Auterion

Skynode Datasheet

For Skynode Enterprise and Skynode OEM

Revision: 1.5.1
Revision date: July 7, 2023

Document Information

Revision	Date	Description
0.1.0	June 18, 2020	Preliminary release of the datasheet
1.0.0	August 10, 2020	Pre-release version of the datasheet
1.1.0	November 10, 2020	Update product pictures and drawings
1.1.1	January 6. 2021	Add information about termination and pull ups, update part numbers
1.2	January 10, 2021	Removing legacy payload section, improve specification for GPS mounting
1.2.1	January 14, 2021	Adjust Dev Kit contents
1.2.2	January 15, 2021	Clarify state of MIPI support
1.2.3	February 3, 2021	Update table of contents
1.2.4	April 8, 2021	Updated explosion drawing of components
1.2.5	May 19, 2021	Adjust 5V_HIPOWER current rating, adjust Buzzer signal description
1.2.6	June 7, 2021	Slight adjustment of wording
1.3	July 6, 2021	Remove evaluation kit content list (now on docs.auterion.com/skynode), add Skynav LT to supported controllers
1.4	October 11, 2022	Updated pinouts, order codes and more precise language in feature set and regulatory section
1.4.1	December 13, 2022	Adjustments to environmental & power specifications
1.5	April 18, 2023	Addition of extra details
1.5.1	July 7, 2023	Addition of expected lifetime

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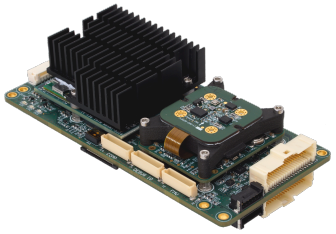
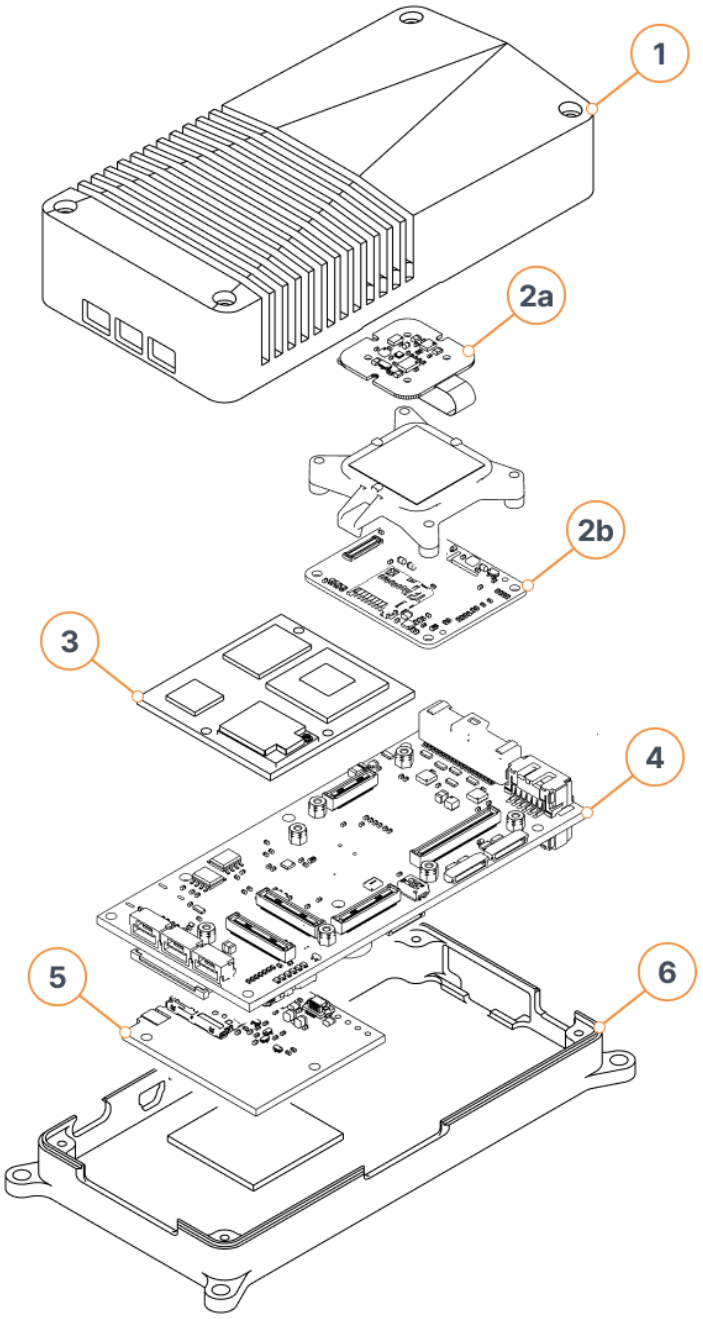
Product Variants

