

# Ellipse Series

## Change-log v1.7.1438-stable

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## 1. Summary

The 1.7 firmware series is a major update that adds several important new features, performance improvements and bug fixes.

The main new features and additions are listed below:

- Up to now, ELLIPSE INS was continuously estimating and refining mechanical installation parameters such as GNSS primary and secondary lever arm antennas. Even if this behavior is great for ease of use, with the 1.7 release, it's now possible to select the best behavior according to your use case and stop online lever arm estimation.
  - This can reduce the alignment time while improving the accuracy and stability of the system.
  - If you can't measure precisely the lever arm (<2 cm), you can use Qinertia to do it automatically
- To better address the automotive market, the ELLIPSE can now output, over the CAN bus, several new quantities such as the velocity expressed in the vehicle frame (body), the slip angle as well as the curvature (turn radius).
- Now, the ELLIPSE is also able to use vehicle's odometer directly through the OBDII connector. This makes the ELLIPSE an outstanding INS for self driving cars and autonomous vehicles with incredible accuracy even in very dense urban environments.
- Doppler Velocity Log (DVL) aiding has also been added to the ELLIPSE to enable INS grade subsea navigation at a very affordable price.
- Finally, preparatory work has been done to fully support air data aiding. This new aiding source aims to improve ELLIPSE attitude and dead reckoning accuracy in case of GNSS drop out. The ELLIPSE is now able to receive and process external true air speed and barometric altitude. This a work in progress feature so please contact SBG Systems support team for more information

This new firmware release also contains bug fixes to improve the overall product stability and remains fully backward compatible with previous firmware revisions.

## 2. Upgrade Procedure

The latest Ellipse firmware version comes with an SDK release. You can download the latest SDK using the SBG Systems support center web area.

To upgrade your device firmware, please use the sbgFirmwareUpdater application.

## 3. All changes for release 1.7.1436-stable

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### 3.1. New Feature

- [ELIFW-294] - Possibility to output data at 40Hz with the Ellipse
- [ELIFW-323] - Add Air data aiding parsing and output logs
- [ELIFW-338] - Add CAN odometer aiding module and configuration
- [ELIFW-352] - Add baseline length field in SBG\_ECOM\_LOG\_GPS#\_HDT log
- [ELIFW-355] - Add CAN output message with track, slip and curvature indications
- [ELIFW-356] - Add CAN output message with vehicle body velocity
- [ELIFW-358] - Add asynchronous IMU Short output log message
- [ELIFW-360] - Add support for Quanta IMU integration
- [ELIFW-391] - Add INDYN NMEA like message output for marine applications
- [ELIFW-402] - Add compatibility support Crossbow AHRS500 series

### 3.2. Improvement

- [ELIFW-316] - Improved WGS48 to NED transformation precision, resulting in better performance
- [ELIFW-319] - Implement DVL aiding based on Teledyne PD6 format
- [ELIFW-365] - Implement fixed lever arms mode for precision application and reduced alignment time
- [ELIFW-377] - Now SBG\_ECAN\_MSG\_ODO\_VELOCITY doesn't use float anymore
- [ELIFW-380] - Fix invalid reported CAN bus status following an error
- [ELIFW-388] - Add support for Novatel log HEADING2
- [ELIFW-396] - Added SBG\_ECOM\_CMD\_GNSS\_1\_INSTALLATION command to set/get GNSS lever arm
- [ELIFW-410] - Updated leap second value to 18s

### 3.3. Bug

- [ELIFW-59] - Fixed pressure sensor status displaying zero
- [ELIFW-297] - Now, reported yaw standard deviation is set to 180° in VG mode
- [ELIFW-353] - Fix ship motion output heave velocity value that was always set to zero
- [ELIFW-354] - Fix UTC sync issue after GNSS loss leading to time stamp not aligned on plain seconds
- [ELIFW-368] - Fix clock alignment status that couldn't return to free running
- [ELIFW-400] - Updated SBG\_ECAN\_MSG\_PRESSURE\_# to SBG\_ECAN\_MSG\_AIR\_DATA\_# and added airspeed

