INS-T-306

Tersus GNSS-Aided Inertial Navigation Systems

Overview

The Tersus GNSS-Aided Inertial Navigation System (INS-T-306) is OEM version of new generation, fully-integrated, combined L1 & L2 GPS, GLONASS and BeiDou navigation and high-performance strapdown system, that determines position, velocity and absolute orientation (Heading, Pitch and Roll) for any device on which it is mounted. Horizontal and Vertical Position, Velocity and Orientation are determined with high accuracy for both motionless and dynamic applications.

The Tersus INS-T-306 utilizes advanced GNSS receiver, barometer, 3-axes each of calibrated in full operational temperature range Magnetometers, Advanced MEMS Accelerometers and Gyroscopes to provide accurate Position, Velocity, Heading, Pitch and Roll of the device under measure. INS-T-306 contains Tersus new on-board sensors fusion filter, state of the art navigation and guidance algorithms and calibration software.

Key Features

- Commercially exportable GNSS-Aided Inertial Navigation System
- 73 x 47 x 33 mm size and 145 gram weight
- High precision IMU (1 deg/hr gyroscopes and 5 micro g accelerometers Bias in-run stability)
- GPS L1/L2, GLONASS, BeiDou, DGPS, SBAS, RTK supported signals
- Compatibility with LiDARs (Velodyne, RIEGL, FARO)
- Up to 200 Hz IMU, 50Hz GNSS positions and 20 Hz GNSS measurements data rate
- Advanced, extendable, embedded Kalman Filter based sensor fusion algorithms
- State-of-the-art algorithms for different dynamic motions of Vessels, Ships, Helicopters, UAV, UUV, UGV, AGV, ROV, Gimbals and Land Vehicles
- Implemented ZUPT, GNSS tracking angle features
- Full temperature calibration of all sensing elements, Environmentally sealed (IP67)
- 8GB embedded data logger
# Technical Specifications

## Performance

<table>
<thead>
<tr>
<th>Output Signals:</th>
<th>Positions, Heading, Pitch &amp; Roll, Velocity, Accelerations, Angular rates, Barometric data, Pulse Per Second</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMU update rate:</td>
<td>1...200 Hz</td>
</tr>
<tr>
<td>Start-up time:</td>
<td>&lt; 1s</td>
</tr>
</tbody>
</table>

## GNSS

Supported Navigation Signals:
- GPS L1/L2, GLONASS, BeiDou, DGPS, SBAS, RTK

<table>
<thead>
<tr>
<th>Number of Antennas:</th>
<th>Single</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel Configuration (3) :</td>
<td>120 channels</td>
</tr>
<tr>
<td>GNSS Positions data rate (4) :</td>
<td>50 Hz</td>
</tr>
<tr>
<td>GNSS Measurements (raw) data rate:</td>
<td>20 Hz</td>
</tr>
<tr>
<td>Velocity accuracy, RMS:</td>
<td>&lt; 0.03 m/s</td>
</tr>
<tr>
<td>Initialization time:</td>
<td>&lt;50s (cold start), &lt;30s (hot start)</td>
</tr>
<tr>
<td>Time accuracy (clock drift) (6) :</td>
<td>20 ns</td>
</tr>
</tbody>
</table>

## Navigation:

| Horizontal position accuracy (GPS L1/L2), RMS: | 1.2m |
| Horizontal position accuracy (DGPS), RMS: | 0.4m |
| Horizontal position accuracy (post processing) (1): | 0.02m |
| Horizontal position accuracy (RTK), RMS: | 0.01m+1 ppm |
| Vertical position accuracy, RMS: | <1m |
| Velocity accuracy, RMS: | 0.03 m/s |
| PPS timestamps accuracy: | 20 ns |

## Orientation:

- **Heading**
  - Range: 0 to 360 deg
  - Static Accuracy (3) : 1 deg
  - Dynamic accuracy (GNSS) (5) : 0.1 deg RMS
  - Post processing accuracy (1) : 0.03 deg RMS

- **Pitch and Roll**
  - Range: Pitch, Roll: ±90, ±180 deg
  - Static Accuracy in whole Temperature Range: 0.01 deg
  - Dynamic Accuracy (6) : 0.1 deg RMS
  - Post processing accuracy (1) : 0.006 deg RMS

## Sensors:

### Gyroscopes
- **Measurement range:** ±450 deg/sec
- **Bias in-run stability (RMS, Allan Variance):** 1 deg/hr
- **Noise density:** 0.004 deg/secVHz

### Accelerometers
- **Measurement range:** ±8 g
- **Bias in-run stability (RMS, Allan Variance):** 0.005mg
- **Noise density:** 0.025 mgVHz

### Magnetometers
- **Measurement range:** ±2 Gauss
- **Bias in-run stability, RMS:** 4 nT
- **Noise density, PSD:** 10 nTVHz

### Pressure
- **Measurement range:** 300 – 1100 hPa
- **Bias in-run stability (RMS, Allan Variance):** 2 Pa
- **Noise density:** 0.8 Pa/VHz

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Notes:
1. RMS, post-processing results use third party software
2. calibrated in whole operational temperature range, in homogeneous magnetic environment, for latitude up to ±65 deg
3. tracks up to 60 L1/L2 satellites
4. according to the INS configuration decision
5. dynamic accuracy may depend on type of motion
6. time accuracy does not include biases due to RF or antenna delay
Technical Specifications

**Electrical**

Supply Voltage: 9V~36V DC
Power Consumption: 3.0W
Output Interface (options): RS-232/RS-422
Output data format: Binary, TSS-1, NMEA 0183 ASCII characters
Embedded Data Logger: 8GB

**Environmental**

Operating Temperature: -40°C ~ +70°C
Operating Temperature: -50°C ~ +85°C
MTBF: 55,500 hours

**Physical**

Size: 73x47x33mm
Weight: 145g

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**INS-T-306 Performance during GNSS outages**

<table>
<thead>
<tr>
<th>Outage duration</th>
<th>Positioning mode</th>
<th>Position accuracy (meters, RMS)</th>
<th>Velocity accuracy (meters/sec, RMS)</th>
<th>Attitude accuracy (degree, RMS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Horizontal</td>
<td>Vertical</td>
<td>Horizontal</td>
</tr>
<tr>
<td>0 sec</td>
<td>RTK</td>
<td>0.01 + 1ppm</td>
<td>0.02 + 1ppm</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>SP</td>
<td>1.2</td>
<td>1.0</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>PP</td>
<td>0.02</td>
<td>0.03</td>
<td>0.02</td>
</tr>
<tr>
<td>60 sec</td>
<td>RTK</td>
<td>7</td>
<td>2</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>SP</td>
<td>8</td>
<td>3</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>PP</td>
<td>0.3</td>
<td>0.2</td>
<td>0.03</td>
</tr>
</tbody>
</table>