

Glossary

This section defines technical terms and abbreviations used in this manual. It includes terms from the field of GPS technology.

2D GPS mode	A procedure of determining a 2D position using signals received from the best (or only) three available GPS satellites. Altitude is assumed to be known and constant. A 2D position solution will only be determined if signals from three or more satellites are available.
2 dRMS	Twice the distance root mean squared. The error distance within which 95% of the position solutions will fall.
3D	Three Dimensional. A 3D position is defined as latitude, longitude, and altitude.
2D	Two Dimensional. A 2D position is defined as latitude, longitude, and altitude.
3D GPS mode	A procedure of determining a 3D position using signals received from the best (or only) four available GPS satellites. A 3D position solution will only be determined if signals from four or more satellites are available.
almanac	A reduced-precision subset of the ephemeris parameters. Used by the receiver to compute the elevation angle, azimuth angle, and estimated Doppler of the satellites. Each satellite broadcasts the almanac for all the satellites in the system.
ASCII	American Standard Code for Information Interchange. A standard set of 128 characters, symbols and control codes used for computer communications. ASCII characters require 7 bits of data to send, but are often sent 8 bits at a time with the extra bit being a zero.
asynchronous communication	A method of sending data in which the bits can be sent at random times. Data transmission is not synchronized to a clock. With asynchronous transmission, each character is transmitted one at a time with a “start” bit at the beginning and one or more “stop” bits at the end. Any amount of time can elapse before the next character is sent. \
auto GPS mode	A procedure of automatically determining either a 2D or 3D position using signals received from GPS satellites. The solution automatically transitions between 2D and 3D depending on the number of satellites available, the PDOP of the available satellites, and the defined PDOP switch value. (See PDOP and PDOP constellation switch).
azimuth angle	The angle of the line-of-site vector, projected on the horizontal plane, measured clockwise from true North.
bandwidth	The range of frequencies occupied by a signal. Also, the information carrying capability of a communication channel or line.

baud	A measure of the speed of data transmission. Baud and bit rate are the same for direct equipment interconnections (e.g., via RS-232). Baud and bit rate are not the same for modulated data links, whether wire or radio.
bit	Binary digit. The smallest unit of information into which digital data can be subdivided and which a computer can hold. Each bit has only two values (e.g., on/off, one/zero, true/false).
bit rate	The rate at which bits are transmitted over a communication path. Normally expressed in bits per second (bps).
byte	A set of contiguous bits that make up a discrete item of information. A byte usually consists of a series of 8 bits, and represents one character.
C/A code	The Coarse/Acquisition code. This is the civilian code made available by the Department of Defense. It is subject to selective availability (SA). Users can reduce the effects of SA by using differential GPS.
carrier	The radio signal on which information is carried. The carrier can be sensed to determine the presence of a signal.
channel	Either a single frequency or a pair of radio frequencies used as a communication path.
chip	The length of time to transmit either a zero or a one in a binary pulse code.
chip rate	Number of chips per second (e.g., C/A code = 1.023 MHz).
configuration	A set of conditions or parameters that define the structure of an item. A configuration defines the GPS processing and characteristics of the RS-232 interface ports. The term configuration can also define the hardware components that comprise a subsystem or system.
data bits	The bits in a byte of data which carry the actual information.
datum	Refers to a mathematical model of the earth. Many local datums model the earth for a small region: e.g., Tokyo datum, Alaska, NAD-27 (North America). Others, WGS-84, for example, model the whole earth.
DCE	Data Communications Equipment. The equipment that provides the functions required to establish, maintain, and terminate a communication connection. Any equipment that connects to DTE using an RS-232 or CCITT V.24 standard interface.
default setting	A preset or initial value that is assumed to be the preferred or appropriate selection for most situations. The SVeeEight Plus GPS receiver is shipped with factory default configuration settings; the settings were determined by Trimble Navigation.
DGPS	see <i>differential GPS</i>
DGPS reference station	A device that tracks all GPS satellites in view, periodically performs inter-channel calibrations, and calculates and transmits differential corrections.
differential capable	A term used to describe a GPS receiver that is capable of receiving and applying differential GPS corrections.

