GPS Receiver Module

GPS-330R

FEATURES

- 16 parallel channel GPS receiver
- 4100 simultaneous time-frequency search bins
- SBAS (WAAS, EGNOS) support
- High Sensitivity:
  - -140dBm acquisition sensitivity
  - -155dBm tracking sensitivity
- Fast Acquisition:
  - < 5 second hot start
  - < 35 seconds warm start
  - < 60 second cold start
- 5m CEP accuracy

GPS-330R (USB Interface)
Fast Acquisition Enhanced Sensitivity
16 Channel GPS Sensor Module

The GPS-330R is a compact all-in-one GPS module solution intended for a broad range of Original Equipment Manufacturer (OEM) products, where fast and easy system integration and minimal development risk is required.

The receiver continuously tracks all satellites in view and provides accurate satellite positioning data. The GPS-330R is optimized for applications requiring good performance, low cost, and maximum flexibility; suitable for a wide range of OEM configurations including handhelds, sensors, asset tracking, PDA-centric personal navigation system, and vehicle navigation products.

Its 16 parallel channels and 4100 search bins provide fast satellite signal acquisition and short startup time. Acquisition sensitivity of –140dBm and tracking sensitivity of –155dBm offers good navigation performance even in urban canyons having limited sky view.

Satellite-based augmentation systems, such as WAAS and EGNOS, are supported to yield improved accuracy.

USB-level serial interface is provided on the interface connector. Supply voltage of 3.8V~8.0V is supported.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS-330R</td>
<td>GPS Module, USB Level, Onboard Antenna</td>
</tr>
</tbody>
</table>
## TECHNICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver Type</td>
<td>16 parallel channel, L1 C/A code</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Position 5m CEP</td>
</tr>
<tr>
<td></td>
<td>Velocity 0.1m/sec</td>
</tr>
<tr>
<td>Startup Time</td>
<td>&lt; 5sec hot start</td>
</tr>
<tr>
<td></td>
<td>&lt; 35sec warm start</td>
</tr>
<tr>
<td></td>
<td>&lt; 60sec cold start</td>
</tr>
<tr>
<td>Signal Reacquisition</td>
<td>1s</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>-140dBm acquisition</td>
</tr>
<tr>
<td></td>
<td>-155dBm tracking</td>
</tr>
<tr>
<td>Update Rate</td>
<td>1Hz</td>
</tr>
<tr>
<td>Dynamics</td>
<td>4G (39.2m/sec²)</td>
</tr>
<tr>
<td>Operational Limits</td>
<td>Altitude &lt; 18,000m or velocity &lt; 515m/s (COCOM limit, either may be exceeded but not both)</td>
</tr>
<tr>
<td>Serial Interface</td>
<td>USB level</td>
</tr>
<tr>
<td>Protocol</td>
<td>NMEA-0183 V3.01</td>
</tr>
<tr>
<td></td>
<td>GPGGA, GPGLL, GPGSA, GPGSV, GPRMC, GPVTG, GPZDA</td>
</tr>
<tr>
<td></td>
<td>4800 baud, 8, N, 1</td>
</tr>
<tr>
<td>Datum</td>
<td>Default WGS-84</td>
</tr>
<tr>
<td></td>
<td>User definable</td>
</tr>
<tr>
<td>Interface Connector</td>
<td>One 1.0mm pitch WTB S/R wafer 87213 SMT R/A type connector</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>3.8V ~ 8.0V</td>
</tr>
<tr>
<td>Current Consumption</td>
<td>&lt; 45mA</td>
</tr>
<tr>
<td>Dimension</td>
<td>34mm L x 34mm W x 8.6mm H</td>
</tr>
<tr>
<td>Weight:</td>
<td>14g</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-40°C ~ +85°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>5% ~ 95%</td>
</tr>
</tbody>
</table>
GPS Receiver Module

