

OEM GNSS units

Automated Survey Systems

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**BUDAPEST UNIVERSITY
OF TECHNOLOGY AND ECONOMICS**

Faculty of Civil Engineering - Since 1782

Department of Geodesy and Surveying

RECEIVERS

- U-blox M8T → single frequency, GPS+GLO+GAL+BDS
- U-blox F9P → dual frequency, GPS+GLO+GAL+BDS, built-in RTK engine)
- Open-source software RTKLIB
(<https://rtklibexplorer.wordpress.com/>)

U-BLOX

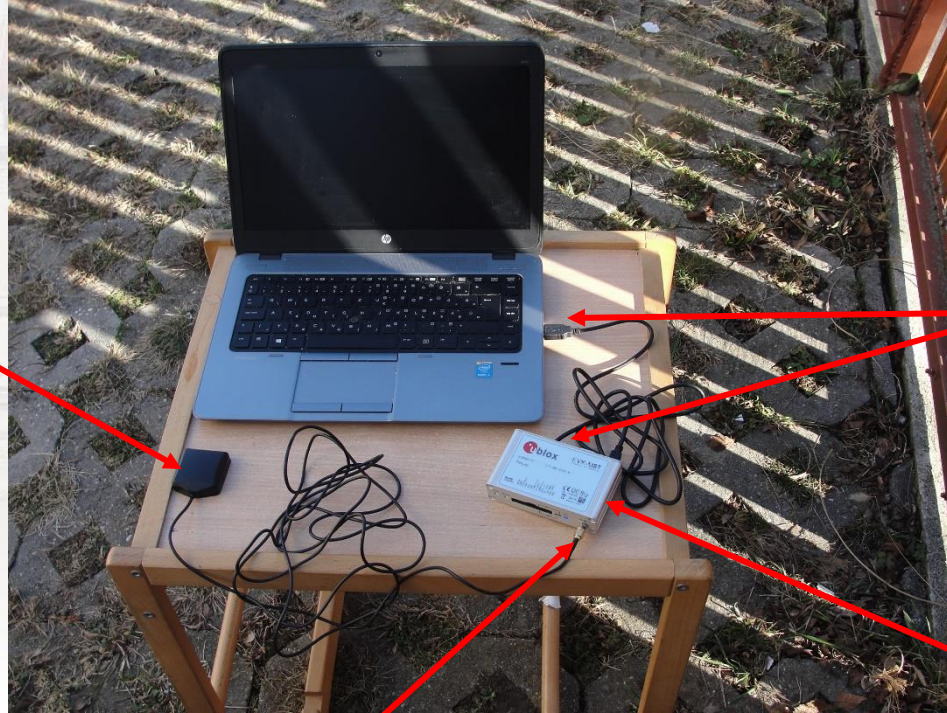
- Connect the antenna
- Connect to the PC (notebook), use USB cable
- In case of any driver issue

