

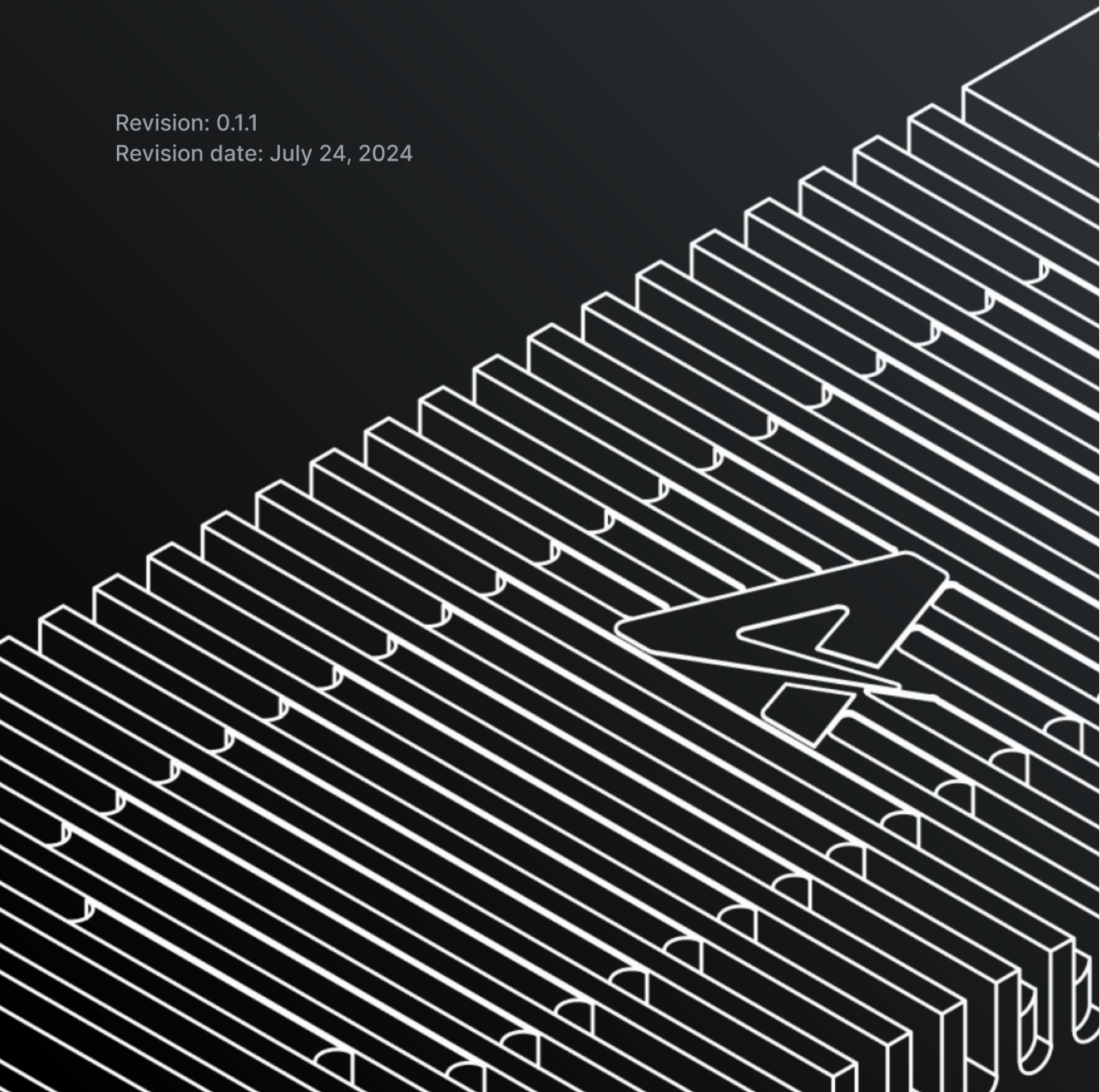
**Auterion**

# Skynode X

## Datasheet

Revision: 0.1.1

Revision date: July 24, 2024



**Document Information**

| Revision | Date               | Description                                       |
|----------|--------------------|---------------------------------------------------|
| 0.1.0    | September 22, 2023 | Preliminary release of the datasheet              |
| 0.1.1    | July 24, 2024      | Updated product variants to reflect current state |

AUTERION OR THIRD PARTIES MAY HOLD INTELLECTUAL PROPERTY RIGHTS IN THE PRODUCTS, NAMES, LOGOS AND DESIGNS INCLUDED IN THIS DOCUMENT. COPYING, REPRODUCTION, MODIFICATION OR DISCLOSURE TO THIRD PARTIES OF THIS DOCUMENT OR ANY PART THEREOF IS ONLY PERMITTED WITH THE EXPRESS WRITTEN PERMISSION OF AUTERION.

THE INFORMATION CONTAINED HEREIN IS PROVIDED “AS IS” AND AUTERION ASSUMES NO LIABILITY FOR ITS USE. NO WARRANTY, EITHER EXPRESS OR IMPLIED, IS GIVEN, INCLUDING BUT NOT LIMITED TO, WITH RESPECT TO THE ACCURACY, CORRECTNESS, RELIABILITY AND FITNESS FOR A PARTICULAR PURPOSE OF THE INFORMATION. THIS DOCUMENT MAY BE REVISED BY AUTERION AT ANY TIME WITHOUT NOTICE. FOR THE MOST RECENT DOCUMENTS, VISIT <https://auterion.com>.

COPYRIGHT © 2023 AUTERION LTD.

## Table of contents

|                                                                      |           |
|----------------------------------------------------------------------|-----------|
| <b>Document Information</b>                                          | <b>2</b>  |
| <b>Table of contents</b>                                             | <b>3</b>  |
| <b>Product Variants</b>                                              | <b>5</b>  |
| Skynode X                                                            | 5         |
| <b>Core Module Components</b>                                        | <b>6</b>  |
| <b>Flight Management Unit Specifications</b>                         | <b>7</b>  |
| General                                                              | 7         |
| Autopilot                                                            | 7         |
| <b>Supported vehicles</b>                                            | <b>8</b>  |
| Multicopter                                                          | 8         |
| VTOL Airplane                                                        | 8         |
| Airplane                                                             | 8         |
| Helicopter                                                           | 8         |
| Rover / UGV                                                          | 8         |
| <b>Mission Computer Specifications</b>                               | <b>9</b>  |
| General                                                              | 9         |
| Video                                                                | 9         |
| Software                                                             | 9         |
| <b>Supported Industry Standards</b>                                  | <b>10</b> |
| Remote ID / ASTM F3411 - 19                                          | 10        |
| Pixhawk Autopilot Standard DS-011                                    | 10        |
| Pixhawk Payload Bus PX P10 - 20                                      | 10        |
| <b>Interfaces</b>                                                    | <b>11</b> |
| Interface Function Map                                               | 11        |
| Attachment Points/Other                                              | 12        |
| Serial Port Mapping on the FMU                                       | 13        |
| Skynode Interfaces (Block Diagram)                                   | 14        |
| <b>Power</b>                                                         | <b>15</b> |
| Power Architecture                                                   | 15        |
| Peripheral Power Domains                                             | 16        |
| <b>Connector Pin Map</b>                                             | <b>17</b> |
| J1 - IO Debug [Int]1 - JST BM10B-SRSS-TB(LF)(SN)                     | 17        |
| J2 - FMU Debug [Int]1 - JST BM10B-SRSS-TB(LF)(SN)                    | 17        |
| J3 - Flight Control Secondary - Molex 5015714007                     | 18        |
| J4 - Flight Control Main - Molex 5015714007                          | 19        |
| J5 - Primary Power Module - Molex 5055670681                         | 20        |
| J6 - Back-up Power Module - Molex 5055670681                         | 20        |
| J7 - Ethernet 1 - JST SM04B-GHS-TB                                   | 20        |
| J8 - USB 1 - JST SM04B-GHS-TB                                        | 20        |
| J9 - USB 2 - JST SM04B-GHS-TB                                        | 20        |
| J10 - Pixhawk Payload Bus - Amp SFV30R-3STBE1HLF                     | 21        |
| J11 - microSD Slot for Mission Computer [Int]1                       | 21        |
| J12 - USB-C OTG for Mission Computer (USB 2.0 only)                  | 22        |
| J13 - Technexion E1 SOM Connector [Int]1                             | 22        |
| J14 - Technexion X2 SOM Connector [Int]1                             | 22        |
| J15 - Technexion X1 SOM Connector [Int]1                             | 22        |
| J16 - LTE module connector [Int]1 - Amp 10132797-011100LF            | 22        |
| J17 - Pixhawk Autopilot Bus X1 [Int]1-HR DF40HC(3.0)-100DS-0.4V(58)  | 22        |
| J18 - Pixhawk Autopilot Bus X2 [Int]1 - HR DF40HC(3.0)-50DS-0.4V(51) | 23        |
| J19 - Mission Computer Debug [Int]1 - JST BM10B-SRSS-TB(LF)(SN)      | 23        |

|                                               |           |
|-----------------------------------------------|-----------|
| J20 - MIPI-CSI Camera Port - Molex 0545482271 | 24        |
| <b>Inertial Sensor Ratings</b>                | <b>25</b> |
| Accelerometers                                | 25        |
| Gyroscopes                                    | 25        |
| Magnetometer                                  | 25        |
| Barometers                                    | 25        |
| <b>Navigation and Control Performance</b>     | <b>26</b> |
| Navigation                                    | 26        |
| Control                                       | 26        |
| <b>Installation</b>                           | <b>27</b> |
| Skynode Mounting                              | 27        |
| Antenna Placement                             | 27        |
| Regulatory Requirements                       | 27        |
| General Recommendations                       | 28        |
| <b>Dimensions and Orientation</b>             | <b>29</b> |
| Skynode X                                     | 29        |
| Skynode OEM Edition                           | 30        |

Product Variants

Skynode X



Recommended for R&D and Enterprise production.

