

# 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  
`$GPRMA` - Recommended minimum specific Loran-C data  
`$GPRMB` - Recommended minimum navigation info  
`$GPRMC` - Recommended minimum specific GPS/Transit data  
`$GPRTE` - Routes  
`$GPTRF` - Transit Fix Data  
`$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,yyyy.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

yyyy.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,yyyy.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,hmmss.ss,A llll.ll = Latitude of position

a = N or S

yyyyy.yy = Longitude of position

a = E or W

hmmss.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 True 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,1111.11,N,11111.11,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,yyyy.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,yyyy.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,GYRIE,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

### Proprietary 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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