GPS-330R

Patch Antenna

pin-1

Lateral View

For MD see Appendix A

PINOUT DESCRIPTION

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Signal Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
<td>N/C (Black wire on plug)</td>
</tr>
<tr>
<td>2</td>
<td>N/C</td>
<td>N/C (Red wire on plug)</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>GND (Green wire on plug)</td>
</tr>
<tr>
<td>4</td>
<td>Data +</td>
<td>Data + (White wire on plug)</td>
</tr>
<tr>
<td>5</td>
<td>Data -</td>
<td>Data - (Blue wire on plug)</td>
</tr>
<tr>
<td>6</td>
<td>Vcc +</td>
<td>3.8V ~ 12.0V DC input (Yellow wire on plug)</td>
</tr>
</tbody>
</table>
GPS Receiver Module

NMEA Messages

The serial interface protocol is based on the National Marine Electronics Association’s NMEA 0183 ASCII interface specification. This standard is fully defined in “NMEA 0183, Version 3.01” The standard may be obtained from NMEA, www.nmea.org

GGA - GPS FIX DATA
Time, position and position-fix related data (number of satellites in use, HDOP, etc.).

Format:
$GPGGA,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,M,<10>,M,<11>,<12>,*<13><CR><LF>

Example:
$GPGGA,104549.04,2447.2038,N,12100.4990,E,1,06,01.7,00078.8,M,0016.3,M,*,5C<CR><LF>

Field | Example | Description
--- | --- | ---
1 | 104549.04 | UTC time in hhmmss.ss format, 000000.00 ~ 235959.99
2 | 2447.2038 | Latitude in ddmm.mmmm format
Leading zeros transmitted
3 | N | Latitude hemisphere indicator, ‘N’ = North, ‘S’ = South
4 | 12100.4990 | Longitude in dddmm.mmmm format
Leading zeros transmitted
5 | E | Longitude hemisphere indicator, ‘E’ = East, ‘W’ = West
6 | 1 | Position fix quality indicator
0: position fix unavailable
1: valid position fix, SPS mode
2: valid position fix, differential GPS mode
7 | 06 | Number of satellites in use, 00 ~ 12
8 | 01.7 | Horizontal dilution of precision, 00.0 ~ 99.9
9 | 00078.8 | Antenna height above/below mean sea level, -9999.9 ~ 17999.9
10 | 0016.3 | Geoidal height, -999.9 ~ 9999.9
11 | Age of DGPS data since last valid RTCM transmission in xxx format (seconds)
NULL when DGPS not used
12 | Differential reference station ID, 0000 ~ 1023
NULL when DGPS not used
13 | 5C | Checksum

Note: The checksum field starts with a ‘*’ and consists of 2 characters representing a hex number. The checksum is the exclusive OR of all characters between ‘$’ and ‘*’. 
GPS - GPS RECEIVER MODULE

**GLL - LATITUDE AND LONGITUDE, WITH TIME OF POSITION FIX AND STATUS**

Latitude and longitude of current position, time, and status.

**Format:**

$\text{GPGLL},<1>,<2>,<3>,<4>,<5>,<6>,<7>*<8><CR><LF>$

**Example:**

$\text{GPGLL},2447.2073,N,12100.5022,E,104548.04,A,A*65<CR><LF>$

<table>
<thead>
<tr>
<th>Field</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2447.2073</td>
<td>Latitude in ddmm.mmmm format, Leading zeros transmitted</td>
</tr>
<tr>
<td>2</td>
<td>N</td>
<td>Latitude hemisphere indicator, 'N' = North, 'S' = South</td>
</tr>
<tr>
<td>3</td>
<td>12100.5022</td>
<td>Longitude in dddmm.mmmm format, Leading zeros transmitted</td>
</tr>
<tr>
<td>4</td>
<td>E</td>
<td>Longitude hemisphere indicator, 'E' = East, 'W' = West</td>
</tr>
<tr>
<td>5</td>
<td>104548.04</td>
<td>UTC time in hhmmss.ss format, 000000.00 ~ 235959.99</td>
</tr>
<tr>
<td>6</td>
<td>A,A</td>
<td>Status, 'A' = valid position, 'V' = navigation receiver warning</td>
</tr>
<tr>
<td>7</td>
<td>A</td>
<td>Mode indicator, 'N' = Data invalid, 'A' = Autonomous, 'D' = Differential, 'E' = Estimated</td>
</tr>
<tr>
<td>8</td>
<td>65</td>
<td>Checksum</td>
</tr>
</tbody>
</table>

**GSA - GPS DOP AND ACTIVE SATELLITES**

GPS receiver operating mode, satellites used for navigation, and DOP values.