Skynode Enterprise	Skynode Government	Skynode OEM
		
AU-SKYNODE-ENT	AU-SKYNODE-GOV	AU-SKYNODE-OEM
Aluminum enclosure		Bare unit with heatsink and IMU mount.
Weight: 188 g		Weight: 89 g
Dimensions: 110 × 58 × 31.5 mm (see page 28)		Dimensions: 97.5 × 47.5 × 29.6 mm (see page 29)
Recommended for R&D and low-rate production.	Recommended for Government use cases.	Recommended for tightly integrated designs.
Debug connectors present but disassembly required		Debug connectors exposed
Fully NDAA Section 848 compliant. Manufactured, tested and provisioned in the US.	Fully NDAA Section 848 compliant. Manufactured, tested and provisioned in the US. LTE, WiFi, and logging can be disabled	Fully NDAA Section 848 compliant. Manufactured, tested and provisioned in the US.
Flight time up to 59 min	Unlimited flight time	Flight time up to 59 min
Same connectors and cabling		
Operating Temperature: -10°C to +50°C		
Relative Humidity: 10% - 90% RH (non-condensing)		
Expected Lifetime: 8 years		

Core Module Components

1. **Enclosure top**
2. **Flight controller**
   - a. **Inertial measurement unit**
     Triple-redundant sensor architecture to minimize failure risk
   - b. **Flight management unit**
     Built on the foundation of the next generation FMUv5x
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

Flight modes	Manual, assisted, missions, terrain following
Waypoint Mission Planning	5000 waypoints saved in autopilot
Black box	50 hours continuous recording, no-logging mode supported for GOV edition
GPS	External u-Blox dual-frequency or Trimble dual-frequency modules supported
GPS denied navigation	Not included, but hardware is powerful enough to run AI or vision algorithms
Supported Peripherals	All standard PX4-compatible sensors
Endurance	Unlimited for government edition or when OEM implements full export compliance processes. This is a legal requirement under US and EU law. Otherwise 59 minutes (commercial).
ECCN	EAR99
Specific Operations Risk Assessment (SORA)	Skynode can be used for operations in the open and specific category.

Autopilot

Flight Controller Architecture	FMUv5X (Pixhawk Autopilot Standard compliant)
Flight Controller	STM32F765 (2MiB Flash, 512KiB RAM)
IO Coprocessor	STM32F103
Inertial sensors	3 axis gyroscopes, 2000°/sec. 3 axis accelerometers, up to ±24g
Supported takeoff weight	1-1000 pounds / 0.5 - 500 kg (expandable)
Number of actuators	Up to 16 via PWM (more via SBUS and UAVCAN)
UART Interfaces	5+2+1 (5 configurable, 2 internal communication, 1 console)
CAN	Dual redundant CAN
Ethernet	100Base-T (onboard switch with VLAN)
Interfaces	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 32GB
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 RC7611 (US), Frequency bands: B2, B4, B5, B12, B13, B14, B25, B26, B66, B71 RC7620 (EMEA), Frequency bands: B1, B3, B7, B8, B20, B28 RC7630 (APAC), Frequency bands: B1, B3, B5, B7, B8, B18, B19, B21

