BEV - APOS

Austrian Positioning Service

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What is APOS?

APOS stands for **Austrian POsitioning Service** and is the Multi-GNSS positioning service of the BEV - Federal Office of Metrology and Surveying. The GNSS signals (GPS, GLONASS and GALILEO) are processed and – to improve the accuracy of the satellite based measurements – the derived parameters are provided.

Vernetzungsrechner
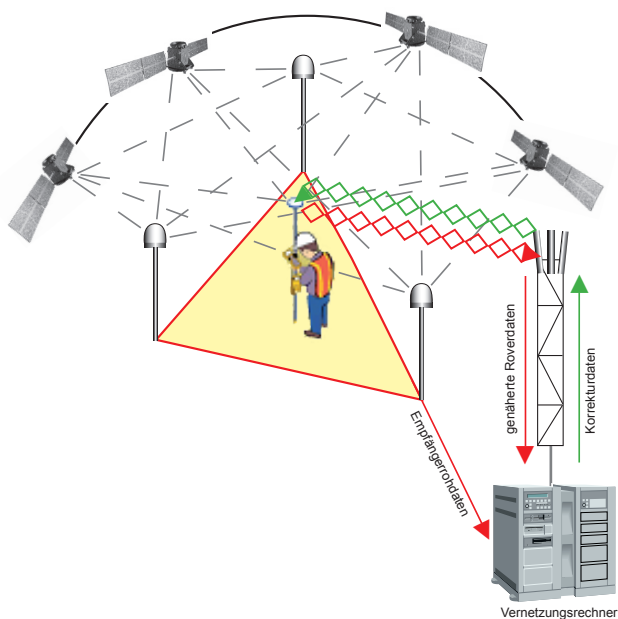
The cooperation with all neighbouring surveying authorities guarantees the involvement of many international GNSS reference stations close to the Austrian boundary. Thus APOS is the positioning service for Austria because it offers homogeneous 3D-coordinates in ETRS89 nation wide and across boundaries.

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APOS – Products

APOS Postprocessing (APOS-PP)

At the APOS Service Centre original data from all
Austrian reference stations are stored for post
processing applications in RINEX format.
The data are available as follows:

APOS-PP-RS1	Interval	1 second
APOS-PP-RS5	Interval	5 seconds
APOS-PP-RS15	Interval	15 seconds
APOS-PP-RS30	Interval	30 seconds

The data will be available for 60 days after recording.
After that you can just order APOS-PP-RS30 as a
24 hour file.

APOS Real Time (APOS-RTK, APOS-DGPS)

APOS Real Time makes it possible to use either the concept "Virtual Reference Station - VRS" or the "Master-Auxiliary-Concept - MAC" for real time positioning. The distance-dependant influences are centrally captured and processed, so that we can guarantee nationwide homogeneous accuracy. The data are delivered exclusively via mobile internet by packet switching applying the Ntrip protocol.

APOS Real Time is offered in two accuracy classes:

APOS-RTK with centimetre-level accuracy for high-precision applications with dual-frequency phase measurement units. The use of mobile internet by means of the GIS grid facilitates Austria wide uniform transformations into the Austrian national geodetic reference system MGI (for GIS applications).

APOS-DGPS with a sub metre accuracy for GIS and navigation applications using phase smoothing code measuring instruments.

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APOS Raw Data (APOS-RAW)

APOS RAW Data are measurement raw data from the Austrian APOS GNSS reference stations of the BEV. The data are provided in second interval in the format RTCM via the central APOS NTRIP-Caster. The raw data consist of the metadata of the stations as well as the code and phase observations of the Multi-GNSS receivers on site.

As a prerequisite for the data connection customers need a permanent internet access and the NTRIP-Client software. To set up a safe communication between the customer client and the APOS NTRIP Caster it is necessary to announce a fixed IP4 address for the activation.