**Format:**

$\text{GPGSA},<1>,<2>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,<4>,<5>,<6>*<7><CR><LF>$

**Example:**

$\text{GPGSA},A,3,26,21,,,,09,17,,,,,,10.8,02.1,10.6*07<CR><LF>$

<table>
<thead>
<tr>
<th>Field</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>Mode, 'M' = Manual, 'A' = Automatic</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>Fix type, 1 = not available, 2 = 2D fix, 3 = 3D fix</td>
</tr>
<tr>
<td>3</td>
<td>26,21,,,,09,17,</td>
<td>PRN number, 01 to 32, of satellite used in solution, up to 12 transmitted</td>
</tr>
<tr>
<td>4</td>
<td>10.8</td>
<td>Position dilution of precision, 00.0 to 99.9</td>
</tr>
<tr>
<td>5</td>
<td>02.1</td>
<td>Horizontal dilution of precision, 00.0 to 99.9</td>
</tr>
<tr>
<td>6</td>
<td>10.6</td>
<td>Vertical dilution of precision, 00.0 to 99.9</td>
</tr>
<tr>
<td>7</td>
<td>07</td>
<td>Checksum</td>
</tr>
</tbody>
</table>
GPS Receiver Module  

**GPS - GPS SATELLITE IN VIEW**
Number of satellites in view, PRN number, elevation angle, azimuth angle, and C/No. Only up to four satellite details are transmitted per message. Additional satellite in view information is sent in subsequent GSV messages.

**Format:**
$GPGSV,<1>,<2>,<3>,<4>,<5>,<6>,<7>,...,<4>,<5>,<6>,<7> *<8><CR><LF>

**Example:**
$GPGSV,2,1,08,26,50,016,40,09,50,173,39,21,43,316,38,17,41,144,42*7C<CR><LF>
$GPGSV,2,2,08,29,38,029,37,10,27,082,32,18,22,309,24,24,09,145,*7B<CR><LF>

<table>
<thead>
<tr>
<th>Field</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>Total number of GSV messages to be transmitted</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Number of current GSV message</td>
</tr>
<tr>
<td>3</td>
<td>08</td>
<td>Total number of satellites in view, 00 ~ 12</td>
</tr>
<tr>
<td>4</td>
<td>26</td>
<td>Satellite PRN number, GPS: 01 ~ 32, SBAS: 33 ~ 64 (33 = PRN120)</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>Satellite elevation number, 00 ~ 90 degrees</td>
</tr>
<tr>
<td>6</td>
<td>016</td>
<td>Satellite azimuth angle, 000 ~ 359 degrees</td>
</tr>
<tr>
<td>7</td>
<td>40</td>
<td>C/No, 00 ~ 99 dB Null when not tracking</td>
</tr>
<tr>
<td>8</td>
<td>7C</td>
<td>Checksum</td>
</tr>
</tbody>
</table>