Fully NDAA Section 848 compliant. Manufactured, tested and provisioned in the US.

Remote ID enabled

Aluminum enclosure

Weight: 159 g

Dimensions: 110 × 58 × 22.2 mm ([see page 29](#))

Same connectors and cabling

Operating Temperature: 0°C to +50°C

Relative Humidity: 10% - 90% RH (non-condensing)

Expected Lifetime: 8 years

OEM units available upon request

## Core Module Components

**1 Enclosure Top**

**2 FMU**

Built on the foundation of the next generation FMUv6x with triple-redundant sensor architecture to minimize failure risk

**3 Mission Computer**

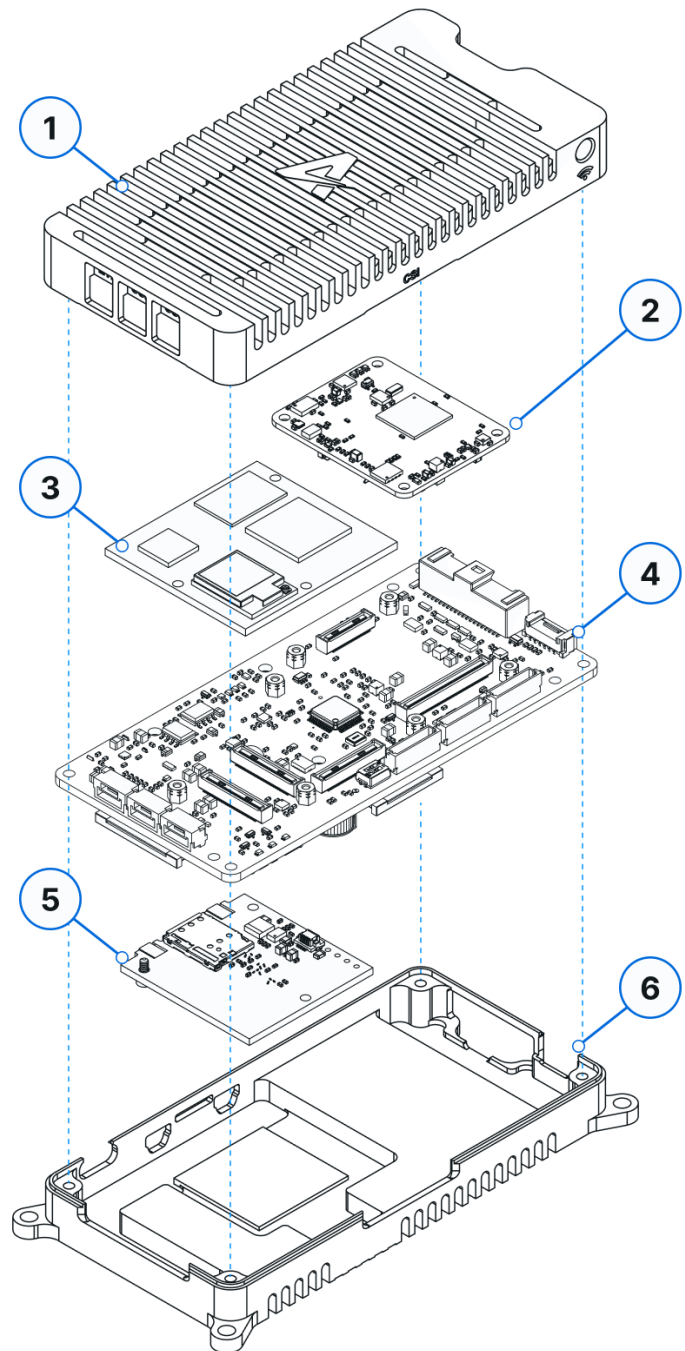
On-board computing power for obstacle avoidance, collision prevention, or video encoding

**4 Base Board**

**5 LTE module**

Built-in LTE communication module for real-time flight logs and over-the-air updates

**6 Enclosure Bottom**



## Flight Management Unit Specifications

### General

|                                                   |                                                                            |
|---------------------------------------------------|----------------------------------------------------------------------------|
| <b>Flight modes</b>                               | Manual, assisted, missions, terrain following                              |
| <b>Waypoint Mission Planning</b>                  | Autopilot supports up to 5000 waypoints                                    |
| <b>Black box</b>                                  | 50 hours continuous recording, no-logging mode supported for GOV edition   |
| <b>GNSS</b>                                       | External u-Blox dual-frequency or Trimble dual-frequency modules supported |
| <b>GNSS denied navigation</b>                     | Available as app from ecosystem partners                                   |
| <b>Supported Peripherals</b>                      | All standard PX4-compatible sensors                                        |
| <b>Endurance</b>                                  | Not limited by Skynode. Depends on the vehicle capabilities                |
| <b>ECCN</b>                                       | EAR99                                                                      |
| <b>Specific Operations Risk Assessment (SORA)</b> | Skynode can be used for operations in the open and specific category.      |

### Autopilot

|                                       |                                                                                                               |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------|
| <b>Flight Controller Architecture</b> | FMUv6X (Pixhawk Autopilot Standard compliant)                                                                 |
| <b>Flight Controller</b>              | STM32H753 (2MB Flash, 1MB RAM)                                                                                |
| <b>IO Coprocessor</b>                 | STM32F103                                                                                                     |
| <b>Inertial sensors</b>               | Triple redundant setup. Each IMU contains: 3 axis gyroscope, 2000°/sec. 3 axis accelerometer, up to $\pm 24g$ |
| <b>Supported takeoff weight</b>       | 1-1000 pounds / 0.5 - 500 kg (expandable)                                                                     |
| <b>Number of actuators</b>            | Up to 16 via PWM (more via SBUS and UAVCAN)                                                                   |
| <b>UART Interfaces</b>                | 5+2+1 (5 configurable, 2 internal communication, 1 console)                                                   |
| <b>CAN</b>                            | Dual redundant CAN                                                                                            |
| <b>Ethernet</b>                       | 100Base-TX (onboard switch with VLAN)                                                                         |
| <b>Interfaces</b>                     | 16× Digital IO, 2× I2C, 1× SPI                                                                                |

## Supported vehicles

### Multicopter

---

|                |                                  |
|----------------|----------------------------------|
| Airframe types | Quad, Hex, Octo, Dodeca, Coaxial |
|----------------|----------------------------------|

---

### VTOL Airplane

---

|                |                               |
|----------------|-------------------------------|
| Airframe types | Multicopter planes, Tiltrotor |
|----------------|-------------------------------|

---

### Airplane

---

|         |                               |
|---------|-------------------------------|
| Takeoff | Hand-launch, runway, catapult |
|---------|-------------------------------|

---

|         |                               |
|---------|-------------------------------|
| Landing | Grass / belly landing, runway |
|---------|-------------------------------|

---

### Helicopter

---

|                                |
|--------------------------------|
| Contact sales for early access |
|--------------------------------|

---

### Rover / UGV

---

|                                |
|--------------------------------|
| Contact sales for early access |
|--------------------------------|

---

## Mission Computer Specifications

### General

|                                        |                                                                                                                                                                                                                                                                   |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Processor Architecture                 | ARM Cortex-A53 Quad Core 1.8GHz                                                                                                                                                                                                                                   |
| Embedded GPU                           | GCNanoUltra for 3D acceleration and GC320 for 2D acceleration                                                                                                                                                                                                     |
| Memory                                 | 4GB LPDDR4                                                                                                                                                                                                                                                        |
| Storage                                | eMMC 16GB, plus internal SD card 128GB                                                                                                                                                                                                                            |
| High-Speed Interfaces                  | 100Base-TX Ethernet (onboard switch), USB 2.0, USB 2.0 OTG (USB 3.0 usage is discouraged due to GPS interference), 4-lane MIPI-CSI (Software support pending)                                                                                                     |
| Wireless Interfaces (Wifi / Bluetooth) | QCA9377, 802.11a/b/g/n/ac (2.4 + 5GHz) + Bluetooth 5                                                                                                                                                                                                              |
| LTE Module                             | LTE Cat-4, 50MBit/s upload and 150MBit/s download<br>RC7611 (US), Frequency bands: B2, B4, B5, B12, B13, B14, B25, B26, B66, B71<br>RC7620 (EMEA), Frequency bands: B1, B3, B7, B8, B20, B28<br>RC7630 (APAC), Frequency bands: B1, B3, B5, B7, B8, B18, B19, B21 |

