HAPPi HAT

High Accuracy Positioning for Raspberry Pi

HAPPi HAT is a robust standalone GNSS receiver that can act as an add-on able to deliver centimeter level accuracy for a large variety of SBC's, micro controllers and autopilots, while also being Plug and Play compatible with Raspberry Pi.

KEY FEATURES

- Multi-band, multi-constellation GNSS receiver that tracks all available signals
- Wide array of interfaces, including an Ethernet over USB for rapid configuration and data handling and a dedicated pin header for easy integration with the Raspberry Pi platform
- Stand-alone operation and on-board SD card slot for autonomous logging
- Low power consumption and small footprint

BENEFITS

Configurable data output

HAPPi outputs data directly using industry standard formats and is compatible with commercially available UAS/UAV autopilots. Raw GNSS data streams can be saved via the built-in SD card slot and logging can also be triggered via a dedicated button. HAPPi can be configured to automatically push to FTP logged files when an internet connection is present.

Internal correction processing

RTK base or rover configurations are easily accessible and the receiver can become an NTRIP client or server. External RTK correction subscriptions can also be used for centimeter level accuracy when relying on 3rd party reference providers.

Easily configurable

HAPPi presents the user with a web based interface for easy access to settings and parameters. User configurations can be stored in the permanent memory for quick start-up with application-specific options and returning to the default settings is straightforward.

Anti-jamming and anti-spoofing technology

With Sepentrio's unique AIM+ technology built-in, HAPPi mitigates against a wide range of attacks affecting the performance of conventional receivers, offering a benchmark of reliability on the market of compact GNSS receivers. A dedicated GNSS spectrum analyser can be used to monitor any interference in the RF bands of interest.

Performance variyng receivers

HAPPi can host different GNSS receivers that best suit the end user needs:

- HAPPi-X - decimeter level precision for the most demanding applications;
- HAPPi-T - for high accuracy timing applications and non-RTK positioning;
- HAPPi-H - for heading determination and decimeter level precision in positioning.

Available for customisation

HAPPi is designed to satisfy varied customers requirements and can be used in a large array of applications in different fields of industry and tailored to specific needs (including Timing and Heading options). Reference versions available as stock are: OEM module (HAPPi HAT configuration), standalone unit (Sapphire configuration) and low cost surveying unit (HAPPi GIS configuration).

HAPPi-X

FEATURES

GNSS technology

448 hardware channels for simultaneous tracking of all visible supported satellite signals:

- GPS: L1C/A, L1C, L1PY, L2C, L2P, L5
- GLONASS: L1CA, L2CA, L2P, L3CDMA
- BeiDou: B1I, B1C, B2a, B2I, B3
- Galileo: E1, E5a, E5b, E5 AltBloc, E6
- QZSS: L1C/A, L1C, L2C, L5, L6
- Navic: L5
- SBAS: Egnos, WAAS, GAGAN, MSAS, SDCM (L1, L5)
- On module L-band

Septentrio's patented GNSS+ technologies

- **AIM+** interference monitoring and mitigation (narrow band, wide band, chirp jammers)
- **IONO+** advanced scintillation mitigation
- **APME+** a posteriori multipath estimator for code and phase multipath mitigation
- **LOCK+** superior tracking robustness under heavy mechanical shocks or vibrations

4 constellation RTK (base and rover)
RAIM (Receiver Autononous integrity Monitoring)
PPP SECORX (optional)
Moving base RTK

Protocols

Septentrio Binary Format (SBF)
NMEA 0183, v2.3, v3.03, v4.0
RINEX v2.x, v3.x
RTCM v2.x, v3.x (MSN included)
CMR v2.0 (out/in), CMR+ (input only)

Interfaces

2 UART (LVTTL, up to 4 Mbps)
Ethernet (RMII/MDIO), 1/100 Mbps
USB device (2.0, HS)
microSD slot (up to 32 GB)
2 Event markers
1 Configurable PPS out
Auxiliary RF interface

PERFORMANCE

RTK performance

Horizontal accuracy	0.6 cm + 0.5 ppm
Vertical accuracy	1 cm + 1 ppm
Initialisation time	7 s

Other positioning modes accuracy

	Horizontal	Vertical
Standalone	1.2m	1.9m
SBAS	1.2m	1.9m
DGNSS	1.2m	1.9m
SECORX (PPP)	1.2m	1.9m

Velocity accuracy

3 cm/s

Maximum update rate

Position	100 Hz
Measurements only	100 Hz

Latency

<10 ms

Time precision

xPPS out	5 ns
Event accuracy	<20 ns

Time to first fix

Cold start	<45 s
Warm start	<20 s
Re-acquisition	1 s

Tracking performance (C/N0 threshold)

