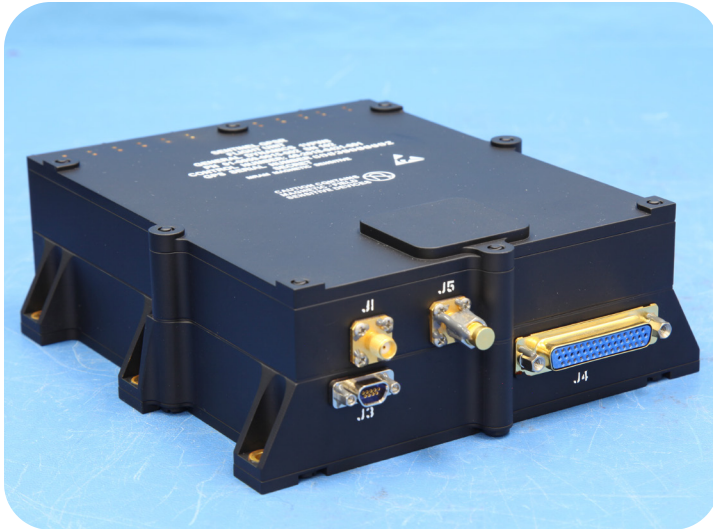


# Sentinel® M-Code GPS Receiver

*Accurate military code certified positioning service in space*



Design Based on Legacy Monarch-M® GPS Receiver  
Space-Qualified Digital Design

1000+ Equivalent Years of Accumulated Trouble-Free DoD  
Space Heritage: >6M Orbits

Same Reliable Position, Velocity, Time, Pseudorange, and  
Carrier Phase

Optional Relative Navigation Position, Velocity, and Time Modes

RS-422 I/O interface and control, protocol similar to our  
Legacy Viceroy® C/A Receiver

Optional MIL-STD-1553B Interface & Control, protocol  
similar to our legacy Monarch-M P(Y) code receiver

## Overview

General Dynamics' Sentinel M-Code GPS Receiver provides Precise Positioning Service position, velocity, and time information for Low Earth Orbit (LEO) and Geostationary Earth Orbit (GEO) applications. MEO and HEO orbits are also available. Performance and satellite visibility are enhanced through the use of dual antennas; each of the 32 GPS channels can be assigned to either antenna (64 channels as an option).

## Key Features and Benefits

- LEO, GEO capable with MEO and HEO option
- GEO Sidelobe Acquisition and Tracking Algorithms enable continuous PNT availability
- Fast Acquisition Processor enables rapid COLD start capability
- Integrated Anti-Jam Technology and anti-spoof algorithms enable superior performance in GPS contested and denied environments.
- 32 Channels, L1 and L2 Capable
- C/A, P(Y) and Modernized M-Code, with optional L2C civil signal
- Provides Near Real-time Position, Velocity and Time Measurements for Superior User Performance
- Relative Navigation Capability Allows for Differential Position, Velocity and Time Determination Between Co-orbiting Spacecraft (Optional)
- Precision Time Stamping Allows Unprecedented Accuracies in Space
- Precise Position Service Key Management Supports All Selective Availability Anti-spoof Module (SAASM) Unique Keying
- Single or Dual Antenna Capability Allows the Spacecraft User Installation Flexibility and Performance
- Qualified and Tested for the Space Environment: Pyrotechnic Shock, Random Vibration, Thermal-vacuum and EMI/EMC (Tailored Mil-Std-461F)

## Performance Characteristics

### Receiver Architecture

- 32 Channels PPS-GPS C/A, P(Y), M-Code Channels, 64 Channels available as an option
- Dual Antenna – any channel to either antenna
- Frequencies & Codes: L1 & L2, C/A Code, P(Y), M-Code, L2C optional
- Narrow Bandwidth Acceleration-Aided Carrier/Code Tracking
- Tracking, and Navigation Algorithms based on Monarch-M GPS Receiver
- Kalman Filter-based navigation solution with integrated high fidelity orbit propagator bridges gaps between GPS outages
- On-Orbit Software Reprogrammable

### Input / Output

- RS-422, Follows Legacy Viceroy Receiver ICD
  - Optional: MIL-STD-1553B, Follows Legacy Monarch-M/Monarch-MICD
- One Pulse per Second (GPS, UTC, or Measurement Epoch Time)
- Time Stamp Input Signal, measures the time of an external pulse

### LEO Solution Accuracy

- Autonomous Position: 4.0 meters, 1 sigma, < 1 meter typical
- Autonomous Velocity: < 2 cm/sec, 1 sigma, < 0.5 cm/sec typical
- Clock and Precise 1PPS Absolute: <20 ns 1 sigma, < 5 ns typical
- Time Strobe Input: < 20 ns, 1 sigma
- Optional Relative PVT Mode: 0.5m, 0.5 cm/sec, 4 ns (1 sigma)

### GEO Solution Accuracy

- Autonomous Position: 25 meters, 1 sigma, < 5 meter typical
- Autonomous Velocity: < 2 cm/sec, 1 sigma, < 0.5 cm/sec typical
- Clock and Precise 1PPS Absolute: < 55 ns 1 sigma, < 8 ns typical
- Time Strobe Input: < 55 ns, 1 sigma

### Cold Start Time to First Fix (self-test complete & assumed keyed)

- LEO < 10 minutes, 67% probability, 4 min Typical
- GEO < 15 minutes, 90% probability, 8 min Typical

### Orbital Dynamics

- Altitude: LEO, GEO (200 km – 45,000 km), MEO & HEO optional
- Velocity: up to 16,000 meters/second
- Acceleration: 1G

### Optional and Custom Features

- External Reference Oscillator or Internal Precision EMXO
- GEO Sidelobe Acquisition and Tracking Software
- High Dynamics Acquisition & Tracking

### Physical/Environmental

- Radiation: 100 Krads
- Single Event Upset: < 1 per year
- Single Event Latchup: Immune
- Reliability: 0.92, 10 year, 30°C Baseplate, 100% duty cycle
- Vibration: 18.6 Grms
- Pyro Shock: 2000 G
- Temperature: -34°C to +71°C
- Size: 180 x 160 x 60 mm-Envelope
- Weight: < 2.5 kg
- DC Power:
  - < 10w typical (dual antenna)
  - < 9w typical (single antenna)

**GENERAL DYNAMICS**

Mission Systems