# 0.1 Garmin GPS Receiver

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1) *Overview*:

The Garmin GPS 35 is a twelve channel GPS receiver with differential GPS capability which out-
puts ASCII serial data in a standard format called NMEA-0183. Several ASCII message strings can
be selected for output, but the only one used with PAM is called "GPRMC". Several other data
parameters can be output as described in the "GARMIN GPS-35/36 Technical Specification".

2) *Wiring*:

GPS-35	AMP 9 pin	EVE RJ-45
-----------	---------------	------------
+12V (red)	8	
GND (black)	7 --optional-jumper--	4 (for comm. using serial test cables)
RxD1 (blue)	2	6 (Eve Tx)
TxD1 (white)	1	5 (Eve Rx)
RxD2 (green)	n/c	
TxD2 (purple)	n/c	
NMEA Out (gray)	n/c	
VAUX [backup power] (yellow)	n/c	
Shield	6	

EVE RJ-45 Connector:

1   8
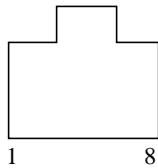
Front View of Male
Cable Plug to EVE front Panel

3) *Garmin Configuration Setup:*

The receiver comes configured from the factory to output the required "GPRMC" message needed to set the EVE real-time clock. However, several extraneous messages are also programmed for output by the factory. The following commands can be used to program the GPS-35 for PAM use.

$PGRMO,,2	Disable all output sentences
$PGRMO,GPRMC,1	Enable the 1-second GPRMC time and position message
$PGRMO,PGRMT,1	Enable the 1-minute status message which reports whether stored values were lost, test results and other values

Note:<cr><lf> is needed for these messages to be received. You may need to use 'enter' and ^j, or else ^m and ^j on the keyboard.

4) *Earth Datum Index:*

There are many stored earth datum values that can be used for position calculations. Garmin technical support recommends using the World Geodetic System of 1984 (WGS-84) index for earth datum since it is the most commonly used for new maps. It is the earth datum used by NASA for earth orbital calculations and the same earth datum as used for locations of the GPS monitoring stations. They say, "unless you are using maps of some other known earth datum, WGS-84 should always be your choice." NCAR GPS receivers use WGS-84 by selecting the appropriate index number in the receiver setup commands. The values reported by the automatic lookup of WGS-84 are: 6378137.00-m for the semi-major axis and 298.257 for inverse flattening factor. The difference between various earth datums generally will not produce large position errors; on the order of 100 meters or less. The following command can be used to display which values are being used:

$PGRMCE	Report the default values
$PGRMC,.....,	See manual for setup command format

5) *Serial Output Format:*

is factory set to 4800,N,8,1. EVE performance is enhanced by reducing the baud rate of asyncronous and polled sensors to the lowest rate required to avoid burst conflicts at interrupt level. For 1-second "GPRMC" messages (70-chars), the configuration can be reduced to 1200,N,8,1. To Set the baud rate to 1200bps:

$PGRMC,,460.,,,,,,,,,1,	Set baud to 1200bps (2=2400, 3=4800, 4=9600) and altitude above sea-level to 460-m.
$PGRMCE	Display current values.

6) *Position and/or time initialization:*

is not needed. The GPS-35 should "AutoLocate" within 5 minutes of power up. If the GPS-35 powers up with valid data in its battery backed memory, then acquisition should be within 15 seconds. To set lat/lon initialization parameters:

$PGRMI,ddmm.mmm,N/S,dddmm.mmm,E/W,

$PGRMIE   Display current values.

7) *Garmin $GPRMC Message Format:*

The message output fields include the following parameters:

UTC (hhmmss)
Status (A=valid, V=warning)
Lat (ddmm.mmmm)
N/S
lon (dddmm.mmmm)
E/W
Speed over ground (0-1851.8 knots)
Course over ground (0-359.9 degrees)
UTC date of position fix (ddmmyy)
Magnetic variation (0-180.0 degrees)
Magnetic variation E/W
Mode indicator (A=autonomous, D=differential, E=estimated, N=data invalid

A sample message looks something like this (taken indoors when no satellites were in view):

$GPRMC,172708,V,3606.2778,N,11956.1321,W,000.0,000.0,191200,015.0,E*75

8) *Sample EVE Configuration:*

The GPS can be used with either the EVE configuration SERIAL command or the GPS command to establish the time base and site location.