### 3.4. Removed Feature

- [ELIFW-395] - Drop support for deprecated PRDID(6) PSBGI(9) PASHR(10) for SBG\_ECOM\_CLASS\_LOG\_NMEA\_0

## 4. All changes for release 1.6.881-stable

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### 4.1. New Feature

- [ELIFW-309] - Add support for new ELLIPSE-D with internal Septentrio GNSS receiver

### 4.2. Improvement

- [ELIFW-290] - Added OEM7 series Novatel logs for Post Processing in GNSS raw payload
- [ELIFW-315] - Improved ELLIPSE-D internal GNSS initialization to reduce boot time

### 4.3. Bug

- [ELIFW-314] - Fix GNSS protocol parsing that could hang if work buffer is filled with trash

## 5. All changes for release 1.5.240-stable

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### 5.1. New Feature

- [ELIFW-302] - Add a heavy machinery motion profile
- [ELIFW-304] - Added support for ELLIPSE Micro M2 hardware

## 6. All changes for release 1.5.224-stable

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### 6.1. New Feature

- [ELIFW-257] - Added support for new ELLIPSE2 micro hardware
- [ELIFW-293] - Added support to ELLIPSE-E to externally configure an Ublox receiver

### 6.2. Improvement

- [ELIFW-275] - Add backward compatibility to NMEA protocol for GST disabled receivers

### 6.3. Bug

- [ELIFW-236] - Fixed NMEA GST message generation
- [ELIFW-261] - Fix Surge and Sway have values when main lever arm is entered
- [ELIFW-263] - Fix a bug that could lead to improper internal GNSS initialization for ELLIPSE-N and D
- [ELIFW-276] - Fixed invalid alignment flag in solution status for message SBG\_ECAN\_LOG\_STATUS\_03
- [ELIFW-277] - Fixed invalid CPU status flag for message SBG\_ECAN\_LOG\_STATUS\_01
- [ELIFW-278] - Fixed invalid CAN bus status for message SBG\_ECAN\_LOG\_STATUS\_02
- [ELIFW-298] - Fix sync out bug for pulses with a duration greater than 65535 us
- [ELIFW-299] - Fixed improper slew rate management for serial Port A, C and E

## 7. All changes for release 1.4.100-stable

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### 7.1. Bug

- [ELIFW-273] - Remove validity condition for PASHR heave output

### 7.2. New Feature

- [ELIFW-248] - Implement SBG\_ECOM\_CMD\_VALIDITY\_THRESHOLDS command to tune attitude and navigation validity flags

## 8. All changes for release 1.3.178-stable

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### 8.1. Bug

- [ELIFW-262] - Fixed direct PPS Sync Out option for ELLIPSE2-N products
- [ELIFW-267] - Fixed incorrect magnetometers status reporting for ELLIPSE2

## 9. All changes for release 1.3.170-stable

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### 9.1. Improvement

- [ELIFW-212] - Better UTC and GPS time management to avoid rounding issues

### 9.2. Bug

- [ELIFW-235] - Fixed heave message in Legacy output that was always outputting 0
- [ELIFW-255] - Fixed a bug that could output empty heave field in PASHR message
- [ELIFW-259] - Fixed a bug that could output empty heave field in sbgECan message

## 10. All changes for release 1.3.147-stable

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### 10.1. Improvement

- [ELIFW-250] - Improved accelerometers initial self test for ELLIPSE2

### 10.2. Bug

- [ELIFW-251] - Fixed accelerometer boot sequence that could lead in rare circumstances to a Z axis zero reading
- [ELIFW-254] - Reverted attitude & navigation validity flag threshold to firmware 1.1 values

## 11. All changes for release 1.3.97-stable

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### 11.1. Improvement

- [ELIFW-247] - Review attitude, navigation and alignment validity thresholds to be more tolerant

