

# sbp2report User's Guide

## Overview

This document describes usage of the sbp2report v2.3.1 Swift Binary Protocol (SBP) log converter tool.

## sbp2report Introduction

The sbp2report software tool, available for Windows, Linux and macOS computers, converts SBP binary and SBP JSON log files to a set of human-friendly files for easy field test data review. The sbp2report generates following output files for each SBP log file:

|                       |  |
|-----------------------|--|
| filename.csv          | - Navigation data in CSV format (time, status, lat, lon, alt, etc.)                    |
| filename-trk.csv      | - Satellite tracking data in CSV format (time, each SV signal level)                   |
| filename-ins.csv      | - Inertial sensors (accelerometer, gyro, magnetometer) raw data in CSV format          |
| filename-msg.csv      | - All messages (partially decoded) in CSV format                                       |
| filename.kml          | - Traveled trajectory in Google Earth format   |
| filename-alt.plt      | - Altitude graph in gnuplot format   |
| filename-bsln.plt     | - RTK baseline length graph in gnuplot format  |
| filename-bsln-trj.plt | - RTK baseline trajectory graph in gnuplot format                                      |
| filename-corr-age.plt | - Corrections age graph in gnuplot format  |
| filename-spd.plt      | - Speed graph in gnuplot format  |
| filename-svs.plt      | - Satellites used in solution graph in gnuplot format                                  |
| filename-trj.plt      | - Traveled trajectory graph in gnuplot format  |
| filename-trk.plt      | - Tracked satellites graph in gnuplot format   |
| filename-trk-xxx.plt  | - Tracked satellites signal levels in gnuplot format. One file per GNSS constellation. |
| filename-stats.txt    | - General statistic information  |

The sbp2report can be downloaded from [support.swiftnav.com](http://support.swiftnav.com) (section Downloads -> Tools). Installation instructions and release notice are included there as well.

A following third-party software tools are recommended to view files created by the sbp2report:

|     |   |
|-----|---|
| KML | - Google Earth ( <a href="https://www.google.com/earth/desktop/">https://www.google.com/earth/desktop/</a> )            |
| CSV | - Microsoft Excel or other spreadsheet program  |
| PLT | - gnuplot ( <a href="http://www.gnuplot.info/">http://www.gnuplot.info/</a> ). See Appendix A for installation details. |
| TXT | - Any text file viewer/editor   |



# sbp2report Usage

The sbp2report is a command line tool. Command Prompt / Terminal window is required to run the program. Start the tool with no parameters to display usage help. The tool can process multiple input files at once. Expected file extensions are .sbp for binary file and .sbp.json for SBP JSON file. Output files are saved in the current working directory.

## Tool options:

|                |   |
|----------------|---|
| -r rate        | - Overrides expected solution data rate settings [Hz]. Default is 10.0 Hz.              |
| -kr rate       | - KML file output data rate [Hz]. Can be 1, 2, 5 or 10. Smaller file loads quicker.     |
| -b             | - Displays base station position in KML file.   |
| -hm            | - Heading mode - changes PLT output files to show heading status instead of position.   |
| -ho offset     | - Heading offset [deg]. Default 0. Range: -180 to 180 deg.                              |
| -tow begin end | - Limits TOW range [begin,end) for output [s]. Output files are saved in sub-directory. |
| -t title       | - Title for the stats and plot output files. Max 20 chars.                              |
| -gicons        | - Use original Google icons in KML.   |

## Usage examples:

sbp2report swift-gnss-20190506-142841.sbp.json <Enter> - converts specified file only

sbp2report -kr 1 \* <Enter> - converts all files with default extension from current directory;

## KML data is decimated to 1 Hz

sbp2report -tow 595925 595940 \* <Enter> - converts all files with default extension from current

directory; output duration is limited to TOW range specified

sbp2report \\* <Enter> - wildcard usage on Linux or macOS system

**Note:** it is recommended to launch the tool from a directory where log files are saved.

Example: if logs are in c:\logs\2019-06-05 directory process data in two steps:

```
c:\> cd \logs\2019-06-05 <Enter>
```

```
c:\logs\2019-06-05> sbp2report (options and log name) <Enter>
```

## Position and heading mode encoding (CSV files):

|   |                       |
|---|-----------------------|
| 0 | - No Fix              |
| 1 | - SPS                 |
| 2 | - DGPS                |
| 3 | - Float RTK           |
| 4 | - Fixed RTK           |
| 5 | - DR (Dead Reckoning) |
| 6 | - SBAS                |

## Position and heading mode color encoding (KML and gnuplot files):

|        |             |
|--------|-------------|
| Red    | - SPS       |
| Cyan   | - DGPS      |
| Blue   | - Float RTK |
| Green  | - Fixed RTK |
| Black  | - DR        |
| Purple | - SBAS      |



# sbp2report Output Examples

Pictures below present a few sample outputs generated by the sbp2report.