APOS – A Quality Benchmark

The APOS productive system is the guarantee for the high level of quality. It consists of the processing center and the network of reference stations. The reference stations are situated within a distance of 50 - 70 km from each other, covering all of Austria and the border regions of the neighboring countries. The stations process Multi-GNSS signals (GPS, GLONASS and GALILEO). The calculation of time series based on daily generated 24 hour files serves to verify the stability of the APOS reference stations. There are also special monitoring stations all over Austria to control the operation and performance of APOS Real Time.

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GIS-Grid

Based on a close meshed, interpolated grid (30" x 45" mesh width) that describes the deviation between ETRS89 and the Austrian system MGI for all of Austria it is possible to make a uniform online transformation between the two systems with a dm-accuracy starting with RTCM 3.1 in real time. The GIS grid was derived from about 28.000 identical points of the national network of control points 1st to 5th order.

3D Interpolation

Before the correction data is sent out a specially implemented module at the APOS-Center is used to prepare the data to avoid problematic meteorological influences. Thus the accuracy of the height determination for the GNSS rover is improved. Among the problematic meteorological influences in alpine regions, in case of big height differences between rover and APOS reference stations, there are mainly the different relative humidity relations. The humidity is a bigger problem in summer and may cause divergences of several dm. The 3D Interpolation is currently only available via Mountpoint APOS_VRS32_MSM_3D (see table right) and is activated for all of Austria.

|	APOS Products	Data format / Mode	Access Mobile Internet Mountpoint (MP)	GPS / GLONASS	GALILEO	GIS Grid	Accuracy position		Accuracy height		3D Interpolation
							ETRS89[1]	MGI	ETRS89[1]	MGI	
Postprocessing	APOS-PP	RINEX 2.10	BEV Shop APOS	✓			± 1.0 cm		± 1.0 - 2.0 cm		
Real Time	APOS-DGPS	RTCM 2.3 (VRS)	APOS-DGPS	✓			± 0.5 m		± 1.0 m		
Real Time		RTCM 2.3 (VRS)	APOS_VRS	✓			± 1.5 cm		± 4.0 cm		
Real Time	APOS-RTK	RTCM 3.1 (VRS)	APOS_VRS3	✓		✓	± 1.5 cm	< 15.0 cm	± 4.0 cm	< 15.0 cm	
Real Time		RTCM 3.1 (MAC)	APOS_NET3	✓		✓	± 1.5 cm	< 15.0 cm	± 4.0 cm	< 15.0 cm	
Real Time		RTCM 3.2 MSM5 (VRS)[2]	APOS_VRS32_MSM	✓	✓	✓	± 1.5 cm	< 15.0 cm	± 4.0 cm	< 15.0 cm	
Real Time		RTCM 3.2 MSM5 (VRS)[2]	APOS_VRS32_MSM_3D	✓	✓	✓	± 1.5 cm [3]	< 15.0 cm	± 4.0 cm	< 15.0 cm	✓

[1] Mean error (confidence level approximately 68%)
[2] MSM - Multi Signal Message
[3] Deterioration of the position accuracy is possible

Availability

The APOS net guarantees a homogenous accuracy in ETRS for all over Austria (INSPIRE conform).
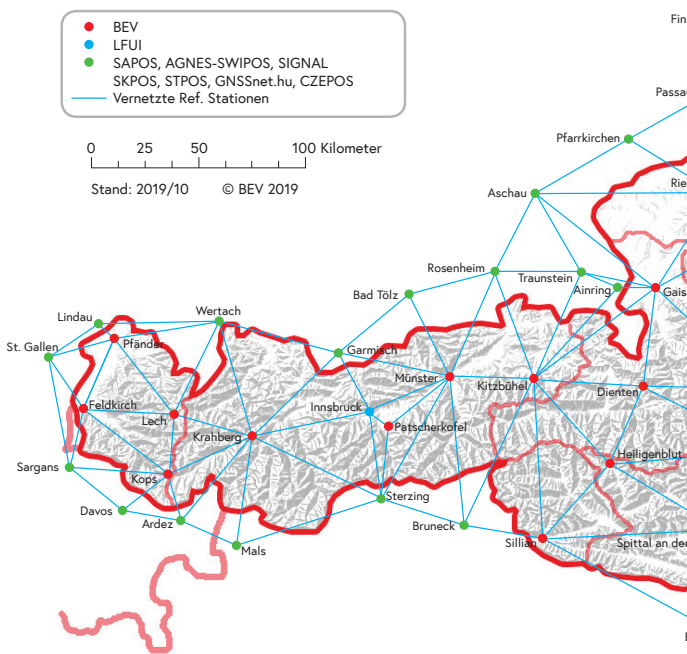
Please visit our website www.bev.gv.at, under the
menu point **APOS-Betriebsstatus** you will find
up-to-date information and status reports about the
availability of APOS and possible system malfunctions
of APOS Real Time und APOS Post Processing.