Video

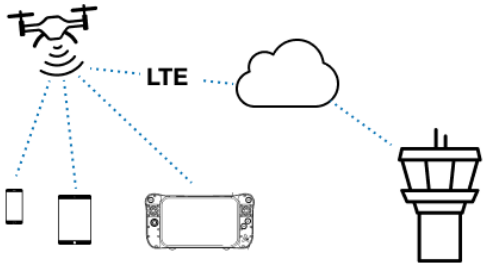
Camera Interfaces	Ethernet, USB, 4-lane MIPI-CSI (Software support pending)
Video Decode	1080p60 H.264
Video Encode	1080p60 H.264 in hardware
HDMI Input	Software support pending

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



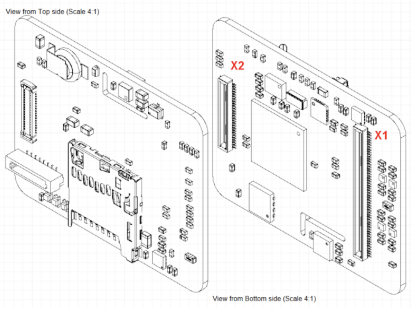
The ASTM remote ID standard supports the remote identification of unmanned aircraft, which is required by international regulatory bodies such as FAA and EASA.

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.