## General File Statistic (text file)

```
Listner - [c:\LOGS\2019-06-11-drive2-sf-280-85-sj\pm1\swift-gnss-20190611-225053-stats.txt]
File Edit Options Encoding Help 50 %
GNSS Statistic Report
File Name: swift-gnss-20190611-225053.sbp.json
SBP Data Length: 47999005 B (45.78 MB)
Valid: 47999005 B (45.78 MB)
Invalid: 0 B
Errors Count: 0
Errors Rate: 0.000 %

Average Data Rate: 8726.9 B/s (8.5 KB/s)

Receiver Name: Piksi Multi
Product ID: Piksi Multi
Serial Number: 00108072917000219
Firmware Version: v2.3.17
Firmware Date: 2019-06-11 19:08:02 UTC
Firmware ID: v2.3.17
Solution Frequency: 10.0 Hz
Heading Offset: 0.0 deg

GPS TOW:
Start: 255071.400 s
End: 260571.500 s

Duration: 5500.100 s (1h 31m 40.1s)
Distance Traveled: 99917.3 m (99.9 km, 62.1 mi)

Messages Count:
Position: 54989 ( 99.98 %)
Speed: 54134 ( 98.42 %)
Heading: 0 ( 0.00 %)

Position Mode:
All Fixes: 54169 ( 98.49 %)
RTK Fixes: 54067 ( 98.30 %)
No fix: 833 ( 1.51 %)
SPS: 21 ( 0.04 %)
SBAS: 55 ( 0.10 %)
DGPS: 26 ( 0.05 %)
RTK Float: 6396 ( 11.63 %)
RTK Fixed: 47671 ( 86.67 %)
DR: 0 ( 0.00 %)

Satellites Tracked:
GPS GLONASS Galileo BeiDou SBAS
All L1 L2 G1 G2 E1 E2 B1 B2 L1
Min: 11 3 0 0 0 1 1 5 1 0
Max: 34 10 6 8 8 8 8 8 3 1
Avg: 27.0 7.7 5.4 3.9 3.0 6.7 6.8 7.6 2.7 1.0

Satellites in Use:
All
Min: 5
Max: 15
Avg: 14.3
```

## Trajectory (Google Earth)

The screenshot shows the Google Earth Pro interface. On the left, the 'Places' panel is expanded to show a folder named 'GNSS Position' containing 'GNSS Track' and 'Base Station'. A yellow popup window is overlaid on the map, displaying the following data:

**Position Mode:** RTK Fixed + INS

**UTC:** 2019-06-12 16:29:30.999  
**Week:** 2057, **TOW:** 318589.000 s  
**Lat:** 37.2403723°, **Lon:** -121.9032378°  
**Alt (ellips):** 47.31 m (155.2 ft)  
**SOG:** 14.46 m/s (52.06 km/h, 32.35 mph)  
**Vertical Velocity:** -0.07 m/s  
**COG:** 58.8°  
**Roll:** 1.4° **Pitch:** 5.7° **Yaw:** 58.1°

**SVs Used:** 15  
**PDOP:** 1.5, **HDOP:** 0.8  
**EHPE:** 0.01 m, **EVPE:** 0.01 m  
**Baseline:** 5.7 km (3.5 mi)  
**Corrections Age:** 2.0 s

The map shows a green trajectory line with arrows along a road, with a red base station icon nearby. The interface includes a search bar, menu bar (File, Edit, View, Tools, Add, Help), and a toolbar.