Tracking	20 dB-Hz
Acquisition	33 db-Hz

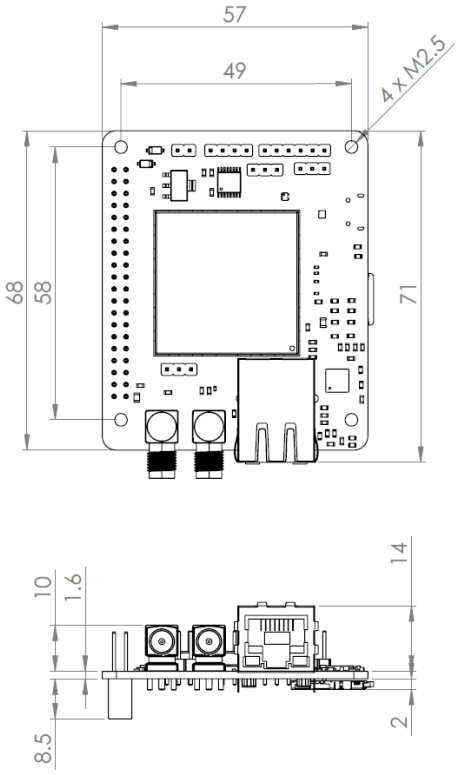
Firmware

Free product lifetime upgrades.

PHYSICAL AND ENVIRONMENTAL

Package

Type	Double-Sided multilayer PCBs
Size	71 x 57 x 24 mm
Weight	40 g / 1.4 oz



Electrical

Antenna pre-amplification range	15-50 dB
Antenna bias voltage	3.0-5.5 V Build-in current limit (150 mA)
Input Voltage	5.0 VDC +/- 5
Power consumption	0.6 W typ 1.1 W max

Note:
* Some options presented may require additional costs or subscriptions.
* All trademarks are the property of their respective owners.
* Optional housing can be ordered.

Romanian InSpace Engineering SRL, Bucharest, Romania
sales@roinspace.com - support @roinspace.com
www.roinspace.com

HAPPi-T

FEATURES

GNSS technology

448 hardware channels for simultaneous tracking of all visible supported satellite signals:

- GPS: L1C/A, L1C, L1PY, L2C, L2P, L5
- GLONASS: L1CA, L2CA, L2P, L3CDMA
- BeiDou: B1I, B1C, B2a, B2I, B3
- Galileo: E1, E5a, E5b, E5 AltBloc, E6
- QZSS: L1C/A, L1C, L2C, L5, L6
- Navic: L5
- SBAS: Egnos, WAAS, GAGAN, MSAS, SDCM (L1, L5)

Septentrio's patented GNSS+ technologies

- **AIM+** interference monitoring and mitigation (narrow band, wide band, chirp jammers)
- **IONO+** advanced scintillation mitigation
- **APME+** a posteriori multipath estimator for code and phase multipath mitigation
- **LOCK+** superior tracking robustness under heavy mechanical shocks or vibrations
- **RAIM+** Receiver Autononous integrity Monitoring

4 constellations

Protocols

Septentrio Binary Format (SBF)
NMEA 0183, v2.3, v3.03, v4.0

Interfaces

2 UART (LVTTL, up to 4 Mbps)
Ethernet (RMII/MDIO), 1/100 Mbps
USB device (2.0, HS)
microSD slot (up to 32GB)
2 Event markers
1 Configurable PPS out

PERFORMANCE

Time precision

xPPS out	5 ns
xPPS out with SBAS	2 ns
Event accuracy	< 20 ns

Positioning modes accuracy

	Horizontal	Vertical
Standalone	1.2m	1.9m
SBAS	0.6m	0.8m

Velocity accuracy

3 cm/s

Maximum update rate

Position 10 Hz

Latency

<10 ms

Time precision

xPPS out	5 ns
Event accuracy	<20 ns

Time to first fix

Cold start	<45 s
Warm start	<20 s
Re-acquisition	1 s

Tracking performance (C/N0 threshold)

Tracking	20 dB-Hz
Acquisition	33 db-Hz

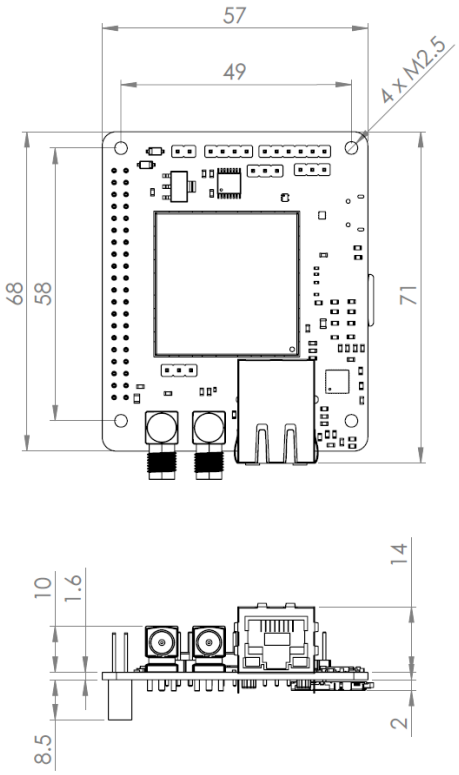
Firmware

Free product lifetime upgrades.