differential GPS	A procedure of correcting GPS solutions to achieve improved position accuracy. Differential GPS provides 2 to 5 meter position accuracy. Differential accuracy is obtained by applying corrections determined by the stationary Differential GPS Reference Station to the GPS data collected by the RPU unit on-board the vehicle.
differential processing	GPS measurements can be differenced between receivers, satellites, and epochs. Although many combinations are possible, the present convention for differential processing of GPS phase measurements is to take differences between receivers (single difference), then between satellites (double difference), then between measurement epochs (triple difference).
differential relative positioning	Determination of relative coordinates of two or more receivers which are simultaneously tracking the same satellites. Static differential GPS involves determining baseline vectors between pairs of receivers. Also see <i>differential GPS</i>
dilution of precision	A description of the purely geometrical contribution to the uncertainty in a position fix, given by the expression $DOP = \text{SQRT TRACE}(AA)$ where AA is the design matrix for the instantaneous position solution (dependent on satellite-receiver geometry). The DOP factor depends on the parameters of the position-fix solution. Standard terms for the GPS application are: GDOP: Geometric (three position coordinates plus clock offset in the solution) PDOP: Position (three coordinates) HDOP: Horizontal (two horizontal coordinates) VDOP: Vertical (height only) TDOP: Time (clock offset only)
DOP	see <i>dilution of precision</i> .
Doppler aiding	The use of Doppler carrier-phase measurements to smooth code-phase position measurements.
Doppler shift	The apparent change in frequency of a received signal due to the rate of change of the range between the transmitter and receiver.
earth-centered earth-fixed	Cartesian coordinate system where the X direction is the intersection of the prime meridian (Greenwich) with the equator. The vectors rotate with the earth. Z is the direction of the spin axis.
elevation angle	The angle between the line of sight vector and the horizontal plane.
elevation mask angle	A measure of the minimum elevation angle, above the horizon, above which a GPS satellite must be located before the signals from the satellite will be used to compute a GPS location solution. Satellites below the elevation angle are considered unusable. The elevation mask angle is used to prevent the GPS receiver from computing position solutions using satellites which are likely to be obscured by buildings or mountains.

ellipsoid	In geodesy, unless otherwise specified, a mathematical figure formed by revolving an ellipse about its minor axis. It is often used interchangeably with spheroid. Two quantities define an ellipsoid; these are usually given as the length of the semimajor axis, a , and the flattening, $f = (a - b)/a$, where b is the length of the semiminor axis.
ephemeris	A set of parameters that describe the satellite orbit very accurately. It is used by the receiver to compute the position of the satellite. This information is broadcast by the satellites.
epoch	Measurement interval or data frequency, as in making observations every 15 seconds. Loading data using 30-second epochs means loading every other measurement.
firmware	A set of software computer/processor instructions that are permanently or semi-permanently resident in read-only memory.
frequency	The number of vibrations per second of an audio or radio signal. Measured in hertz (Hz), kilohertz (kHz), or megahertz (MHz). GPS frequencies are: L1 = 1575.42 MHz L2 = 1227.60 MHz
GDOP	Geometric Dilution of Precision. GDOP describes how much an uncertainty in pseudo-range and time affects the uncertainty in a position solution. GDOP depends on where the satellites are relative to the GPS receiver and on GPS clock offsets.
geodetic datum	A mathematical model designed to best fit part or all of the geoid. It is defined by an ellipsoid and the relationship between the ellipsoid and a point on the topographic surface established as the origin of datum. This relationship can be defined by six quantities, generally (but not necessarily) the geodetic latitude, longitude, and the height of the origin, the two components of the deflection of the vertical at the origin, and the geodetic azimuth of a line from the origin to some other point. The GPS uses WGS-84.
geoid	The actual physical shape of the earth which is hard to describe mathematically because of the local surface irregularities and sea-land variations. In geodetic terms it is the particular equipotential surface which coincides with mean sea level, and which may be imagined to extend through the continents. This surface is everywhere perpendicular to the force of gravity.
GPD	GPS with differential corrections applied.
GPS	Global Positioning System. A constellation of 24 radio navigation (not communication) satellites which transmit signals used (by GPS receivers) to determine precise location (position, velocity, and time) solutions. GPS signals are available world-wide, 24 hours a day, in all weather conditions. This system also includes 5 monitor ground stations, 1 master control ground station, and 3 upload ground stations.
GPS antenna	An antenna designed to receive GPS radio navigation signals.
GPS processor	An electronic device that interprets the GPS radio navigation signals (received by a GPS antenna) and determines a location solution. The GPS processor may also be able to apply (and determine) differential GPS corrections.