<https://rtklibexplorer.wordpress.com/2016/11/10/issue-with-u-blox-usb-drivers/>

- Check-out com port

U-BLOX M8T

antenn
a

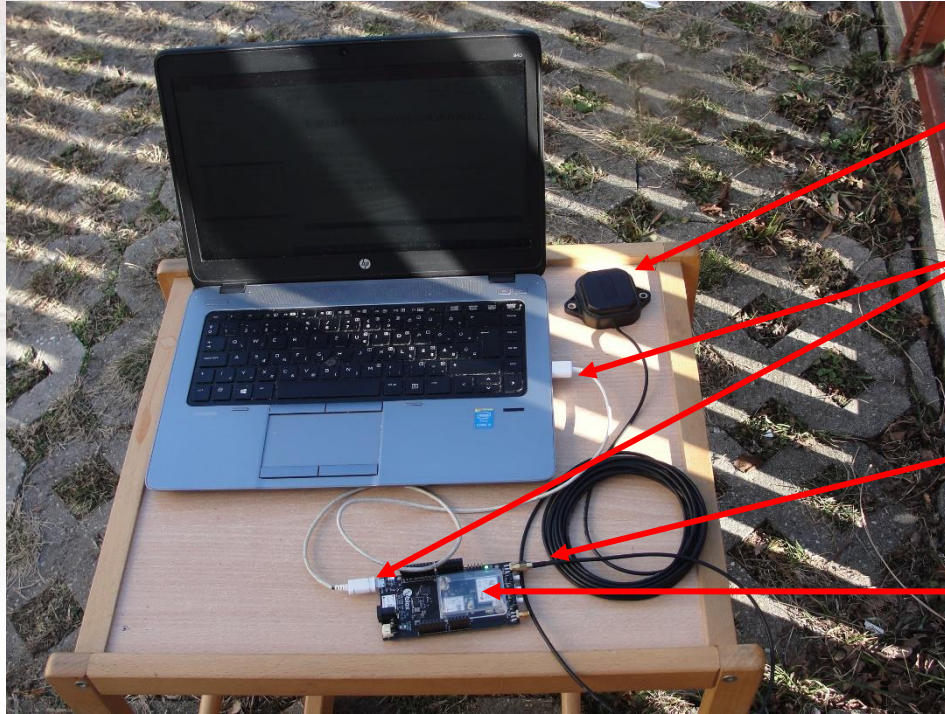


usb cable

receiver

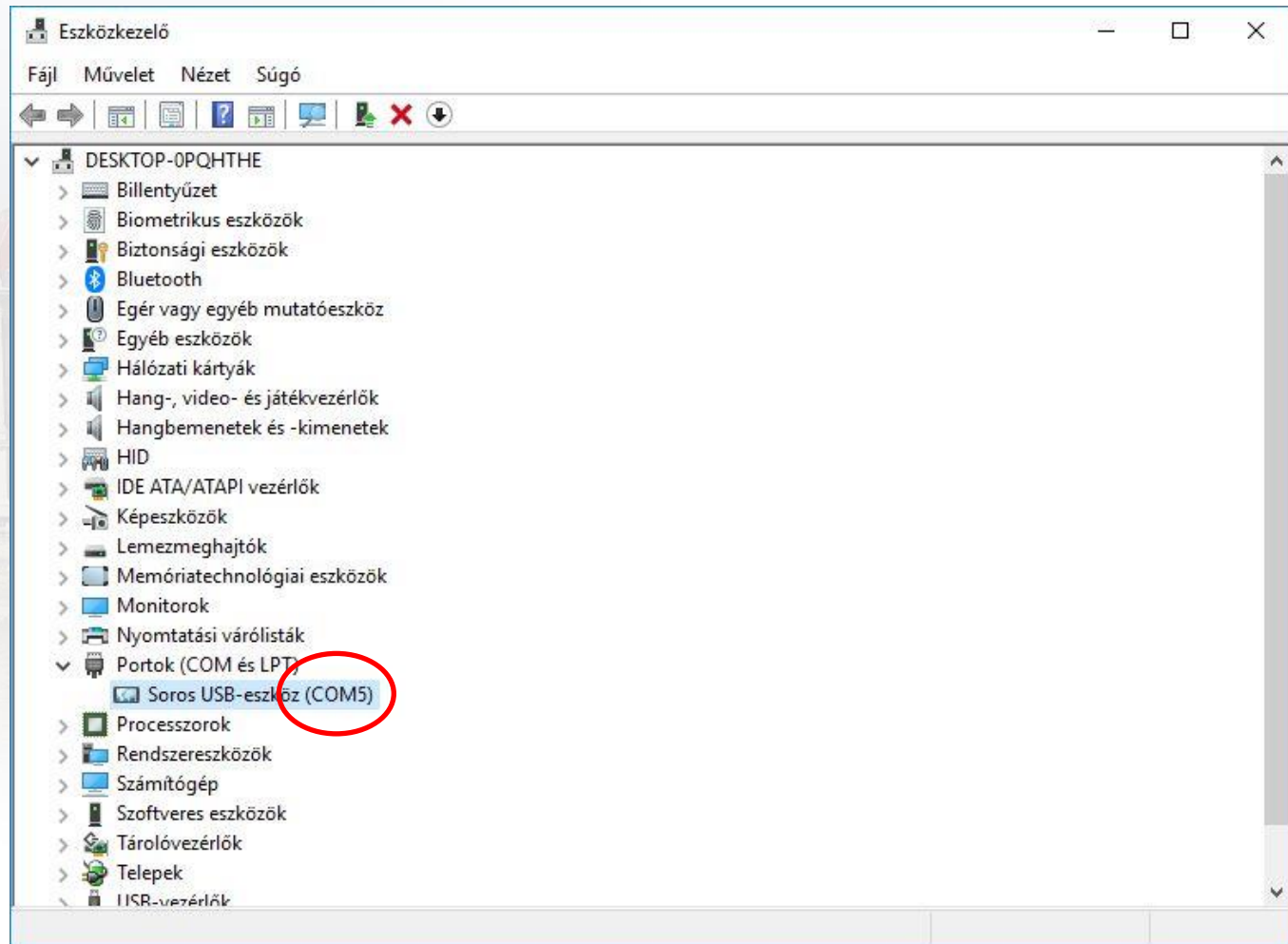
antenna cable

