GI3100 Series

GNSS INS

Technical Manual

V4.0

BWSENSING

GI3100
GNSS INS




Feature

BW-GI3100 is a high-performance and high-precision fibre-optic combined navigation system developed by BWSENSING for aerial surveying and mapping, unmanned aerial vehicle (UAV), sea-based and road-based fields. Built-in three-axis fibre-optic gyroscope, three-axis accelerometer, optional three-axis magnetic sensor, high-precision barometric pressure sensor, including a BD/GPS/GLONASS tri-mode receiver. It can measure the velocity, position and attitude of the carrier, as well as output the compensated angular rate, acceleration, magnetic field, air pressure, temperature and other information.

BW-GI3100 is equipped with a new combined navigation sensor fusion algorithm engine, optimised for multi-path interference, which can well meet the needs of long-time, high-precision and high-reliability navigation applications in urban and field complex environments. The product supports a variety of sensors such as GNSS/ odometer/ DVL/ barometric altimeter etc., which has excellent scalability. By adopting multi-sensor data fusion technology to combine inertial measurements with satellite navigation, odometer information, etc., the system's adaptability to the geographical area and robustness can be greatly improved.

BW-GI3100 combined navigation system adopts the tight-coupling technology to combine the high-precision, professional-grade, multi-channel, dual-antenna, single-frequency carrier-phase and pseudo-range GPS receiver and high-precision fibre-optic inertial measurement unit with the features of small size, light weight and high performance.

Application

- Space stabilization platform, antenna system stabilization
- Attitude/orientation reference system, multi-beam attitude sensing
- Unmanned vehicle, unmanned aircraft, unmanned ship navigation and control
- Spatial stabilization platform, intelligent control of mining roadheaders and coal excavators
- Automatic farming, container tracking

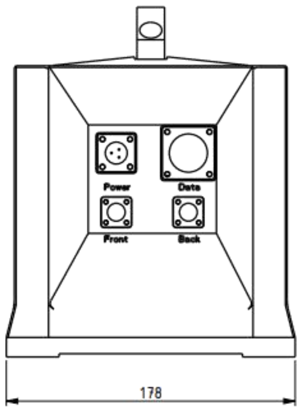
Indicators

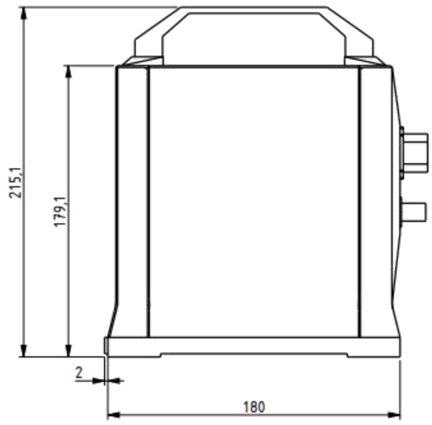
Performance indicators

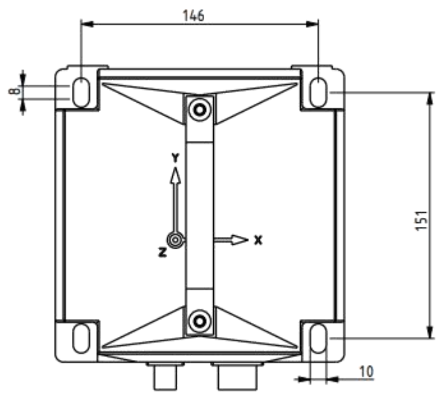
External GPS valid 4m baseline	North seeking accuracy (deg)	≤0.05*Secant Latitude
	Azimuth Accuracy(deg)	≤0.01
	Attitude Angle Accuracy(deg)	≤0.005
	Velocity Accuracy(m/s)	≤0.03/RTK 0.01
	Position Accuracy(m)	≤2m/RTK 2cm
GPS Invalid	Azimuth Holding Accuracy(deg)	≤0.01， 1h
	Attitude Angle Holding Accuracy(deg)	≤0.005， 1h
	Position accuracy(km)	≤1.5，1h ≤0.04，5min
System Measurement Range	Azimuth Measuring Range(deg)	±180
	Attitude Measuring range(deg)	±90
Environmental parameters	Operating Temperature(℃)	-45～+70
	Storage temperature (℃)	-55～+80
	Vibration (Hz, g2/Hz)	20～500,0.06
	Shock (g, ms)	30,11
Electrical Parameters	Input Voltage (Vdc)	+18~+36
	Power (W)	20
	Data Output Format	RS-422/RS-232
	Data Refresh Rate (Hz)	100
Physical parameters	Dimension (mm)	178×180×179.1(handle not included)
	Weight (kg)	6
	Connector	XCE12F3Z1D1； XCE24F26Z1D1

Product Size

Product Size：L178 ×W180 ×H179.1（mm）







Note: Unannotated dimensional tolerances are in accordance with GB/T1804-2000 Grade C.

