GPS - NMEA sentence information

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19 Interpreted sentences

```
   $GPBOD - Bearing, origin to destination
   $GPBWC - Bearing and distance to waypoint, great circle
   $GPGGA - Global Positioning System Fix Data
   $GPGLL - Geographic position, latitude / longitude
   $GPGSA - GPS DOP and active satellites
   $GPGSV - GPS Satellites in view
   $GPHDT - Heading, True
   $GPR00 - List of waypoints in currently active route
   $GPRMA - Recommended minimum specific Loran-C data
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   $GPSTN - Multiple Data ID
   $GPVBW - Dual Ground / Water Speed
   $GPVTG - Track made good and ground speed
   $GPWPL - Waypoint location
   $GPXTE - Cross-track error, Measured
   $GPZDA - Date & Time
```

There is a full list of $GPxxx sentence codes available, without links to format details.

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$GPBOD

Bearing Origin to Destination

```
eg.  BOD,045.,T,023.,M,DEST,START
           045.,T       bearing 045 degrees True from "START" to "DEST"
           023.,M       breaing 023 degrees Magnetic from "START" to "DEST"
           DEST         destination waypoint ID
           START        origin waypoint ID
```

Example 1: $GPBOD,099.3,T,105.6,M,POINTB,*01
Waypoint ID: "POINTB" Bearing 99.3 True, 105.6 Magnetic
This sentence is transmitted in the GOTO mode, without an active route on your GPS. WARNING: this is the bearing from the moment you press enter in the GOTO page to the destination waypoint and is NOT updated dynamically! To update the information, (current bearing to waypoint), you will have to press enter in the GOTO page again.

Example 2: $GPBOD,097.0,T,103.2,M,POINTB,POINTA*52
This sentence is transmitted when a route is active. It contains the active leg information: origin waypoint "POINTA" and destination waypoint "POINTB", bearing between the two points 97.0 True, 103.2 Magnetic. It does NOT display the bearing from current location to destination waypoint! WARNING Again this information does not change until you are on the next leg of the route. (The bearing from POINTA to POINTB does not change during the time you are on this leg.)

$GPBWC

Bearing and distance to waypoint, great circle

```
eg1. $GPBWC,081837,,,,,,T,,M,,N,*13

        BWC,225444,4917.24,N,12309.57,W,051.9,T,031.6,M,001.3,N,004*29
           225444       UTC time of fix 22:54:44
           4917.24,N    Latitude of waypoint
           12309.57,W   Longitude of waypoint
           051.9,T      Bearing to waypoint, degrees true
           031.6,M      Bearing to waypoint, degrees magnetic
           001.3,N      Distance to waypoint, Nautical miles
           004          Waypoint ID


eg2. $GPBWC,220516,5130.02,N,00046.34,W,213.8,T,218.0,M,0004.6,N,EGLM*11
               1      2    3     4    5    6  7   8   9    10  11 12 13


      1    220516    timestamp
      2    5130.02   Latitude of next waypoint
      3    N         North/South
      4    00046.34  Longitude of next waypoint
      5    W         East/West
      6    213.0     True track to waypoint
      7    T         True Track
      8    218.0     Magnetic track to waypoint
      9    M         Magnetic
      10   0004.6    range to waypoint
      11   N         unit of range to waypoint, N = Nautical miles
      12   EGLM      Waypoint name
      13   *11       checksum
```

$GPGGA

Global Positioning System Fix Data

Name	Example Data	Description
Sentence Identifier	$GPGGA	Global Positioning System Fix Data
Time	170834	17:08:34 Z
Latitude	4124.8963, N	41d 24.8963' N or 41d 24' 54" N
Longitude	08151.6838, W	81d 51.6838' W or 81d 51' 41" W
Fix Quality: - 0 = Invalid - 1 = GPS fix - 2 = DGPS fix	1	Data is from a GPS fix
Number of Satellites	05	5 Satellites are in view
Horizontal Dilution of Precision (HDOP)	1.5	Relative accuracy of horizontal position
Altitude	280.2, M	280.2 meters above mean sea level
Height of geoid above WGS84 ellipsoid	-34.0, M	-34.0 meters
Time since last DGPS update	blank	No last update
DGPS reference station id	blank	No station id
Checksum	*75	Used by program to check for transmission errors

Courtesy of Brian McClure, N8PQI.