U-BLOX F9P



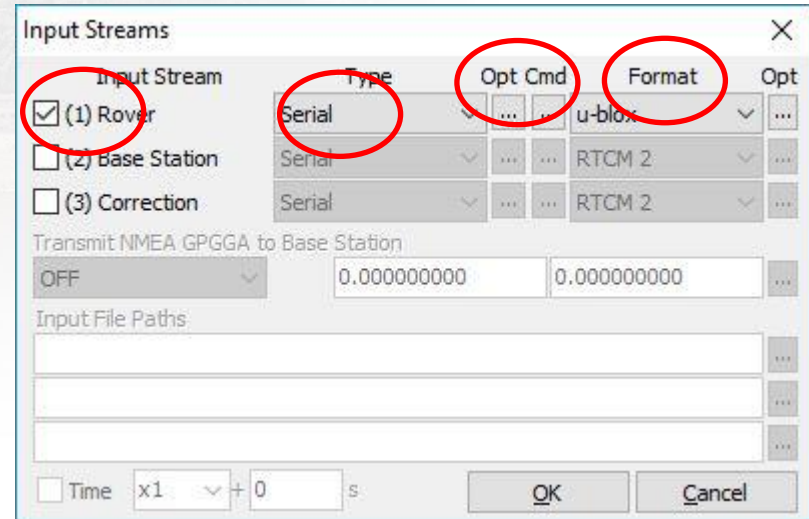
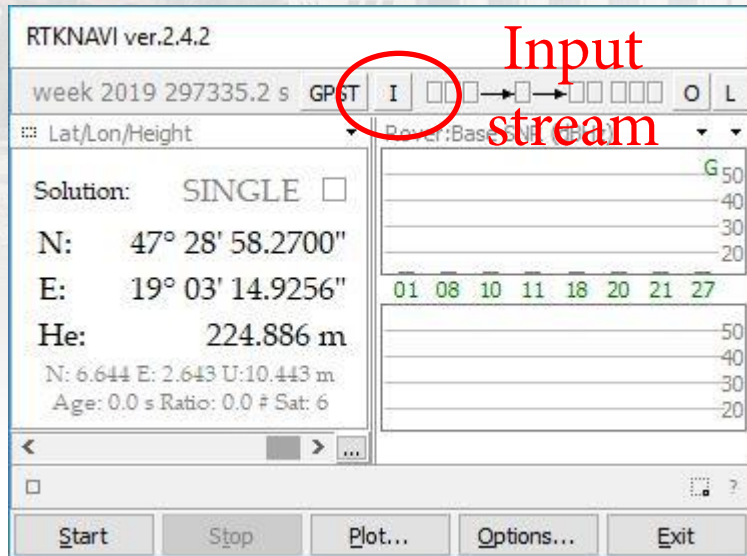
- antenn
- a
- usb cable
- antenna cable
- receiver

COM PORT



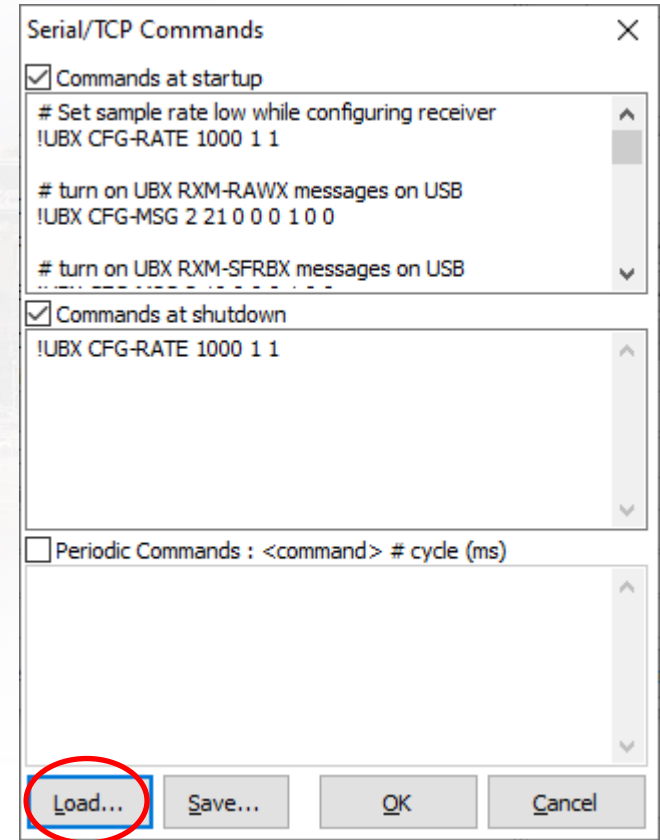
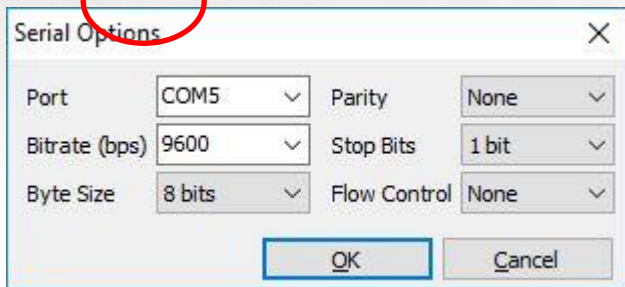
INPUT SETTINGS