To the Point

You save time and costs – with APOS you are always one step ahead and more efficient. With the high performance and accuracy of APOS you will always have an efficient solution, wherever you want to determine your position.

- Direct connection to the network of control points
- High accuracy
- 3-D reference system
- Real time data transfer
- Access via Mobile Internet for cost-effective data transfer
- Nation wide homogeneous availability in ETRS89 or MGI
- High technical reliability
- Quality assurance
- Technical support
- Invoicing based on actual use

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APOSition Yourself

Reliability and economic aspects are two reasons for the increased use of mobile positioning systems. APOS has proven itself a reliable partner in many areas and for many applications.

- Control, cadastral as well as scientific survey
- Agriculture and forestry
- Construction and engineering survey
- Airborne remote sensing
- Geological and geophysical survey
- GIS survey
- Stakeouts and routings
- Machine control

Prerequisites

APOS Postprocessing (APOS-PP)

You have two possibilities to buy RINEX data:

Either you send the signed order form to our Costumer Service or via internet quickly and easily. At the **BEV Shop APOS** you can order and download all post processing data from all Austrian reference stations online. Just visit us at www.bev.gv.at and register.

APOS Real Time (APOS-RTK, APOS-DGPS)

Under www.bev.gv.at you will get further information as well as the order form for the APOS Real Time registration. Please chose the products and tariff models best suited for your purposes and send the signed order form to our Costumer Service. After the activation of your accesses you will receive the login data.

The following technical prerequisites are necessary to be able to use all the advantages of APOS Real Time optimally:

- VRS or MAC compatible GNSS receiver with mobile internet module (as of 2G)
- RTCM 2.3, RTCM 3.1, RTCM 3.2
- Mobile internet network capacity of the provider (as of 2G)
- Implementation of the NTRIP client programs (a function that is included in all up-to-date devices respectively upgradeable)
- Access after registration at the Customer Service by means of an individual account

In case your device can not process the GIS grid provided by the BEV via RTCM 3, please contact your device manufacturer.

Standard Charges

APOS Postprocessing (APOS-PP)

	Price in € per minute
APOS-PP-RS1 data rate 1 second	0,10
APOS-PP-RS5 data rate 5 second	0,05
APOS-PP-RS15 data rate 15 seconds	0,05
APOS-PP-RS30 data rate 30 seconds	0,05

APOS Real Time (APOS-RTK, APOS-DGPS)

	Price in €
APOS Real Time – installation fee	50,00

APOS-RTK (cm-accuracy)

Flat rate per second	0,0015
Flat rate per day	20,00
Flat rate per month	200,00

APOS-DGPS (dm-accuracy)

Flat rate per second	0,00015
Flat rate per day	2,00
Flat rate per month	20,00

APOS Raw Data (APOS-RAW)

	Price in € (annual fee)
Austria, entire national area	50 000,00

The standard charges of the BEV include just the service costs. The connection charges are not included as they are based on the data transfer charges of the respective provider and thus are invoiced separately by the provider.

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When do you receive the APOS Real Time invoice?

- The installation fees will be charged at the first invoice once and per NTRIP access.
- The different flat rates are charged per month. Accounting period is the calendar month.

How do you receive the APOS Real Time invoice?

The respective flat rate chosen by you is charged per commenced unit. If you do not use APOS during one calendar month you do not have to pay for the service.

- The flat rate per month is charged only if there was really at least one log-in during the calendar month.
- The flat rate per day is charged for each calendar day when APOS was used.
- The flat rate per second is charged accurately for the respective login time per second per calendar month.

