

POS LV™

Position and Orientation System for Land Vehicles

Position and Orientation System for Land Vehicles
enabling mobile spatial data acquisition

Applanix POS LV technology delivers repeatable position and orientation data, even through GNSS outages. Spatial data captured from a moving platform can be accurately georeferenced and reliably utilized for a wide variety of surveying and GIS applications




applanix™
A TRIMBLE COMPANY

The POS LV Position and Navigation System

Enabling Mobile Spatial Data Acquisition.

Engineering and survey professionals know operational productivity improves alongside technology. From optical devices to Global Navigation Satellite System (GNSS), the goal has always been to achieve better accuracy – but development so far has been mainly in static, stationary measurement applications and for very specific tasks.

Almost in unison, the growth of Geographic Information Systems (GIS) is placing renewed emphasis on data visualization. As a result, output expectations are expanding from conventional 2-dimensional static representations to the construction of highly illustrative 3-dimensional spatial models that support stronger visualizations and better understanding. The problem that arises is one of time.

Even though large scale geospatial collection missions can quickly supply GIS systems with data from air and space platforms, collaboration with data collected from ground surveying remains an essential requirement for decision makers. Unlike the bird's eye perspective, roadside assets, roads and laneways, buildings and other attributes of interest, require repeatable dynamic data capture from the ground level for proper identification. With a more suitable resolution and with a high degree of measurable accuracy, a Geographic Information System becomes complete and accurate enough for practical civil applications. Mapping right-of-way assets, pavement conditions, signage use, temporal changes, safety barrier status, building frontages, line-of-sight, vandalism, and other urban geographic interests requires the most advanced and dependable ground level data collection solution available. And to be practical enough to keep up with demand, it must be mobile.

For true mobile spatial data acquisition, the key enabling technology more teams depend upon is the Applanix POS LV. Spatial data capture from a moving vehicle using direct georeferencing requires accurate position (of the vehicle relative to the object of

interest) and orientation (to determine where the sensor is positioned relative to the vehicle and object of interest). With these two critical details, measurements from a host of sensors can be accurately and reliably utilized in all GNSS environments.

POS LV real time and post processed product solutions generate the robust, reliable, and repeatable results needed for mobile data acquisition systems. Utilized by Government transportation agencies, engineering companies, GIS consultants, and mobile mapping system integrators around the world, POS LV provides precise and accurate position and orientation measurements under the most difficult GPS conditions.

POS LV system features are designed to provide operators with a turn key positioning and orientation solution that enables mobile spatial data acquisition to begin sooner rather than later.

In addition to superior product, operators benefit from almost 20 years of Applanix systems integration experience, which helps make the integration of the POS LV with your equipment a more worry free process. Our aim is to ensure that your investment delivers results and generates returns starting with your very first job. Our goal is to see that our equipment is handled by your operators effectively through the best training from Applanix Customer Support Professionals. Our conviction is that you will recognize how POS LV, fully supported worldwide, represents the best solution for your operational needs.

Introducing POS LV Version 5



Expanding the operational capability of land-based mobile mapping with POS LV V5

The redesigned POS LV V5 is rugged, sealed, and with a POS Computer System (PCS) that is half the size of the previous version. Because it delivers accurate, uninterrupted positioning and orientation information from a moving vehicle with superior reliability and from almost any environment, it significantly expands the operational capability of land-based mobile mapping. So whether battling rough jungle roads, or even rugged off-road terrain, the system provides accurate measurements of the position, roll, pitch and true heading of the moving survey vehicle and the sensors onboard. This improved durability and reliability allows users to take POS LV into extreme environments, thus addressing mobile mapping and navigation applications previously not possible.



POS LV™

Components explained

The Tightly Coupled Inertial GNSS System

Robust positioning is critical to virtually eliminating the need for data reacquisition, saving operator costs and allowing more efficient data collection...