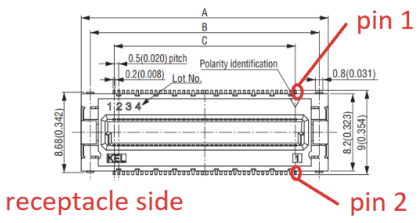
Pixhawk Autopilot Standard DS-011



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

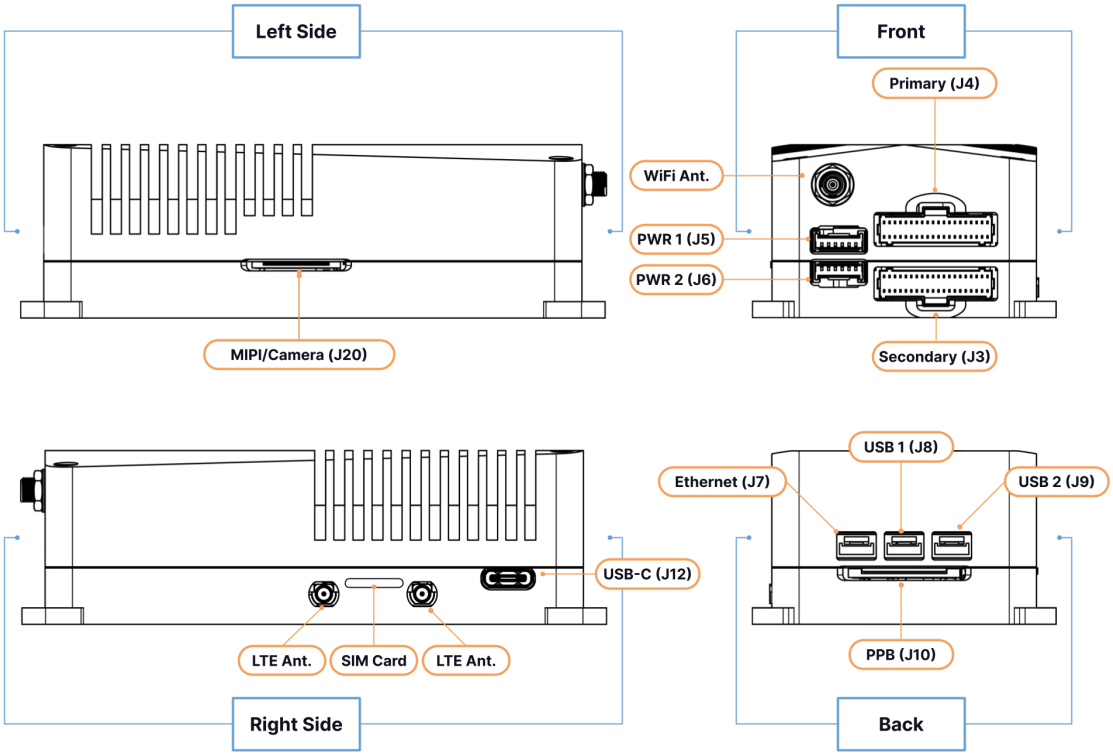


The Pixhawk payload bus standardizes the electrical, mechanical and software interfaces for drone payloads connected to the main avionics system of a drone. This enables payload manufacturers and drone manufacturers to more effectively offer well-integrated solutions.

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 TELEM3, GPS2, CAN2 MON PWM, SBUS OUT	Secondary avionics port with redundant interfaces.
J4	✓	Primary	Flight Control Main TELEM1, GPS1, CAN1 FMU PWM	Main avionics port
J5	✓	PWR 1	First Power module	5V/5A Redundant power inputs to Skynode.
J6	✓	PWR 2	Second Power module	5V/5A Redundant power inputs to Skynode.
J7	✓	ETH	Ethernet	100 Base-T standard ethernet.
J8	✓	USB 1	USB 2.0 port	USB 2.0 does not interfere with GPS while USB 3.0 does.

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

Attachment Points/Other

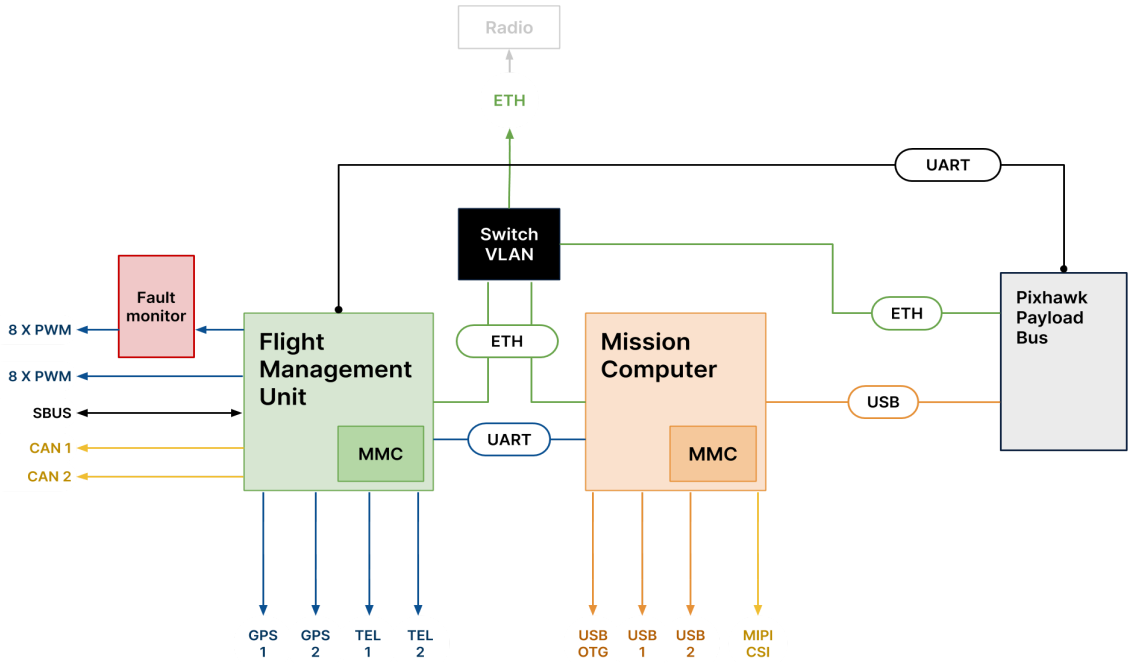
There are external attachment points for two LTE Antennas, and a Wifi Antenna. There is also a port for inserting a SIM card.

