# Ellipse Series

## MINIATURE
## HIGH PERFORMANCE
# Inertial Sensors

3rd GENERATION

0.05° RMS

ITAR Free

IMU
AHRS
MRU
INS
VG

## Navigation, Motion & Heave Sensing

ELLIPSE SERIES sets up new standard for miniature and cost-effective inertial systems with an extremely rugged design, cutting-edge sensors, enhanced capabilities, and advanced algorithms.

**SBG** SYSTEMS

# Ellipse Series - High-end technology in the smallest package

**Robust L1/L2 RTK**
with no extra charge

**New 64bit processor**
for maximum performance

**Best performance and SWaP** of its category

**OEM version** when size and cost matters

**Easy integration**
Get more out of your Ellipse with Qinertia Post-processing software (INS)

Ellipse Series is a successful line of industrial-grade inertial sensors known for their high level of robustness. This 3rd generation embeds a 64Bit microprocessor running latest generation algorithms. All the INS/GNSS are now provided with multi-band RTK receiver for centimetric position and more accurate orientation.

Robust Heading within seconds
Immune to magnetic disturbances
Very short baseline down to 50 cm

## Product Line

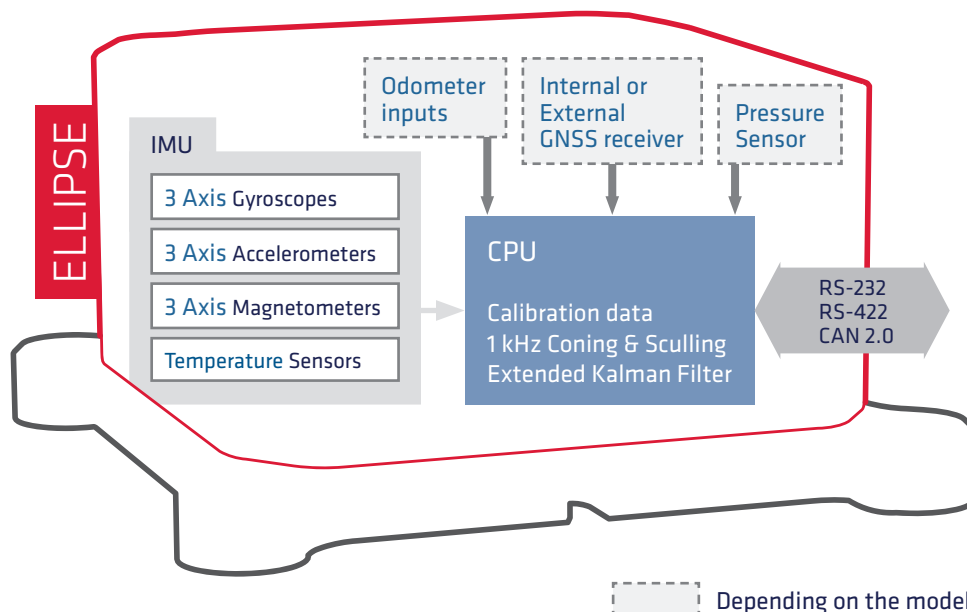| | Ellipse-A | Ellipse-E | Ellipse-N | Ellipse-D |
|---|---|---|---|---|
| Application | Motion Sensor | INS with your own GNSS receiver | INS for dynamic and automotive applications | INS for low dynamics and robust heading |
| Heading | Magnetic | Magnetic or GNSS | Magnetic or Mono-antenna GNSS | Dual antenna GNSS |
| Heave: 5 cm or 5% | ● | ● | ● | ● |
| Odometer aiding | | Pulse / CAN OBD-II | Pulse / CAN OBD-II | Pulse / CAN OBD-II |
| Navigation | | Navigation with external GNSS receiver | L1/L2 GNSS receiver 1 cm RTK GNSS Accuracy | L1/L2 GNSS receiver 1 cm RTK GNSS Accuracy |
| Post-Processing | | ● | ● | ● |

Motion & Heave Monitoring

Data Georeferencing

Payload Orientation & Positioning

# Features Inherited from High End INS/GNSS



**ELLIPSE**

**IMU**
- 3 Axis Gyroscopes
- 3 Axis Accelerometers
- 3 Axis Magnetometers
- Temperature Sensors

Odometer inputs

Internal or External GNSS receiver

Pressure Sensor

**CPU**
Calibration data
1 kHz Coning & Sculling
Extended Kalman Filter

RS-232
RS-422
CAN 2.0

Depending on the model

**2-year Warranty**

**No Export Restriction** ITAR

**Drivers for:**

:::ROS

PX4 autopilot

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| Best-in-class IMU | Advanced Algorithms | Easy Integration |
|---|---|---|
| » Industrial grade MEMS, superior vibration rejection<br>» Extensive test and calibration from -40 to 85°C with individual calibration report<br>» Integrated hard & soft magnetic disturbances calibration tools | » Real-time fusion of inertial with aiding sensors (GNSS, RTK, DMI, DVL,etc.)<br>» Robust position with invalid GNSS measurements detection and RAIM | » Select your motion profile to automatically adjust Kalman filter and dynamic constraints for optimal performance<br>» Automatic lever arm estimation (Enter rough lever arms, Ellipse will refine them automatically) |

