

RTK Positioning with U-Blox AEK-4T + 6T and RTKLIB

Launch rtklaunch (C:\Program Files (x86)\rtklib_2.4.2\bin\rtklaunch.exe).

1 Calculation of the single position solutions

This must be done for the base station as the position of its antenna is needed further in the process.

It is interesting to do it also for the rover, to compare this single solution with the future rtk solution.

- Click on the RTKPOST icon,
- Set the name of the observation file in the “RINEX OBS” field. This file has been generated during the conversion step and has a “.obs” extension,
- Set the name of the navigation file in the “RINEX *NAV/CLK, SP3, IONEX or SBS/EMS” first field. This file has been generated during the conversion step and has a “.nav” extension,
- The name of the precise ephemeris/clock corrections file can also be set in the “RINEX *NAV/CLK, SP3, IONEX or SBS/EMS” second field. This file can be downloaded from the IGS network and has a “.sp3” extension,
- The name of the satellite augmentation file can also be set in the “RINEX *NAV/CLK, SP3, IONEX or SBS/EMS” third field. This file has been generated during the conversion step and has a “.sbs” extension.
- Press the “Options...” button to set the different options for the calculation of the PVT solutions:

The 'Options' dialog box, 'Setting1' tab, shows various configuration options for RTK positioning. The 'Positioning Mode' is set to 'Single'. 'Frequencies / Filter Type' is set to 'L1' and 'Forward'. 'Elevation Mask (°) / SNR Mask (dBHz)' is set to '15'. 'Rec Dynamics / Earth Tides Correction' is set to 'OFF'. 'Ionosphere Correction' is set to 'Broadcast'. 'Troposphere Correction' is set to 'Saastamoinen'. 'Satellite Ephemeris/Clock' is set to 'Broadcast'. There are checkboxes for 'Sat PCV', 'Rec PCV', 'PhWindup', 'Reject Ed', and 'RAIM FDE'. The 'Excluded Satellites (+PRN: Included)' field is empty. The 'GPS' checkbox is checked, while 'GLO', 'Galileo', 'QZSS', 'SBAS', and 'BeiDou' are unchecked. At the bottom are 'Load...', 'Save...', 'OK', and 'Cancel' buttons.

The 'Options' dialog box, 'Setting2' tab, shows integer ambiguity resolution settings. 'Integer Ambiguity Res (GPS/GLO)' is set to 'OFF'. 'Min Ratio to Fix Ambiguity' is set to '3'. 'Min Confidence / Max FCB to Fix Amb' is set to '0.9999' and '0.2'. 'Min Lock / Elevation (°) to Fix Amb' is set to '0' and '0'. 'Min Fix / Elevation (°) to Hold Amb' is set to '10' and '0'. 'Outage to Reset Amb/Slip Thres (m)' is set to '5' and '0.050'. 'Max Age of Diff (s) / Sync Solution' is set to '30.0' and 'ON'. 'Reject Threshold of GDOP/Innov (m)' is set to '30.0' and '30.0'. 'Number of Filter Iteration' is set to '1'. The 'Baseline Length Constraint (m)' is set to '0.000' and '0.000'. At the bottom are 'Load...', 'Save...', 'OK', and 'Cancel' buttons.

The 'Options' dialog box, 'Output' tab, shows output format and processing options. 'Solution Format' is set to 'Lat/Lon/Height'. 'Output Header/Processing Options' is set to 'ON' and 'ON'. 'Time Format / # of Decimals' is set to 'hh:mm:ss GPST' and '3'. 'Latitude / Longitude Format' is set to 'ddd.ddddddd'. 'Field Separator' is empty. 'Datum/Height' is set to 'WGS84' and 'Ellipsoidal'. 'Geoid Model' is set to 'Internal'. 'Solution for Static Mode' is set to 'All'. 'NMEA Interval (s) RMC/GGA, GSA/GSV' is set to '0' and '0'. 'Output Solution Status / Debug Trace' is set to 'OFF' and 'OFF'. At the bottom are 'Load...', 'Save...', 'OK', and 'Cancel' buttons.

The 'Options' dialog box, 'Stats' tab, shows measurement errors and process noises. Under 'Measurement Errors (1-sigma)', 'Code/Carrier-Phase Error Ratio L1/L2' is set to '100.0' and '100.0'. 'Carrier-Phase Error a+b/sinE1 (m)' is set to '0.003' and '0.003'. 'Carrier-Phase Error/Baseline (m/10km)' is set to '0.000'. 'Doppler Frequency (Hz)' is set to '10.000'. Under 'Process Noises (1-sigma/sqrt(s))', 'Receiver Accel Horiz/Vertical (m/s2)' is set to '1.00E+01' and '1.00E+01'. 'Carrier-Phase Bias (cycle)' is set to '1.00E-04'. 'Vertical Ionospheric Delay (m/10km)' is set to '1.00E-03'. 'Zenith Tropospheric Delay (m)' is set to '1.00E-04'. 'Satellite Clock Stability (s/s)' is set to '5.00E-12'. At the bottom are 'Load...', 'Save...', 'OK', and 'Cancel' buttons.