Global Positioning System Fix Data. Time, position and fix related data for a GPS receiver.

eg2. $--GGA,hhmmss.ss,llll.ll,a,yyyyy.yy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx

hhmmss.ss = UTC of position
llll.ll = latitude of position
a = N or S
yyyyy.yy = Longitude of position
a = E or W
x = GPS Quality indicator (0=no fix, 1=GPS fix, 2=Dif. GPS fix)
xx = number of satellites in use
x.x = horizontal dilution of precision
x.x = Antenna altitude above mean-sea-level
M = units of antenna altitude, meters
x.x = Geoidal separation
M = units of geoidal separation, meters
x.x = Age of Differential GPS data (seconds)
xxxx = Differential reference station ID

```
eg3. $GPGGA,hhmmss.ss,llll.ll,a,yyyyy.yy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx*hh
1    = UTC of Position
2    = Latitude
3    = N or S
4    = Longitude
5    = E or W
6    = GPS quality indicator (0=invalid; 1=GPS fix; 2=Diff. GPS fix)
7    = Number of satellites in use [not those in view]
8    = Horizontal dilution of position
9    = Antenna altitude above/below mean sea level (geoid)
10   = Meters  (Antenna height unit)
11   = Geoidal separation (Diff. between WGS-84 earth ellipsoid and
       mean sea level.  -=geoid is below WGS-84 ellipsoid)
12   = Meters  (Units of geoidal separation)
13   = Age in seconds since last update from diff. reference station
14   = Diff. reference station ID#
15   = Checksum
```

$GPGLL

Geographic Position, Latitude / Longitude and time.

```
eg1. $GPGLL,3751.65,S,14507.36,E*77
eg2. $GPGLL,4916.45,N,12311.12,W,225444,A


           4916.46,N    Latitude 49 deg. 16.45 min. North
           12311.12,W   Longitude 123 deg. 11.12 min. West
           225444       Fix taken at 22:54:44 UTC
           A            Data valid


eg3. $GPGLL,5133.81,N,00042.25,W*75
               1    2     3    4 5

      1    5133.81   Current latitude
      2    N         North/South
      3    00042.25  Current longitude
      4    W         East/West
      5    *75       checksum
```

$--GLL,lll.ll,a,yyyyy.yy,a,hhmmss.ss,A llll.ll = Latitude of position

a = N or S
yyyyy.yy = Longitude of position
a = E or W
hhmmss.ss = UTC of position
A = status: A = valid data

$GPGSA

GPS DOP and active satellites

```
eg1. $GPGSA,A,3,,,,,,16,18,,22,24,,,3.6,2.1,2.2*3C
eg2. $GPGSA,A,3,19,28,14,18,27,22,31,39,,,,,1.7,1.0,1.3*35


1    = Mode:
       M=Manual, forced to operate in 2D or 3D
       A=Automatic, 3D/2D
2    = Mode:
       1=Fix not available
       2=2D
       3=3D
3-14 = IDs of SVs used in position fix (null for unused fields)
15   = PDOP
16   = HDOP
17   = VDOP
```

$GPGSV

GPS Satellites in view

```
eg. $GPGSV,3,1,11,03,03,111,00,04,15,270,00,06,01,010,00,13,06,292,00*74
    $GPGSV,3,2,11,14,25,170,00,16,57,208,39,18,67,296,40,19,40,246,00*74
    $GPGSV,3,3,11,22,42,067,42,24,14,311,43,27,05,244,00,,,,*4D


    $GPGSV,1,1,13,02,02,213,,03,-3,000,,11,00,121,,14,13,172,05*67


1    = Total number of messages of this type in this cycle
2    = Message number
3    = Total number of SVs in view
4    = SV PRN number
5    = Elevation in degrees, 90 maximum
6    = Azimuth, degrees from true north, 000 to 359
7    = SNR, 00-99 dB (null when not tracking)
8-11 = Information about second SV, same as field 4-7
12-15= Information about third SV, same as field 4-7
16-19= Information about fourth SV, same as field 4-7
```

$GPHDT

Heading, True.

