Duro® Inertial

PRODUCT SUMMARY

Ruggedized Multi-Band, Multi-Constellation Centimeter-Accurate GNSS + INS Solution

Duro Inertial—an enclosed dual-frequency GNSS receiver with an integrated inertial navigation system—allows for continuous centimeter-accurate positioning in the harshest of environments. Designed and built to survive long-term, outdoor deployments, Duro Inertial combines centimeter-accurate positioning with military ruggedness at a breakthrough price.

CONTINUOUS AND ROBUST INERTIAL NAVIGATION SYSTEM (INS) POSITIONING

Duro Inertial combines the raw inertial sensor measurements from the on-board Bosch BMI160 inertial measurement unit (IMU) with the position, velocity and time (PVT) solution from Swift Navigation's Starling® positioning engine to deliver a continuous and robust positioning system for a variety of applications. INS integration provides positioning during GNSS outages and times where there is little to no GNSS visibility. This combination of technologies enables Duro Inertial to be more robust to anomalies and to provide position solutions with higher availability and smoother trajectory.

BUILT TO BE TOUGH

Packaged in an IP67 ruggedized enclosure, Duro Inertial leverages design principles typically used in military-grade hardware and results in an easy-to-deploy receiver. Duro Inertial is protected against weather, moisture, vibration, dust, water immersion and unexpected circumstances that can occur in long-term, outdoor deployments.

EASY INTEGRATION AND FLEXIBLE INTERFACES

Duro Inertial's M12 connectors are sealed and industry standard, which perfectly balances ruggedization with user-friendliness and ease of integration. No external sealing is required to deploy in even the harshest conditions. A variety of interfaces are supported, including RS232 and Ethernet, to allow for simple and easy integrations.

CENTIMETER-LEVEL ACCURACY

Applications requiring precise positioning everywhere and at all times—especially those that perform critical functions—can depend on Duro Inertial, which utilizes RTK technology in conjunction with standard GNSS to provide a solution that is 100 times more accurate than standard GNSS-only solutions.

MULTI-CONSTELLATION, MULTI-BAND

This ruggedized multi-band, multi-constellation GNSS receiver houses Swift's Piksi® Multi receiver. Duro supports GPS L1/L2, GLONASS G1/G2, BeiDou B1/B2 and Galileo E1/E5b for real-time kinematic (RTK) measurements and positioning along with SBAS for robust sub-meter positioning in non-RTK mode. No additional upgrade charges for constellations supported.

BENEFITS

- Combines GNSS + RTK + IMU Technologies
- Continuous Position Outputs even in GNSS-Denied Areas
- Increased Robustness to Challenging GNSS Environments
- Future-Proof Hardware with In-Field Software Upgrades
- Intuitive LEDs for Status and Diagnostics
- Flexible and Electrically-Protected I/O Ports
- Highly Competitive Pricing

FEATURES

- Integrated Inertial Navigation Capability
- Centimeter-Level Positioning Accuracy
- Provides GNSS + INS Solutions at up to 10Hz Update Frequency
- Compatible with Swift's Skylark™ Cloud Corrections Service
- Designed for Long-Term Deployments in Harsh Environments
- IP67 Rated

Duro Inertial

Physical & Environmental

Dimensions	130 mm x 130 mm x 65 mm
Weight	0.8 kg (Cast Al Housing)
Temperature	
Operating	-40° C to +75° C
Storage	-40° C to +85° C
Humidity	95% non-condensing
Sealing	IP67
Vibration[1]	
Operating and Survival (Random Vibe)	7.7 g
Operating and Survival (Sinusoidal Vibe)	5 g
Mechanical Shock[1]	
Operating	40 g
Survival	75 g

Electrical & I/O[2]

Power

Input Voltage[3]	10 - 35 V DC
Typical Power Consumption[4]	5.0 W

Antenna LNA Power Specifications

Output Voltage	4.85 V DC
Max Output Current	100 mA

External Connector Ports[2]

- 2 x RS232 Serial Ports with Optional Hardware Flow Control
- Ethernet Support up to 100 Mbps
- PPS, PV, 3 x Event Inputs
- Configurable Digital Inputs and Outputs
- 12 V at 1A and 5 V at 250 mA Power Outputs

Performance Characteristics

GNSS Signal Tracking

GPS L1/L2, GLONASS G1/G2,
BeiDou B1/B2, Galileo E1/E5b
SBAS (WAAS, EGNOS, GAGAN, MSAS)

Position Update Rate (GNSS+INS)	Up to 10 Hz

GNSS Data Rates[5]

Measurements (Raw Data)	Up to 10 Hz
Standard Position Outputs	Up to 10 Hz
RTK Position Outputs	Up to 10 Hz
Swift Binary Protocol (SBP) and NMEA-0183	

Maximum Operating Limits[6]

Velocity	515 m/s

IMU Specifications[7]

Angular Range	+/- 250 deg/sec (Default) +/- 125 / 500 / 1000 / 2000 (Configurable)
Acceleration	+/- 4 g (Default) +/- 2 / 8 / 16 g (Configurable)
IMU Raw Data Rate	25 - 200 Hz (100Hz recommended)

GNSS Performance Specifications[8]

Position, Velocity & Time Accuracy

Horizontal Position Accuracy (CEP 50 in SBAS Mode)	0.40 m
Velocity Accuracy	0.08 m/s RMS
Time Accuracy	60 ns RMS
Attitude Accuracy	Pitch/Roll 0.2 Degrees RMS[9] Heading 0.8 Degrees RMS[9]

Real Time Kinematic (RTK Accuracy 1σ)

- Horizontal	0.010 m + 1 ppm
- Vertical	0.015 m + 1 ppm

RTK Initialization Parameters

- Initialization Time	< 10 s
- Initialization Reliability	> 99%

Communication

Navigation Outputs	SBP and NMEA 0183 (Configurable)
Reference Inputs / Outputs	RTCM 3.x
Network Protocol Supported	NTRIP Client

Performance During GNSS-RTK Outages

		Position Accuracy 2-Sigma (m) RMS		Velocity Accuracy (m/s) RMS	
Outages	Prior Position Mode	Horizontal	Vertical	Horizontal	Vertical
1 second	RTK	0.02	0.06	0.035	0.020
5 seconds	RTK	0.05	0.09	0.040	0.030
10 seconds	RTK	0.17	0.16	0.055	0.045

The accuracy of position and velocity solutions provided during GNSS outages is dependent on the accuracy of solutions prior to the GNSS outage. The table above represents solution performance during GNSS outages directly preceded by RTK fix GNSS solutions.

[1] Vibration and Shock will affect the performance of the INS.

[2] See Duro product summary for detailed connector pinout diagrams.

[3] Maximum allowed input Voltage range. Recommended Voltage input range from 12 - 24V.

[4] Power draw ~ 5W.

[5] Please refer to the Piksi Multi product summary for additional specifics.

[6] As required by the U.S. Department of Commerce to comply with export licensing restrictions.

[7] Please refer to the Bosch BMI160 datasheet.

[8] In open sky and strong signal conditions.

[9] Typical value after INS alignment at velocity greater than 1 m/s and RTK mode positioning mode.