### Video

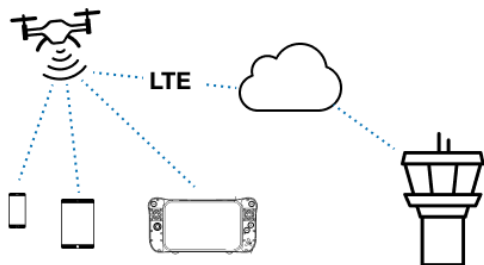
|                   |                                                           |
|-------------------|-----------------------------------------------------------|
| Camera Interfaces | Ethernet, USB, 4-lane MIPI-CSI (Software support pending) |
| Video Decode      | 1080p60 H.264                                             |
| Video Encode      | 1080p60 H.264 in hardware                                 |
| HDMI Input        | Software support pending                                  |

### Software

|                   |                                                                                    |
|-------------------|------------------------------------------------------------------------------------|
| Software Stack    | Auterion Enterprise PX4                                                            |
| Application Stack | Auterion Payload Manager, Auterion Connection Manager, Auterion Flight Log Manager |
| App Support       | Container Architecture                                                             |

# Supported Industry Standards

## Remote ID / [ASTM F3411 - 19](#)



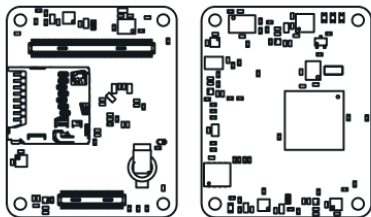
The ASTM remote ID standard supports the remote identification of unmanned aircraft, which is required by international regulatory bodies such as FAA and EASA.

The standard is implemented on Wifi (802.11).

AuterionOS 2.5.6 and above includes all software features to ensure a fully compliant system can be built . Final compliance remains the responsibility of the OEM.

|              |                                                           |
|--------------|-----------------------------------------------------------|
| Applications | All drone operations will mandate this standard 2021/22   |
| Main Benefit | Drones can be operated in a regulatory compliant fashion. |

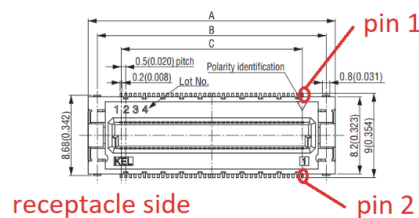
## Pixhawk Autopilot Standard [DS-011](#)



The Pixhawk autopilot standard allows the integration of a standard flight management module into an aircraft. This enables drone manufacturers to build airframes that fit the standard and leverage different types and generations of autopilots.

|              |                                                        |
|--------------|--------------------------------------------------------|
| Applications | All commercial and government drones (incl. group 2)   |
| Main Benefit | Standardization of electronic components, supply chain |

## Pixhawk Payload Bus [PX P10 - 20](#)

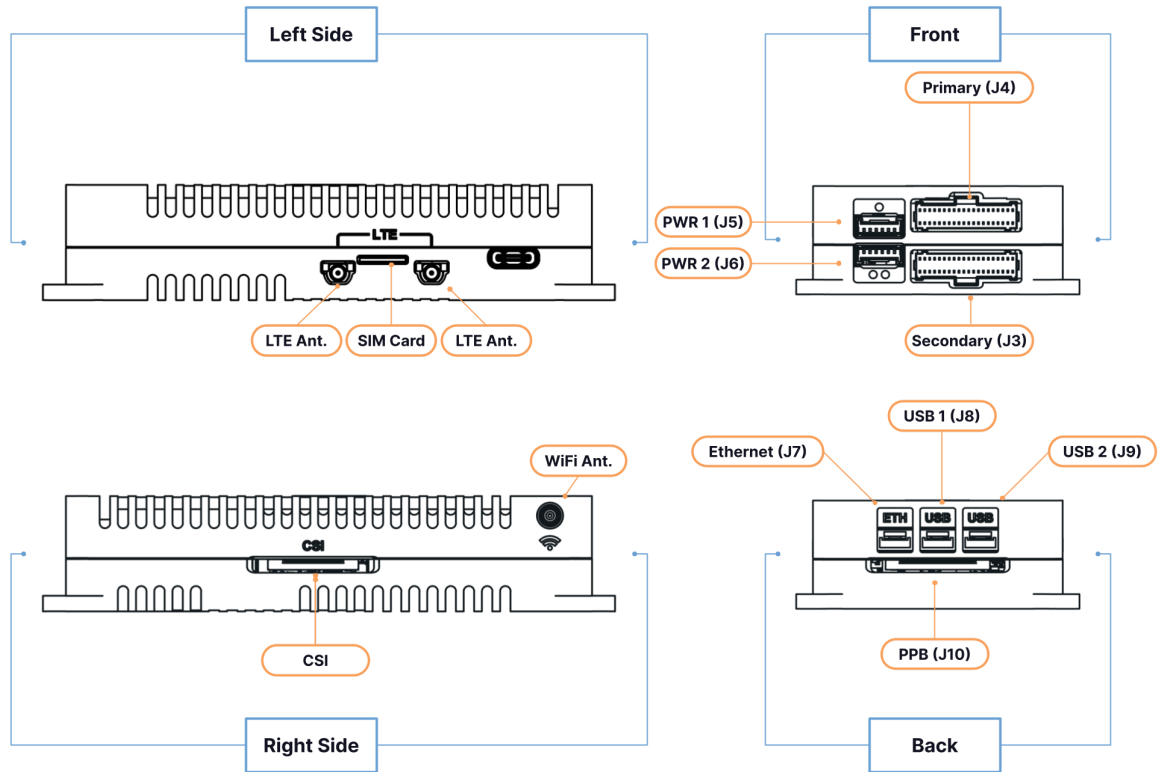


The Pixhawk payload bus standardizes the electrical, mechanical and software interfaces for drone payloads connected to the main avionics system of a drone. This enables payload manufacturers and drone manufacturers to more effectively offer well-integrated solutions.

|              |                                                          |
|--------------|----------------------------------------------------------|
| Applications | Payloads up to 5kg                                       |
| Main Benefit | Payloads of different manufacturers are interchangeable. |

## Interfaces

### Interface Function Map



| Ext | Name        | Main Functions                                                      | Description                                             |
|-----|-------------|---------------------------------------------------------------------|---------------------------------------------------------|
| J1  | IO DEBUG    | SWD / Debug                                                         | Debug connector for product development.                |
| J2  | FMU DEBUG   | SWD / Debug                                                         | Debug connector for product development.                |
| J3  | ✓ Secondary | Flight Control Secondary<br>TELEM3, GPS2, CAN2<br>MON PWM, SBUS OUT | Secondary avionics port with redundant interfaces.      |
| J4  | ✓ Primary   | Flight Control Main<br>TELEM1, GPS1, CAN1<br>FMU PWM                | Main avionics port                                      |
| J5  | ✓ PWR 1     | Primary Power module                                                | 5V/5A Redundant power inputs to Skynode.                |
| J6  | ✓ PWR 2     | Back-up Power module                                                | 5V/5A Redundant power inputs to Skynode.                |
| J7  | ✓ ETH       | Ethernet                                                            | 100 Base-TX standard ethernet.                          |
| J8  | ✓ USB 1     | USB 2.0 port                                                        | USB 2.0 does not interfere with GPS while USB 3.0 does. |

# Auterion

|            |   |          |                                                 |                                                                                          |
|------------|---|----------|-------------------------------------------------|------------------------------------------------------------------------------------------|
| <b>J9</b>  | ✓ | USB 2    | USB 2.0 port                                    | USB 2.0 does not interfere with GPS while USB 3.0 does.                                  |
| <b>J10</b> | ✓ | PPB      | Pixhawk Payload Bus<br>ETH, UART, CAN, PPS, CAM | Industry standard bus for drone payloads.                                                |
| <b>J11</b> |   | MICROSD  | MicroSD storage                                 | Internal storage of the mission computer. This slot can be used to increase the storage. |
| <b>J12</b> | ✓ | USB-OTG  | Mission computer USB                            | This port is the primary interface for on-site firmware updates and diagnostics.         |
| <b>J13</b> |   | MC E1    | Mission computer socket E1                      | Socket for the onboard mission computer.                                                 |
| <b>J14</b> |   | MC X2    | Mission computer socket X2                      | Socket for the onboard mission computer.                                                 |
| <b>J15</b> |   | MC X1    | Mission computer socket X1                      | Socket for the onboard mission computer.                                                 |
| <b>J16</b> |   | LTE      | USB port for LTE modem                          |                                                                                          |
| <b>J17</b> |   | PAB X1   | Autopilot socket X1                             | Socket for the onboard flight controller.                                                |
| <b>J18</b> |   | PAB X2   | Autopilot socket X2                             | Socket for the onboard flight controller.                                                |
| <b>J19</b> |   | MC DEBUG | Mission computer debug port                     | Debug connector for product development.                                                 |
| <b>J20</b> | ✓ | MIPI     | MIPI-CSI Camera Interface                       | Camera Interface connector (Software support pending)                                    |

