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)

Technical Specifications

Performance

Output Signals: Positions, Heading, Pitch & Roll, Velocity, Accelerations, Angular rates, Barometric data, Pulse Per Second	
IMU update rate:	1…200 Hz
Start-up time:	< 1s

GNSS:

Supported Navigation Signals: GPS L1/L2, GLONASS, BeiDou, DGPS, SBAS, RTK	
Number of Antennas:	Single
Channel Configuration [3] :	120 channels
GNSS Positions data rate [4] :	50 Hz
GNSS Measurements (raw) data rate:	20 Hz
Velocity accuracy, RMS:	< 0.03 m/s
Initialization time: <50s (cold start), <30s (hot start)	
Time accuracy (clock drift) [6] :	20 ns

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

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 $\pm$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

Orientation:

Heading

Range:	0 to 360 deg
Static Accuracy [2] :	1 deg
Dynamic accuracy (GNSS) [5] :	0.1 deg RMS
Post processing accuracy [1] :	0.03 deg RMS

Pitch and Roll

Range: Pitch, Roll:	$\pm$90, $\pm$180 deg
Angular Resolution:	0.01 deg
Static Accuracy in whole Temperature Range:	0.05 deg
Dynamic Accuracy [5] :	0.1 deg RMS
Post processing accuracy [1] :	0.006 deg RMS

Sensors:

Gyroscopes

Measurement range:	$\pm$450 deg/sec
Bias in-run stability (RMS, Allan Variance):	1 deg/hr
Noise density:	0.004 deg/sec√Hz

Accelerometers

Measurement range:	$\pm$8 g
Bias in-run stability (RMS, Allan Variance):	0.005mg
Noise density:	0.025 mg√Hz

Magnetometers

Measurement range:	$\pm$2 Gauss
Bias in-run stability, RMS:	4 nT
Noise density, PSD:	10 nT√Hz

Pressure

Measurement range:	300 − 1100 hPa
Bias in-run stability (RMS, Allan Variance):	2 Pa
Noise density:	0.8 Pa/√Hz

Technical Specifications

Electrical

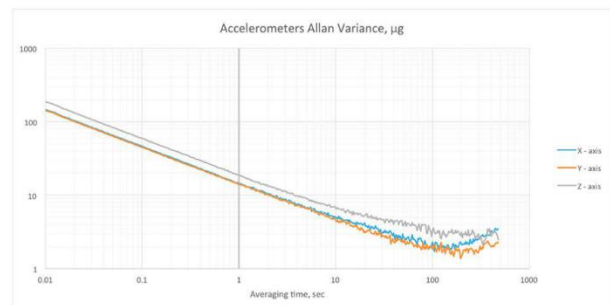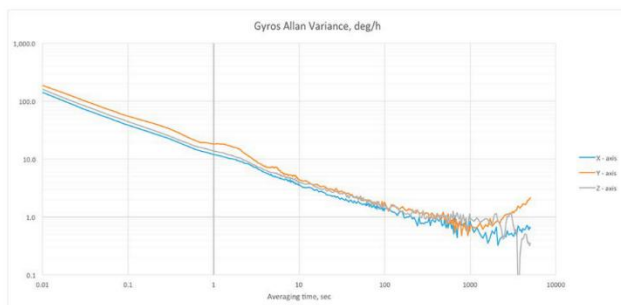|	
Supply Voltage:	9V~36V DC
Power Consumption:	3.0W
Output Interface (options):	RS-232/RS-422
Output data format:	
Binary, TSS-1, NMEA 0183 ASCII characters	

