reboot required after change |
| **Public protocol scope** | DroneCAN only |
| **Verify commands** | param show DRCANFD_ENABLE / UAVCAN_ENABLE; dronecan_fd status; uavcan status |

| Message group / data type | Default | Parameter / range |
| --- | --- | --- |
| **uavcan.equipment.ahrs.RawIMU** | 100 Hz | DRCANFD_RATE_IMU 0-400 Hz |
| **uavcan.equipment.ahrs.Solution** | 50 Hz | DRCANFD_RATE_ATT 0-200 Hz |
| **uavcan.navigation.GlobalNavigationSolution** | 10 Hz | DRCANFD_RATE_NAV 0-50 Hz |
| **MagneticFieldStrength / MagneticFieldStrength2** | 50 Hz | DRCANFD_RATE_MAG 0-200 Hz |
| **GNSS Fix / Fix2 / Auxiliary** | 5 Hz | DRCANFD_RATE_GNSS 0-20 Hz |
| **device.Temperature** | 5 Hz | DRCANFD_RATE_TEMP 0-50 Hz |
| **Air-data / range / arming / debug groups** | 1-10 Hz | DRCANFD_RATE_AIR / RNG / ARM / DBG |

Publication rate on CAN differs from internal IMU sampling rate. Change one rate group at a time and confirm with dronecan_fd status.

SECTION 05

# Integration, Ordering and Notes

Use the released firmware profile and SP13 pin map. Keep RC/host failsafe policy independent of optional application software.

### Bring-up sequence

- Mount using the four enclosure ears; keep orientation consistent with firmware configuration.
- Wire SP13: VIN (pin 1), GND (pins 4/9) and the selected CAN pair. Do not rewire while powered.
- Flash px4_fmu-v6x-hbq_default through QGroundControl, then reboot fully.
- Select CAN1 (FD adapter) or CAN2 (classic CAN). Set a unique Node ID on the chosen bus if required.
- Confirm enable flags, status commands and expected message rates before application use.

| TYPICAL USE | SOFTWARE / TOOLING |
|---|---|
| - Autopilot sensor-node integration over DroneCAN<br>- GNSS-aided attitude and navigation publishing<br>- Dual-bus architectures with FD and classic CAN<br>- Field bring-up and bus diagnostics | - Firmware target: px4_fmu-v6x-hbq_default<br>- QGroundControl parameter editor<br>- dronecan_fd status / uavcan status<br>- DroneCAN DSDL-compatible decoders |

### Ordering information

| Model | Description | Availability |
|---|---|---|
| **INS / IMU Navigation Module** | Enclosed GNSS-aided inertial navigation module with dual DroneCAN buses | Contact HBQ |

### Release notes

- Message availability depends on valid source topics at runtime.
- CAN2 message and rate behavior must be confirmed on the target system; the explicit rate table applies to CAN1.
- Firmware rotation IDs are not a customer-facing axis map; use an approved calibration procedure.
- Power ratings, mechanical envelope and environmental ratings are provided in controlled documentation when released.
- Product appearance may vary by hardware revision.

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