- Launch rtknavi (rtklib)
- set input stream: u-blox



INPUT STREAM SETTINGS – U-BLOX M8T

- Choose com port
- Set serial parameters
- Open serial commands : e.g. C:\rtklib\m8t_1hz_usb.cmd



SINGLE POINT POSITIONING, JUST GPS

RTKNAVI ver.2.4.2

2018/09/19 11:58:32.6 GPST I □□□→□→□□□□□ O L

Lat/Lon/Height Rover:Base SNR (dBHz)

Solution: SINGLE

N: 47° 28' 55.7426"

E: 19° 03' 14.8077"

He: 200.541 m

N: 3.026 E: 2.213 U: 5.118 m

Age: 0.0 s Ratio: 0.0 # Sat:12

GR 50
40
30
20

010310111418222728320607152223

50
40
30
20

< > ...

□ ?

Start Stop Plot... Options... Exit

Options

Setting1 Setting2 Output Statistics Positions Files Misc

Positioning Mode Single

Frequencies / Filter Type 1171.2 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

SET OUTPUT STREAM

RTKNAVI ver.2.4.2

2018/09/19 11:58:32.6 GPST I O L

Lat/Lon/Height

Solution: SINGLE

N: 47° 28' 55.7426"

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Age: 0.0 s Ratio: 0.0 # Sat:12

Rover:Base SNR (dBHz)

GR
50
40
30
20
0 10 31 0 1 1 1 4 1 8 2 2 2 2 7 2 8 3 2 0 6 0 7 1 5 2 2 2 3
50
40
30
20

Start Stop Plot... Options... Exit

Output Streams

Output Stream	Type	Option	Format
<input checked="" type="checkbox"/> (4) Solution 1	File	...	NMEA0183
<input type="checkbox"/> (5) Solution 2	File	...	Lat/Lon/Height

Output File Paths

E:\oktatas\geodeziai_automatizalas\2022\gnss\%y%\n%\h%M%S.log

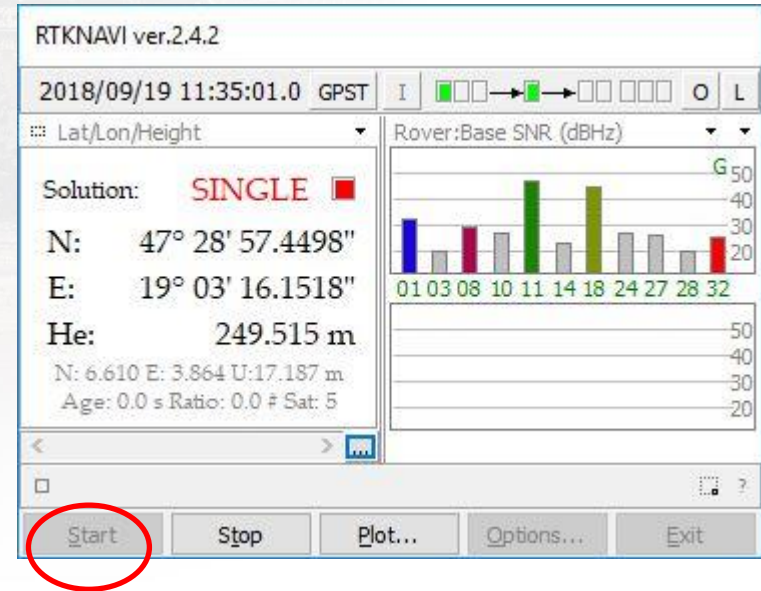
Time-Tag Swap Intv H ?

