# Duro®

## Product Summary

**Carnegie Robotics®**

**swift NAVIGATION**

## Ruggedized Multi-Band, Multi-Constellation Centimeter-Accurate GNSS

Swift Navigation, in partnership with Carnegie Robotics, introduces Duro—an enclosed version of the Piksi® Multi dual-frequency RTK receiver. Built for the outdoors, Duro combines centimeter-accurate positioning with military ruggedness at a breakthrough price.

**Built to Be Tough**

Duro leverages design principles typically used in military hardware and results in an easy-to-deploy sensor, protected against weather, moisture, vibration, dust, water immersion and unexpected circumstances that can occur in long-term, outdoor employments.

**Easy Integration**

Duro's M12 connectors are sealed and industry standard, which balances ruggedization perfectly with user-friendliness. No external sealing is required to deploy in even the harshest conditions. The exposed interfaces support varied use cases without integration headaches.

**Centimeter-Level Accuracy**

Autonomous devices require precise navigation—especially those that perform critical functions. Swift Navigation's Piksi Multi module within Duro utilizes real-time kinematics (RTK) technology, providing location solutions that are 100 times more accurate than traditional GPS.

**Fast Convergence Times**

Multiple signal bands enable fast convergence times to high-precision mode. Single band RTK systems converge in minutes, while Piksi Multi converges to a high-precision solution within seconds. This allows for much faster system start times, as well as faster reacquisition, critical to robotic systems.

**Field Upgradeable**

Swift Navigation and Carnegie Robotics have partnered to create a product that offers a technology development platform that can easily be software-upgraded to leverage Swift Navigation's and Carnegie Robotics' future intellectual property and technology.

**Leverages Piksi Multi**

Multiple signal bands enable fast convergence times and multiple satellite constellations enhance availability.Piksi Multi supports GPS L1/L2 and GLONASS G1/G2 for RTK measurements and positioning. Other constellations such as BeiDou, Galileo, SBAS are planned to be rolled out in the near future. No additional upgrade charges for constellation upgrades.

### Benefits

- Ruggedized Sensor for Long-Term Deployment
- Uses Swift Navigation's Piksi Multi
- Highly-Competitive Pricing
- Flexible Mounting Interfaces
- Future-Proof Hardware with In-Field Software Upgrades
- Intuitive LEDs for Status and Diagnostics
- Electrical Protection on all IO
- Durable and Chemical Resistant Powder-Coating
- Passive Thermal Design

### Features

- IP67 rated
- Centimeter-Level Positioning
- Dual Frequency GNSS RTK
- Raw Data Outputs from On-Board MEMS IMU

# Duro®

## 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** | |
| Operating and Survival (Random Vibe) | 7.7 g |
| Operating and Survival (Sinusoidal Vibe) | 5 g |
| **Mechanical Shock** | |
| Operating | 40 g |
| Survival | 75 g |

## Electrical & I/O

### Power

| | |
|---|---|
| Input Voltage[1] | 10 - 35 V DC |
| Typical Power Consumption[2] | 5.0 W |

### Antenna LNA Power Specifications

| | |
|---|---|
| Output Voltage | 4.85 V DC |
| Max Output Current | 100 mA |

### External Connector Ports

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

## GNSS Characteristics

### GNSS Signal Tracking

GPS L1/L2C and GLONASS G1/G2[3]

### GNSS Data Rates[4]

| | |
|---|---|
| Measurements (Raw Data) | Up to 20 Hz |
| Standard Position Outputs | Up to 20 Hz |
| RTK Position Outputs | Up to 10 Hz |
| Swift Binary Protocol (SBP) and NMEA-0183 | |

### Maximum Operating Limits[5]

| | |
|---|---|
| Altitude | 18,000 m |
| Velocity | 515 m/s |

## Position Performance Specifications[6]

### Position, Velocity & Time Accuracy

| | |
|---|---|
| Horizontal Position Accuracy (CEP 50 in SPP Mode) | 1.1 m |
| Velocity Accuracy | 0.03 m/s RMS |
| Time Accuracy | 60 ns RMS |
| **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% |
| - Solution Latency | < 30 ms |

### SERIAL M12/A/F 8 POS

| | |
|---|---|
| 1 | Serial 0 TX |
| 2 | Serial 0 RX |
| 3 | CTS |
| 4 | RESERVED |
| 5 | GND |
| 6 | 12 V Out |
| 7 | PPS Out |
| 8 | RTS |

### GNSS ANTENNA TNC

| Pin | Antenna |
|---|---|
| Body | Chassis |

### AUX M12-A/F 17 POS

| | |
|---|---|
| 1 | CAN Low |
| 2 | 5V Out |
| 3 | RTS |
| 4 | CTS |
| 5 | 12V Out |
| 6 | GND |
| 7 | RESERVED |
| 8 | RESERVED |
| 9 | RESERVED |
| 10 | TX |
| 11 | Rx |
| 12 | CAN High |
| 13 | PPS |
| 14 | GND |
| 15 | RESERVED |
| 16 | RESERVED |
| 17 | DO/PV |

### ETHERNET M12-D/F 4 POS

| | |
|---|---|
| 1 | TX + |
| 2 | RX + |
| 3 | TX - |
| 4 | RX - |

### POWER M12/A/M 5 POS

| | |
|---|---|
| 1 | Voltage In |
| 2 | Chassis GND |
| 3 | Power GND |
| 4 | PPS |
| 5 | Event A |

**CELLULAR MODEM ANTENNA SMA[7]**



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

[2] Power draw without cell modem activated ~ 5W. Power draw with cell modem active ~ 6W

[3] Hardware-ready for BeiDou B1/B2, Galileo E1/E5b, QZSS L1/L2 and SBAS (Satellite Based Augmentation Systems such as WAAS & EGNOS. Piksi Multi GNSS Module has the RF front end to receive these signals but there are no precise implementation dates for future satellite systems.

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

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

[6] In open sky and strong signals conditions.

[7] Currently a Beta Feature. While this feature is currently available to end-customers and can be used, it still has a Beta developmental status. This implies that while the feature will work, there is a potential for unknown firmware bugs which Swift Navigation is or isn't aware of. Customers using this feature need to note that user documentation for it may not be fully complete and Swift Navigation is not liable for customers intending to use a Beta feature in a final production environment.

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