Alberding solutions for GNSS infrastructure operators

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4th EUPOS® Technical Meeting
21-22 November 2017, Bratislava, Slovakia
Outline

Alberding Ntrip Caster

Alberding GNSS Status Software

Correction service monitoring

Alberding GNSS receivers
Alberding GmbH

- German GNSS software and hardware development company
- Based in Wildau (near Berlin)
- More than 20 years of experience in high-accuracy GNSS positioning
- Specialised in GNSS data communication, management, processing and monitoring
- Customised solutions for GNSS infrastructure operators and RTK service providers
- Independent from GNSS receiver manufacturers
Alberding Ntrip Caster

Alberding GNSS Status Software

Correction service monitoring

Alberding GNSS receivers
Alberding Ntrip Caster

• Professional Ntrip Caster software for Linux OS
• Supports both Ntrip versions 1.0 and 2.0
• Dirk Stöcker (Alberding GmbH) is chair of the RTCM SC-104 Internet Protocol WG: Ntrip standardisation
• Designed for mass usage
  – can handle hundreds of reference stations (mountpoints) and thousands of simultaneous user connections
  – minimal latency times, low system requirements
Alberding Ntrip Caster advantages

• Brand neutral solution – no GNSS receiver priorities

• Separation of network RTK correction service from raw data provision to neighbouring countries, other service providers, etc. → optimise licensing

• Scalable, easily expandable software

• Supports multiple ports and domain names (virtual casters)

• User NMEA position forwarding to 3rd party Ntrip Casters

• Fault-tolerant architecture: backup Ntrip Caster
Alberding Ntrip Caster advantages

- Nearest base station auto-selection and auto-switch
- Web interface for system configuration, data and user management and monitoring
- Different levels of access to the web interface (admin, subadmin, basic)
- Map display with fleet management functionality and rover quality control
- SQL export of user connection information
Alberding Ntrip Caster

Alberding GNSS Status Software

Correction service monitoring

Alberding GNSS receivers
Alberding GNSS Status Software

- **Modular software for monitoring**
  - GNSS observation data quality
  - Reference station antenna stability (post-processed PPP)
  - DGNSS/RTK/PPP service quality
  - External sensor data
  - Troposphere (real-time PPP)

- **Data logging and redirection**
  - RINEX logging (v 2.11, v 3.0x)
  - Real-time data redirection (TCP, Ntrip)

- **Web interface**
  - Visualisation
  - Alarming
  - Reporting
Alberding GNSS Status Software

- **GNSS observation data quality**
  - Raw data availability, latency, completeness
  - Number of satellites
  - DOP values, skyplot
  - Multipath
  - Cycle slips
  - Signal quality (C/N₀)

- **Position quality**
  - Accuracy (N,E,H)
  - Statistical values

- **External sensor data**
  - Weather station
  - Tilt sensor
  - Geotechnical sensors

- **Troposphere**
  - Zenith Total Delay
  - Integrated Water Vapour
GNSS Status Software web interface
Observation data monitoring
Post-processed PPP monitoring

- Reference station coordinates
- Independent from the RTK networking algorithms
- Post processing of 24h RINEX files
- Web based status monitoring
- History data on time series plots
- Comparative analysis, differential plots
- Customisable alarm generation
Troposphere monitoring

- Real-time Precise Point Positioning (PPP) based troposphere estimation
- Tropospheric Zenith Total Delay (ZTD)
- Integrated Water Vapour (IWV)

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Troposphere monitoring

- ZTD and IWV time series plots
- Temperature and pressure differences

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Troposphere monitoring

- Real-time ZTD, IWV, temperature and pressure surface maps

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Alberding GNSS Status Software

Correction service monitoring

Alberding GNSS receivers
Alberding-QC – service monitoring

• Quality control software for DGNSS, RTK and PPP service providers
• Multi-purpose tool: 3 modules integrated into a single web interface
• Monitors service availability, accuracy and data contents
• Software licence or service provided by Alberding GmbH
Alberding-QC software modules

Checkstream
- Ntrip stream availability and data consistency

RTK-Check
- Positioning accuracy and ambiguity fixing time

InspectRTCM
- GNSS binary data decoding and visualisation
Checkstream – Ntrip monitoring

- Ntrip stream availability and Ntrip Caster server accessibility monitoring
- Periodic connections and data sampling
- Data decoding - format verification (RTCM, CMR, raw binary data…)
- Data content analysis – message types (incl. MSM, SSR) and update rates
- Data age analysis
- Monitoring multiple casters from a single website
- Monitoring hundreds of Ntrip mountpoints
- NMEA output for network RTK streams
- Availability statistics for 24/7 and normal working hours
- Automatic email/SMS warnings with flexible settings
- PDF reporting
Checkstream – web interface
RTK-Check