Actual vessel heading in degrees Ture produced by any device or system producing true heading.

$--HDT,x.x,T
x.x = Heading, degrees True

$GPR00

List of waypoint IDs in currently active route

```
eg1. $GPR00,EGLL,EGLM,EGTB,EGUB,EGTK,MBOT,EGTB,,,,,,,*58
eg2. $GPR00,MINST,CHATN,CHAT1,CHATW,CHATM,CHATE,003,004,005,006,007,,,*05


List of waypoints. This alternates with $GPWPL cycle
which itself cycles waypoints.
```

$GPRMA

Recommended minimum specific Loran-C data

```
eg. $GPRMA,A,llll.ll,N,lllll.ll,W,,,ss.s,ccc,vv.v,W*hh
1    = Data status
2    = Latitude
3    = N/S
4    = longitude
5    = W/E
6    = not used
7    = not used
8    = Speed over ground in knots
9    = Course over ground
10   = Variation
11   = Direction of variation E/W
12   = Checksum
```

$GPRMB

Recommended minimum navigation information (sent by nav. receiver when a destination waypoint is active)

```
eg1. $GPRMB,A,0.66,L,003,004,4917.24,N,12309.57,W,001.3,052.5,000.5,V*0B


           A            Data status A = OK, V = warning
           0.66,L       Cross-track error (nautical miles, 9.9 max.),
                                steer Left to correct (or R = right)
           003          Origin waypoint ID
           004          Destination waypoint ID
           4917.24,N    Destination waypoint latitude 49 deg. 17.24 min. N
           12309.57,W   Destination waypoint longitude 123 deg. 09.57 min. W
           001.3        Range to destination, nautical miles
           052.5        True bearing to destination
           000.5        Velocity towards destination, knots
           V            Arrival alarm  A = arrived, V = not arrived
           *0B          mandatory checksum


eg2. $GPRMB,A,4.08,L,EGLL,EGLM,5130.02,N,00046.34,W,004.6,213.9,122.9,A*3D
             1   2  3   4    5    6     7   8      9   10    11    12   13


      1    A         validity
      2    4.08      off track
      3    L         Steer Left (L/R)
      4    EGLL      last waypoint
      5    EGLM      next waypoint
      6    5130.02   Latitude of Next waypoint
      7    N         North/South
      8    00046.34  Longitude of next waypoint
      9    W         East/West
      10   004.6     Range
      11   213.9     bearing to waypt.
      12   122.9     closing velocity
      13   A         validity
      14   *3D       checksum


eg3. $GPRMB,A,x.x,a,c--c,d--d,llll.ll,e,yyyyy.yy,f,g.g,h.h,i.i,j*kk
1    = Data Status (V=navigation receiver warning)
2    = Crosstrack error in nautical miles
3    = Direction to steer (L or R) to correct error
4    = Origin waypoint ID#
5    = Destination waypoint ID#
6    = Destination waypoint latitude
7    = N or S
8    = Destination waypoint longitude
9    = E or W
10   = Range to destination in nautical miles
11   = Bearing to destination, degrees True
12   = Destination closing velocity in knots
13   = Arrival status; (A=entered or perpendicular passed)
14   = Checksum
```