The POS LV tightly coupled inertial GNSS System continuously verifies available raw GNSS data as it arrives to make certain that only valid signals become a part of the positioning solution while also presenting a continuous position and orientation solution throughout a total or partial GNSS outage. POS LV's robust positioning helps eliminate the need for stationary data reacquisition, saving operator costs while allowing more efficient data collection to take place without interruption.

Maximum Accuracies with IARTK

Incorporate the inertial solution into the RTK computation to achieve centimeter-level positioning accuracies faster...

Real-Time Kinematic (RTK) surveying uses GNSS observations from an unknown position in conjunction with observations from a known position to achieve a high level of precision. This allows the receiver to determine the integer number of wavelengths in the carrier radio signal between itself and the transmitting satellites. But in city environments, interruptions frequently interfere with GNSS satellite signals and prevent RTK ambiguity resolution. Inertially Aided Real-Time Kinematic (IARTK) surveying drastically reduces ambiguity resolution process, which is essential in areas of spurious GNSS reception. The result is the ability to conduct high precision data collects with minimum downtime.

POS LV uses Inertially-Aided RTK (IARTK), which incorporates the inertial solution into this computation for better time-to-ambiguity resolution. The POS LV IMU and Distance Measuring Indicator (DMI) maintain an accurate position and velocity

solution to reduce error potential and achieve IARTK and centimeter-level positioning accuracies within seconds of signal reacquisition. This system is ideal for robust RTK-level positioning in adverse environments such as in urban canyons, under impenetrable tree canopy, and in high multipath environments.

Improved Performance with DMI

Discover greater data integrity, even in dense urban canyons or places where normal GNSS cannot be completely depended upon...

The Distance Measuring Indicator (DMI), a standard POS LV feature, is a wheel-mounted rotary shaft encoder that measures precise linear distance traveled and helps constrain GNSS outage drift.

Each ever so slight turn of the wheel generates an electrical pulse that relates to the short distance traveled. These pulses can come from a wheel-mounted encoder or from the vehicle's internal electronics. Joined to the POS LV timing system, the DMI also serves as a speed sensor used to constrain potential velocity errors in the IMU during GNSS outages or to detect that the vehicle is at rest, thereby allowing it to perform self-calibrations. The DMI most notably improves POS LV performance during GNSS outages. Without this measure, changing accelerometer biases cause exponential position error growth. With a DMI, along-track position error becomes a function of DMI accuracy (approximately 0.03 percent of distance traveled) and data integrity, even in narrow city corridors and other places where GNSS cannot be completely depended upon, becomes virtually certain.

Precise Heading with GAMS

Avoid inertial drift typically experienced by single antenna systems when vehicle dynamics are low...

Working with highly accurate heading measurements greatly helps stem the rate of position accuracy decay during GNSS outages, producing a far more precise association of remotely sensed data to real-world coordinates. The more accurate the heading determination at the start of an outage, the longer a system can stay on target. Standard with POS LV 220, 420 and 520 systems, the GNSS Azimuth Measurement Subsystem (GAMS) consists of two GNSS receivers and two antennas affixed to the vehicle two meters apart. POS LV then computes a moving baseline RTK solution that uses GNSS phase measurements to get a precise determination of one antenna's position relative to the other. This approach helps eliminate inertial drift errors that are typically produced in single antenna systems when vehicle progress stops. GAMS makes it possible to determine the vehicle's heading very accurately regardless of speed, resulting in the best possible heading accuracy and the best performance in any environment.



Simplified Post-Processing with POSPAC MMS

Improve productivity, data accuracy, and output reliability with easy to learn and apply processing software...

POSPac™ MMS (Mobile Mapping Suite) post-processing software is designed to maximize the accuracy potential of the POS LV system. From project planning through to completion, POSPac MMS software simplifies mission scheduling, utilizes smart time-saving features including pre-planning and batch processing resources, and offers customizable options with powerful quality control and data analysis tools. Easy to apply differential GNSS techniques and other advanced smoothing algorithms combine with batch-processing features to shorten user operation time and improve overall production levels.