PHYSICAL AND ENVIRONMENTAL

Package

Type	Double-Sided multilayer PCBs
Size	71 x 57 x 24 mm
Weight	40 g / 1.4 oz



Electrical

Antenna pre-amplification range	15-50 dB
Antenna bias voltage	3.0-5.5 V
	Build-in current limit (150 mA)
Input Voltage	5.0 VDC +/- 5
Power consumption	0.6 W typ
	1.1 W max

Note:
* Some options presented may require additional costs or subscriptions.
* All trademarks are the property of their respective owners.
* Optional housing can be ordered.

Romanian InSpace Engineering SRL, Bucharest, Romania
sales@roinspace.com - support @roinspace.com
www.roinspace.com

HAPPi-H

FEATURES

GNSS technology

448 hardware channels for simultaneous tracking of all visible supported satellite signals:

- GPS: L1, L2
- GLONASS: L1, L2
- BeiDou: B1, B2
- Galileo: E1, E5b
- QZSS: L1,L2
- Navic: L5
- SBAS: Egnos, WAAS, GAGAN, MSAS, SDCM (L1)

Septentrio's patented GNSS+ technologies

- **AIM+** interference monitoring and mitigation (narrow band, wide band, chirp jammers)
- **IONO+** advanced scintillation mitigation
- **APME+** a posteriori multipath estimator for code and phase multipath mitigation
- **LOCK+** superior tracking robustness under heavy mechanical shocks or vibrations
- **RAIM+** Receiver Autononous integrity Monitoring

RTK
GNSS heading

Protocols

Septentrio Binary Format (SBF)
NMEA 0183, v2.3, v3.03, v4.0
RINEX v2.x, v3.x
RTCM v2.x, v3.x (MSN included)
CMR v2.0 (in), CMR+ (input only)

Interfaces

2 UART (LVTTL, up to 4 Mbps)
Ethernet (RMII/MDIO), 10/100 Mbps
USB device (2.0, HS)
microSD (up to 32GB)
2 Event markers
1 Configurable PPS out

PERFORMANCE

RTK performance

Horizontal accuracy	0.6 cm + 0.5 ppm
Vertical accuracy	1 cm + 1 ppm
Initialisation time	7 s

Other positioning modes accuracy

	Horizontal	Vertical
Standalone	1.2m	1.9m
SBAS	0.6m	0.8m
DGNSS	0.4m	0.7m

Velocity accuracy

3 cm/s

GNSS attitude accuracy

Antenna separation	Heading	Pitch
1m	0.15°	0.25°
5m	0.03°	0.05°

Maximum update rate

Measurements only	100 Hz
Standalone, SBAS, DGPS + attitude	50 Hz
RTK + attitude	20 Hz

Latency

<10 ms

Time precision

xPPS out	5 ns
Event accuracy	<20 ns

Time to first fix

Cold start	<45 s
Warm start	<20 s
Re-acquisition	1 s

Tracking performance (C/N0 threshold)

Tracking	20 dB-Hz
Acquisition	33 db-Hz

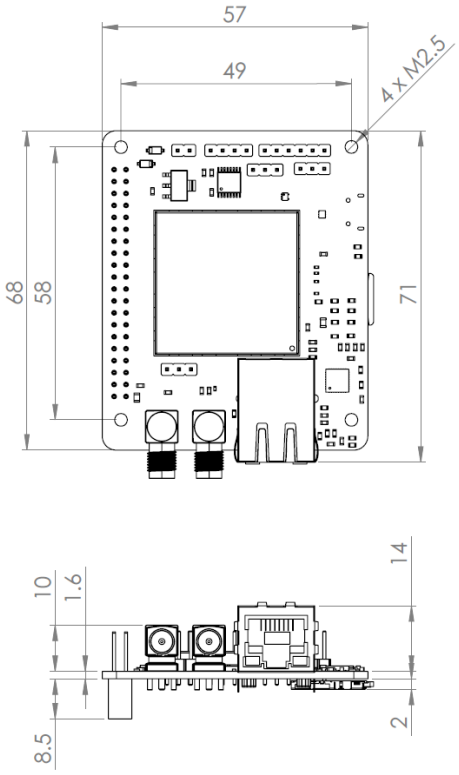
Firmware

Free product lifetime upgrades.

PHYSICAL AND ENVIRONMENTAL

Package

Type	Double-Sided multilayer PCBs
Size	71 x 57 x 24 mm
Weight	40 g / 1.4 oz



Electrical

Antenna pre-amplification range	15-35 dB
Antenna bias voltage	3.0-5.5 V
	Build-in current limit (150 mA)
Input Voltage	5.0 VDC +/- 5
Power consumption	0.6 W typ
	1.1 W max

Note:
* Some options presented may require additional costs or subscriptions.
* All trademarks are the property of their respective owners.
* Optional housing can be ordered.

Romanian InSpace Engineering SRL, Bucharest, Romania
sales@roinspace.com - support @roinspace.com
www.roinspace.com