GPS receiver	The combination of a GPS antenna and a GPS processor.
GPS time	The length of the second is fixed and is determined by primary atomic frequency standards. Leap-seconds are not used, as they are in UTC. Therefore, GPS time and UTC differ by a variable whole number of seconds.
HDOP	Horizontal Dilution of Precision.
HOW	Handover word. The word in the GPS message that contains time synchronization information for the transfer from C/A to P-code.
interface cable (serial)	The interface cable allows data to flow between the SVeeEight Plus GPS receiver and the communication equipment. One end of the cable has a 9-pin female RS-232 connector and the other end of this cable has a 9-pin male RS-232 connectors.
interference	Refers to the unwanted occurrences on communication channels that are a result of natural or man-made noises and signals, not properly a part of the signals being transmitted or received.
integrated Doppler	A measurement of Doppler shift frequency or phase over time.
IODE	Issue Of Data, Ephemeris. Part of the navigation data. It is the issue number of the ephemeris information. A new ephemeris is available usually on the hour. Especially important for Differential GPS operation that the IODE change is tracked at both the reference station and mobile stations.
jamming	Interference (in either transmitting or receiving signals) caused by other radio signals at exactly or approximately the same frequency
Kalman filter	A numerical method used to track a time-varying signal in the presence of noise. If the signal can be characterized by some number of parameters that vary slowly with time, then Kalman filtering can be used to tell how incoming raw measurements should be processed to best estimate those parameters as a function of time.
masks	See <i>satellite masks</i> .
maximum PDOP	A measure of the maximum Position Dilution of Precision (PDOP) that is acceptable in order for the GPS processor to determine a location solution (see PDOP).
NAVSTAR	The name given to the GPS satellites, built by Rockwell International, which is an acronym formed from NAVigation System with Time And Ranging.
NMEA	National Marine Electronics Association. An association that defines marine electronic interface standards for the purpose of serving the public interest.
NMEA 0183 message	NMEA 0183 is a standard for interfacing marine electronics navigational devices. The standard specifies the message format used to communicate with marine devices/components.
packet	An “envelope” for data, which contains addresses and error checking information as well as the data itself.
parity	A scheme for detecting certain errors in data transmission. Parity defines the condition (i.e., even or odd) of the number of items in a set (e.g., bits in a byte).

PDOP	Position Dilution of Precision. PDOP is a unitless figure of merit that describes how an uncertainty in pseudo-range affects position solutions.
PDOP constellation switch	A value, based on PDOP, that defines when the GPS receiver/processor should switch between 2D and 3D GPS modes. The PDOP constellation switch is only active when the GPS mode of operation is set to Auto.
PRN	Pseudo-random noise. Each GPS satellite generates its own distinctive PRN code, which is modulated onto each carrier. The PRN code serves as identification of the satellite, as a timing signal, and as a subcarrier for the navigation data.
protocol	A formal set of rules that describe a method of communication. The protocol governs the format and control of inputs and outputs.
pseudo-range	A measure of the range from the GPS antenna to a GPS satellite. Pseudo-range is obtained by multiplying the speed of light by the apparent transit time of the signal from the GPS satellite. Pseudo-range differs from actual range because the satellite and user clocks are offset from GPS time and because of propagation delays and other errors.
RAM	Random-Access Memory.
random-access memory	Memory in which information can be referred to in an arbitrary or random order. The contents of RAM are lost when the System Unit is turned off.
range	A term used to refer to the distance radio signals can travel before they must be received or repeated due to loss of signal strength, the curvature of the earth and the noise introduced because of moisture in the air surrounding the earth's surface.
range rate	The rate of change of range between the satellite and receiver. The range to a satellite changes due to satellite and observer motions. Range rate is determined by measuring the Doppler shift of the satellite beacon carrier.
read-only memory	Memory whose contents can be read, but not changed. Information is placed into ROM only once. The contents of ROM are not erased when the system unit's power is turned off.
real time clock	An electronic clock, usually battery powered, that keeps current time. Used by a GPS receiver during a warm or hot start to determine where to search for GPS satellite signals.
relative positioning	The process of determining the vector distance between two points and the coordinates of one spot relative to another. This technique yields GPS positions with greater precision than a single point positioning mode can.
rise/set time	Refers to the period during which a satellite is visible; i.e., has an elevation angle that is above the elevation mask. A satellite is said to "rise" when its elevation angle exceeds the mask and "set" when the elevation drops below the mask.
ROM	Read-Only Memory.
RS-232	A communication standard for digital data. Specifies a number of signal and control lines. RS-232 is often associated with a 25 pin connector called a DB-25.

