

GPS basics
Tue, 9:00 AM

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- I. Introduction
 - A. Early developments
 - 1. Positioning technology for the US military
 - 2. Removal of Selective Availability (SA)
 - B. On-going developments
 - 1. Ever increasing accuracy and widespread adoption
 - 2. Global view: Global Navigation Satellite System (GNSS)

- II. Principles of operation
 - A. Satellite-based information
 - 1. Atomic clocks: Time/distance relationships
 - 2. Trilateration to determine position
 - a) Lat/long coordinates
 - b) Computations of horizontal and vertical positioning
 - B. Earth models and projection systems
 - C. Differential correction
 - 1. Broad area (Beacon and WAAS)
 - 2. Close-range networks (CORS and private networks)
 - 3. Satellite-based

- III. Accuracy and Precision
 - A. Standard measures of accuracy and precision
 - 1. Statistical parameters
 - 2. Pass-to-pass
 - 3. Horizontal and vertical dilution of precision (HDOP and VDOP)
 - B. Classification of GPS receivers based on accuracy/precision
 - 1. Sub-meter
 - 2. RTK
 - 3. Cost considerations
 - C. Effects of satellite constellation

- IV. Instrumentation
 - A. Important hardware characteristics
 - 1. Ruggedized design
 - 2. Match between antenna and receiver
 - B. Communications protocol
 - 1. Serial output: 8-N-1 asynchronous mode serial port configuration
 - 2. NMEA 0183 standard
 - a) Description
 - b) Commonly used messages (GGA and RMC)

- C. Serial signal output
 - 1. In-door demonstration: Trimble AgGPS 442 with RS-232 serial output
 - a) Observe GGA signal updates at 1 Hz
 - b) Determine stability of geographic coordinates and elevation

- V. Practical points for field use
 - A. Changes due to satellite constellation: by date and time of the day
 - B. Update receiver software
 - C. Hardware connections and output cable splitter
 - D. Obtaining GPS information from equipment with auto-guidance

References

- Andrade-Sanchez, P. and Heun, J.T., 2012. From GPS to GNSS: Enhanced functionality of GPS-integrated systems in agricultural machines. Bulletin AZ1558. Arizona Cooperative Extension. The University of Arizona
- Viacheslav I. Adamchuk, V.I., 2001. Untangling the GPS data string. Bulletin EC 01-157. Nebraska Cooperative Extension. University of Nebraska
- National Marine Electronics Association (NMEA). <https://www.nmea.org/>

On-line resources

Contact vendors for information on options, pricing and technical support:

Trimble: <http://www.trimble.com/>

Hemisphere: <http://hemispheregnss.com>