## Attachment Points/Other

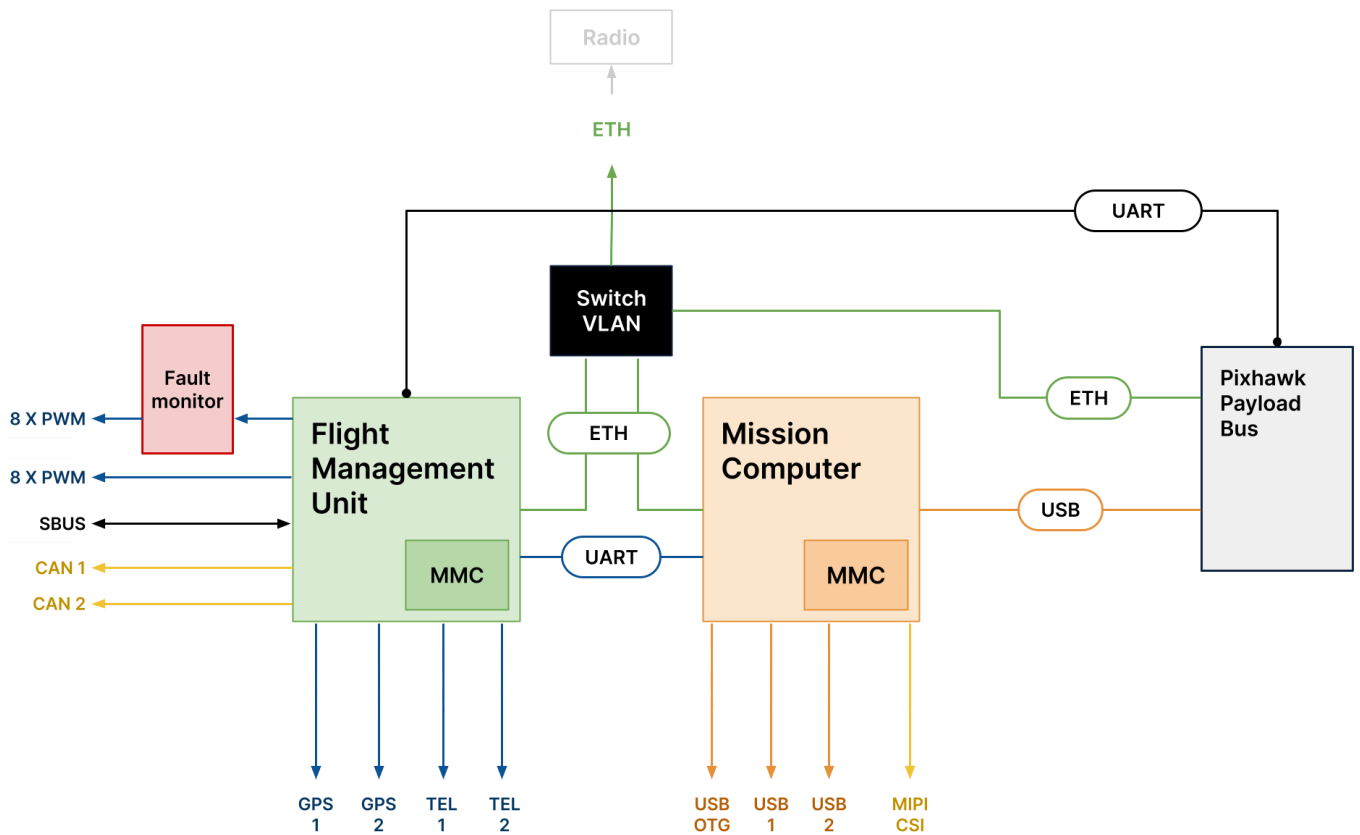
There are external attachment points for two LTE Antennas, and a Wifi Antenna. There is also a port for inserting a SIM card.

| Name         | Connector | Description                                                                                                                                                                                                               |
|--------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SIM Port     | Nano SIM  | SIM card is typically included and preconfigured. To insert/remove, press in with another SIM (or similar tool) until there is a click sound. After clicking for removal, the SIM can easily be pulled out using fingers. |
| LTE Antenna  | MMCX      | Attachment point for LTE antennas (included).<br>Note: In order to comply with FCC regulations, all antennas must be located at least 20cm apart from each other.                                                         |
| WiFi Antenna | MMCX      | Attachment point for the WiFi antenna (included)<br>Note: In order to comply with FCC regulations, all antennas must be located at least 20cm apart from each other.                                                      |

Serial Port Mapping on the FMU

| UART  | Device     | Port                                  |
|-------|------------|---------------------------------------|
| UART1 | /dev/ttyS0 | GPS1                                  |
| UART2 | /dev/ttyS1 | TELEM3                                |
| UART3 | /dev/ttyS2 | Debug (Internal)                      |
| UART4 | /dev/ttyS3 | Pixhawk Payload Bus                   |
| UART5 | /dev/ttyS4 | TELEM2 (Internal to Mission Computer) |
| UART6 | /dev/ttyS5 | (Internal for IO)                     |
| UART7 | /dev/ttyS6 | TELEM1                                |
| UART8 | /dev/ttyS7 | GPS2                                  |

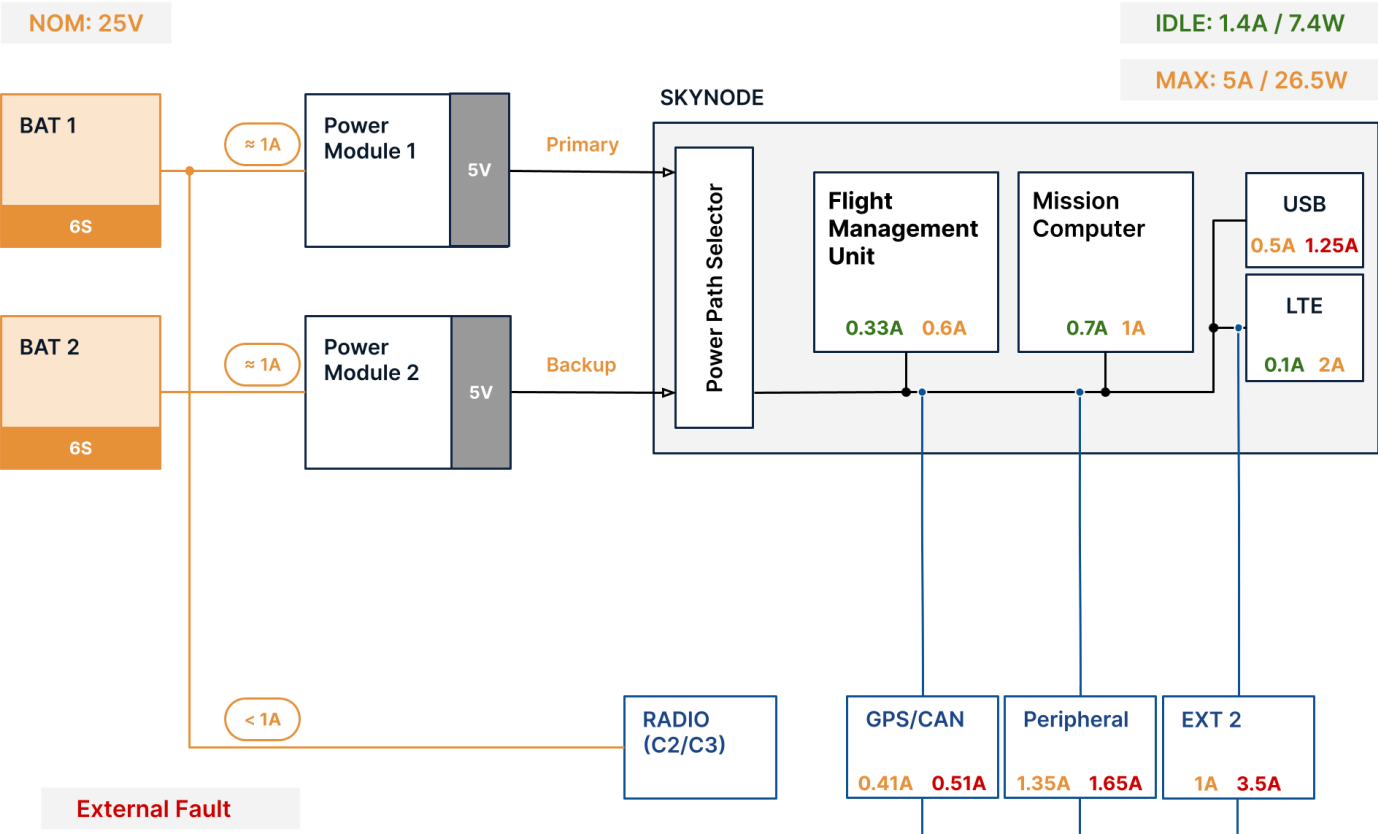
## Skynode Interfaces (Block Diagram)