Environmental

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

Physical

Size:	73x47x33mm
Weight:	145g

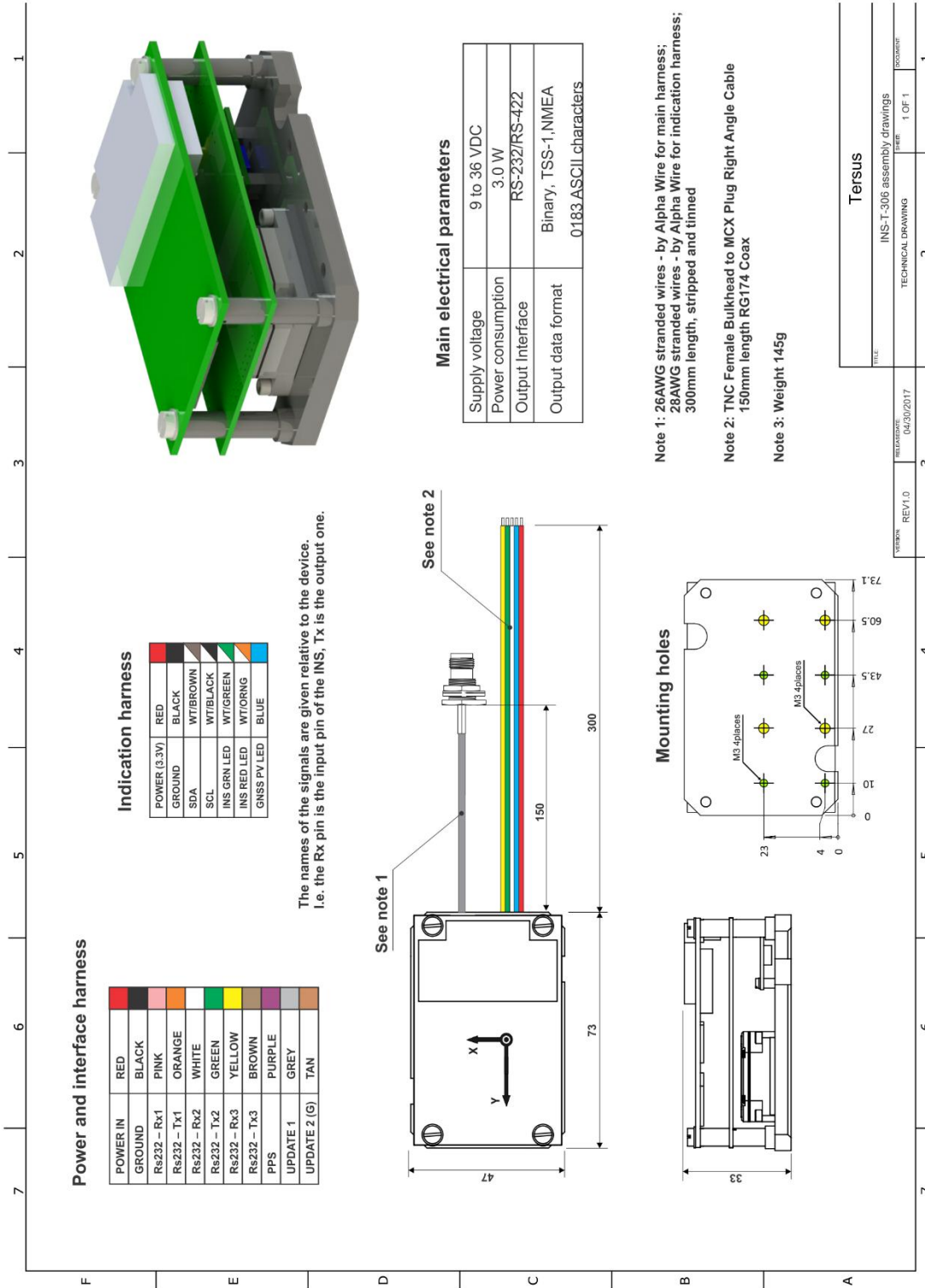## INS-T-306 Performance during GNSS outages

Outage duration	Positioning mode	Position accuracy (meters, RMS)		Velocity accuracy (meters/sec, RMS)		Attitude accuracy (degree, RMS)	
		Horizontal	Vertical	Horizontal	Vertical	Pitch, Roll	Heading
0 sec	RTK	0.01 + 1ppm	0.02 + 1ppm	0.02	0.01	0.015	0.08
	SP	1.2	1.0	0.03	0.02	0.1	0.1
	PP	0.02	0.03	0.02	0.01	0.006	0.03
60 sec	RTK	7	2	0.3	0.1	0.05	0.15
	SP	8	3	0.3	0.1	0.05	0.5
	PP	0.3	0.2	0.03	0.05	0.01	0.1

Gyros Allan Variance, deg/h

Accelerometers Allan Variance, µg

Electrical and Mechanical interface drawing

Main electrical parameters

Supply voltage	9 to 36 VDC
Power consumption	3.0 W
Output Interface	RS-232/RS-422
Output data format	Binary, TSS-1 ,NMEA
	0183 ASCII characters

Note 1: 26AWG stranded wires - by Alpha Wire for main harness;
28AWG stranded wires - by Alpha Wire for indication harness;
300mm length, stripped and tinned

Note 2: TNC Female Bulkhead to MCX Plug Right Angle Cable
150mm length RG174 Coax

Note 3: Weight 145g

Indication harness

POWER (3.3V)	RED
GROUND	BLACK
SDA	WT/BROWN
SCL	WT/BLACK
INS GRN LED	WT/GREEN
INS RED LED	WT/ORNG
GNSS PV LED	BLUE

The names of the signals are given relative to the device.
I.e. the Rx pin is the input pin of the INS, Tx is the output one.

Power and interface harness

POWER IN	RED
GROUND	BLACK
Rs232 – Rx1	PINK
Rs232 – Tx1	ORANGE
Rs232 – Rx2	WHITE
Rs232 – Tx2	GREEN
Rs232 – Rx3	YELLOW
Rs232 – Tx3	BROWN
PPS	PURPLE
UPDATE 1	GREY
UPDATE 2 (G)	TAN

See note 2

See note 1

Mounting holes
M3 4places
M3 4places

Tersus
INS-T-306 assembly drawings
TECHNICAL DRAWING
SHEET 1 OF 1
TITLE
VERSION REV1.0
RELEASE DATE 04/30/2017