## 12. All changes for release 1.3.85-stable

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### 12.1. New Feature

- [ELIFW-240] - Add an uptime indication in SBG\_ECOM\_LOG\_STATUS
- [ELIFW-226] - Added GPS number of SV used and diff corrections details in sbgECan protocol
- [ELIFW-195] - Add support for NMEA VTG output log
- [ELIFW-176] - Automatically output a GGA frame at 1 Hz for ELLIPSE-D on PORT C when RTCM corrections are enabled
- [ELIFW-149] - Added proprietary NMEA message PASHR for roll, pitch, heading, heave
- [ELIFW-131] - Added NMEA GST input support for better accuracy when using NMEA GPS
- [ELIFW-126] - Added direct PPS from internal GNSS Sync Output (SBG\_ECOM\_CMD\_SYNC\_OUT\_CONF)
- [ELIFW-120] - Added support for new ELLIPSE2 hardware
- [ELIFW-100] - Reworked IMU filters topology to reduce the delay
- [ELIFW-90] - Add the alignment indication in the SBG\_ECOM\_LOG\_STATUS
- [ELIFW-89] - Added the CPU consumption flag in SBG\_ECOM\_LOG\_STATUS
- [ELIFW-87] - Added UTC offset (leap second) initial settings for better NMEA GPS support
- [ELIFW-82] - Added SBG Proprietary NMEA message with acceleration and angular rate
- [ELIFW-72] - Added SBF (Septentrio) protocol support on Ellipse-E
- [ELIFW-56] - Added SBG\_ECOM\_LOG\_FAST\_IMU\_DATA, 1KHz IMU message for low latency applications

### 12.2. Improvements

- [ELIFW-242] - Reduced CAN generator latency and jitter
- [ELIFW-238] - Improve EKF stability in rare static conditions
- [ELIFW-200] - improved ZUPT using windows
- [ELIFW-191] - Eased heading alignment in case of helicopter or UAV platforms
- [ELIFW-190] - Added UAV Rotary wing motion profile for low dynamic UAV applications
- [ELIFW-181] - Initializes both position and velocity at the same time in the EKF
- [ELIFW-180] - Improved System performance in low dynamic applications
- [ELIFW-179] - Allow magnetic aiding only in case of reasonably accurate good roll and pitch angle
- [ELIFW-178] - Improved AHRS fallback mode in case of long GNSS outages
- [ELIFW-175] - Improved performance at RTK fix recovery
- [ELIFW-174] - Allow GPS lever arm estimation under lower dynamics
- [ELIFW-156] - Discard magnetic calibration data when the attitude is not accurate enough
- [ELIFW-147] - Improved overall system initializations (velocity, position, heading)
- [ELIFW-143] - Added a limit to the GPS position aiding (in comparison to the EKF precision)
- [ELIFW-141] - Improved odometer aiding performance
- [ELIFW-140] - Improve overall automotive performance
- [ELIFW-138] - Disable velocity aiding in case of RTK fix
- [ELIFW-137] - Improve performance under RTK GNSS outages
- [ELIFW-136] - Improved EKF quality feedback
- [ELIFW-132] - Improved NMEA / ASCII output string generation method for float / int

- [ELIFW-95] - Improved covariance matrix symmetrization method
- [ELIFW-94] - Better time stamping for Novatel true heading solution
- [ELIFW-93] - Better handling of GPS protocol when no valid Time of Week is parsed
- [ELIFW-92] - Improved GNSS antenna alignment and lever Arm estimation under low dynamics
- [ELIFW-81] - Improved Noisy mags Tolerant magnetometer error model
- [ELIFW-78] - Improved ZUPT handling when odometer is enabled
- [ELIFW-75] - Kalman filter performance improvement and error models refining
- [ELIFW-74] - Returns empty fields for NMEA logs ZDA and HDT when data are not valid
- [ELIFW-71] - The 2D calibration can find a solution with fewer points.
- [ELIFW-67] - Improved logics to chose whenever PORT A & PORT E slew rate should be set to high/low
- [ELIFW-66] - Improved Accelerometer bias estimation and tolerance tuning
- [ELIFW-51] - Improve NMEA integration under very low dynamics
- [ELIFW-48] - Increased raw GPS data buffer size from 2048 to 4086 bytes