Precision Positioning - IMU Meets GNSS

Mobile GNSS performance with position and orientation time-tagged for speed and accuracy generate consistently reliable data captures...

Applanix uses only the highest quality selection of GNSS receivers in the industry, providing complete flexibility for optimal accuracy combined with the latest in high performance dual frequency receiver technology. GNSS receivers are dedicated to supporting the POS LV Inertial Measurement Unit (IMU), the heart of the POS LV system. More than just a positioning system, the POS LV IMU uses three accelerometers and three gyroscopes to measure accelerations and angular velocities necessary for

computing all aspects of vehicle motion, including position, speed, acceleration, orientation, and rotation rates.

By combining easy sensor system integration (lasers...) with time-tagged position and orientation data logged at up to 200 Hz, POS LV sustains highly consistent and reliable data capture. POS LV filters raw GNSS so that only well-founded signals are incorporated into the results. Robust positioning helps eliminate need for data reacquisition, saving operator costs and allowing more efficient data collection.

Derived quantities such as lateral shift, radius of curvature, and slip angle are computed with an unmatched high degree of accuracy. Precise timing, an added benefit of GNSS, allows these measurements to be synchronized with all manners of remote sensing equipment.

With the option of utilizing OmniSTAR VBS, XP, and HP services, POS LV delivers varying levels of GNSS performance right down to the sub-decimeter level, even without the use of a base station (reducing cost, setup time, and base station theft risk).

Ruggedized Processing with the PCS

Solid-state engineering for uninterrupted productivity with accuracy, yet simple enough for solo-user operation...

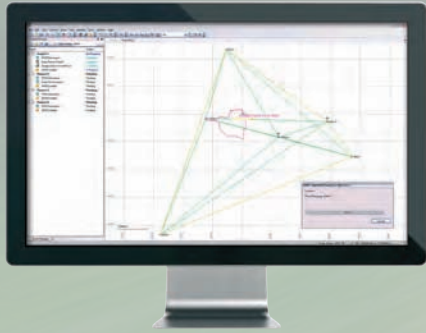
If the IMU is the heart of the POS LV then the POS Computer System (PCS) is the brain. The PCS enables raw GNSS data

from as few as one satellite to be processed directly into the system in order to compute accurate positional information in areas of intermittent or even absent GNSS reception. Ruggedized, power efficient, and light-weight, the Applanix PCS offers built-in logging features in a space efficient unit that includes an embedded state-of-the-art survey grade GNSS receiver. This central processing computer houses the USB Logging drive, implements all data processing orders, and serves as the power distribution hub for all POS LV components.

Another standard feature within POS LV and an important link to the POS computer, the LV POSView Controller offers an effective interface for monitoring of performance and critical control system functions. This component reduces operator workload and training time, while making it possible for only one person to operate the entire system. The PCS and LV POSView Controller are built to comfortably support a system with a conventionally high data rate and low system latency in order to provide better overall system integration while ensuring that position and orientation data is continuously captured in a fast, reliable, and uninterrupted process.



The 2007 DARPA Urban Challenge Winner, the Tartan Racing Team from Carnegie Mellon University, who utilized POS LV to cross the finish line first.



POSPac™ MMS
 POSpac™ Mobile Mapping Suite (MMS) is Applanix' next generation, industry-leading software for Direct Georeferencing of mobile mapping sensors using GNSS and inertial technology. Compatible with a variety of mapping sensors, this smart software solution achieves both maximum accuracy and maximum efficiency for Direct Georeferencing.



GAMS
 GAMS (GNSS Azimuth Measurement Subsystem) integrates an IMU with a 2-antenna heading measurement system. By utilizing a carrier phase differential GNSS algorithm to measure the relative position vector between the two antennas, GAMS continuously calibrates the IMU and ensures that azimuth does not drift (as long as there is GNSS coverage).