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). 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) 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

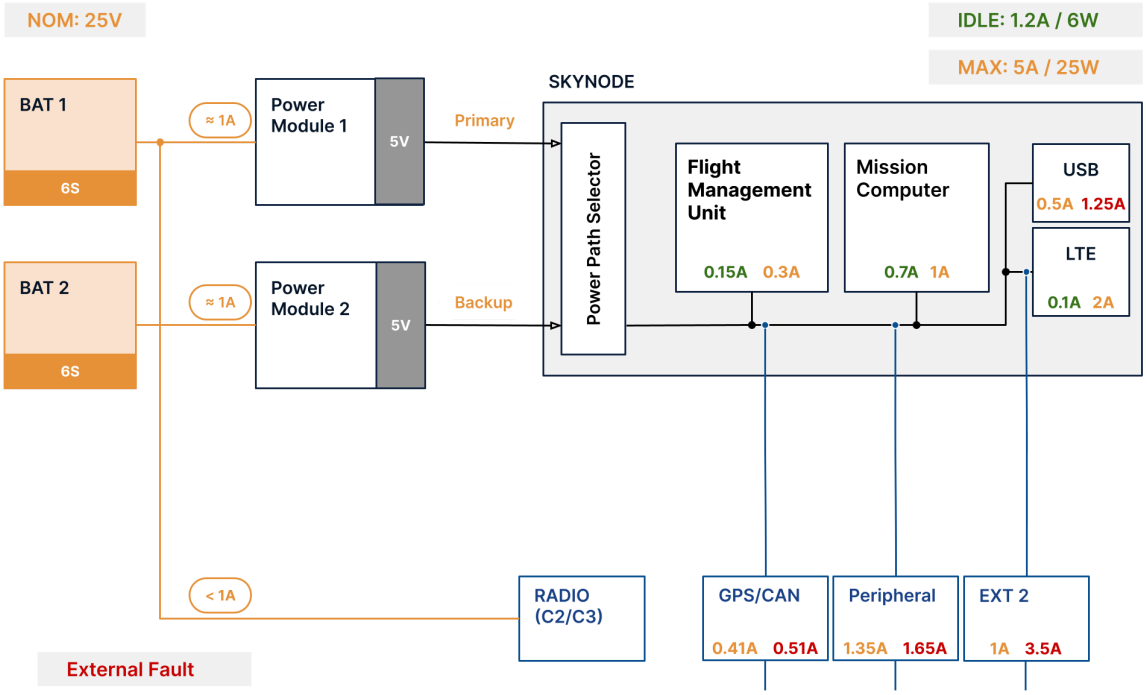
Skynode Interfaces (Block Diagram)



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	1.2A		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][1] - 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][1] - 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

[1] **[Int] - Internal Connector (not accessible when assembled in the enclosure)**

J3 - Flight Control Secondary - Molex 5015714007

Pin	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 **			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	
29	FMU_CH3	I/O	3.3V	
30	FMU_CH7	I/O	3.3V	IMPORTANT: Connected to pin 11 of J10
31	FMU_CH4	I/O	3.3V	
32	FMU_CH8	I/O	3.3V	IMPORTANT: Connected to pin 13 of J10
33	GND			Ground
34	VDD_SERVO_SENSE	IN	<9V	
35	CAN1_P		5V	Connected to J10 pin 8, *
36	GND			Ground
37	CAN1_N		5V	Connected to J10 pin 9, *
38	GND			Ground
39	GND			Ground
40	VDD_5V_CAN1_GPS1		5V	5V supply for primary GPS and CAN interface

J5 - First 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 - Second 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][1]

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][1]

Pin	Name	Dir	Lvl	Function

Pinout as specified by Technexion E1 connector

J14 - Technexion X2 SOM Connector [Int][1]

Pin	Name	Dir	Lvl	Function

Pinout as specified by Technexion X2 connector

J15 - Technexion X1 SOM Connector [Int][1]