### 12.3. Bug

- [ELIFW-244] - Removed New data output on RAW GNSS data message for ELLIPSE-N
- [ELIFW-237] - Fix CAN log that were not correctly output on a New Data condition
- [ELIFW-230] - Fixed impossibility to initialize dual antenna heading in case of NMEA GNSS + high dynamic motion profiles
- [ELIFW-204] - Fixed potential incompatibility with newer Novatel protocol versions
- [ELIFW-203] - Fixed RMC Date not correct
- [ELIFW-197] - Fix invalid CRC error when migrating old settings
- [ELIFW-189] - Fixed IMU Fast Data log user/product alignment
- [ELIFW-142] - FIX EKF behavior when no velocity aiding input is available, but position input is
- [ELIFW-133] - Fix impossibility to switch to Navigation Mode in rare situations (with Dual antenna heading)
- [ELIFW-129] - Increased GGA altitude output digits from 3 to up to 5
- [ELIFW-102] - Fixed invalid configuration when an event in is used to output a log
- [ELIFW-96] - Improved handling of infinite rejection mode handling
- [ELIFW-91] - Fixed invalid GPS data time stamping when one GPS is providing timing data while the second one has no fix
- [ELIFW-86] - Fixed invalid LLA position when overflow
- [ELIFW-85] - Fixed NMEA / ASCII output frame time formatting issue
- [ELIFW-79] - Allow larger sync out pulse length than 4.5 ms
- [ELIFW-77] - Improved GPS position initialization in case of long GPS lever arm
- [ELIFW-76] - Fixed PORT A impossible configuration in RS-422 mode

### 12.4. Removed Feature

- [ELIFW-214] - Removed deprecated "course" from the GNSS configurable aiding sources

## 13. All changes for release 1.1.3232-stable

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### 13.1. New Feature

- [ELIFW-6] - CAN output added
- [ELIFW-9] - Added diff. correction age, diff base id and num sv to the SBG\_ECOM\_LOG\_GPS#\_POS
- [ELIFW-13] - Added support for Novatel protocol (GPS aiding)
- [ELIFW-21] - Added support of commands to set motion profile and error model IDs directly
- [ELIFW-29] - Added official support for additional output interfaces PORT C and PORT E
- [ELIFW-34] - GPS RAW message output added
- [ELIFW-35] - Device and GNSS features added
- [ELIFW-36] - Added license upload functionality
- [ELIFW-37] - Added message class enable/disable command
- [ELIFW-47] - Fixed bug in Legacy output (fixed point output mode).

### 13.2. Improvements

- [ELIFW-4] - Odometer status ODO\_REAL\_MEAS now effective
- [ELIFW-12] - Updated world magnetic model to WMM2015
- [ELIFW-24] - Improved ZUPT detection and robustness
- [ELIFW-25] - Improved GPS handling robustness in case of inconsistent measurements
- [ELIFW-31] - Improved PPS and UTC time handling
- [ELIFW-38] - Handle the GGA frame even if no undulation is provided
- [ELIFW-39] - Reduced RS-232 stream output jitter
- [ELIFW-41] - Modified firmware version numbering scheme
- [ELIFW-42] - Improved heave period computation performance
- [ELIFW-43] - Output logs trigger configuration are now restricted to New Data only for external aiding logs
- [ELIFW-49] - Added SBAS corrections on Novatel protocol

### 13.3. Bug

- [ELIFW-5] - Fixed GPS lever arm and alignment use in Marine & General Purpose motion profiles
- [ELIFW-8] - Fixed Wrong PRDID Heading output
- [ELIFW-11] - Fixed wrong negative altitude reading in NMEA protocol input
- [ELIFW-15] - Fixed CAN standard/extended ID issue
- [ELIFW-16] - Fixed CAN messages SBG\_ECAN\_MSG\_EKF\_ALTITUDE and SBG\_ECAN\_MSG\_PRESSURE\_ALTITUDE
- [ELIFW-17] - Fixed incorrect time rollover handling in system status
- [ELIFW-19] - Fixed impossibility to change GPS model in Ellipse-E
- [ELIFW-20] - FIXED incorrect position initialization after long term run in vertical gyro mode
- [ELIFW-23] - Fixed unexpected behavior in case of internal time rollover
- [ELIFW-32] - Fixed a bug that disturbs the clock estimation during a time stamp rollover
- [ELIFW-40] - Fixed invalid sensor alignment angle unit – Sensor now expects radians as written in the documentation now