OK Cancel

START MEASURING

Check out

- Number of satellites
- Signal strength
- position
- Estimated accuracy
- Input/output led is blinking
- Output file size



RELATIVE POSITIONING

Input Streams

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

Transmit NMEA GPGGA to Base Station
OFF 0.000000000 0.000000000

Input File Paths

Time x1 + 0 s

OK Cancel

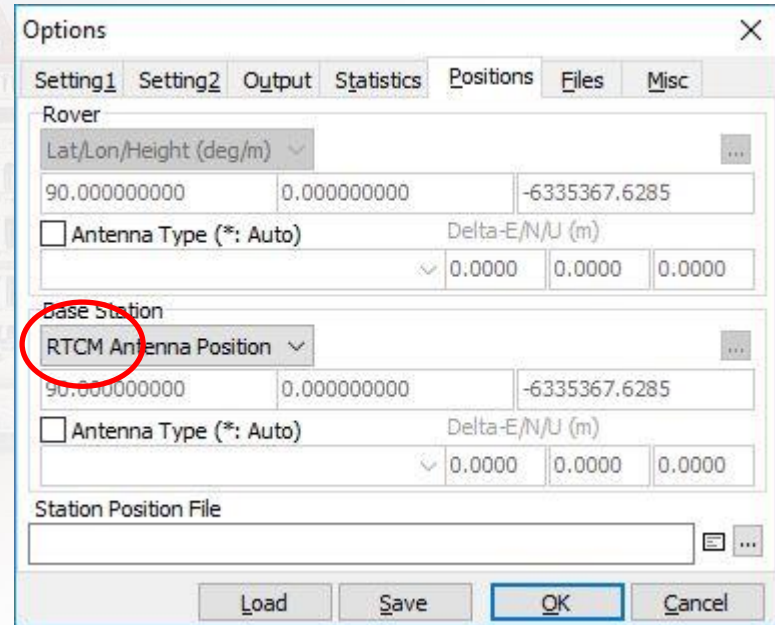
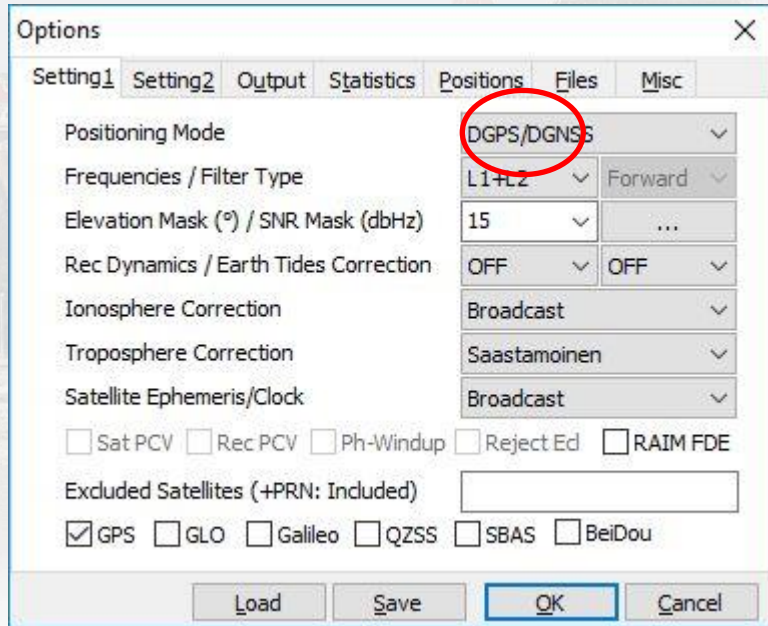
NTRIP Client Options

NTRIP Caster Address: gsmet.agt.bme.hu Port: 2101

Mountpoint: BME 10 User ID: localization Password:

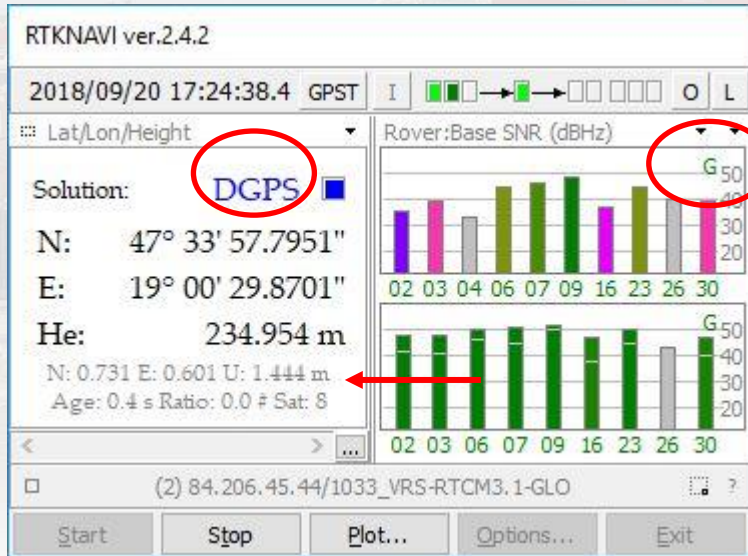
Browse... Get Mountp OK Cancel

DIFFERENTIAL GPS

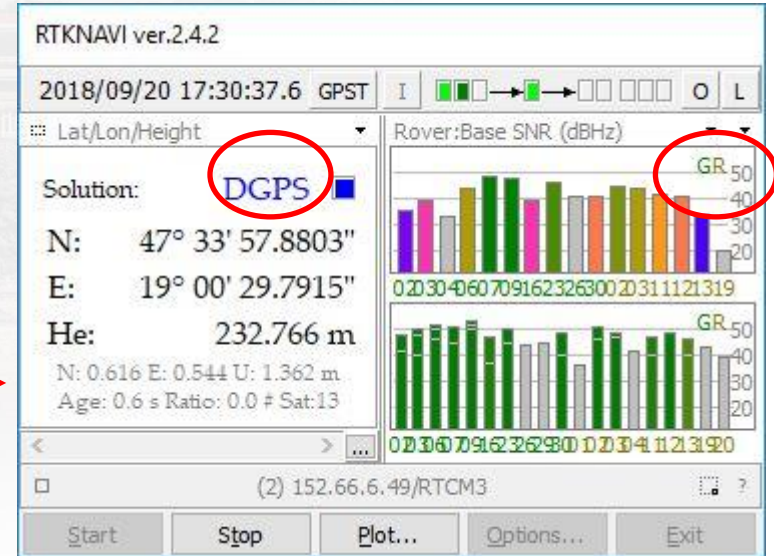


Base station position from RTCM messages

DIFFERENTIAL GPS



accuracy



Add Glonass satellites

REAL-TIME KINEMATIC (RTK)

Options

Setting₁ Setting₂ Output Statistics Positions Files Misc

Positioning Mode: Static

Frequencies / Filter Type: L1 Forward

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

Rec Dynamics / Earth Tides Correction: ON OFF

Ionosphere Correction: Broadcast

Troposphere Correction: Saastamoinen

Satellite Ephemeris/Clock: Broadcast

Sat PCV Rec PCV PhWU Rej Ed RAIM FDE DBCorr

Excluded Satellites (+PRN: Included)