Power

| Rating                             | Min  | Typ  | Max  | Note                                   |
|------------------------------------|------|------|------|----------------------------------------|
| 6S Power module supply voltage     | 9V   | 25V  | 36V  | 3-6S LiPo batteries supported          |
| 12S Power module supply voltage    | 12V  | 45V  | 51V  | 4-12S LiPo batteries supported         |
| Unit supply voltage                | 5.1V | 5.3V | 5.4V | Use supplied power module (low-noise)  |
| Skynode supply current @ 5V        | 1.4A |      | 5A   | Skynode supply without any peripherals |
| System (incl. radio) current @ 25V | 0.4A |      | 2A   | Depends on vehicle configuration       |

Power Architecture



## Peripheral Power Domains

| Domain           | Lvl  | Max Current | Description                                                         |
|------------------|------|-------------|---------------------------------------------------------------------|
| VDD_5V_SBUS_RC   | 5V   | 250mA       | 5V supply for SBUS RC receiver and output                           |
| FMU_VDD_3V3      | 3.3V | 50mA        |                                                                     |
| VDD_5V_HIPOWER   | 5V   | 3.0A        | External 2, shared with the internal LTE module which allocates 2A. |
| VDD_5V_PERIPH    | 5V   | 1.5A        | 5V supply for flight control peripherals                            |
| VDD_5V_CAN1_GPS1 | 5V   | 0.46A       | 5V supply for the primary GPS and CAN                               |
| VBUS1DN1         | 5V   | 500mA       | USB VBUS                                                            |
| VBUS1DN2         | 5V   | 500mA       | USB VBUS                                                            |
| VBUS1DN3         | 5V   | 500mA       | USB VBUS                                                            |
| USBC_VBUS        | 5V   | 500mA       | USB VBUS, enabled when in USB-C host mode                           |
| COMP_3V3_VDD     | 3.3V | 500mA       | 3.3V supply for the MIPI CSI camera                                 |

## Connector Pin Map

### J1 - IO Debug [Int]<sup>1</sup> - [JST BM10B-SRSS-TB\(LF\)\(SN\)](#)

| Pin | Name               | Dir | Lvl  | Function             |
|-----|--------------------|-----|------|----------------------|
| 1   | IO_VDD_3V3         | OUT | 3.3V | Target voltage sense |
| 2   | IO_USART1_TX_DEBUG | OUT | 3.3V | PX4 console TX       |
| 3   |                    | NC  | 3.3V | Not connected        |
| 4   | IO_SWDIO           | I/O | 3.3V | ARM SWDIO            |
| 5   | IO_SWCLK           | IN  | 3.3V | ARM SWCLK            |
| 6   | IO_SWO             | OUT | 3.3V | ARM SWO              |
| 7   | IO_SPARE_GPIO1     | I/O | 3.3V | TRACE1               |
| 8   | IO_SPARE_GPIO2     | I/O | 3.3V | TRACE2               |
| 9   | IO_nRST            | IN  | 3.3V | ARM RST              |
| 10  | GND                |     |      | Ground               |

### J2 - FMU Debug [Int]<sup>1</sup> - [JST BM10B-SRSS-TB\(LF\)\(SN\)](#)

| Pin | Name                     | Dir | Lvl  | Function             |
|-----|--------------------------|-----|------|----------------------|
| 1   | FMU_VDD_3V3              | OUT | 3.3V | Target voltage sense |
| 2   | USART3_TX_DEBUG          | OUT | 3.3V | PX4 console TX       |
| 3   | RX_DEBUG_CATHODE         | IN  | 3.3V | PX4 console RX       |
| 4   | FMU_SWDIO                | I/O | 3.3V | ARM SWDIO            |
| 5   | FMU_SWCLK                | IN  | 3.3V | ARM SWCLK            |
| 6   | SPI6_SCK_EXTERNAL1 / SWO | OUT | 3.3V | ARM SWO              |
| 7   | NFC_GPIO                 | I/O | 3.3V | TRACE1               |
| 8   | PH11                     | I/O | 3.3V | TRACE2               |
| 9   | FMU_nRST                 | IN  | 3.3V | ARM RST              |
| 10  | GND                      |     |      | Ground               |

<sup>1</sup>[Int] - Internal Connector (not accessible when assembled in the enclosure)

## J3 - Flight Control Secondary - [Molex 5015714007](#)

| Pi<br>n | Name            | Dir | Lvl  | Function                                             |
|---------|-----------------|-----|------|------------------------------------------------------|
| 1       | VDD_5V_PERIPH   | OUT | 5V   | 5V supply for peripherals                            |
| 2       | SPI6_DRDY1      | IN  | 3.3V |                                                      |
| 3       | SPIX_SYNC       | OUT | 3.3V |                                                      |
| 4       | GND             |     |      | Ground                                               |
| 5       | SPI6_SCK        | OUT | 3.3V |                                                      |
| 6       | SPI6_MOSI       | OUT | 3.3V |                                                      |
| 7       | GND             |     |      | Ground                                               |
| 8       | SPI6_nCS1       | OUT | 3.3V |                                                      |
| 9       | USART2_TX       | OUT | 3.3V | TELEM3 TX                                            |
| 10      | SPI6_nRESET     | OUT | 3.3V |                                                      |
| 11      | USART2_RX       | IN  | 3.3V | TELEM3 RX                                            |
| 12      | SPI6_MISO       | IN  | 3.3V |                                                      |
| 13      | VDD_5V_PERIPH   | IN  | 5V   |                                                      |
| 14      | GND             |     |      | Ground                                               |
| 15      | VDD_5V_SBUS_RC  | OUT | 5V   | Max 250mA                                            |
| 16      | IO_SBUS_OUTPUT  | OUT | 3.3V | SBUS protocol output                                 |
| 17      | GND             |     |      | Ground                                               |
| 18      | UART8_TX        | OUT | 3.3V | GPS2 TX                                              |
| 19      | I2C2_SCL        | I/O | 3.3V | I2C SCL, connected to J6 pin 3, internal PU 1kΩ      |
| 20      | UART8_RX        | IN  | 3.3V | GPS2 RX                                              |
| 21      | I2C2_SDA        | I/O | 3.3V | I2C SDA, connected to J6 pin 4, internal PU 1kΩ      |
| 22      | VDD_5V_PERIPH   | OUT | 5V   |                                                      |
| 23      | GND             |     |      | Ground                                               |
| 24      | GND             |     |      | Ground                                               |
| 25      | IO_CH1          | OUT | 3.3V | PWM channels from fault monitor                      |
| 26      | IO_CH5          | OUT | 3.3V |                                                      |
| 27      | IO_CH2          | OUT | 3.3V |                                                      |
| 28      | IO_CH6          | OUT | 3.3V |                                                      |
| 29      | IO_CH3          | OUT | 3.3V |                                                      |
| 30      | IO_CH7          | OUT | 3.3V |                                                      |
| 31      | IO_CH4          | OUT | 3.3V |                                                      |
| 32      | IO_CH8          | OUT | 3.3V |                                                      |
| 33      | GND             |     |      | Ground                                               |
| 34      | VDD_SERVO_SENSE | IN  | <9V  | IMPORTANT: NC, used for FMU rail sensing (J4 pin 34) |
| 35      | CAN2_P          | I/O | 5V   | *                                                    |
| 36      | GND             |     |      | Ground                                               |
| 37      | CAN2_N          | I/O | 5V   | *                                                    |
| 38      | GND             |     |      | Ground                                               |
| 39      | GND             |     |      | Ground                                               |
| 40      | VDD_5V_PERIPH   | OUT | 5V   |                                                      |

