



Phoenix

Spaceborne GPS Receiver

The Phoenix GPS receiver is a 12-channel single-frequency receiver specifically designed for high-dynamics and space applications. The receiver is based on Zarlink's advanced GP4020 baseband processor, which results in a small size and low power consumption. In combination with DLR's proprietary firmware, the receiver offers precision measurements for advanced navigation applications as well as robust tracking even under extreme dynamics. Three specific receiver versions (Phoenix-S/-XNS and Phoenix-HD) are offered to optimally support both orbital and ballistic missions.

Recommended applications of the Phoenix GPS receiver in low-Earth orbit (LEO) include real-time navigation, onboard time-synchronization, precise-orbit determination and spacecraft formation flying. On sounding rockets or launch vehicles the receiver provides navigation and timing information for range-safety operations, flight performance monitoring and experiment execution.

Dedicated qualifications tests have demonstrated that the Phoenix GPS receiver tolerates the environmental conditions (thermal-vacuum, vibration, ionizing radiation) encountered in representative space missions despite the exclusive use of commercial-off-the-shelf (COTS) electronics components.



The high performance and minimal resource requirements make the Phoenix receiver an ideal candidate for innovative space missions with tight budgets and limited quality assurance requirements.

Phoenix-S and -XNS receivers for nano- and micro-satellites have been selected by various universities and space agencies. Among others, they will provide precision relative navigation for an upcoming formation flying mission.

The Phoenix-HD receiver constitutes the primary tracking system for future sounding rocket missions within the European micro-gravity program and the German national space program.

Phoenix Receiver Versions

Customers can select among various versions of the Phoenix receiver to cover a wide range of mission applications:

The basic **Phoenix-S** receiver is optimized for use on LEO satellites. It offers a built-in orbit propagator to aid the initial acquisition and to allow a short time-to-first-fix. Low-noise code and carrier phase measurements are achieved through carefully optimized tracking loops. Full cycle integer ambiguities enable precision relative navigation in carrier phase differential GPS applications.

The **Phoenix-XNS** extends the functionality of the basic receiver version by a built-in navigation filter for LEO satellites. It offers a dynamically smoothed and continuous navigation solution even in case of limited GPS satellite visibility. The measurement processing inside the Phoenix-XNS provides a rigorous elimination of ionospheric path delays and enables a real-time navigation accuracy meeting the requirements of advanced remote sensing satellites.

The **Phoenix-HD** receiver is specifically adapted to the needs of high-dynamics platforms such as sounding rockets, launch vehicles and re-entry capsules. It employs a specially designed tracking loop tolerating extreme accelerations and jerk. Ballistic trajectory polynomials can be loaded to support a rapid re-acquisition in case of temporary signal losses. Furthermore, instantaneous-impact-point predictions are performed inside the receiver to support range-safety monitoring at the launch site.

Technical Data

Unless otherwise noted, the following data apply for the Phoenix-S, -XNS, and -HD receiver versions.

Tracking

- 12 correlator channels for GPS L1 C/A-code
- 3rd order PLL with FLL assist
- Signal dynamics up to 2 G / 15 G (-S/-HD)
- Acquisition threshold 35 dB-Hz
- Warm/cold start TTFF of 1/15 min

Measurements

- Low noise L1 C/A code and carrier phase (Phoenix-S: 0.4 m and 0.5 mm at 45 dB-Hz)
- Range rate from Doppler and carrier phase (Phoenix-S: 8 cm/s and 2 cm/s)
- Smoothed pseudo-range (0.1 m)
- Carrier-to-Noise density

Navigation

- Single-point solution (pos 10 m, vel 0.1 m/s)
- Filtered solution (1-2 m; -XNS only)
- Update rates of 1 Hz (-S/-XNS) to 5 Hz (-HD)

Input/Output

- Two serial ports (LVTTTL, 9.6-57.6 kbaud)
- ASCII protocol (WinMon, NMEA)
- 1PPS signal (LVTTTL, 0.5 μ s)
- Discrete input line (lift-off-signal)
- Programming pin

Physical

- Dimension 70 x 47 x 15 mm
- Mass 20 g
- Power 0.85 W

Environmental

- Operating temperature -20°C to +50°C
- Storage temperature -30°C to +70°C
- Total ionization dose >10 krad

Accessories

Available accessories for the Phoenix GPS receiver include

- a Win-XP console program,
- a light weight low-noise amplifier,
- passive patch, helix and blade antennas,
- an evaluation kit with housing and interface board for ground testing.



Further Information

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Disclaimer

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