GPS GLONASS Galileo QZSS BDS NavIC SBAS

Load... Save OK Cancel

Options

Setting₁ Setting₂ Output Statistics Positions Files Misc

Integer Ambiguity Res (GPS/GLO/BDS): Fix and Fix i OFF

Ratio to Fix Ambiguity (Min/Nom/Max): 1.5 3.0 10

GLO HW Bias: 0.000

Min Lock / Elevation (°) to Fix Amb: 0 15

Min Fix / Elevation (°) to Hold Amb: 20 15

Slip Thresholds: Doppler (Hz) / Geom-Free (m): 0.000 0.050

Max Age of Diff (s) / Outs to Reset Amb: 30.0 20

Reject Threshold of GDOP/Innov (m): 30.0 30.0

of Filter Iter / Sync Solution: 1 OFF

Baseline Length Constraint (m): 0.000 0.000

Min Fix Sats / Min Hold Sats: 4 5

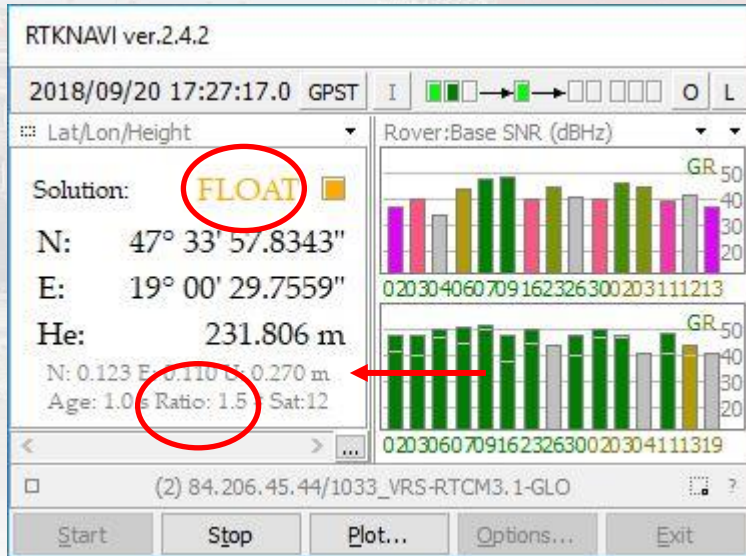
Min Drop Sats: 10

Max Pos Var for AR / AR Filter: 0.100 ON

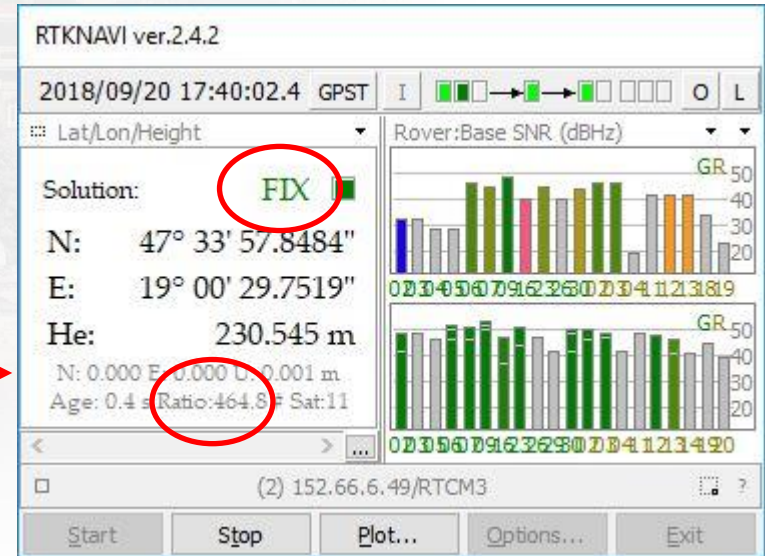
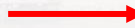
Hold Amb Var / Hold Amb Gain: 0.1000 0.0100

Load... Save OK Cancel

INITIALIZATION



accuracy



On single frequency it may take for a longer time

U-BLOX F9P-SPP

- Receiver is configured e.g. in u-center to output NMEA GGA, GNS, ZDA, baud rate 9600
- Launch strsvr
- Input: serial, output: file

STRSVR ver.demo5 b34e

2022/02/12 09:27:29 GPST Connect Time: 0d 00:00:10

Stream	Type	Opt	Cmd	Conv	Log	Bytes	Bps
<input type="checkbox"/> (0) Input	Serial	...	...		...	2,255	0
<input type="checkbox"/> (1) Output	File	...	...	...	...	2,255	0
<input type="checkbox"/> (2) Output		...	...	...	...	0	0
<input type="checkbox"/> (3) Output		...	...	...	...	0	0

?

▶ Start ⚙ Options... Exit

File Options

Output File Path ?

E:\pktatas\geodezjai_automatizalas\2022\gnss\ublox\fp\proba.txt

TimeTag Swap Intv H 64bit

OK Cancel

Serial Options

Port: COM5 Parity: None

Bitrate (bps): 9600 Stop Bits: 1 bit

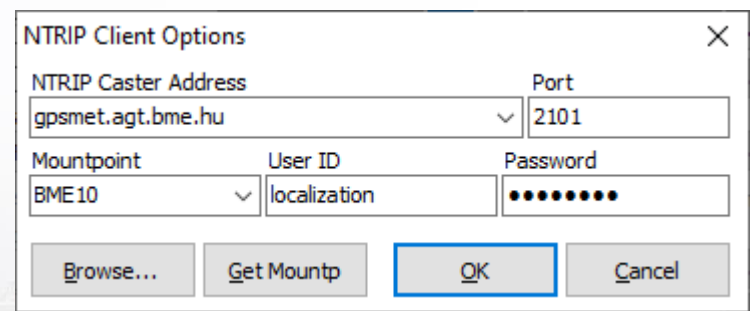
Byte Size: 8 bits Flow Control: None

Output Received Stream to TCP Port :