## J4 - Flight Control Main - [Molex 5015714007](#)

| Pin | Name                                  | Dir | Lvl  | Function                                        |
|-----|---------------------------------------|-----|------|-------------------------------------------------|
| 1   | VDD_5V_SBUS_RC                        | OUT | 5V   | 5V supply for RC receiver, max 250mA            |
| 2   | IO_SBUS_INPUT                         | IN  | 5V   | SBUS protocol RC input                          |
| 3   | FMU_IO_SAFETY_SWITCH_IN               | IN  | 3.3V | Safety switch state input                       |
| 4   | GND                                   |     |      | Ground                                          |
| 5   | FMU_IO_nSAFETY_SWITCH_LED_OUT         | OUT | 3.3V | Safety switch led output                        |
| 6   | BUZZER_1_INV                          | OUT |      | Buzzer output (Open drain)                      |
| 7   | GND                                   |     |      | Ground                                          |
| 8   | FMU_VDD_3V3                           | OUT | 3.3V | 3.3V supply for peripherals, max 50mA           |
| 9   | UART7_TX                              | OUT | 3.3V | TELEM1 TX                                       |
| 10  | UART7_CTS                             | IN  | 3.3V | TELEM1 CTS                                      |
| 11  | UART7_RX                              | IN  | 3.3V | TELEM1 RX                                       |
| 12  | UART7_RTS                             | OUT | 3.3V | TELEM1 RTS                                      |
| 13  | VDD_5V_HIPOWER                        | OUT | 5V   | 5V supply for peripherals, max. 1.0A            |
| 14  | GND                                   |     |      | Ground                                          |
| 15  | VDD_5V_HIPOWER                        | OUT | 5V   | 5V supply for peripherals, fused with pin 13    |
| 16  | GND                                   |     |      | Ground                                          |
| 17  | FMU_CAP1_AUX / GND <a href="#">**</a> |     |      | Ground                                          |
| 18  | USART1_TX                             | OUT | 3.3V | GPS1 TX                                         |
| 19  | I2C1_SCL                              | I/O | 3.3V | I2C SCL, connected to J5 pin 3, internal PU 1kΩ |
| 20  | USART1_RX                             | IN  | 3.3V | GPS1 RX                                         |
| 21  | I2C1_SDA                              | I/O | 3.3V | I2C SDA, connected to J5 pin 4, internal PU 1kΩ |
| 22  | VDD_5V_CAN1_GPS1                      | OUT | 5V   | 5V supply for primary GPS and CAN interface     |
| 23  | GND                                   | I/O | 3.3V | GPS PPS                                         |
| 24  | GND                                   |     |      | Ground                                          |
| 25  | FMU_CH1                               | I/O | 3.3V | PWM channels from FMU, input capable            |
| 26  | FMU_CH5                               | I/O | 3.3V |                                                 |
| 27  | FMU_CH2                               | I/O | 3.3V |                                                 |
| 28  | FMU_CH6                               | I/O | 3.3V | IMPORTANT: Connected to pin 11 of J10           |
| 29  | FMU_CH3                               | I/O | 3.3V |                                                 |
| 30  | FMU_CH7                               | I/O | 3.3V |                                                 |
| 31  | FMU_CH4                               | I/O | 3.3V | IMPORTANT: Connected to pin 13 of J10           |
| 32  | FMU_CH8                               | I/O | 3.3V |                                                 |
| 33  | GND                                   |     |      |                                                 |
| 34  | VDD_SERVO_SENSE                       | IN  | <9V  | Ground                                          |
| 35  | CAN1_P                                |     | 5V   | Connected to J10 pin 8, <a href="#">*</a>       |
| 36  | GND                                   |     |      | Ground                                          |
| 37  | CAN1_N                                |     | 5V   | Connected to J10 pin 9, <a href="#">*</a>       |
| 38  | GND                                   |     |      | Ground                                          |
| 39  | GND                                   |     |      | Ground                                          |
| 40  | VDD_5V_CAN1_GPS1                      |     | 5V   | 5V supply for primary GPS and CAN interface     |

## J5 - Primary Power Module - [Molex 5055670681](#)

| Pin | Name          | Dir | Lvl  | Function                                |
|-----|---------------|-----|------|-----------------------------------------|
| 1   | VDD_5V_BRICK1 | IN  | 5V   | 5V input                                |
| 2   | VDD_5V_BRICK1 | IN  | 5V   | 5V input (redundant)                    |
| 3   | I2C1_SCL      | I/O | 3.3V | Connected to J4 pin 19, internal PU 1kΩ |
| 4   | I2C1_SDA      | I/O | 3.3V | Connected to J4 pin 21, internal PU 1kΩ |
| 5   | GND           |     |      |                                         |
| 6   | GND           |     |      |                                         |

## J6 - Back-up Power Module - [Molex 5055670681](#)

| Pin | Name          | Dir | Lvl  | Function                                |
|-----|---------------|-----|------|-----------------------------------------|
| 1   | VDD_5V_BRICK2 | IN  | 5V   | 5V input                                |
| 2   | VDD_5V_BRICK2 | IN  | 5V   | 5V input (redundant)                    |
| 3   | I2C2_SCL      | I/O | 3.3V | Connected to J3 pin 19, internal PU 1kΩ |
| 4   | I2C2_SDA      | I/O | 3.3V | Connected to J3 pin 21, internal PU 1kΩ |
| 5   | GND           |     |      |                                         |
| 6   | GND           |     |      |                                         |

## J7 - Ethernet 1 - [JST SM04B-GHS-TB](#)

| Pin | Name     | Dir | Lvl  | Function           |
|-----|----------|-----|------|--------------------|
| 1   | ETH_RD_N | IN  | 3.3V | Receive - (Diff.)  |
| 2   | ETH_RD_P | IN  | 3.3V | Receive + (Diff.)  |
| 3   | ETH_TD_N | OUT | 3.3V | Transmit - (Diff.) |
| 4   | ETH_TD_P | OUT | 3.3V | Transmit + (Diff.) |

## J8 - USB 1 - [JST SM04B-GHS-TB](#)

| Pin | Name       | Dir | Lvl  | Function |
|-----|------------|-----|------|----------|
| 1   | VBUS1DN2   | OUT | 5V   | USB VBus |
| 2   | USB_GH_1_N | I/O | 3.3V | USB D-   |
| 3   | USB_GH_1_P | I/O | 3.3V | USB D+   |
| 4   | GND        |     |      | GND      |

## J9 - USB 2 - [JST SM04B-GHS-TB](#)

| Pin | Name       | Dir | Lvl  | Function |
|-----|------------|-----|------|----------|
| 1   | VBUS1DN3   | OUT | 5V   | USB VBus |
| 2   | USB_GH_2_N | I/O | 3.3V | USB D-   |
| 3   | USB_GH_2_P | I/O | 3.3V | USB D+   |
| 4   | GND        |     |      | GND      |

## J10 - Pixhawk Payload Bus - [Amp SFV30R-3STBE1HLF](#)

| Pin | Name               | Dir | Lvl  | Function                                                       |
|-----|--------------------|-----|------|----------------------------------------------------------------|
| 1   | GND                |     |      | Ground                                                         |
| 2   | UART4_TX           | OUT | 3.3V | FMU UART TX                                                    |
| 3   | UART4_RX           | IN  | 3.3V | FMU UART RX                                                    |
| 4   | GND                |     |      | Ground                                                         |
| 5   | I2C3_SDA           | I/O | 3.3V | FMU I2C SDA, 0×25 and 0×51 reserved addresses, internal PU 1kΩ |
| 6   | I2C3_SCL           | I/O | 3.3V | FMU I2C SCL, 0×25 and 0×51 reserved addresses, internal PU 1kΩ |
| 7   | GND                |     |      | Ground                                                         |
| 8   | CAN1_P             | I/O | 5V   | FMU CAN, connected to pin 35 of J4, terminated with 120Ω       |
| 9   | CAN1_N             | I/O | 5V   | FMU CAN, connected to pin 37 of J4, terminated with 120Ω       |
| 10  | GND                |     |      | Ground                                                         |
| 11  | FMU_CH7            | I/O | 3.3V | Connected to pin 30 of J4                                      |
| 12  | RES1_EXT           |     |      | Reserved pin, NC in Skynode                                    |
| 13  | FMU_CH8            | I/O | 3.3V | Connected to pin 32 of J4                                      |
| 14  | GND                |     |      | Ground                                                         |
| 15  | FMU_CAP1_AUX       | I/O | 3.3V | GPS PPS                                                        |
| 16  | GND                |     |      | Ground                                                         |
| 17  | ETH_TD_P           | OUT | 3.3V | Transmit + (Diff.)                                             |
| 18  | ETH_TD_N           | OUT | 3.3V | Transmit - (Diff.)                                             |
| 19  | GND                |     |      | Ground                                                         |
| 20  | ETH_RD_P           | IN  | 3.3V | Receive + (Diff.)                                              |
| 21  | ETH_RD_N           | IN  | 3.3V | Receive - (Diff.)                                              |
| 22  | GND                |     |      | Ground                                                         |
| 23  | COMP_GPIO5_IO20    | I/O | 1.8V | Mission Computer GPIO                                          |
| 24  | VBUS1DN1           | OUT |      | USB VBus                                                       |
| 25  | USB_PAYLOAD_N      | I/O |      | USB D-                                                         |
| 26  | USB_PAYLOAD_P      | I/O |      | USB D+                                                         |
| 27  | GND                |     |      | Ground                                                         |
| 28  | VDD_5V_HIPOWER_nEN | OUT |      | High-Power enable pin (VBAT)                                   |
| 29  | VDD_5V_PERIPH_nEN  | OUT |      | Peripheral-Power enable pin                                    |
| 30  | GND                |     |      | Ground                                                         |

## J11 - microSD Slot for Mission Computer [Int]<sup>1</sup>

| Pin | Name    | Dir | Lvl | Function |
|-----|---------|-----|-----|----------|
| 1   | DAT2    | /   | /   | /        |
| 2   | CD/DAT3 |     |     |          |
| 3   | CMD     |     |     |          |

|   |      |
|---|------|
| 4 | VDD  |
| 5 | CLK  |
| 6 | VSS  |
| 7 | DAT0 |
| 8 | DAT1 |

## J12 - USB-C OTG for Mission Computer (USB 2.0 only)

| Pin | Name | Dir | Lvl | Function |
|-----|------|-----|-----|----------|
|-----|------|-----|-----|----------|

Pinout as specified by USB-C standard.