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**AUTO-ADJUSTING HEAVE**
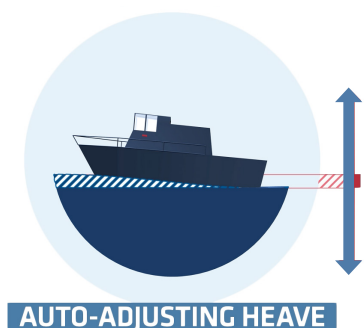
## High Accuracy Heave

Ellipse Marine version delivers a 5-cm accurate heave which automatically adjusts to the wave period.

Ellipse is a cost-effective alternative solution for instrumented buoys, helideck, or boat motion monitoring applications.

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Autonomous Navigation

Orientation

Pointing & Stabilization

# All you need to quickly get started

## Development Kit

The Development kit comes with your first Ellipse. It contains:

» Your Ellipse sensor calibration report
» A Quick start guide
» All required accessories depending on the chosen model (USB cable, Antenna(s), Development boards)

The SDK contains the sbgcenter which allows visualization, configuration, analysis, and export to Excel, Matlab, Google Earth formats as well as code examples for easy integration.

## Services

As expert of inertial navigation, we are at your side, helping you to get the most of your sensor:

» Free technical support by phone and email
» Unlimited firmware updates
» Dedicated support platform (Knowledge center, documentation, etc.)
» Custom remote initiation or on-site training on demand
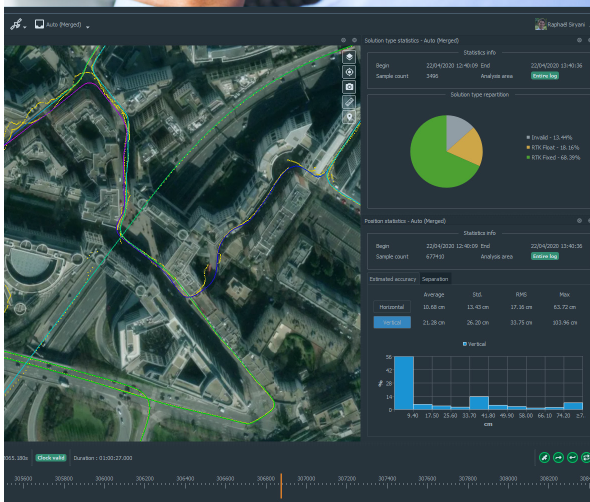
## Qinertia

Get more with your Ellipse INS using Qinertia (in option):

» Detailed analysis after the mission
» Replay the sensor data with different configuration
» Refine the mechanical installation (GNSS lever arm) to the centimeter level for improved real time behavior
» Reach ultimate sensors performance using Forward/ Backward/Merge processing

Dynamics Analysis

Navigation
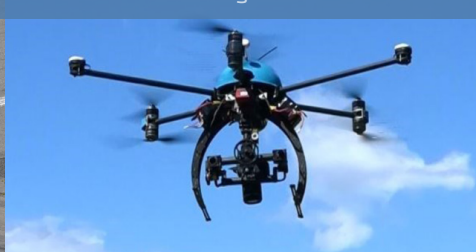
Autonomous Industrial Vehicles

# Specifications

## ACCURACY (RMS)   360° sensing in all axes, no mounting limitation

| Model | A | E[1] / N / D |
|---|---|---|
| **Roll / Pitch** | 0.1° | 0.1° SP<br>0.05° RTK<br>0.03° PPK[4] |
| **Heading** | 0.8° Magnetic[2] | 0.2° Dual antenna 2m<br>0.2° Single antenna with dynamics<br>0.1° PPK[4] |
| **Velocity**[3] | - | 0.03 m/s |
| **Navigation**[3] | - | 1.2 m Single Point<br>1 m SBAS<br>1 cm RTK / PPK[3] + 1 ppm |
| **Heave accuracy** | 5 cm or 5% - Valid for Marine version | |
| **Heave period** | Up to 15 s - Automatically adjusts to the wave period | |

[1] With Supported GNSS receiver
[2] Under homogenous magnetic field
[3] Under good GNSS availability
[4] Optional PPK = Post-processing Kinematic