OK Cancel

U-BLOX F9P-RTK

- Launch 1st strsvr
- Input: ntrip client, output: serial + localhost

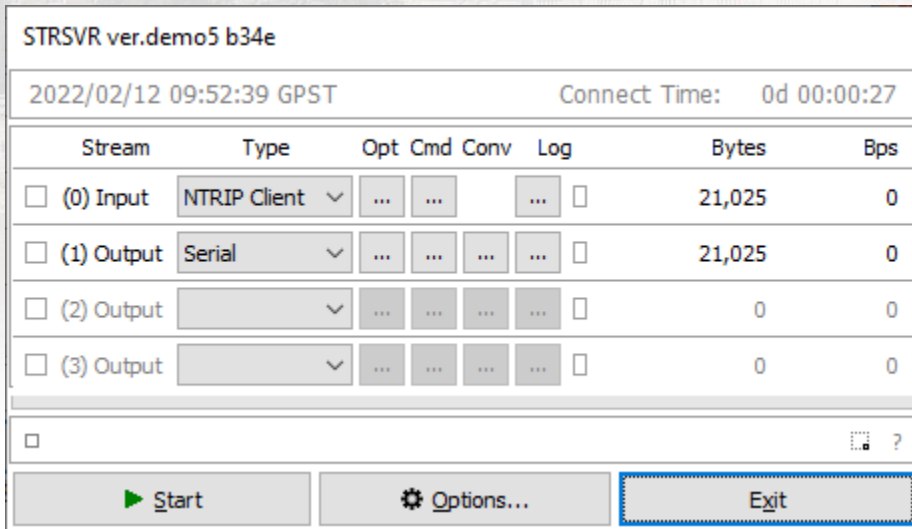


NTRIP Client Options

NTRIP Caster Address: gpsmet.agt.bme.hu | Port: 2101

Mountpoint: BME10 | User ID: localization | Password:

Buttons: Browse..., Get Mountp, OK, Cancel

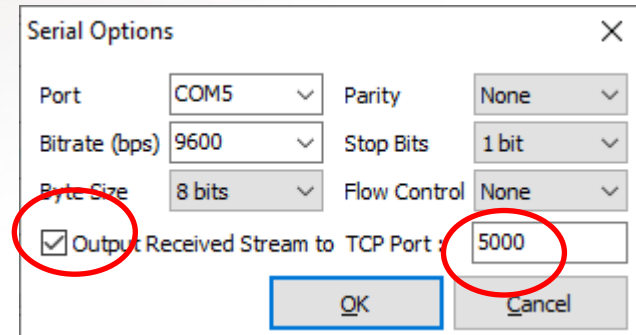


STRSVR ver.demo5 b34e

2022/02/12 09:52:39 GPST | Connect Time: 0d 00:00:27

Stream	Type	Opt	Cmd	Conv	Log	Bytes	Bps
<input type="checkbox"/> (0) Input	NTRIP Client	<input type="checkbox"/>	21,025	0
<input type="checkbox"/> (1) Output	Serial	<input type="checkbox"/>	21,025	0
<input type="checkbox"/> (2) Output		<input type="checkbox"/>	0	0
<input type="checkbox"/> (3) Output		<input type="checkbox"/>	0	0

Buttons: Start, Options..., Exit



Serial Options

Port: COM5 | Parity: None

Bitrate (bps): 9600 | Stop Bits: 1 bit

Byte Size: 8 bits | Flow Control: None

Output Received Stream to TCP Port: 5000

Buttons: OK, Cancel

U-BLOX F9P-RTK

- Relay messages

Options

Buffer Size (bytes)	32768	Period of Rate (ms)	1000
Server Cycle (ms)	10	File Swap Margin (s)	30
Inactive Timeout (ms)	10000	Relay Messages	(1) -> (0) ▼
Reconnect Interval (ms)	10000	Output Log Level	None ▼
Progress Bar Range (KB)	2000	<input type="checkbox"/> NMEA Cycle (ms)	0
<input type="checkbox"/> Station ID	0		
Lat/Lon/Height	0.00000000	0.00000000	0.000 ...
Offset E/N/U (m)	0.0000	0.0000	0.0000
Antenna Info			
Receiver Info			
FTP/HTTP Local Dir			...
HTTP/NTRIP Proxy			
Log File			...

OK Cancel

U-BLOX F9P-RTK

- Launch 2nd strsvr
- Input: TCP client, output: file

STRSVR ver.demo5 b34e

2022/02/12 10:04:30 GPST Connect Time: 0d 00:00:04

Stream	Type	Opt	Cmd	Conv	Log	Bytes	Bps
<input checked="" type="checkbox"/> (0) Input	TCP Client	<input type="checkbox"/>	1,065	1,704
<input checked="" type="checkbox"/> (1) Output	File	<input type="checkbox"/>	1,065	1,704
<input type="checkbox"/> (2) Output		<input type="checkbox"/>	0	0
<input type="checkbox"/> (3) Output		<input type="checkbox"/>	0	0

(0) localhost

Stop Options... Exit

TCP Client Options

Server Address: localhost Port: 5000

Mountpoint: User ID: Password:

File Options

Output File Path: ?

E:\pktatas\geodeziai_automatizalas\2022\gnss\ublox\ublox_f9p\proba.txt

TimeTag Swap Intv: H 64bit

TASKS TO DO

1. Do the first measurements in the room. The antenna might be close to the window. Make sure all the communication works, the quality of your position is less relevant..
2. Take measurements outdoors. Have a good view to the sky. Wait for initialization is done. Log a few minute with fix positions. Then restart and repeat a few times. Plot the number of satellites, position quality, coordinates in time, see the 2nd (NMEA) practice. Gain your own experience.