## J13 - Technexion E1 SOM Connector [Int]<sup>1</sup>

| Pin | Name | Dir | Lvl | Function |
|-----|------|-----|-----|----------|
|-----|------|-----|-----|----------|

Pinout as specified by Technexion E1 connector

## J14 - Technexion X2 SOM Connector [Int]<sup>1</sup>

| Pin | Name | Dir | Lvl | Function |
|-----|------|-----|-----|----------|
|-----|------|-----|-----|----------|

Pinout as specified by Technexion X2 connector

## J15 - Technexion X1 SOM Connector [Int]<sup>1</sup>

| Pin | Name | Dir | Lvl | Function |
|-----|------|-----|-----|----------|
|-----|------|-----|-----|----------|

Pinout as specified by Technexion X1 connector

<sup>1</sup>[Int] - Internal Connector (not accessible when assembled in the enclosure)

## J16 - LTE module connector [Int]<sup>1</sup> - [Amp 10132797-011100LF](#)

| Pin | Name | Dir | Lvl | Function |
|-----|------|-----|-----|----------|
|-----|------|-----|-----|----------|

|    |                 |  |      |  |
|----|-----------------|--|------|--|
| 1  | VDD_5V_HIPOWER  |  | 5V   |  |
| 2  | VDD_5V_HIPOWER  |  | 5V   |  |
| 3  | VDD_5V_HIPOWER  |  | 5V   |  |
| 4  | GND             |  |      |  |
| 5  | GND             |  |      |  |
| 6  | COMP_PWR_ON_LTE |  | 1.8V |  |
| 7  | COMP_RST_LTE    |  | 1.8V |  |
| 8  | GND             |  |      |  |
| 9  | USB_LTE_N       |  |      |  |
| 10 | USB_LTE_P       |  |      |  |

## J17 - Pixhawk Autopilot Bus X1 [Int]<sup>1</sup> - [HR DF40HC\(3.0\)-100DS-0.4V\(58\)](#)

| Pin | Name | Dir | Lvl | Function |
|-----|------|-----|-----|----------|
|-----|------|-----|-----|----------|

Pinout as specified by Pixhawk Autopilot Bus standard X1 connector

## J18 - Pixhawk Autopilot Bus X2 [Int]<sup>1</sup> - [HR DF40HC\(3.0\)-50DS-0.4V\(51\)](#)

| Pin | Name | Dir | Lvl | Function |
|-----|------|-----|-----|----------|
|-----|------|-----|-----|----------|

Pinout as specified by Pixhawk Autopilot Bus standard X2 connector

## J19 - Mission Computer Debug [Int]<sup>1</sup> - [JST BM10B-SRSS-TB\(LF\)\(SN\)](#)

| Pin | Name           | Dir | Lvl  | Function                    |
|-----|----------------|-----|------|-----------------------------|
| 1   | COMP_3V3_VDD   | OUT | 3.3V | Target voltage sense        |
| 2   | COMP_UART1_TXD | OUT | 3.3V | Mission computer console TX |
| 3   | COMP_UART1_RXD | IN  | 3.3V | Mission computer console RX |
| 4   |                | NC  | -    | Not connected               |
| 5   |                | NC  | -    | Not connected               |
| 6   |                | NC  | -    | Not connected               |
| 7   |                | NC  | -    | Not connected               |
| 8   |                | NC  | -    | Not connected               |
| 9   | COMP_RESET     | IN  | 1.8V | Mission computer reset RST  |
| 10  | GND            |     |      | Ground                      |

<sup>1</sup>[Int] - Internal Connector (not accessible when assembled in the enclosure)

## J20 - MIPI-CSI Camera Port - [Molex 0545482271](#)

| Pin | Name                   | Dir | Lvl  | Function                   |
|-----|------------------------|-----|------|----------------------------|
| 1   | COMP_3V3_VDD           | OUT | 3.3V | Camera power               |
| 2   | COMP_I2C3_SDA          | I/O | 3.3V | I2C SDA, internal PU 1.5kΩ |
| 3   | COMP_I2C3_SCL          | I/O | 3.3V | I2C SCL, internal PU 1.5kΩ |
| 4   | GND                    |     |      |                            |
| 5   | CAM_CCM_CLK01          | OUT | 3.3V | CCM Clock                  |
| 6   | CAM_GPIO0_RESET        | OUT | 3.3V | Reset                      |
| 7   | GND                    |     |      |                            |
| 8   | CAM_MIPI_CSI_D3_EXT_P  | I/O | 3.3V | MIPI CSI D3 P              |
| 9   | CAM_MIPI_CSI_D3_EXT_N  | I/O | 3.3V | MIPI CSI D3 N              |
| 10  | GND                    |     |      |                            |
| 11  | CAM_MIPI_CSI_D2_EXT_P  | I/O | 3.3V | MIPI CSI D2 P              |
| 12  | CAM_MIPI_CSI_D2_EXT_N  | I/O | 3.3V | MIPI CSI D2 N              |
| 13  | GND                    |     |      |                            |
| 14  | CAM_MIPI_CSI_CLK_EXT_P | I/O | 3.3V | MIPI CSI clock P           |
| 15  | CAM_MIPI_CSI_CLK_EXT_N | I/O | 3.3V | MIPI CSI clock N           |
| 16  | GND                    |     |      |                            |
| 17  | CAM_MIPI_CSI_D1_EXT_P  | I/O | 3.3V | MIPI CSI D1 P              |
| 18  | CAM_MIPI_CSI_D1_EXT_N  | I/O | 3.3V | MIPI CSI D1 N              |
| 19  | GND                    |     |      |                            |
| 20  | CAM_MIPI_CSI_D0_EXT_P  | I/O | 3.3V | MIPI CSI D0 P              |
| 21  | CAM_MIPI_CSI_D0_EXT_N  | I/O | 3.3V | MIPI CSI D0 N              |
| 22  | GND                    |     |      |                            |

\* For Baseboard versions before and including 9, the CAN lines are terminated with **120Ω resistors**. Please check the Baseboard **version** with the command **ver all** in the [MAVLink Shell](#).

\*\* For Baseboard versions before and including 9, **PIN 17** is **GND**.  
For Baseboard versions after 9, **PIN 17** is **FMU\_CAP1\_AUX**.  
Please check the Baseboard **version** with the command **ver all** in the [MAVLink Shell](#).

## Inertial Sensor Ratings

### Accelerometers

Triple redundant sensor set (properties stated for primary sensor)

|               |            |                        |
|---------------|------------|------------------------|
| Range         | ±24g       |                        |
| Resolution    | 0.733mg    |                        |
| Zero Offset   | ±20mg      | Typical over life-time |
| Noise Density | 190 µg/√Hz |                        |
| Nonlinearity  | 0.5 % FS   |                        |
| Bandwidth     | 245 Hz     | 3dB cutoff frequency   |

### Gyroscopes

Triple redundant sensor set (properties stated for primary sensor)

|               |               |
|---------------|---------------|
| Range         | ±2000 °/s     |
| Resolution    | 0.061 °/s     |
| Zero Offset   | ±1 °/s        |
| Noise Density | 0.014 °/s/√Hz |
| Nonlinearity  | 0.05 % FS     |
| Bandwidth     | 532 Hz        |

### Magnetometer

|              |                          |
|--------------|--------------------------|
| Range        | ±0.13T (x,y), ±0.25T (z) |
| Resolution   | 0.3µT                    |
| Zero Offset  | ±40µT                    |
| Nonlinearity | < 1 % FS                 |

### Barometers

Dual redundant sensor set

|                   |              |
|-------------------|--------------|
| Range             | 300-1250 hPa |
| Resolution        | 0.016 Pa     |
| Relative Accuracy | ± 0.03 hPa   |
| Absolute Accuracy | ± 0.5 hPa    |
| Bandwidth         | 200 Hz       |

## Navigation and Control Performance

### Navigation

*Specification with an external GPS (u-Blox ZED F9P based).*

| Rating                       | Max                       | Note                                                        |
|------------------------------|---------------------------|-------------------------------------------------------------|
| Heading Compass              | 1 degree RMS              |                                                             |
| Roll-Pitch (Static)          | < 1 degree RMS            |                                                             |
| Roll-Pitch (Dynamic)         | < 0.2 degree RMS          |                                                             |
| Position Accuracy Horizontal | PVT 1.5m CEP<br>RTK 0.01m | As per F9P datasheet                                        |
| Position Accuracy Vertical   | RTK 0.01 CEP              | As per F9P datasheet                                        |
| Velocity Accuracy            | 0.05 m/s                  | 50% @ 30 m/s for dynamic operation<br>As per F9P datasheet. |
| Vibration resilience         | 12 g / 1000 Hz            |                                                             |
| Maximum speed                | 250 m/s                   |                                                             |

### Control

| Rating                        | Max      | Note |
|-------------------------------|----------|------|
| Angular rate loop update rate | 1000 Hz  |      |
| Angular rate control latency  | < 0.1 ms |      |
| Attitude loop update rate     | 250 Hz   |      |
| Position loop update rate     | 50 Hz    |      |

## Installation

### Skynode Mounting

For best performance and longevity it is recommended to mount Skynode in an orientation where the z-axis ([Dimensions and Orientation](#)) points down.