Pin	Name	Dir	Lvl	Function

Pinout as specified by Technexion X1 connector

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

J16 - LTE module connector [Int][1] - 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][1]-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][1] - 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][1] - 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

[1][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_CLKO1	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
Range	±24g	
Resolution	0.733mg	
Zero Offset	±20mg	Typical over life-time
Noise Density	175 µg/√Hz	
Nonlinearity	0.5 % FS	
Bandwidth	280 Hz	3dB cutoff frequency

Gyroscopes

		Triple redundant sensor set
Range	±2000 °/s	
Resolution	0.061 °/s	
Zero Offset	±1 °/s	Typical over life-time
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	± 0.08 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 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 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 (early access units)	Sierra Wireless HL7588	N7NHL7588
LTE US (current gen)	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
Microhard (in kit, not built into Skynode)	Microhard pMDDL2450	NS918PMDDL2450

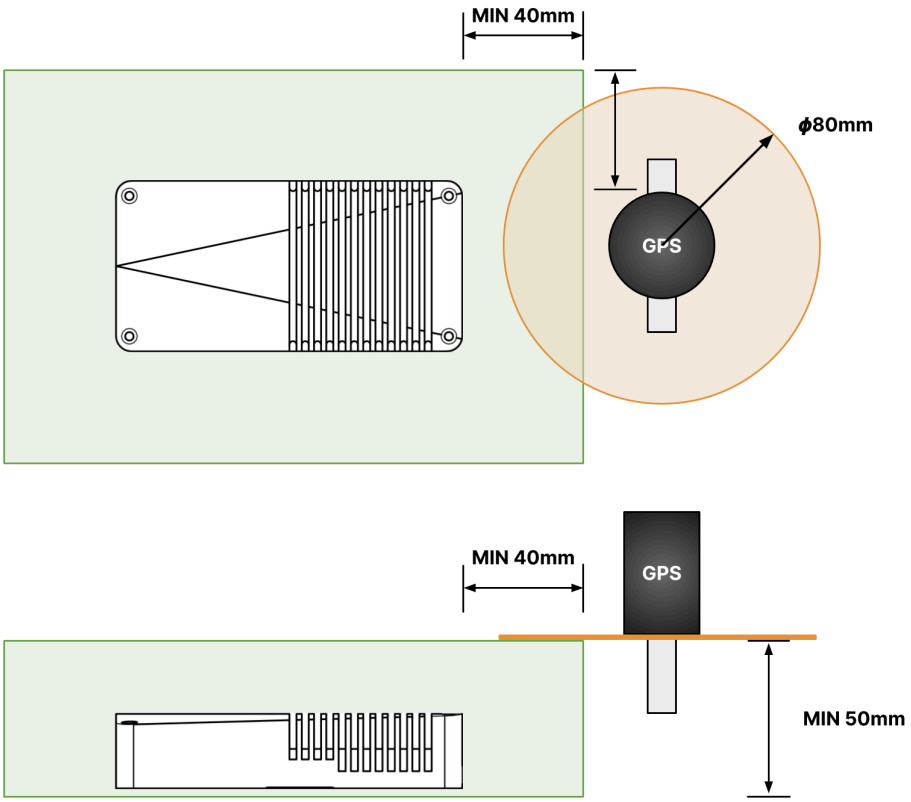
General Recommendations

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.

