

## KEY FEATURES

Proven GNSS-Aided Inertial technology from Trimble Applanix

Centimeter level mobile positioning accuracy

Industry leading continuous positioning performance in GNSS denied environments

Full position and orientation solution for direct georeferencing of remote sensing systems

Fully supported for all dynamic environments: terrestrial, airborne and marine

## EMBEDDED GNSS-INERTIAL SYSTEMS FOR CONTINUOUS MOBILE POSITIONING AND DIRECT GEOREFERENCING APPLICATIONS

The Trimble AP60 GNSS-Inertial OEM System is an embedded GNSS-Inertial OEM board set plus Inertial Measurement Unit (IMU) in a compact form factor. It is designed to give system integrators the ability to harness the best in GNSS multi-frequency positioning technology, with the superior capabilities of inertial data for continuous mobile positioning in poor signal environments, and for the orientation of imaging sensors.

The Trimble AP60 features a high-performance precision GNSS receiver and the industry leading Applanix IN-Fusion™ GNSS-Inertial integration technology running on a powerful, dedicated Inertial Engine (IE) board. This flexible, modular design ensures the ability to perform full high-powered GNSS-inertial processing without sacrificing performance, and an upgrade path to next generation GNSS boards as they become available

### PERFORMANCE YOU CAN TRUST

Whether it be guiding autonomous vehicles to winning finishes in the DARPA Urban challenge or georeferencing airborne sensors to centimetre level accuracy from high in the sky, Trimble GNSS with Applanix inertial technology has a proven track record of performance without compromise. With Trimble AP products you know exactly what positioning performance you will get for your mobile application.



AP60 GNSS BOARD SET

## TECHNICAL SPECIFICATIONS<sup>1</sup>

- Advanced Applanix IN-Fusion™ GNSS-Inertial integration technology
- Advanced Trimble Maxwell™ 6 Custom GNSS survey technology (two chipsets)
- Primary Chipset
  - GPS: Simultaneous L1 C/A, L2E, L2C, L5
  - GLONASS: Simultaneous L1 C/A, L1 P, L2 C/A, L2 P
  - SBAS: Simultaneous L1 C/A, L5
  - BeiDou: B1, B2
  - Galileo<sup>9</sup>: Simultaneous L1 BOC, E5A, E5B, E5AltBOC2
  - QZSS: L1 C/A, L1 SAIF, L2C, L5
  - L-Band: OmniSTAR VBS, HP, XP and G2, Trimble CenterPoint RTX
- Secondary Chipset
  - GPS: Simultaneous L1 C/A, L2E, L2C
  - GLONASS: Simultaneous L1 C/A, L1 P, L2 C/A, L2 P
  - BeiDou: B1

High precision multiple correlator for GNSS pseudorange measurements

- Unfiltered, unsmoothed pseudorange measurements data for low noise, low multipath error, low time domain correlation and high dynamic response
- Very low noise GNSS carrier phase measurements with <1 mm precision in a 1 Hz bandwidth
- Proven Trimble low elevation tracking technology
- Support for optional Distance Measurement Indicator (DMI) input
- Support for optional GNSS Azimuth Measurement System (GAMS™)
- Support for optional POSPac Mobile Mapping Suite post-processing software

## INPUT/OUTPUT

### LAN

|                |   |
|----------------|---|
| Parameters     | Time tag, status, position, attitude, velocity, track and speed, dynamics, performance metrics, raw IMU data (200 Hz), raw GNSS data (5 Hz) |
| Display Port   | Low rate UDP protocol output (1 Hz)   |
| Control Port   | TCP/IP input for system commands  |
| Primary Port   | Real-time TCP/IP or UDP protocol output (1 – 200 Hz)  |
| Secondary Port | Buffered TCP/IP protocol output for data logging to external device (1 – 200 Hz)  |

### Internal Logging (1 – 200 Hz)

|            |   |
|------------|---|
| Parameters | Time tag, status, position, attitude, velocity, track and speed, dynamics, performance metrics, raw IMU data (200 Hz), raw GNSS data (5 Hz) |
|------------|---|

### RS232 Input

Parameter AUX GPS Input (RTK, SBAS), CMR, CMR+, RTCM v2.x, RTCM v3.x

### RS232 NMEA Output (1 – 50 Hz)

Parameter Position (\$INGGA), Heading (\$INHDT), Track and Speed (\$INVTG), Statistics (\$INGST), Attitude (\$PASHR), Time and Date (\$INZDA), Events (\$EVT1, \$EVT2)

