

STARPACK

The StarPack platform

StarPack provides multiple, high precision, GNSS positioning solutions. The unit comes with a survey-grade 72 channel, triple frequency GNSS receiver and powerful processor.

This combination provides multiple, robust, precise, simultaneous position calculations. The system provides extensive QC through comparisons between the different high precision calculations. For maximum system reliability the internal software is embedded on flash memory configured on the processor. Control and configuration of the system is via the backlit LCD front panel display, via a (LAN) web interface, or RS232 serial port.

Four (4) serial ports are provided on the rear of the system (in addition to the integrated receiver) to either read multiple correction sources or provide user configured outputs.

Simultaneous positioning solutions available on the StarPack:

- Starfix.HP
- SkyFix-XP
- Starfix.L1 (VBS)
- Starfix.Plus
- Starfix.XP
- Starfix.HP / XP combined



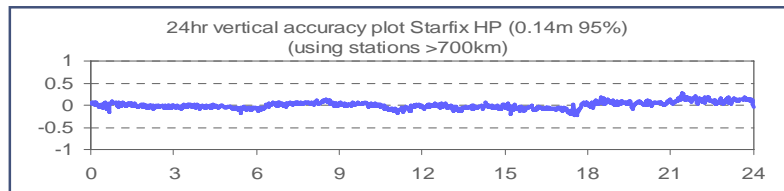
Ten (10) days of raw dual frequency data is continuously logged to enable high quality support in case of any problems. The user can download this data to Fugro's development centre for either problem analysis or re-processing.

Positioning solutions available in the StarPack

Fugro is the un-rivalled world leader in global high precision GNSS positioning services. Fugro is consistently first in introducing new high precision positioning services and technology. Fugro invests heavily in the development of future services that will incorporate the latest generation GNSS signals. These signals include modernized GPS (L2C, L5), Russian Glonass and the planned European Galileo. The StarPack is easily upgradeable to benefit from these new signals.

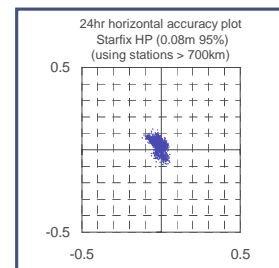
Applications of the StarPack

- Accurate relative positioning of structures.
- Automated vessel guidance.
- Accurate height for tidal corrections and heave compensation.
- Accurate position for seabed mapping surveys.
- Accurate vertical reference for "out of straightness" pipeline surveys.
- Accurate (instantaneous) heading source in combination with a second unit.
- Stable position for station keeping on DP vessels



Starfix.HP

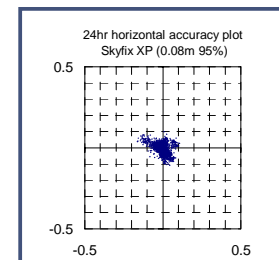
In 2001, Fugro deployed Starfix.HP (High Precision). This dual frequency GPS carrier phase based service was a breakthrough in global positioning. Starfix.HP offers sub-decimeter horizontal position accuracies 95% at distances up to 500km and 20cm horizontal position accuracies up to 1000km from the closest reference station. Vertical accuracies are 15cm and 30 cm, respectively. Fugro operates an extensive network of over 100 high accuracy dual frequency reference stations world-wide. The network has 100% redundancy in both infrastructure and control.



SkyFix-XP

For clients who are looking for the ultimate in independence, SkyFix-XP is also available. SkyFix-XP is a completely separate system that uses PPP state space technology but with a completely different code base (part of MultiFix IV).

SkyFix-XP provides positioning accuracies comparable to Starfix XP while using the same JPL state space data stream. For easy comparison, the SkyFix-XP calculation has also been made available in the StarPack and can be selected / de-selected at the sole discretion of the user.