GPS command Usage:
Note that this only works with EVE Code Revisions beginning 1/2001.
With the GPS command, less processing overhead is required because: the 'GPS_in' process runs at priority slightly below that of ascii serial ingest routines; you can optionally set how often to update EVE's gps data thereby ignoring most of the 1-second messages; and the 'GPS_in' process is tailored to the function rather than shoe-horned in to the generic serial routine. The following example sets the EVE clock every 3 hours and updates its position every 30-seconds. Note: the GPS command pre-defines variable names recognized by EVE as shown in the output message.

```
#----------------------------------------------------
# GPS on /tyCo/6
# Note: LAT/LONG are broken into integer and decimal portions to
#       keep all significant digits in data reporting.
# Note: Clock update
# GPS: /tyCo/6  GPS_CLOCK_UPDATE=3 FASTOUT=206
# Note: Because the TRH uses the magnetic declanation
#       created here, this section must appear in the
#       config. before the TRH
#----------------------------------------------------
SIO: /tyCo/6 1200 none 8
GPS: /tyCo/6  GPS_CLOCK_UPDATE=3 SKIPCOUNT=30 FASTOUT=206
:

MESG: GPS
LAT  = %.3g deg %.2g min %.4g sec = %7.4g real\n\
LONG = %.3g deg %.2g min %.4g sec = %7.4g real\n\
DECLINATION = %.4g (west is neg) Errors=%d\n
GPS.LATd
GPS.LATm
GPS.LATs
GPS.LATreal
GPS.LONGd
GPS.LONGm
GPS.LONGs
GPS.LONGreal
```

SERIAL command Usage:
Note with EVE code revisions prior to 1/2001, the format shown is required including the 'MULTI_LINE' switch even though there is only 1 ingest line enabled per the setup described above. This is because of the way the asynchronous 'serial' ingest routine was written. The following example sets EVE's clock once every hour:

```
# GPS on /tyCo/3
# Not LAT/LONG are broken into integer and decimal portions to
# keep all significant digits in data reporting.
SIO: /tyCo/3 1200 none 8
SERIAL: GPS /tyCo/3  GPS_CLOCK_UPDATE=1 MULTI_LINE
LINE=$GPRMC
```

```
$GPRMC,%*d,%*c,%2d%2d.%4d,%c,%3d%2d.%4d,%c,%*f,%*f,%*f,%f,%c
LATd I 1 0
LATm I 1 0
LATs I .006 0
LATns B 1 0
LONGd I 1 0
LONGm I 1 0
LONGs I .006 0
LONGew B 1 0
MAGN F
MAGNew B 1 0
:

# If north/south = S (83 decimal) negate
CREATE: LATd=ifEQscale GPS.LATns GPS.LATd 83 -1.0 0
# If east/west = W (87 decimal) negate
CREATE: LONGd=ifEQscale GPS.LONGew GPS.LONGd 87 -1.0 0
# If magnetic declination east/west = W (87 decimal) negate
CREATE: MAGN=ifEQscale GPS.MAGNew GPS.MAGN 87 -1.0 0
# NOTE: GPS position data is output without averaging due to rollover problem
DO: AVG GPS.MAGN

MESG: GPS
LAT  = %.3g deg %.2g min %.4g sec\n\
LONG = %.3g deg %.2g min %.4g sec\n\
DECLINATION =%.4g (west is neg)\n\
 ERROR COUNT = %4d\n
GPS.LATd
GPS.LATm
GPS.LATs
GPS.LONGd
GPS.LONGm
GPS.LONGs
GPS.MAGN
GPS/ERR
:
...output statement...
# GPS data output with no averaging -- deg/min/sec rollover issue
GPS.LATd   S 12 1 0        |short_name="d.lat"    |units="deg"
GPS.LATm   U 6 1 0         |short_name="m.lat"    |units="min"
GPS.LATs   S 18 166.667 0     |short_name="s.lat"    |units="sec"
GPS.LONGd   S 12 1 0   |short_name="d.long"   |units="deg"
GPS.LONGm   U 6 1 0         |short_name="m.long"   |units="min"
GPS.LONGs   S 18 166.667 0     |short_name="s.long"   |units="sec"
```