$GPRMC

Recommended minimum specific GPS/Transit data

```
eg1. $GPRMC,081836,A,3751.65,S,14507.36,E,000.0,360.0,130998,011.3,E*62
eg2. $GPRMC,225446,A,4916.45,N,12311.12,W,000.5,054.7,191194,020.3,E*68


           225446       Time of fix 22:54:46 UTC
           A            Navigation receiver warning A = OK, V = warning
           4916.45,N    Latitude 49 deg. 16.45 min North
           12311.12,W   Longitude 123 deg. 11.12 min West
           000.5        Speed over ground, Knots
           054.7        Course Made Good, True
           191194       Date of fix  19 November 1994
           020.3,E      Magnetic variation 20.3 deg East
           *68          mandatory checksum


eg3. $GPRMC,220516,A,5133.82,N,00042.24,W,173.8,231.8,130694,004.2,W*70
              1    2    3    4    5     6    7    8      9     10  11 12


      1   220516     Time Stamp
      2   A          validity - A-ok, V-invalid
      3   5133.82    current Latitude
      4   N          North/South
      5   00042.24   current Longitude
      6   W          East/West
      7   173.8      Speed in knots
      8   231.8      True course
      9   130694     Date Stamp
      10  004.2      Variation
      11  W          East/West
      12  *70        checksum


eg4. $GPRMC,hhmmss.ss,A,llll.ll,a,yyyyy.yy,a,x.x,x.x,ddmmyy,x.x,a*hh
1    = UTC of position fix
2    = Data status (V=navigation receiver warning)
3    = Latitude of fix
4    = N or S
5    = Longitude of fix
6    = E or W
7    = Speed over ground in knots
8    = Track made good in degrees True
9    = UT date
10   = Magnetic variation degrees (Easterly var. subtracts from true course)
11   = E or W
12   = Checksum
```

$GPRTE

Routes

```
eg. $GPRTE,2,1,c,0,PBRCPK,PBRTO,PTELGR,PPLAND,PYAMBU,PPFAIR,PWARRN,PMORTL,PLISMR*73
    $GPRTE,2,2,c,0,PCRESY,GRYRIE,GCORIO,GWERR,GWESTG,7FED*34
           1 2 3 4 5 ..
```

1. Number of sentences in sequence
2. Sentence number
3. 'c' = Current active route, 'w' = waypoint list starts with destination waypoint
4. Name or number of the active route
5. onwards, Names of waypoints in Route

$GPTRF

Transit Fix Data

Time, date, position, and information related to a TRANSIT Fix.

$--TRF,hhmmss.ss,xxxxxx,llll.ll,a,yyyyy.yy,a,x.x,x.x,x.x,x.x,xxx
hhmmss.ss = UTC of position fix
xxxxxx = Date: dd/mm/yy
llll.ll,a = Latitude of position fix, N/S
yyyyy.yy,a = Longitude of position fix, E/W
x.x = Elevation angle
x.x = Number of iterations
x.x = Number of Doppler intervals
x.x = Update distance, nautical miles
x.x = Satellite ID

$GPSTN

Multiple Data ID.

This sentence is transmitted before each individual sentence where there is a need for the Listener to determine the exact source of data in the system. Examples might include dual-frequency depthsounding equipment or equipment that integrates data from a number of sources and produces a single output.

$--STN,xx
xx = Talker ID number, 00 to 99

$GPVBW

Dual Ground / Water Speed

Water referenced and ground referenced speed data.

$--VBW,x.x,x.x,A,x.x,x.x,A
x.x = Longitudinal water speed, knots
x.x = Transverse water speed, knots
A = Status: Water speed, A = Data valid
x.x = Longitudinal ground speed, knots
x.x = Transverse ground speed, knots
A = Status: Ground speed, A = Data valid

$GPVTG

Track Made Good and Ground Speed.

```
eg1. $GPVTG,360.0,T,348.7,M,000.0,N,000.0,K*43
eg2. $GPVTG,054.7,T,034.4,M,005.5,N,010.2,K


           054.7,T      True track made good
           034.4,M      Magnetic track made good
           005.5,N      Ground speed, knots
           010.2,K      Ground speed, Kilometers per hour


eg3. $GPVTG,t,T,,,s.ss,N,s.ss,K*hh
1    = Track made good
2    = Fixed text 'T' indicates that track made good is relative to true north
3    = not used
4    = not used
5    = Speed over ground in knots
6    = Fixed text 'N' indicates that speed over ground in in knots
7    = Speed over ground in kilometers/hour
8    = Fixed text 'K' indicates that speed over ground is in kilometers/hour
9    = Checksum
```

The actual track made good and speed relative to the ground.