Starfix.Plus

In 1998 it became apparent that the maximum of the 11 year solar cycle would have a significant negative impact on GPS based positioning services. Position errors of over 20m were becoming common near the geomagnetic equator, this caused by solar activity impacting the ionosphere. Fugro was the first to develop a system to combat this problem, releasing the Starfix Plus system in 1999. Starfix Plus provided an accuracy of 2m 95% under these extreme conditions caused by the solar maximum in equatorial and auroral areas. The prime operating principle is based on measuring the ionospheric delays using direct GPS L1/L2 code measurements as opposed to modelling of the ionosphere.

Starfix.XP

The Starfix.XP GPS positioning service is complementary to the existing Starfix.HP service. Starfix.XP is based on clock and orbit corrections supplied by NASA's Jet Propulsion Laboratory (JPL). Starfix.XP is a Precise Point Positioning (PPP) technology, which distinguishes itself from the traditional differential approach as satellite errors are not lumped together but estimated per source, per satellite; it is also known as State Space solution. The GPS clock and orbit corrections are computed independently, free of ionospheric and tropospheric effects.

The advantages of Starfix.XP are:

- A single set of corrections per satellite valid independent of the geographic location.
- Independence from the existing Fugro reference station network
- Simplicity for the user

Direct comparisons with competing providers' capabilities and performance show that Fugro continues to lead in accuracy and robustness of solution. Starfix.XP has a 95% accuracy of 10cm horizontal and 20cm vertical.

Combined Starfix.HP / XP

Taking advantages of the fundamental strengths of both HP and XP services in a single calculation, an integrated HP/XP engine was developed. This engine uses both the HP differential corrections and the XP state space data in a single computation. A benefit of this solution is improved robustness and accuracy of the solution. It also provides for seamless transition between the two services if one or the other data stream is lost.

With Fugro, clients have a clear choice between fully independent, redundant, high performance solutions with Starfix.HP, XP and combined HP/XP.

Convergence time and recovery after loss of GPS lock.

A disadvantage of solutions like Starfix.HP / XP and SkyFix-XP, as opposed to solutions with RTK integer ambiguity resolution, is the initial and re-convergence time. Convergence typically takes 30 minutes, and in some instances up to an hour, before the full accuracy is achieved. In a marine environment this is generally not a problem as the antenna is usually mounted on a location with an un-obstructed view to the sky. For applications that do not have the advantage of clear skies Fugro has developed an algorithm which bridges temporary disruption of the GPS signals, without the need for full convergence. This unique method will bridge gaps up to 60 seconds in the GPS data. The algorithm is integral in the combined HP / XP engine.

ProTrack heading

To add accurate and reliable GPS vessel heading capability to the StarPack, a second unit (with a second antenna) can be connected. Alternatively the unit can be fitted with two boards. The StarPack can be configured to compute the heading of the baseline between the two antennas. The accuracy of this heading is 0.1 deg for a baseline of 10m. ProTrack provides instantaneous ambiguity resolution on single epoch dual frequency data.

Technical Specifications

GNSS hardware engine (optionally 2 cards):

- Novatel OEMV: 72 channel, triple frequency board that includes L2C,
- GLONASS measurements and hardware support for the future L5 GPS frequency

Corrections:

- Integrated receiver for Starfix differential and state space corrections

Processor:

- Intel Pentium 3, Embedded Linux

- Data Rate 1Hz, optional 20 Hz
- Size (WxHxD): 245 x 60 x 195 mm
- Weight 2 kg
- Input Voltage 80 – 250 VAC, 40-60Hz
- Input / Output 4 RS232 COM ports, 1PPS, LAN, USB
- Op. Temp - 20°C to +50°C
- Stor. Temp -40°C to +85°C
- Humidity 95% non-condensing
- Compliant EMC 2004/108/EC (EN 60945:2002)

Accuracy (95%)	Horizontal	Vertical
Starfix.VBS	0.5 m	1 m
Starfix.Plus	2 m	2 m
Starfix.HP	0.08 m	0.15 m
SkyFix-XP	0.1 m	0.2 m
Starfix.HP/XP	0.1 m	0.2 m