The flat rate is based on the login time of the rover; it begins with the dial-in and ends with the exit even if no data were processed on the rover side.

If you change or cancel a tariff model (flat rate) this will become operative with the first day of the following month.

Information as of February 2020
The standard charges are subject to change without prior notice.

Glossary

DGPS (Differential GPS)
General term for a GPS measurement procedures with less accuracy using simultaneously at least 2 GNSS receivers for post processing or Real Time applications.

Real Time Application
All satellite-based measurement methods that use mobile equipment for quick data transfer.

ETRS89 (European Terrestrial Reference System 1989)
European reference system that was defined by the European sub-commission of the IAG (EUREF) and that is explicitly acknowledged as the binding coordinate reference system in the INSPIRE Directive. In Austria ETRS89 is realized by ETRS89 / Austria 2002, the official Austrian datum based on a EUREF measurement campaign in Austria in 2002.

EUREF (European Reference Frame)
The IAG Reference Frame Sub-Commission for Europe which deals with the definition, realization and maintenance of the European Reference System in 3-D and 1-D.

GALILEO
The space-based satellite navigation system of the European Union.

GLONASS/GPS
The space-based satellite navigation systems of Russia and the USA.

GNSS (Global Navigation Satellite System)
General term for a space-based satellite navigation system (GPS, GLONASS, GALILEO, etc.) and its augmentation system (WAAS, EGNOS, etc.).

GNSS Reference Station
In case of APOS a station based on the criteria of EUREF (mm-accuracy, high stability, high data availability) with the infrastructure for the permanent data transfer (permanent station) to a computer centre.

INSPIRE Directive
Directive for the establishing of a geodata infrastructure for the European Community. In Austria it is implemented within the frame of the Geodateninfrastrukturgesetzes - GeoDIG.

MAC (Master-Auxiliary-Concept)
Network messages based on the concept developed by LEICA Geosystems.

Mobile Internet
Describes the provision of an internet connection on mobile devices via different access technologies (as of 2G).

NMEA (National Marine Electronics Association)
NMEA 0813 is an international standard format derived from marine communication for the transmission of position data.

NTRIP (Networked Transport of RTCM via Internet Protocol)
A procedure developed by the German Federal Agency for Cartography and Geodesy (BKG) and the Dortmund University Department of Computer Science for streaming differential GPS (DGPS) data over the internet in accordance with specification published by RTCM.

Post Processing
Subsequent calculation of baselines with the help of recorded respectively converted raw data (e.g. in RINEX format).

RINEX (Receiver Independent Exchange Format)
Receiver-neutral, international and standardised data exchange format for GNSS measurement data.

RTCM – SC104
(Radio Technical Commission for Maritime Services - Special Committee Number 104)
Standard for the transmission of corrections and raw data.

RTK (Real Time Kinematik)

A DGPS measurement method of high accuracy (also "PDGPS - Precise DGPS") based on the data transfer (correction or raw data) from a reference station to a rover (user) in real time. The term is originally derived from the highly accurate positioning of objects in motion.

UTC (Universal Time Coordinated)

The primary time standard by which the world regulates clocks and time. For Austria: summer time minus 2 hours / winter time minus 1 hour.

VRS (Virtual Reference Station)

Synthetic (virtual) reference station that is generated by the central networking software exactly for the approximate position transmitted by the rover in NMEA format and that can be directly processed by the rover; the provision of virtuel GNSS measurement data and of distance-dependant model parameters for satellite orbits, troposphere and ionosphere in RTCM format make short measurement periods (short baselines) possible.

General Terms and Conditions

The terms of delivery and payment as well as the copyright notice are set out in the current Terms and Licensing Conditions of the BEV.

Standard Charges and Licensing Conditions

The prices and licensing conditions for the products of the BEV are regulated in the "Standard Charges and Licensing Conditions of the BEV" as applicable from time to time. The current version was published in the Amtsblatt für das Vermessungswesen (official journal for surveying) and can be found on www.bev.gv.at.

Contact

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