$--VTG,x.x,T,x.x,M,x.x,N,x.x,K
x.x,T = Track, degrees True
x.x,M = Track, degrees Magnetic
x.x,N = Speed, knots
x.x,K = Speed, Km/hr

$GPWPL

Waypoint location

```
eg1. $GPWPL,4917.16,N,12310.64,W,003*65


           4917.16,N    Latitude of waypoint
           12310.64,W   Longitude of waypoint
           003          Waypoint ID


             When a route is active, this sentence is sent once for each
             waypoint in the route, in sequence. When all waypoints have
             been reported, GPR00 is sent in the next data set. In any
             group of sentences, only one WPL sentence, or an R00
             sentence, will be sent.


eg2.  $GPWPL,5128.62,N,00027.58,W,EGLL*59
         1      2      3    4  5   6


      1    5128.62   Latitude of nth waypoint on list
      2    N         North/South
      3    00027.58  Longitude of nth waypoint
      4    W         East/West
      5    EGLL      Ident of nth waypoint
      6    *59       checksum
```

$GPXTE

Cross Track Error, Measured

```
eg1. $GPXTE,A,A,0.67,L,N


           A            General warning flag V = warning
                                (Loran-C Blink or SNR warning)
           A            Not used for GPS (Loran-C cycle lock flag)
           0.67         cross track error distance
           L            Steer left to correct error (or R for right)
           N            Distance units - Nautical miles


eg2. $GPXTE,A,A,4.07,L,N*6D
             1 2  3   4 5 6


      1    A         validity
      2    A         cycle lock
      3    4.07      distance off track
      4    L         steer left (L/R)
      5    N         distance units
      6    *6D       checksum
```

$GPZDA

Date & Time

UTC, day, month, year, and local time zone.

$--ZDA,hhmmss.ss,xx,xx,xxxx,xx,xx
hhmmss.ss = UTC
xx = Day, 01 to 31
xx = Month, 01 to 12
xxxx = Year
xx = Local zone description, 00 to +/- 13 hours
xx = Local zone minutes description (same sign as hours)

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6 Garmin proprietary sentences with 4 interpreted

```
   $PGRME - Estimated Position Error
   $PGRMF - Position Fix Sentence
   $PGRMM - Map Datum
   $PGRMV - Velocity Sentence
   $PGRMZ - Altitude Information
   $PSLIB - Differential Control
```

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$PGRME

Estimated Position Error

```
eg. $PGRME,15.0,M,45.0,M,25.0,M*22


           15.0,M       Estimated horizontal position error in metres (HPE)
           45.0,M       Estimated vertical error (VPE) in metres
           25.0,M       Overall spherical equivalent position error
```

$PGRMM

Map datum

```
eg1. $PGRMM,Astrln Geod '66*51
eg2. $PGRMM,NAD27 Canada*2F


       Currently active horizontal datum
```

$PGRMZ

Altitude Information

```
eg1. $PGRMZ,246,f,3*1B
eg2. $PGRMZ,93,f,3*21


      93,f         Altitude in feet
       3            Position fix dimensions 2 = user altitude
                                            3 = GPS altitude
  This sentence shows in feet, regardless of units shown on the display.


eg3.  $PGRMZ,201,f,3*18
              1  2 3


      1  201   Altitude
      2  F     Units - f-Feet
      3  checksum
```

$PSLIB

Proprietry Garman (Differential Control)

