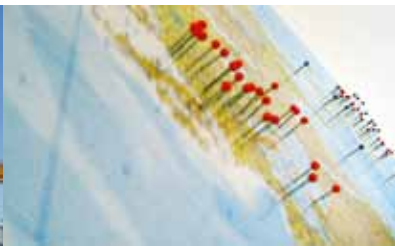




## GeoBasis-DE

Satellite Positioning Service of the  
German Landesvermessung

Landesamt für Geoinformation und  
Landentwicklung Niedersachsen



## SAPOS®

Precise positioning  
in location and height

OFFICIAL GERMAN SURVEYING AND MAPPING AUTHORITY



**SAPOS<sup>®</sup>** provides you with your position in location and height to the point, reliably and safely!



**SAPOS<sup>®</sup>** will enable highly accurate positioning in location and height.

**SAPOS<sup>®</sup>**, a joint project of the Working Committee of the Vermessungsverwaltungen of the Länder (AdV), is based on a network of reference stations which permanently process satellite signals of the Global Navigation Satellites Systems (GNSS) and provide observation and/or correction data via data communication media.

**SAPOS<sup>®</sup>** is available all over Germany, uses internationally standardised formats and offers you a high investment security owing to its official quality and more than 20 years of experience. Owing to its multifunctionality, the high availability and quality, **SAPOS<sup>®</sup>** has been recognised international for many years.



## **SAPOS®** Satellite Positioning Service of the German Landesvermessung

SAPOS® is your solution when you want to coordinate information, navigate vehicles or geo-reference thematic data. With modern means you receive spatial reference easily and comfortably for your data quickly and precisely on the basis of the Satellite Navigation Systems GPS, GLONASS and in future also Galileo. The following services are offered fine-tuned to your individual requirements in different accuracy classes and application in real-time or post-processing:

### **SAPOS® - HEPS**

High Precision Real Time Positioning Service with a horizontal accuracy of 1 to 2 cm and vertical accuracy of 2 to 3 cm.

### **SAPOS® - EPS**

Real Time Positioning Service with a horizontal accuracy of 0.5 to 3 m and vertical accuracy of 1 to 5 m.

### **SAPOS® - GPPS**

Geodetic Postprocessing Positioning Service with a horizontal accuracy of 1 cm and better and vertical accuracy of 1 to 2 cm.

## Competencies

- ▶ The satellite positioning service of the German Landesvermessung (SAPOS®) provides the official spatial reference with the most modern technique. The implementation of geodetic spatial reference belongs to the sovereign core tasks of the Länder.
- ▶ The SAPOS® - services are continuously developed further in constant cooperation with the economy and science in accordance with user requirements.



## Infrastructure

- ▶ SAPOS® utilises more than 270 of its own reference stations in Germany as well as 30 further from neighbouring countries for a nationwide widespread network. Operators of SAPOS® are the German Länder.

## Real time

- ▶ The coordinates determination occurs directly during the measuring process on site.

## Post processing

- ▶ Subsequent to the local measurement the coordinate determination is achieved by a later processing in your office.



What for may SAPOS® be actually used?  
Several applications in daily practice

## 1. Example: Real estate cadastre

The high accuracy requirements of a few centimetres in the real estate cadastre pose a challenge to the satellite positioning services. SAPOS® can fulfil these requirements with sovereignty even under less convenient measuring conditions through the application of GPS and GLONASS.

The fixed point density will decrease already today but increasingly in the near future. SAPOS® offers an excellent alternative to the classic tacheometry for your task solutions.

The SAPOS® - measurements always occur in the official ETRS89 reference system. Official thereby stands for reliability and high quality. For authorities and companies this means enormous investment security.



## 2. Example: Supply documentation

The ease of operation of the receiver and elegant linkage of correction data make SAPOS® an efficient and indispensable documentation aid – also non-professionals learn how to handle SAPOS® in the shortest time.

SAPOS® thus supplements the most modern sensors, computer, communication and processing modules to a mobile real time system with continuous digital data flow and graphical field book.

### „GNSS opens new dimensions.

In the marine survey it is now possible to determine the height in real time through the application of SAPOS®- HEPS. This means an accuracy increase in contrast to the in-feed to date via water level and an optimisation of the evaluation process.“

(Gunther Braun, Wasser- und Schifffahrtsdirektion Nordwest)

## 3. Example: Hydrography

SAPOS® caters for an optimum 3-D data acquisition of the waterway beds with cm accuracy on sounding ships and dredging in water for many years. Besides exact location coordinates, also height information of highest quality are generated. The ultra-precision Geoidmodels (e.g. the AdV Quasigeoid) that are available in the mean time allow a nearly lossless conversion of the ellipsoidal height information won with SAPOS® in to physical heights.