### Antenna Placement

#### Regulatory Requirements

To stay compliant with FCC regulations, antennas of Skynode must not be co-located with antennas of other transmitters.

Antennas of Skynode that are not connected to the same wireless module have to be installed with a distance of at least 25 centimeters to each other. This means that Wifi, 4G and the ground station link (e.g. Microhard or Silvus) antennas need each to be spaced 25 centimeters apart. If a module has two or more antennas, then these can be placed closer to each other.

#### Applicable Regulatory Approvals

Skynode is an evaluation platform for the Auterion software stack, and thus not a certified consumer product. It is the OEM's responsibility to ensure the devices they are selling adhere to the local regulations of where the devices are deployed. Auterion's reference design includes only pre-certified RF emitter modules and was designed in hardware and software with due diligence in regard to regulatory requirements in the EU and North America, promoting a swift process when the OEM submits their final integration for approval certification.

Skynode contains modules with the following FCC IDs:

| Component      | Module                   | FCC ID        |
|----------------|--------------------------|---------------|
| LTE US         | Sierra Wireless RC7611   | N7NRC76B      |
| LTE EMEA       | Sierra Wireless RC7620   | n/a           |
| LTE APAC       | Sierra Wireless RC7630   | n/a           |
| Wifi/Bluetooth | Qualcomm Atheros QCA9377 | 2AKZA-QCA9377 |

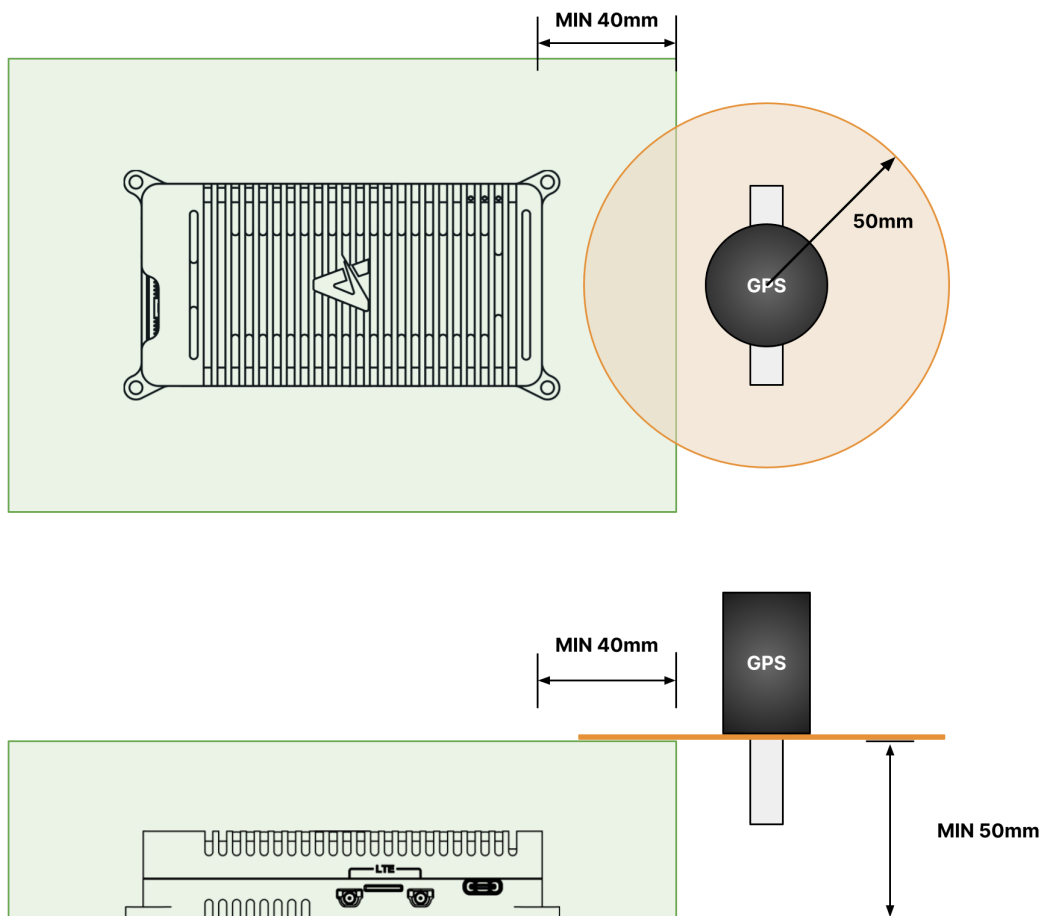
## General Recommendations

Any avionics requires careful considerations when mounting the unit to avoid external disturbances and interferences. The recommendations below are industry-standard and apply in general.

Skynode has been carefully engineered to de-conflict the objective of adding state-of-the-art high-speed interfaces including ethernet, USB and MIPI-CSI while keeping the EMI impact to a minimum. These design considerations include avoiding USB 3.0 frequencies (which overlap with GPS frequencies) by using USB 2.0.

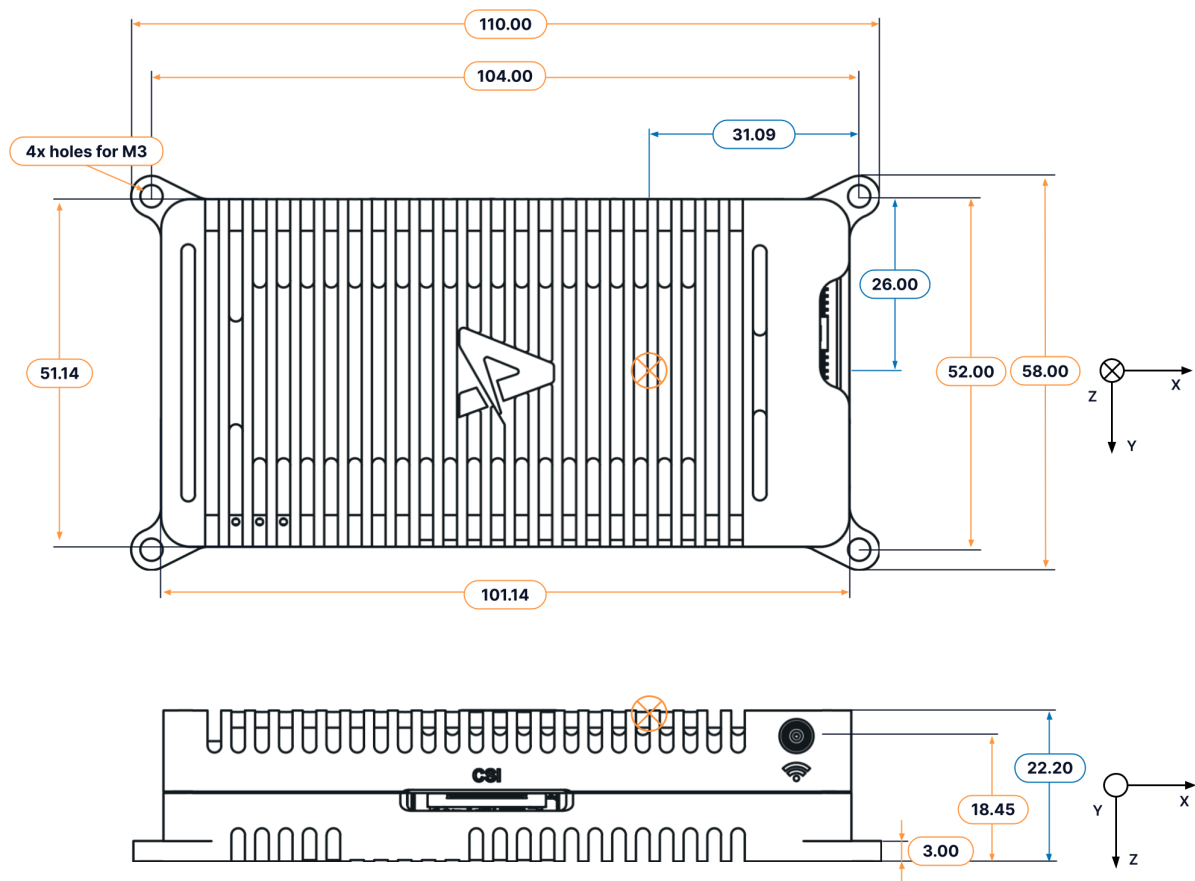
1. In order to maximize the flight performance, the GPS antenna requires a significant ground plane (shown in orange). The GPS receiver should not be closer than 40 mm horizontally and 50 mm vertically to the Skynode. This keep out zone is shown in green.
2. Note that emissions from high speed signals like USB or Ethernet interfere with the GPS. It is therefore recommended to route high speed cables as far as possible from the GPS and the GPS wire.
3. The keep out zone should be avoided by high-current wiring or ESC / motor wires with high switching frequencies.
4. The keep out zone should be properly ventilated to not exceed 60 degrees Celsius ambient temperature.

**Skynode will provide optimal navigation and control performance when these constraints are met.**



Dimensions and Orientation

Skynode X



Skynode OEM Edition