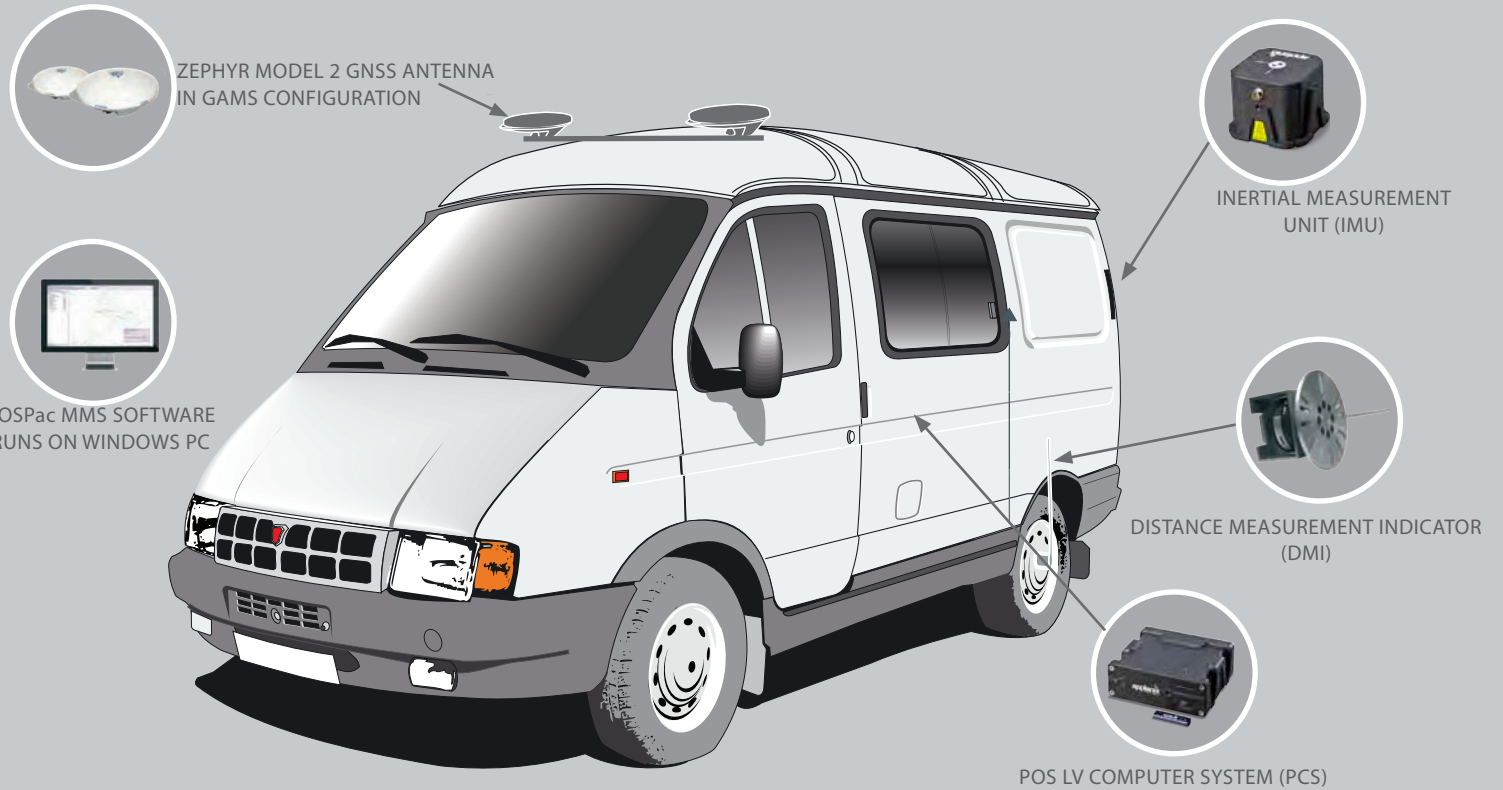


POS LV COMPUTER SYSTEM (PCS)
 The POS LV Computer System, is the central processing computer that houses the GNSS receivers, USB logging drive, data processing, and power distribution units for all components of the POS LV.