**RMC - RECOMMENDED MINIMUM SPECIFIC GPS/TRANSIT DATA**
Time, date, position, course and speed data.

**Format:**
$GPRMC,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,<10>,<11>,<12>*<13><CR><LF>

**Example:**
$GPRMC,104549.04,A,2447.2038,N,12100.4990,E,016.0,221.0,250304,003.3,W,A*22<CR><LF>

<table>
<thead>
<tr>
<th>Field</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>104549.04</td>
<td>UTC time in hhmmss.ss format, 000000.00 ~ 235959.99</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>Status, 'V' = navigation receiver warning, 'A' = valid position</td>
</tr>
<tr>
<td>3</td>
<td>2447.2038</td>
<td>Latitude in dddmm.mmmm format Leading zeros transmitted</td>
</tr>
<tr>
<td>4</td>
<td>N</td>
<td>Latitude hemisphere indicator, 'N' = North, 'S' = South</td>
</tr>
<tr>
<td>5</td>
<td>12100.4990</td>
<td>Longitude in dddmm.mmmm format Leading zeros transmitted</td>
</tr>
<tr>
<td>6</td>
<td>E</td>
<td>Longitude hemisphere indicator, 'E' = East, 'W' = West</td>
</tr>
<tr>
<td>7</td>
<td>016.0</td>
<td>Speed over ground, 000.0 ~ 999.9 knots</td>
</tr>
<tr>
<td>8</td>
<td>221.0</td>
<td>Course over ground, 000.0 ~ 359.9 degrees</td>
</tr>
<tr>
<td>9</td>
<td>250304</td>
<td>UTC date of position fix, ddmmyy format</td>
</tr>
<tr>
<td>10</td>
<td>003.3</td>
<td>Magnetic variation, 000.0 ~ 180.0 degrees</td>
</tr>
<tr>
<td>11</td>
<td>W</td>
<td>Magnetic variation direction, 'E' = East, 'W' = West</td>
</tr>
<tr>
<td>12</td>
<td>A</td>
<td>Mode indicator 'N' = Data invalid 'A' = Autonomous 'D' = Differential 'E' = Estimated</td>
</tr>
<tr>
<td>13</td>
<td>22</td>
<td>Checksum</td>
</tr>
</tbody>
</table>
GPS Receiver Module

**VTG - COURSE OVER GROUND AND GROUND SPEED**
Velocity is given as course over ground (COG) and speed over ground (SOG).

**Format:**

GPVTG,<1>,T,<2>,M,<3>,N,<4>,K,<5>*<6><CR><LF>

**Example:**

$GPVTG,221.0,T,224.3,M,016.0,N,0029.6,K,A*1F<CR><LF>

<table>
<thead>
<tr>
<th>Field</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>221.0</td>
<td>True course over ground, 000.0 ~ 359.9 degrees</td>
</tr>
<tr>
<td>2</td>
<td>224.3</td>
<td>Magnetic course over ground, 000.0 ~ 359.9 degrees</td>
</tr>
<tr>
<td>3</td>
<td>016.0</td>
<td>Speed over ground, 000.0 ~ 999.9 knots</td>
</tr>
<tr>
<td>4</td>
<td>0029.6</td>
<td>Speed over ground, 0000.0 ~ 1800.0 kilometers per hour</td>
</tr>
<tr>
<td>5</td>
<td>A</td>
<td>Mode indicator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>'N' = Data invalid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>'A' = Autonomous</td>
</tr>
<tr>
<td></td>
<td></td>
<td>'D' = Differential</td>
</tr>
<tr>
<td></td>
<td></td>
<td>'E' = Estimated</td>
</tr>
<tr>
<td>6</td>
<td>1F</td>
<td>Checksum</td>
</tr>
</tbody>
</table>

**ZDA TIME AND DATE**

**Format:**

$GPZDA,<1>,<2>,<3>,<4>,<5>,<6>*<7><CR><LF>

**Example:**

$GPZDA,104548.04,25,03,2004,,*6C<CR><LF>

<table>
<thead>
<tr>
<th>Field</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>104548.04</td>
<td>UTC time in hhmmss.ss format, 000000.00 ~ 235959.99</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>UTC time: day (01 ... 31)</td>
</tr>
<tr>
<td>3</td>
<td>03</td>
<td>UTC time: month (01 ... 12)</td>
</tr>
<tr>
<td>4</td>
<td>2004</td>
<td>UTC time: year (4 digit year)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Local zone hour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not being output by the receiver (NULL)</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Local zone minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not being output by the receiver (NULL)</td>
</tr>
<tr>
<td>7</td>
<td>6C</td>
<td>Checksum</td>
</tr>
</tbody>
</table>

**Binary Messages**