### Other I/O

|                 |   |
|-----------------|---|
| 1PPS            | 1 pulse-per-second Time Sync output, normally high, active low pulse (configurable) |
| Event Input (6) | Six time mark of external events. TTL pulses > 1 ms width, max rate 100 Hz.         |

## PHYSICAL CHARACTERISTICS

|            |  |
|------------|--|
| Board Set  |  |
| Size       | 130 L x 100 W x 39 H mm (nominal)  |
| Weight     | 0.28 kg (nominal)  |
| Power      | 10 – 28 Volts DC, 20 Watts (max, with GAMS Option)   |
| Connectors | I/O: Samtec QSH-060-01-L-D-DP-A-RT1<br>Power: Samtec TFM-105-12-S-D-LC<br>Antenna: MMCX receptacle |

## ENVIRONMENTAL CHARACTERISTICS

|             |  |
|-------------|--|
| Temperature | -40 deg C to +75 deg C (Operational)<br>-55 deg C to +85 deg C (Storage) |
|-------------|--|

## INERTIAL MEASUREMENT UNIT (IMU)

| Type   | Class | Temperature            | Power               | Size (L x W x H) mm | Weight  |
|--------|-------|------------------------|---------------------|---------------------|---------|
| IMU-21 | COM   | -40 deg C to +70 deg C | +28 Vdc, 42 W (max) | 163 X 165 X 163     | 4.49 kg |
| IMU-57 | COM   | -20 deg C to +55 deg C | 8-36Vdc, 15W (max)  | 179 X 126 X 127     | 2.6 kg  |

## PERFORMANCE SPECIFICATIONS<sup>1</sup> (RMS ERROR)

### Airborne Applications

|                                 | SPS          | RTX <sup>2</sup> | RTX Post-Processed <sup>4</sup> | SmartBasePost-Processed <sup>4</sup> |
|---------------------------------|--------------|------------------|---------------------------------|--------------------------------------|
| Position (m)                    | 1.5 H<br>3 V | <0.1 H<br><0.2 V | <0.1 H<br><0.2 V                | <0.05 H<br><0.1 V                    |
| Velocity (m/s)                  | 0.030        | 0.030            | 0.0050                          | 0.0050                               |
| Roll & Pitch (deg)              | 0.005        | 0.005            | 0.0025 <sup>3</sup>             | 0.0025 <sup>3</sup>                  |
| True Heading <sup>2</sup> (deg) | 0.030        | 0.020            | 0.0050                          | 0.0050                               |

## TERRESTRIAL APPLICATIONS<sup>7</sup>, NO GNSS OUTAGES

|                                 | SPS       | VBS <sup>8</sup> | IARTK <sup>6</sup> | Post-Processed <sup>4</sup> |
|---------------------------------|-----------|------------------|--------------------|-----------------------------|
| Position (m)                    | 1.5 – 3.0 | 0.1 – 0.5        | 0.02 – 0.05        | 0.02 – 0.05                 |
| Velocity (m/s)                  | 0.030     | 0.010            | 0.010              | 0.005                       |
| Roll & Pitch (deg)              | 0.005     | 0.005            | 0.005              | 0.005                       |
| True Heading <sup>2</sup> (deg) | 0.020     | 0.020            | 0.020              | 0.015                       |

## TERRESTRIAL APPLICATIONS<sup>7</sup>, 60 SECOND GNSS OUTAGE

|                                 | SPS   | VBS <sup>8</sup> | IARTK <sup>6</sup> | Post-Processed <sup>4</sup> |
|---------------------------------|-------|------------------|--------------------|-----------------------------|
| Position (m)                    | 4.0   | 0.41 - 0.51      | 0.10 - 0.28        | 0.07 – 0.10                 |
| Roll & Pitch (deg)              | 00.08 | 0.005            | 0.005              | 0.005                       |
| True Heading <sup>2</sup> (deg) | 0.050 | 0.020            | 0.020              | 0.015                       |

<sup>(1)</sup> Typical performance. Actual results are dependent upon satellite configuration, atmospheric conditions and other environmental effects

<sup>(2)</sup> Typical mission profile, max RMS error

<sup>(3)</sup> Trimble RTX service, typical airborne results, subject to regional coverage. Subscription sold separately.

<sup>(4)</sup> POSPac MMS

<sup>(5)</sup> With GAMS option, 2 m baseline

<sup>(6)</sup> Applanix IN-Fusion Inertially-Aided RTK, typical results

<sup>(7)</sup> With DMI option

<sup>(8)</sup> Virtual Base Station corrections

<sup>(9)</sup> Developed under a License of the European Union and the European Space Agency

Specifications subject to change without notice.