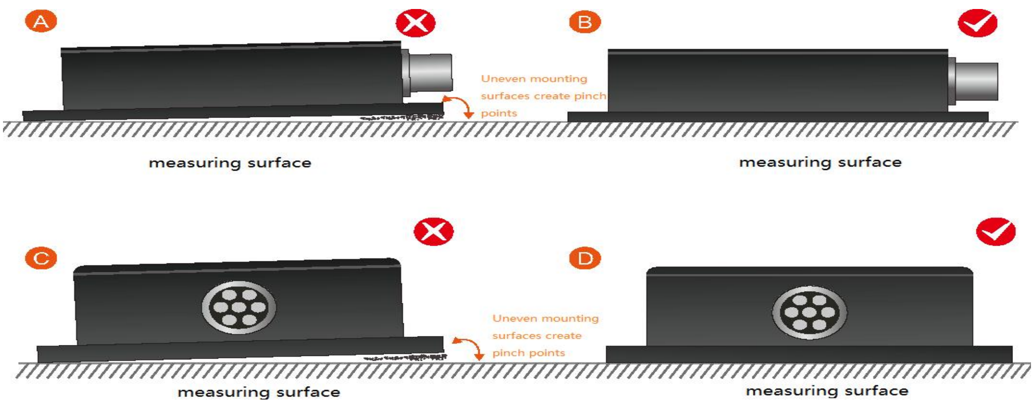
Installation

The GPS antennas we routinely use are zero-phase measurement type antennas, and general navigation type antennas cannot be used for this product. Although some navigation type antennas can also be oriented, the accuracy will be greatly reduced and may also lead to errors. If the user replaces an antenna that is not configured or specified by the Company and the system does not work properly or other consequences occur, the Company is not responsible for this.

Correct installation can avoid measurement errors. The combined navigation system is manufactured with a CNC mill to produce absolutely smooth surfaces on the bottom and measuring surfaces to facilitate installation, which should be done as follows:

First of all, to ensure that their own equipment has two absolutely smooth plane, and the two surfaces are absolutely perpendicular, as far as possible and the body coordinate system coincide, in order to reduce the installation error.

Secondly, when installing the product, the bottom surface of the combined navigation system and the bottom surface of the fuselage overlap, gently push the combined navigation system to make the combined navigation system measuring surface and the fuselage measuring surface overlap, to ensure that the two surfaces are close to each other, and there should not be any pinch angle as shown in Figures A and C. The correct installation method is shown in Figures B and D.



Finally, after the combined navigation system and the body are tightly affixed, screws are used for fixing to ensure tight fixation, flat contact and stable rotation, and to avoid measurement errors due to acceleration and vibration. Remember that the screws only play a role in fixing, not positioning, the screw holes of the combined navigation system are processed into an oval shape for easy adjustment.

Electrical connections

Data cable RS422 interface definition, DB9 female:

DB9 Connector Pin	interface definition	Remarks
1	R+	Receive Positive
2	R-	Receive Negative
3	T+	Send Positive
4	T-	Negative

Testing

Steps to use the software:

① Ensure that the inertial guidance is absolutely stationary, correctly connect the serial port hardware of the combined navigation, and connect the power supply.

② Select the computer serial port and baud rate and click to connect the serial port.

③ Input the correct geographic latitude and longitude, click the inertial guidance to start ¡ú Command input, the working state on the screen shows static alignment, and so on the working state becomes INS navigation, then the inertial guidance enters the working state and can be used.

communication protocols

After the system is powered on, normal operation at 100Hz frequency, RS422 communication 115200bps, n, 8, 1

Sending navigation data outward in broadcast mode, 48 bytes of data per frame as shown in the table below:

Navigation data			
byte symbol	element	data type	byte count
1-2	Frame header: 0X5A 0X A5	Byte	2
3	Working status: 0-monitoring status, 1-static alignment, 2-INS navigation	Byte	1
4-5	Inertial Pitch ([-90, 90] degrees), unit 0.01 degrees	short int(low byte first, high byte last)	2
6-7	Inertial roll angle ([-180, 180] degrees), unit 0.01 degree.		2
8-9	guidance azimuth ([-180, 180] degrees), NNE is negative, NW is positive, unit 0.01 degrees		2
10-11			2
12-13			2
14-15			2
16-17			2
18-19			2
20-21			2
22-23	Velocity after GPS satellite positioning, unit 0.1 meter/sec.		2
24-25	angle ([-180, 180] degrees), NNE is negative, NW is positive, unit 0.1 degree.		2
26-27	GPS Satellite Number		2
28-29	GPS altitude in 0.1 meter		2
30-33		float (low byte first, high byte second) in the range [-90,90] degrees.	4
34-37	Latitude after GPS satellite positioning, in degrees	North latitude is positive, south latitude is negative.	4
38-41		float (low byte first, high byte	4

42-45	Longitude after GPS satellite positioning, in degrees	second)	4
46	Transmit serial number (0-255 cyclic increment)	Byte	1
47	Parity byte, summed bytes 3 through 46		1
48	End of frame: 0X55		1

Executive standard

●Enterprise quality system standard: ISO9001:2008 standard (certificate number: 10114Q16846ROS)

●CE certification (Certificate No.: 3854210814)
●ROHS (Certificate No.: SO81426003)
●GB/T 191 SJ 20873-2003 General Specification for Tiltmeters and Leveling Devices
●GBT 18459-2001 Calculation method of main static performance index of sensor
●JJF 1059-1999 Measurement Uncertainty Assessment and Representation
●GBT 14412-2005 Mechanical vibration and shock Mechanical installation of accelerometers
GJB 450A-2004 General Requirements for Equipment Reliability
GJB 909A Quality control of critical and important components
GJB 899 Reliability qualification and acceptance tests
GJB150-3A High temperature test
GJB150-4A Low temperature test
●GJB150-8A Rain test
●GJB150-12A Sand and dust test
●GJB150-16A Vibration test
●GJB150-18A Impact test
●GJB150-23A Tilt and sway test
●GB/T 17626-3A Radiofrequency electromagnetic field radiation immunity test
●GB/T 17626-5A Surge immunity test
●GB/T 17626-8A Magnetic field immunity test at industrial frequency
●GB/T 17626-11A Immunity to voltage dips, short-term interruptions and voltage variations
●GB/T 2423.22-2012 Environmental test Part 2: Test methods Test N: Temperature change (IEC60068-2-14:2009, IDT)
●GB/T 10125-2012 Artificial atmosphere corrosion test Salt spray test (ISO 9227:2006, IDT)

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