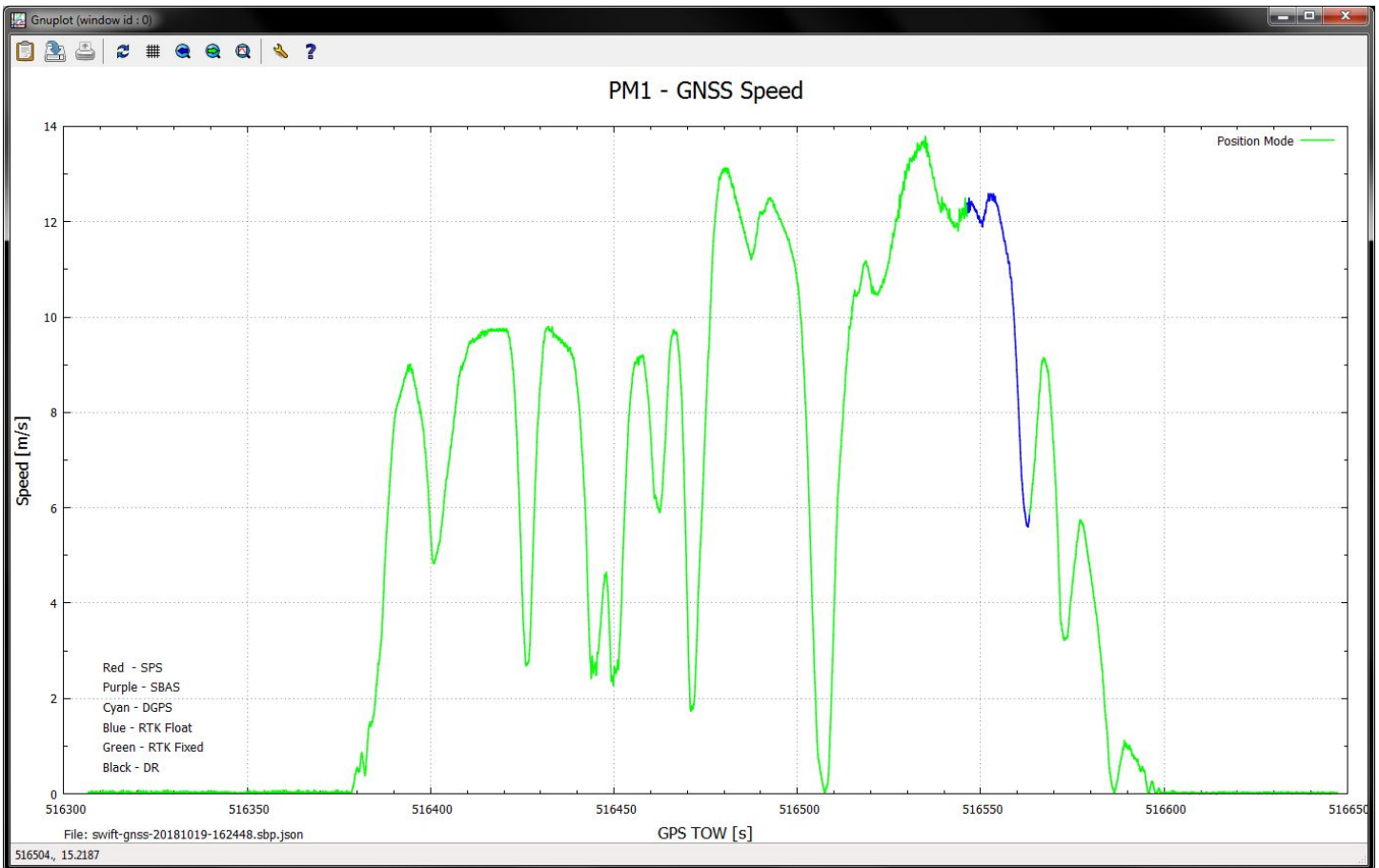
### Hints:

- Click on position icon to display detailed information
- Position icons, Track lines and base station position can be individually enabled/disabled
- Use data decimation option (-kr X) for larger (over 1 hour) logs

Base station position indicator:



## Vehicle Speed (gnuplot)

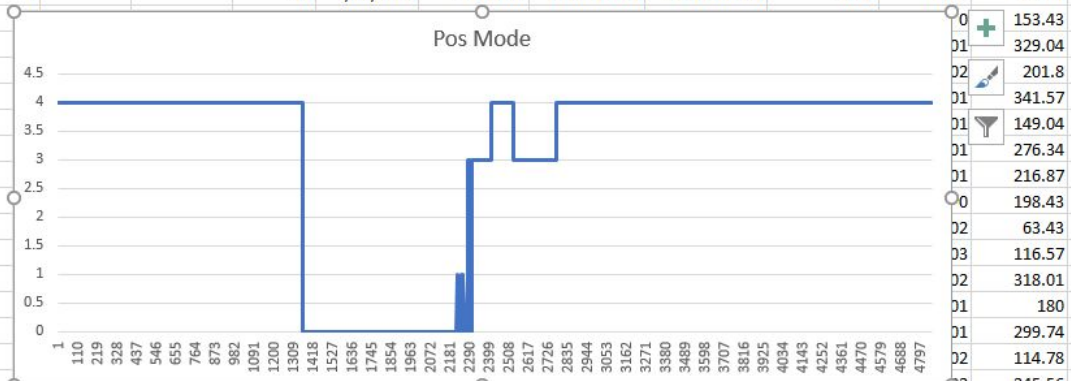


### Hints:

- Enable gnuplot option *"Don't quit until all windows are closed (persist)"* to keep graph on the screen
- Mouse roller scrolls graph up/down
- Shift key + mouse roller scrolls graph left/right
- Ctrl key + mouse roller zooms graph in/out
- Q key quits gnuplot

## Navigation Data (Excel)

|    | A        | B           | C        | D        | E        | F           | G        | H         | I          | J           | K            | L              | M         | N         |
|----|----------|-------------|----------|----------|----------|-------------|----------|-----------|------------|-------------|--------------|----------------|-----------|-----------|
| 1  | GPS Week | GPS TOW [s] | Pos Mode | INS Mode | Hdg Mode | SVs Tracked | SVs Used | UTC Date  | UTC Time   | Lat [deg]   | Lon [deg]    | Alt Ellips [m] | SOG [m/s] | COG [deg] |
| 2  | 2010     | 322312.4    | 4        | 0        |          | 24          | 15       | 7/18/2018 | 17:31:34.4 | 37.77118501 | -122.4030965 | -6.96          | 0.01      | 59.04     |
| 3  | 2010     | 322312.5    | 4        | 0        |          |             | 15       | 7/18/2018 | 17:31:34.5 | 37.77118502 | -122.4030966 | -6.95          | 0.04      | 270       |
| 4  | 2010     | 322312.6    | 4        | 0        |          |             | 15       | 7/18/2018 | 17:31:34.6 | 37.77118502 | -122.4030965 | -6.96          | 0.03      | 80.54     |
| 5  | 2010     | 322312.7    | 4        | 0        |          |             | 15       | 7/18/2018 | 17:31:34.7 | 37.77118502 | -122.4030965 | -6.95          | 0.05      | 116.57    |
| 6  | 2010     | 322312.8    | 4        | 0        |          |             | 15       | 7/18/2018 | 17:31:34.8 | 37.77118502 | -122.4030966 | -6.95          | 0.04      | 213.69    |
| 7  | 2010     | 322312.9    | 4        | 0        |          | 17          | 15       | 7/18/2018 | 17:31:34.9 | 37.77118501 | -122.4030966 | -6.95          | 0.01      | 194.04    |
| 8  | 2010     | 322313      | 4        | 0        |          |             | 15       | 7/18/2018 | 17:31:35.0 | 37.77118501 | -122.4030966 | -6.95          | 0.01      | 51.34     |
| 9  | 2010     | 322313.1    | 4        |          |          |             |          |           |            |             |              |                |           | 153.43    |
| 10 | 2010     | 322313.2    | 4        |          |          |             |          |           |            |             |              |                |           | 329.04    |
| 11 | 2010     | 322313.3    | 4        |          |          |             |          |           |            |             |              |                |           | 201.8     |
| 12 | 2010     | 322313.4    | 4        |          |          |             |          |           |            |             |              |                |           | 341.57    |
| 13 | 2010     | 322313.5    | 4        |          |          |             |          |           |            |             |              |                |           | 149.04    |
| 14 | 2010     | 322313.6    | 4        |          |          |             |          |           |            |             |              |                |           | 276.34    |
| 15 | 2010     | 322313.7    | 4        |          |          |             |          |           |            |             |              |                |           | 216.87    |
| 16 | 2010     | 322313.8    | 4        |          |          |             |          |           |            |             |              |                |           | 198.43    |
| 17 | 2010     | 322313.9    | 4        |          |          |             |          |           |            |             |              |                |           | 63.43     |
| 18 | 2010     | 322314      | 4        |          |          |             |          |           |            |             |              |                |           | 116.57    |
| 19 | 2010     | 322314.1    | 4        |          |          |             |          |           |            |             |              |                |           | 318.01    |
| 20 | 2010     | 322314.2    | 4        |          |          |             |          |           |            |             |              |                |           | 180       |
| 21 | 2010     | 322314.3    | 4        |          |          |             |          |           |            |             |              |                |           | 299.74    |
| 22 | 2010     | 322314.4    | 4        |          |          |             |          |           |            |             |              |                |           | 114.78    |
| 23 | 2010     | 322314.5    | 4        |          |          |             |          |           |            |             |              |                |           | 245.56    |
| 24 | 2010     | 322314.6    | 4        | 0        |          |             | 15       | 7/18/2018 | 17:31:36.6 | 37.77118502 | -122.4030966 | -6.95          | 0.02      | 234.46    |
| 25 | 2010     | 322314.7    | 4        | 0        |          |             | 15       | 7/18/2018 | 17:31:36.7 | 37.77118503 | -122.4030966 | -6.95          | 0.03      | 47.12     |
| 26 | 2010     | 322314.8    | 4        | 0        |          |             | 15       | 7/18/2018 | 17:31:36.8 | 37.77118502 | -122.4030966 | -6.95          | 0.02      | 150.26    |