- Positioning accuracy and RTK fixing time monitoring
- Physical monitor station receiver (fw solution) ➔ Alberding A10
- RTKLIB algorithms (sw solution)
- Periodic connection sessions
- Statistics generation
- Visualisation of the results
- Email warnings with customisable warning thresholds
  - no NMEA data, no RTK Fix, high position error, low number of SVs, high data age
- Multiple position computations
- Supports RTCM 3.x incl. MSM and SSR
- PDF reports, CSV export
RTK-Check web interface

![RTK-Check web interface screenshot]

**RTK-Check**

**Monitoring**

**Time Zone**: 2014-05-30T12:57:33 UTC

Reloaded: 06:00:47

**Settings**

- **Begin**: 2014-05-30
- **End**: 2014-05-31
- **Time frame**: 1.0 [h]

**Streams**

- WALTBD-POT50\_Real
- WALTBD-WILD\_RTK\_Real
- Lost Real

**Statistics**

- Min: -43.3
- Max: 22.2
- Mean: -9.9
- Std: 8.8

- Min: -18.0
- Max: 22.4
- Mean: 1.0
- Std: 1.4
RTK-Check history data analysis
InspectRTCM

- GNSS binary data decoder software for detailed data content analysis

RTCM binary → InspectRTCM → RTCM ASCII

- Real-time visualisation
- RTCM (incl. MSM, SSR, etc.), CMR, RTCA, raw binary input
- NMEA GGA output for network RTK streams
- Transmission delay analysis
- Data rate analysis of individual message types

- Real-time streams (TCP/UDP/Ntrip/serial) and file input
InspectRTCM web interface
Alberding DataConv

- Real-time GNSS data translation

**Raw data** → **DataConv** → **RTCM, CMR, RINEX**

- Leica
- Trimble
- Topcon
- Ashtech
- Septentrio
- Javad
- NovAtel
- Hemisphere GPS
- U-blox
- NVS
- etc.

- RTCM 2.x
- RTCM 3.x
- CMR
- CMR+
- RINEX 2.11
- RINEX 3.0x
Alberding DataConv

- Real-time GNSS data translation

- Raw data $\xrightarrow{\text{DataConv}}$ RTCM, CMR, RINEX
- RTCM $\xrightarrow{\text{DataConv}}$ CMR, RINEX
- RTCA $\xrightarrow{\text{DataConv}}$ RTCM
Alberding Ntrip Caster

Alberding GNSS Status Software

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Alberding GNSS receivers
Alberding A07-RTK

- Low-cost L1 GNSS RTK receiver
- Multi-constellation (GPS, GLONASS, BeiDou)
- Centimetre accuracy
- Integrated GPRS modem, Bluetooth module
- Integrated processor for data management
- Data storage (32 GB memory card)
- RS232 serial port
- Li-Po battery
- Available in 2 different housings: A07-RTK Standard and A07-RTK Robust
- Alberding AGIS software (Android) for field data collection
- Applications: GIS / surveying, machine positioning, wireless data transfer, geo-monitoring
GIS data collection

- Effective **geo data capture** in the field
- Simple, lightweight and productive
- The A07-RTK receives corrections via **Ntrip**
- **RTK position** solution
- Position transmission via **Bluetooth**

**A07-RTK**  +  **AGIS Mapping Software**

- Low-cost L1 GNSS multi-constellation receiver
- GIS field software for Android
Geo-monitoring with Alberding A07

- A07-MON: GNSS measurements and telemetry
- On the server: automatic processing
- Sub-cm level displacement monitoring
- Alarming – email/ SMS

- Visualisation of time series plots, PDF reports, CSV output
Alberding A10

- Multi-constellation, dual-frequency RTK GNSS receiver with telemetry functionality
- Different compatible GNSS OEM boards
- Integrated 4G LTE modem
- Bluetooth module with antenna
- Cortex M3 processor with Alberding GNSS data management software
- 26-pin multi-port connector
- **Embedded PC with Linux OS**
- Applications:
  - RTK surveying
  - GNSS monitor station
  - Machine auto-steering
  - Service development and testing
Alberding A10 – PPP-RTK test

- SAPOS SSR performance test in Germany
- SSR data generated and broadcast by SAPOS Bavaria
- SSR2OSR conversion on board A10
- Geo++ SSR2OSR algorithm installed on the embedded Linux computer
- PPP-RTK position computation directly on the receiver
Thank you for your attention!

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