BUILDING DEPENDABILITY...

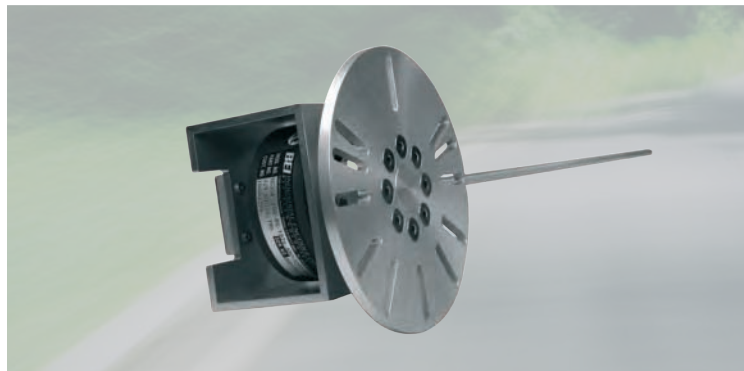
POSLV integrates leading inertial technologies with proven GNSS support, computing power, data storage, and distance measurement hardware, calculating vehicle and sensor position and orientation with confidence at up to 200 times per second. Top-quality inertial accuracy means uninterrupted onboard computer (PCS) processing, even during prolonged GNSS outages typical when survey operations enter urban centers, tunnels, and other GNSS-denied environments.

Applanix POS LV solutions are used around the world for a wide variety of applications, including advanced vehicle design research and engineering, roadway geometry surveying and pavement inspection, general mobile mapping operations for road and rail right-of-ways, robotic vehicle automation, and other dynamic vehicle roles that require exceptional uninterrupted georeferencing.



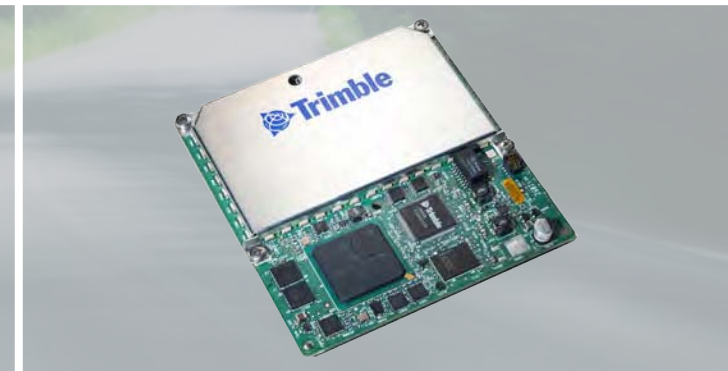
INERTIAL MEASUREMENT UNIT (IMU)

The Inertial Measurement Unit (IMU) contains three accelerometers and three gyroscopes that measure the acceleration and angular velocities necessary for computing all aspects of vehicle motion. The IMU is the heart of the POS LV system.



DISTANCE MEASUREMENT INDICATOR (DMI)

Distance Measurement Indicator, a wheel-mounted rotary shaft encoder that measures precise linear distance traveled. Sampled at a regular interval, these measurements give the POS LV a very accurate velocity measurement that helps constrain drift errors during GNSS outages. Internal DMI rim options also available.



TRIMBLE BD960 GNSS RECEIVER INSIDE

Within the PCS lies the Trimble BD960 GNSS receiver module, a multi-channel, multi-frequency OEM GNSS receiver. With the Trimble BD960 and Zephyr II GNSS antenna the POS LV can obtain centimeter-level positioning and can easily harness GPS and GLONASS signals. Omnistar correction services are also supported on-board.

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