### Your benefit

- ▶ exact coordinates in location, height and 3-D
- ▶ measuring directly in the official reference system
- ▶ simple transformation in arbitrary target systems
- ▶ digital data flow
- ▶ comfortable data exchange with third-party
- ▶ realisation of the one man squad
- ▶ time saving due to maximum flexibility
- ▶ long-term investment security

SAPOS® offers you maximum quality, security and reliability

### Further application areas

- ▶ Traffic guidance system, logistics and fleet management
- ▶ Authorities and organisations with security duties (BOS)
- ▶ Agriculture and forestry, environmental protection
- ▶ GIS-data acquisition in municipal and private enterprise system area
- ▶ Aerial photograph and airborne laser scanning – exact determination of projection centres
- ▶ Hydrological, geological and geodynamic investigations
- ▶ Coastal protection, structural monitoring and level monitoring
- ▶ Land consolidation, ground valuation
- ▶ Engineering survey
- ▶ Classical tasks of the Landesvermessung





## RTCM

SAPOS® is collaborating with the Radio Technical Commission for Maritime Services (RTCM) since 2003. The formats defined by RTCM Special Committee No. 104 (SC-104) for the transmission of GNSS correction data in real time have developed to a world-wide standard. SAPOS® contributes actively in the SC-104 in order to represent the interests of our users and/or our services effectively.



## Ntrip

A Technique for the transmission of GNSS data flows via the Internet was created in the form of Ntrip (Networked transport of RTCM via internet protocol). The SAPOS® data can be retrieved via GPRS or UMTS connection by the so-called „Casters“ on the Internet.



## Network

The distance-dependent error shares of the differential GNSS (Ionosphere, Troposphere and Satellite orbits) are essentially reduced from the distance of the rover to the reference station with the network of the SAPOS® - reference stations. The network allows higher accuracies and quicker initialisation.

## RINEX

RINEX stands for Receiver Independent Exchange format. The format is used as standard for the provision of SAPOS® data for post processing applications.

# How do you become SAPOS® - user?

Quickly and easily in two steps ...

## 1. The following device equipment is required:

For **SAPOS® -HEPS** you need a Rover equipment with a geodetic, RTK-capable GNSS-receiver as well as a mobile phone (GPRS, UMTS, GSM, etc.) for the receiving of SAPOS® - data. As SAPOS® - user you are entitled to outline agreements with special terms for data communication.

To use **SAPOS® -EPS**, a DGNSS-capable single-frequency receiver is sufficient. The receiving of SAPOS® - data is implemented via a mobile phone (GPRS, UMTS).

In **SAPOS® -GPPS** GNSS observation data are provided in the RINEX format via Internet through corresponding data server for a subsequent evaluation (post processing). The GNSS-receiver must thereby be capable of recording its observations.


## 2. Registration as SAPOS® - user



Log in and let yourself be registered:

- with the responsible **Landesvermessung** for enabling in your Land
- with the **central office SAPOS®** for a nationwide or cross-border enablement.

## SAPOS® - an overview

	HEPS	EPS	GPPS
Method	Real-time	Real-time	Postprocessing
Accuracy- horizontal	0.01 - 0.02 m	0.5 - 3 m	≤ 0.01 m
Accuracy- vertical	0.02 - 0.03 m	1 - 5 m	0.01 - 0.02 m
Transmission technique	Internet: (GPRS, UMTS) GSM	Internet: (GPRS, UMTS)	Internet (Web server)
Data rate	1 Second	3 - 5 Seconds	≥ 1 Second
Unit	1Minute	inapplicable	1 Minute
SAPOS® - fee per unit	0.10 €	150,- € p. a.	0.20 €
Data format	RTCM 3, RTCM 2.3	RTCM 2.3	RINEX 2.1

## Future SAPOS® - developments

As SAPOS® - operator, we are constantly working on the quality increase of our service. Thus, added-value services such as provision of transformation information to the user are possible.

In order to further increase the satellite availability in future after the integration of GLONASS, the widespread introduction of Galileo in SAPOS® will take place. Through this, SAPOS® - users will be enabled to have higher accuracy and reliability during positioning.

### Contact partner

#### GeoBasis-DE

Satellite Positioning Service of the  
German Landesvermessung  
Landesamt für Geoinformation und  
Landentwicklung Niedersachsen

or the SAPOS®-distribution agencies of your Land  
(contact, see reverse side)



## GNSS

Global Navigation Satellite System (GNSS) is the generic term for satellite aided Navigation and Positioning systems. GNSS is not restricted alone to GPS, but is based likewise on GLONASS, Galileo as well as local extension systems (e.g. EGNOS).

## GPS

The Global Positioning System (GPS) was already developed in the 70's by US-American military. It is being used also for civil applications since the 80's. Extensive system expansions (inter-alia 3. carrier frequency L5) have been planned for the future.

## GLONASS

The construction of the Russian system GLONASS took place at the same time with GPS. At the present time GLONASS has again been expanded to the nominal strength.

## Galileo

The European Union (EU) and the European Space Agency (ESA) are working on the construction of Galileo, an independent civil GNSS. The operative business of Galileo is scheduled as from the year 2014.

## Cross-border, nationwide distribution agencies of the official German surveying and mapping

### GeoBasis-DE

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## SAPOS® - Vertriebsstellen in den Bundesländern

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Working Committee of the Surveying Authorities of the Länder of the Federal Republic of Germany

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