Options

Setting1 Setting2 Output Stats Positions **Files** Misc

Rover

Lat/Lon/Height (deg/m) ...

90.000000000 0.000000000 -6335367.6285

☐ Antenna Type (*: Auto) Delta-E/N/U (m)

0.0000 0.0000 0.0000

Base Station

Lat/Lon/Height (deg/m) ...

90.000000000 0.000000000 -6335367.6285

☐ Antenna Type (*: Auto) Delta-E/N/U (m)

0.0000 0.0000 0.0000

Station Position File

Load... Save... OK Cancel

Options

Setting1 Setting2 Output Stats Positions **Files** Misc

Satellite/Receiver Antenna PCV File ANTEX/NGS PCV ...

Geoid Data File ...

DCB Data File ...

EOP Data File ...

OTL BLQ File ...

Ionosphere Data File ...

Load... Save... OK Cancel

Options

Setting1 Setting2 Output Stats Positions Files **Misc**

Time Interpolation of Base Station Data OFF

DGPS/DGNSS Corrections SBAS

SBAS Satellite Selection (0: All) 0

RINEX Opt (Rover)

RINEX Opt (Base)

Station ID List

Station ID List	Rovers	Base Stations
? : Keywords in File Path		
#...: Comment in List		

Load... Save... OK Cancel

- Press the “Execute” button.
- The “View...” button gives access to the PVT solutions in text format.
- The “Plot...” button plots a 2D representation of the PVT solutions.
 - Write down the average lat/long/height position (ORI= ... in the plot window) for further reference.

2 Calculation of the rtk position solution

- Click on the RTKNAVI icon,
- Click on the “I” button at the top right and set the ubx file names for the rover and the base station,

Input Streams

Input Stream	Type	Opt Cmd	Format	Opt
<input checked="" type="checkbox"/> (1) Rover	File	...	u-blox	...
<input checked="" type="checkbox"/> (2) Base Station	File	...	u-blox	...
<input type="checkbox"/> (3) Correction	Serial	...	RTCM 2	...

Transmit NMEA GPBGA to Base Station
 OFF 0.000000000 0.000000000

Input File Paths

C:\Users\blaisan\pwnCloud\clientsync\Rech_Expert\GPS_PVT_u-blox_AEK- ...
 C:\Users\blaisan\pwnCloud\clientsync\Rech_Expert\GPS_PVT_u-blox_AEK- ...
 ...

☐ Time x1 + 0 s

OK Cancel

- Click on the “O” button at the top right and set the output file name for the rtk positions of the rover,

Output Streams

Output Stream	Type	Option	Format
<input checked="" type="checkbox"/> (4) Solution 1	File	...	Lat/Lon/Height
<input type="checkbox"/> (5) Solution 2	Serial	...	Lat/Lon/Height

Output File Paths

C:\Users\blaisan\pwnCloud\clientsync\Rech_Expert\GPS_PVT_u-blox_AE ...

☐ Time-Tag Swap Intv H ?

OK Cancel

- Click on the “Options...” button at the bottom and set the parameters as follows:
 - Positioning Mode to Kinematic,
 - Relax the Max Age of Diff (s) to 1 hour, that is 3600 s,
 - The antenna position of the base station must be set to the average position noted at the end of the single position calculation process,

Options

Setting1 Setting2 Output Statistics Positions Files Misc

Positioning Mode Kinematic

Frequencies / Filter Type L1 Forward

Elevation Mask (°) / SNR Mask (dBHz) 15 ...

Rec Dynamics / Earth Tides Correction OFF OFF

Ionosphere Correction Broadcast

Troposphere Correction Saastamoinen

Satellite Ephemeris/Clock Broadcast

☐ Sat PCV ☐ Rec PCV ☐ Ph-Windup ☐ Reject Ed ☐ RAIM FDE

Excluded Satellites (+PRN: Included)

☒ GPS ☒ GLO ☒ Galileo ☒ QZSS ☒ SBAS ☒ BeiDou

Load Save OK Cancel

Options

Setting1 Setting2 Output Statistics Positions Files Misc

Integer Ambiguity Res (GPS/GLO) OFF OFF

Min Ratio to Fix Ambiguity 3.0

Min Confidence / Max FCB to Fix Amb 0.9999 0.20

Min Lock / Elevation (°) to Fix Amb 0 0

Min Fix / Elevation (°) to Hold Amb 10 0

Outage to Reset Amb / Slip Thres (m) 5 0.050

Max Age of Diff (s) / Sync Solution 3600.0 OFF

Reject Threshold of GDOP/Innov (m) 30.0 30.0

Number of Filter Iteration 1

☐ Baseline Length Constraint (m) 0.000 0.000

Load Save OK Cancel

- Press the “Plot” button, then the “Start” button. At the end of the processing, press the “Stop” button.