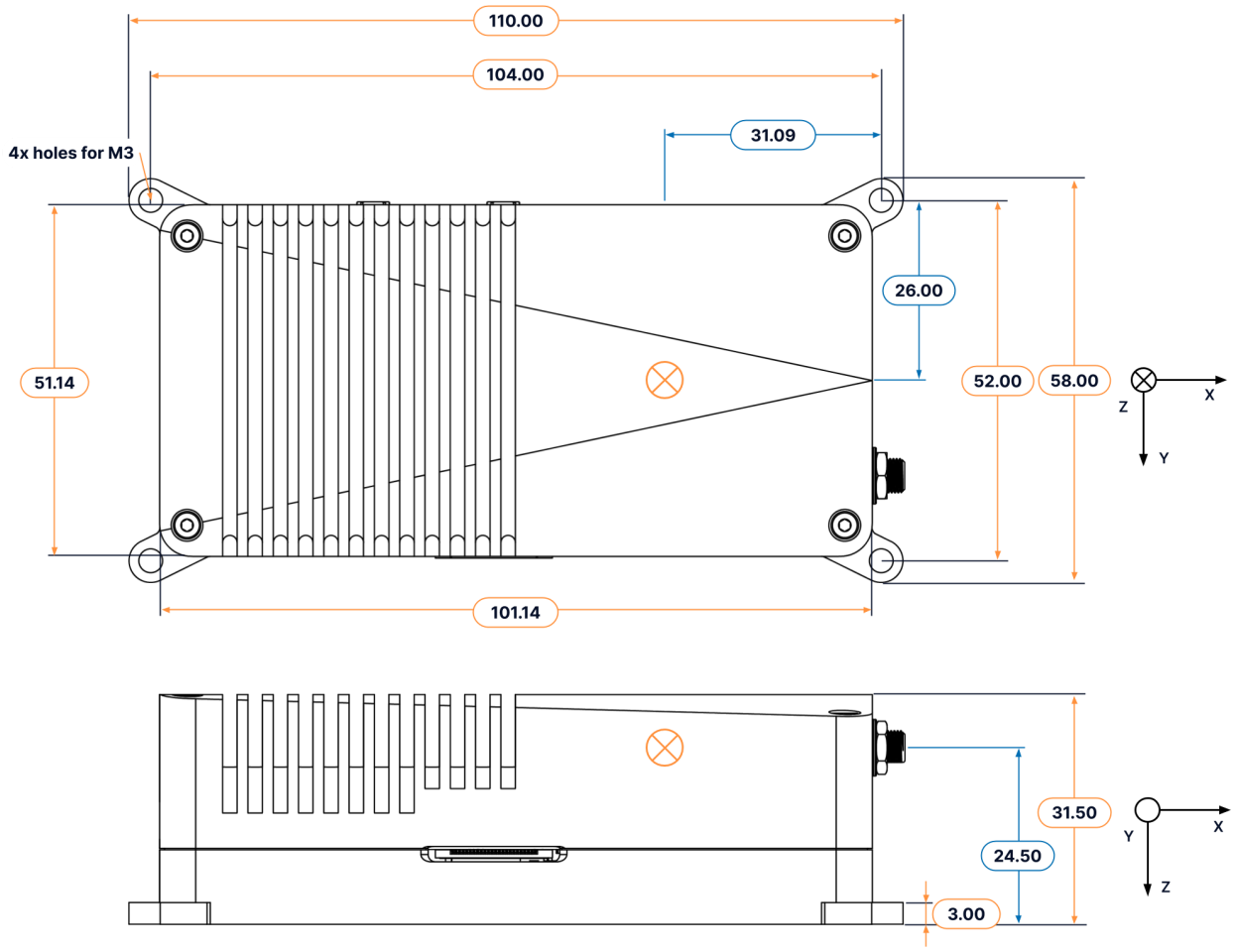
1. In order to maximize the flight performance, the GPS antenna requires a significant ground plane. The GPS receiver should not be closer than 40 mm horizontally and 50 mm vertically to the unit.
2. No wiring that contains high-speed signals (USB, ethernet) should be routed in the green zone marked as keepout area, as emissions from these lines can couple back into wires that run to other units, such as GPS. Cables in the green keepout zone should only enter/exit Skynode and perpendicular to it.
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 ambient temperature.
5. In the mounting orientation shown below, the external magnetometer rotation relative to Skynode is Roll-270-Yaw-90 (push button pointing away from Skynode)

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



Dimensions and Orientation

Skynode Enterprise Edition



Skynode OEM Edition