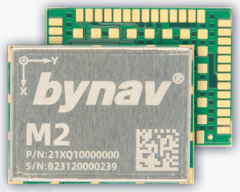
M21/M22 High-precision Module

GNSS+IMU Deeply-coupled combined navigation system

Brief Introduction

M21/M22 are based on GNSS technology with completely independent intellectual property rights. They have high-precision measurement and navigation engine, inertial navigation unit and functional safety engine, can reach the functional safety ASIL B and support high performance NRTK/PPP/PPP-RTK solution, deeply-coupled combined navigation, anti-jamming, L-Band and CLAS SBAS. They can deal with harsh environments with satellite signal interference or loss, provide continuous, real-time and reliable accurate position and attitude. It can be applied to automated driving, advanced driver assistance, lane-level navigation, drones, intelligent robots and many other fields.



Technological Advantage

Full-Temperature Calibrated IMU and Deeply-Coupled Navigation

The built-in high-precision IMU has been calibrated over full temperature, which improves key indicators such as bias stability and dead reckoning accuracy. The deeply-coupled combined navigation algorithm based on Alice lifts the quality of GNSS signal observation. Aided by IMU, deeply-coupled algorithm will increase the positioning accuracy by twice to 5 times than loosely-coupled algorithm. So the original automatic driving positioning unit (like P-BOX or IMU-BOX assembly) can be replaced to reduce system complexity and cost, simplify wiring and improve vehicle integration.

Anti-jamming GNSS Measurement and Positioning Engine

Bynav REAL (Ransac Enhanced Advanced Location) GNSS positioning engine has integrity monitoring and partial ambiguity solution algorithm to improve the fault tolerance and fixed solution rate under multipath and interference conditions in urban environments. To meet the expected functional safety and network security requirements, high-quantity signal preprocessing and interference suppression are adopted to deal with vehicle anti-tracking equipment, radar/airport signal towers, etc., so it can greatly improve the availability and integrity of high-precision positioning in vehicle scenarios.

L-Band/CLAS SBAS and NRTK/PPP/PPP-RTK

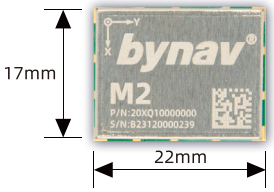
Beidou-3 B2b PPP solution, QZSS CLAS PPP-RTK solution and prevailing PPP-RTK differential service are supported to provide high-precision positioning in environments without conventional differential or mobile communication services. Beidou and Galileo four-frequency signals are used to greatly speed up PPP convergence and improve the availability of high-precision positioning.

Functional Safety ASIL B

The design is based on ISO26262 ASIL B functional safety requirements. With built-in functional safety IMU and GNSS SoC Alice, high-precision position and attitudes with system-level functional safety can be provided for intelligent vehicles and automated driving.

Feature

- **Independent intellectual proper rights**
- **Deeply-coupled system (DR accuracy can reach 0.2%)**
- **Full constellations and full frequencies (1507 channels)**
- **L-Band/CLAS SBAS**
- **NRTK/PPP/PPP-RTK**
- **Anti-jamming and anti-deception**
- **AEC-Q104**
- **ISO 26262 ASIL B**



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Function

Constellation

GPS、BDS、GLO、GAL、QZSS、IRNSS

Number of Channel

1507 channels

Tracking

L-Band

BDS	B1I、B2I、**B3I**、**B1C***、B2a、**B2b*(PPP)**
GPS	L1 C/A、L1C*、L2、L5
GLO	G1, G2
GAL	E1、**E5a**、E5b、**E6***
QZSS	L1 C/A、L2、L5、**L6(CLAS*)**
NavIC (IRNSS)	L5
SBAS*	L1 C/A

Anti-interference

Single-frequency, Multitone, Sweeping、Pulse;
Narrowband, Interference-Signal Ratio: 65 dBc

DR Accuracy[6]

Model	M21	M22
ADR position error (2σ)	0.8%	0.2%

Horizontal Positioning Accuracy (RMS) [1]

Single Point	1.5 m
RTK	1.0 cm + 1 ppm

Vertical Positioning Accuracy (RMS) [1]

Single Point	2.5 m
RTK	1.5 cm + 1 ppm

Max Transfer Rate

GNSS Observation [7]	50 Hz
GNSS Position Results [8]	5 Hz
INS Position Results	100 Hz
IMU Raw Data	100 Hz