Proprietary sentences to control a Starlink differential beacon receiver. (I assume Garmin's DBR is made by Starlink)

```
eg1.    $PSLIB,,,J*22
eg2.    $PSLIB,,,K*23
           These two sentences are normally sent together in each group
           of sentences from the GPS.
           The three fields are: Frequency, bit Rate, Request Type.  The
           value in the third field may be:
                J = status request
                K = configuration request
                blank = tuning message


           When the GPS receiver is set to change the DBR frequency or
           baud rate, the "J" sentence is replaced (just once) by (for
           example): $PSLIB,320.0,200*59 to set the DBR to 320 KHz, 200
           baud.
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All $GPxxx sentence codes and short descriptions

- $GPAAM - Waypoint Arrival Alarm
- $GPALM - GPS Almanac Data
- $GPAPA - Autopilot Sentence "A"
- $GPAPB - Autopilot Sentence "B"
- $GPASD - Autopilot System Data
- $GPBEC - Bearing & Distance to Waypoint, Dead Reckoning
- $GPBOD - Bearing, Origin to Destination
- $GPBWC - Bearing & Distance to Waypoint, Great Circle
- $GPBWR - Bearing & Distance to Waypoint, Rhumb Line
- $GPBWW - Bearing, Waypoint to Waypoint
- $GPDBT - Depth Below Transducer
- $GPDCN - Decca Position
- $GPDPT - Depth
- $GPFSI - Frequency Set Information
- $GPGGA - Global Positioning System Fix Data
- $GPGLC - Geographic Position, Loran-C
- $GPGLL - Geographic Position, Latitude/Longitude
- $GPGSA - GPS DOP and Active Satellites
- $GPGSV - GPS Satellites in View
- $GPGXA - TRANSIT Position
- $GPHDG - Heading, Deviation & Variation
- $GPHDT - Heading, True
- $GPHSC - Heading Steering Command
- $GPLCD - Loran-C Signal Data
- $GPMTA - Air Temperature (to be phased out)
- $GPMTW - Water Temperature
- $GPMWD - Wind Direction
- $GPMWV - Wind Speed and Angle
- $GPOLN - Omega Lane Numbers
- $GPOSD - Own Ship Data
- $GPR00 - Waypoint active route (not standard)
- $GPRMA - Recommended Minimum Specific Loran-C Data
- $GPRMB - Recommended Minimum Navigation Information
- $GPRMC - Recommended Minimum Specific GPS/TRANSIT Data
- $GPROT - Rate of Turn
- $GPRPM - Revolutions
- $GPRSA - Rudder Sensor Angle
- $GPRSD - RADAR System Data
- $GPRTE - Routes
- $GPSFI - Scanning Frequency Information
- $GPSTN - Multiple Data ID
- $GPTRF - Transit Fix Data
- $GPTTM - Tracked Target Message
- $GPVBW - Dual Ground/Water Speed
- $GPVDR - Set and Drift
- $GPVHW - Water Speed and Heading
- $GPVLW - Distance Traveled through the Water
- $GPVPW - Speed, Measured Parallel to Wind
- $GPVTG - Track Made Good and Ground Speed
- $GPWCV - Waypoint Closure Velocity
- $GPWNC - Distance, Waypoint to Waypoint
- $GPWPL - Waypoint Location
- $GPXDR - Transducer Measurements
- $GPXTE - Cross-Track Error, Measured
- $GPXTR - Cross-Track Error, Dead Reckoning
- $GPZDA - Time & Date
- $GPZFO - UTC & Time from Origin Waypoint
- $GPZTG - UTC & Time to Destination Waypoint

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Format of latitudes and longitudes

Where a numeric latitude or longitude is given, the two digits immediately to the left of the decimal point are whole minutes, to the right are decimals of minutes, and the remaining digits to the left of the whole minutes are whole degrees.

eg. 4533.35 is 45 degrees and 33.35 minutes. ".35" of a minute is exactly 21 seconds.

eg. 16708.033 is 167 degrees and 8.033 minutes. ".033" of a minute is about 2 seconds.

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References

This information on NMEA sentences has been sourced from all over the 'net and I make no apologies for any inaccuracies or errors. Still, it's useful stuff. I wish to thank all the sources, which are listed on my GPS Links page. Please contact me if you know of freely available interpretations of sentences which are not on this page.

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