## INTERFACES

| | |
|---|---|
| **Available data** | Euler angles, quaternion, velocity, position, heave, calibrated sensor data, delta angles & velocity, barometric data, status, GPS data, UTC time, GNSS raw data (Post-processing), etc. |
| **Aiding sensors** | GNSS, Odometer, RTCM |
| **Output rate** | 200 Hz, 1,000 Hz (IMU data) |
| **Main Serial Interface** | RS-232, RS-422, USB - up to 921,600 bps |
| **Serial protocols** | Binary eCom, NMEA, ASCII, TSS |
| **CAN interface** | CAN 2.0A/B - up to 1 Mbit/s |
| **Pulses** | Inputs: Events, PPS, DMI (Direction or quadrature) |
| | Outputs: Synchronization (PPS) |
| | Model A/N/D: 2 inputs / 1 output |
| | Model E: 4 inputs / 2 outputs |

## SENSORS

| | Accelerometers | Gyroscopes | Magnetometers |
|---|---|---|---|
| **Gain stability** | 1000 ppm | 500 ppm | < 0.5 % |
| **Non-linearity** | 1500 ppm | 50 ppm | < 0.1 % FS |
| **Bias stability** | ± 5 mg | ± 0.2 °/s | ± 1 mGauss |
| **Random walk Noise density** | 57 µg/√Hz | 0.15 °/√hr | 3 mGauss |
| **Bias in-run instability**[1] | 14 µg | 7 °/h | 1.5 mGauss |
| **VRE** | 50 µg/g² RMS | 1 °/h/g² RMS | - |
| **Alignment error** | < 0.05 ° | < 0.05 ° | < 0.1 ° |
| **Bandwidth** | 390 Hz | 133 Hz | 22 Hz |

[1] Allan Variance, @ 25 °C

## MECHANICAL   Box version are IP68, resistant to dust and water. OEM version are PCB mounted for tight integration.

| Model | A | E | N | D |
|---|---|---|---|---|
| Box | | | | |
| **Size** | 46 x 45 x 24 mm | 46 x 45 x 24 mm | 46 x 45 x 24 mm | 46 x 45 x 32 mm |
| **Weight** | 45 g | 47 g | 49 g | 65 g |
| OEM | | | | |
| **Size** | TBD | TBD | 29.5 x 25.5 x 16 mm | 29.5 x 25.5 x 16 mm |
| **Weight** | TBD | TBD | 17 g | 17 g |

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**All parameters apply to full specified temperature range, unless otherwise stated.** Full specifications can be found in the Ellipse Hardware Manual available upon request.

## ORDERING INFORMATION
*Pick one of each category*

### MODEL
A: AHRS
E: Externally Aided INS
N: INS with integrated RTK GNSS
D: INS with dual antenna RTK GNSS

### VERSION
Marine: 8 g – 450°/s
Land Air: 16 g – 450°/s
High Dynamics: 40 g – 1000°/s

### PACKAGE
BOX RS-232 / 422
BOX RS-232 / CAN
OEM TTL

## INTERNAL GNSS (N & D MODELS)

| | |
|---|---|
| **Features** | SBAS, RTK, RAW |
| **Signals** | GPS: L1C/A, L2C<br>GLONASS: L1OF, L2OF<br>GALILEO: E1, E5b,<br>BEIDOU: B1/B2 |
| **Update rate** | 5 Hz |
| **Cold start / Hot start** | < 24 s / < 2 s |

## PRESSURE SENSOR (models E/N/D)

| | |
|---|---|
| **Resolution** | 1.2 Pa / 10 cm / 0.3 ft |
| **Pressure accuracy** | ± 50 Pa / ± 200 Pa Relative / Absolute |

## ELECTRICAL & ENVIRONMENTAL

| | |
|---|---|
| **Input voltage** | 5 - 36 V |
| **Power consumption** | A/E: < 460 mW |
| | N/D: < 1,000 mW |
| **Specified temperature** | -40 to 85 °C |
| **Shock limit** | 2,000 g |
| **Operating vibration** | 8 g RMS (20 Hz to 2 k Hz per MIL-STD 810G) |
| **MTBF** | 50,000 hours |

# SBG SYSTEMS

SBG Systems is a leading supplier of inertial motion sensing solutions. The company provides a wide range of inertial solutions from miniature to high accuracy. Combined with cutting-edge calibration techniques and advanced embedded algorithms, SBG Systems products are ideal solutions for industrial & research projects such as unmanned vehicle control, antenna tracking, camera stabilization, and surveying applications.
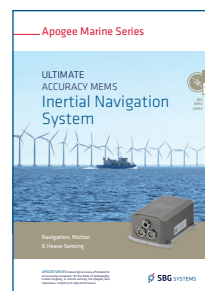
## PRODUCT LINES
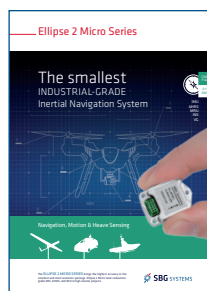


Ellipse Micro



Ekinox Series



Apogee Series

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