### Notes:

- Empty cells indicate invalid or not available data
- Last three columns (Delta TOW, 2D Delta Position and 2D Delta Position) are computed by the tool. All other data come directly from SBP messages.
- The Delta TOW, 2D Delta Pos and 3D Delta Pos compute delta from a previous data set.

### Acronyms used in CSV file headers

- TOW - Time Of the Week
- Pos - Position
- INS - Inertial
- Hdg - Heading
- SV - Satellite Vehicle
- UTC - Universal Time Coordinated
- Lat - Latitude
- Lon - Longitude
- Alt - Altitude
- Ellips - Ellipsoid
- SOG - Speed Over Ground
- COG - Course Over Ground
- Vert - Vertical
- Vel - Velocity
- PDOP - Position Dilution Of Precision
- HDOP - Horizontal Dilution Of Precision
- EHPE - Estimated Horizontal Position Error
- EVPE - Estimated Vertical Position Error



2D - Two-dimensional (horizontal)  
3D - Three-dimensional  
Corr - Corrections  
IMU - Inertial Measurement Unit  
Temp - Temperature  
Acc - Accelerometer  
Gyr - Gyroscope  
Mag - Magnetometer  
GPS - Global Positioning System  
GLO - GLONASS  
GAL - Galileo  
BDS - BeiDou

# Appendix A - gnuplot Installation Details

The easiest and recommended way to display PLT files with gnuplot is to associate .plt file extension with gnuplot program and then double-click on a file . On MacOS association needs to be done to the gnuplot-launch program.

It is recommended to install gnuplot with wxt (wxWidgets) terminal for interactive plot control.

Below are detailed gnuplot installation instructions for Windows, Linux and MacOS.

## Windows

1. Program installer can be downloaded from <http://gnuplot.info/download.html>
2. During installation enable file association for .plt files and enable "Add application directory to the PATH environment variable".
3. After first start enable gnuplot option "*Don't quit until all windows are closed (persist)*" to keep graph on the screen.

## Linux

1. Install gnuplot using command `sudo apt-get install gnuplot-qt` or `sudo apt-get install gnuplot-x11`
2. In the file viewer right-click on any .plt file and in Open With option select gnuplot

Note: The terminal type needs to be updated manually in the .plt file.

## MacOS

1. Install gnuplot using command: `brew install gnuplot --with-wxmac`
2. Copy gnuplot-install app to the Applications folder
3. In Finder control-click (right-click) on any .plt file generated by sbp2report and click Get Info. In Open With section click Other and enable All Applications view. Then select gnuplot-launch as application and check Always Open With checkbox.

Note: The -trk.plt files do not open correctly at this time.