Initialization and Timing

Cold Start[2]	≤ 30 s
Hot Start[3]	≤ 5 s
RTK Initialization[1]	≤ 5 s
Re-acqusition Time	≤ 1 s
Timing Accuracy (RMS)[4]	≤ 20 ns

Solution Delay

INS	≤ 5 ms
RTK	≤ 50 ms

Interfaces

UART	×4
SPI*	×1
CANFD	×2
Wheel tick	×1
ANT_DETECT	×1
GEOFENCE	×1
PPS	×1
FuSa	×2
EVENT_IO	×5
RMII	×1

Environment and Certification

Operating Temperature [9]	-40° C ~ +105° C
Storage Temperature[10]	-55° C ~ +150° C
Humidity	95% Non-condensing

IATF 16949*
ISO 26262 ASIL D (Management)*
ISO 26262 ASIL B (Product)*
AEC-Q104*
AEC-Q100 (Built-in Chips)*
RoHS
FCC
IC
CE
UKCA
REACH

IMU Parameter

	Model	M21	M22
Gyroscope	Measure range (±° /s)	300	460(z)300(xy)
	Angular radom walk (° / √ h)	0.5	0.08(z)0.5(xy)
	Bias instability (° /h)	5	1(z)5(xy)
	Bias (° /s)	0.3	0.07(z)0.3(xy)
	Scale error	4‰	2‰ (z)4‰ (xy)
	Cross coupling error	1.7‰ (0.1°)	1.7‰ (0.1°)
Accelerometer	Measure range (±g)	16	16
	Velocity random walk (m/ s/ √ h)	0.3	0.3
	Bias instability (μg)	50	50
	Bias (mg)	5	5
	Scale error	2‰	2‰
	Cross coupling error erro	0.9‰ (0.05°)	0.9‰ (0.05°)
	System functional safety	ASIL B*	ASIL B*

Mechanical and Electrical

Model	M21	M22
Size (mm)	17..0×22.0×2.75	17.0×22.0×2.75
Weight (g)	3	4
Power Consumption (mW)[5]	500	500

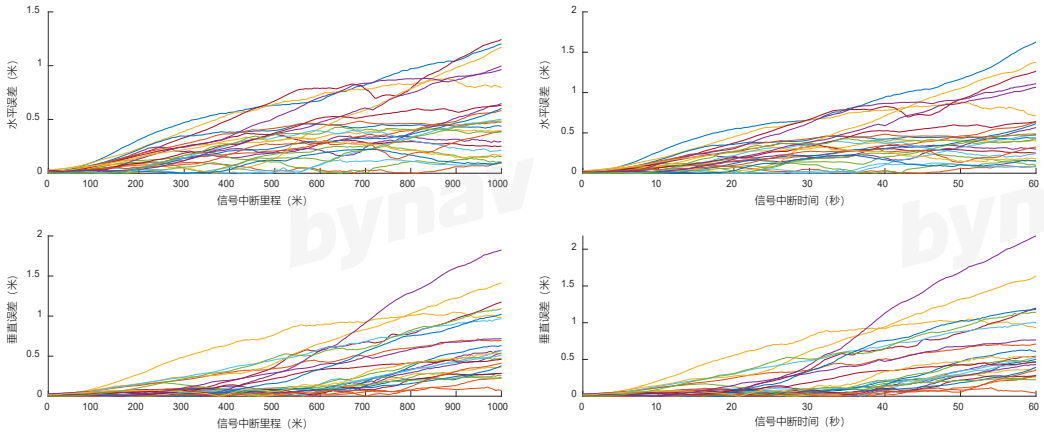
Note:

1. Typical value.Performance will be affected by GNSS status, satellites' location, baseline length, multipath and other interference;
2. Typical value. There is no almanac, ephemeris and approximate position or time;
3. Typical value. Almanac, ephemeris and approximate position or time are preserved.
4. Optional. Bias caused by RF and antenna is not included;
5. Typical value. Power of antenna and peripherals is not included;
6. When odometer is connected and vehicle model is used;
7. When high-speed communication interface is used;
8. 10Hz is supported when combined navigation closed;
9. There are optional temperature range of -40℃ ~85℃ and -20℃ ~65℃ ;
10. There are optional temperature range of -40℃ ~105℃ and -40℃ ~65℃ .

* Optional or supported in special firmware

GNSS Signal Outage

Bias of M22 in 26 tunnel tests (WSS is used) :



More information, please refer to
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