RTCM	Radio Technical Commission for Maritime Services. Commission that recommends standards for differential GPS services. "RTCM Recommended Standards For Differential GPS Service," prepared by RTCM Special Committee No. 104 (RTCM SC-104), defines a communication protocol for sending GPS differential corrections from a differential reference station to remote GPS receivers.
satellite masks	As satellites approach the horizon, their signals can become weak and distorted, preventing the receiver from gathering accurate data. Satellite masks enable you to establish criteria for using satellite data in a position solution. There are three types of satellite masks: Elevation, SNR, and PDOP.
SA	Selective Availability. This is the name of the policy and the implementation scheme by which unauthorized users of GPS will have their accuracy limited to 100 meters 2D RMS horizontal and 156 meters 2D RMS vertical.
SEP	Spherical Error Probability. The radius of a sphere such that 50% of the position estimates will fall within the surface of the sphere.
serial communication	A system of sending bits of data on a single channel one after the other, rather than simultaneously.
serial port	A port in which each bit of information is brought in/out on a single channel. Serial ports are designed for devices that receive data one bit at a time.
signal to noise level	GPS signals with SNRs that do not meet the mask criteria are considered unusable.
signal to noise ratio	A measure of the relative power levels of a communication signal and noise on a data line. SNR is expressed in decibels (dB).
SNR	Signal to Noise Ratio.
spread spectrum	The received GPS signal is a wide bandwidth, low-power signal (-160dBW). This property results from modulating the L-band signal with a PRN code in order to spread the signal energy over a bandwidth which is much greater than the signal information bandwidth. This is done to provide the ability to receive all satellites unambiguously and to provide some resistance to noise and multipath.
SPS	Standard Positioning Service. Refers to the GPS as available to the authorized user.
start bit	In asynchronous transmission, the start bit is appended to the beginning of a character so that the bit sync and character sync can occur at the receiver equipment.
stop bit	In asynchronous transmission, the stop bit is appended to the end of each character. It sets the receiving hardware to a condition where it looks for the start bit of a new character.
SV	Space Vehicle (GPS satellite).
synchronous communication	A method of sending digital data in which the bits come at fixed, rather than random, times and are synchronized to a clock.

TAIP	Trimble ASCII Interface Protocol. Designed originally for vehicle tracking applications, TAIP uses printable uppercase ASCII characters in 16 message types for easy integration with mobile data modems, terminals, and personal computers. The TAIP protocol is defined in full in Appendix C.
TANS	Trimble Advanced Navigation Sensor. Also refers to a Trimble-specified interface protocol for digital packet communication to/from the GPS receiver. Data output includes time-tagged position and velocity, satellite status, dilution of precision factors and diagnostics of GPS receiver operational status. Also see <i>TSIP</i>
TNL 4000RL	Trimble Navigation, Ltd. Reference Locator (4000RL). Product name for the Differential GPS Reference Station.
TSIP	Trimble Standard Interface Protocol. A binary/hex packet bi-directional protocol, also known as the TANS protocol. Used by a large number of Trimble sensors. TSIP is the subset of TANS which is recognized by all Trimble sensors except the 4000 series. The TSIP protocol is defined in full in Appendix A.
URA	Satellite user range accuracy. The URA is sent by the satellite and is computed by the GPS operators. It is a statistical indicator of the contribution of the apparent clock and ephemeris prediction accuracies to the ranging accuracies obtainable with a specific satellite based on historical data.
UTC	Universal Time Coordinated. Uniform atomic time system/standard that is maintained by the US Naval Observatory. UTC defines the local solar mean time at the Greenwich Meridian.
UTC offset	The difference between local time and UTC (Example: UTC - EST = 5 hours).