GARMIN℠

GPS 31/31 SL TracPak™

TECHNICAL INFORMATION

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May, 1996 190-00103-00 Rev. C

CAUTION

The GPS system is operated by the government of the United States which is solely responsible for its accuracy and maintenance. Although the GPS 31/31 SL is a precision electronic NAVigation AID (NAVAID), any NAVAID can be misused or misinterpreted, and therefore become unsafe. Use the GPS 31/31 SL at your own risk. To reduce the risk, carefully review and understand all aspects of this Technical Manual before using the GPS 31/31 SL. When in actual use, carefully compare indications from the GPS 31/31 SL to all available navigation sources including the information from other NAVAIDs, visual sightings, charts, etc. For safety, always resolve any discrepancies before continuing navigation.

NOTE

This device has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this device does cause harmful interference to radio or television reception, which can be determined by turning the device off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between this device and the receiver.

- Connect this device to an outlet on a different circuit than that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device contains no user-serviceable parts. Repairs should only be performed by an authorized GARMIN service center. Unauthorized repairs or modifications to this device could void your warranty and your authority to operate this device under Part 15 regulations.

TABLE OF CONTENTS

SECTION 1

INTRODUCTION

1.1 OVERVIEW

The GARMIN GPS 31/31 SL is a complete GPS receiver, including an embedded antenna, designed for a broad spectrum of Marine system applications. Based on the proven technology found in all GARMIN GPS receivers, the GPS 31/31 SL will track up to 8 satellites at a time while providing fast time-to-first-fix, one second navigation updates and low power consumption. Its far reaching capability meets the sensitivity requirements of land navigation as well as the dynamics requirements of high performance aircraft.

The GPS 31/31 SL design utilizes the latest technology and high level circuit integration to achieve superior performance while minimizing space and power requirements. All critical components of the system including the RF/IF receiver hardware and the digital baseband are designed and manufactured by GARMIN to ensure the quality and capability of the GPS 31/31 SL. This hardware capability combined with software intelligence makes the GPS 31/31 SL easy to integrate and use.

The GPS 31/31 SL is designed to withstand rugged operating conditions and is completely water resistant. A minimum system must provide the GPS 31/31 SL with a source of power and a clear view of the GPS satellites. The system may communicate with the GPS 31/31 SL via a choice of two RS-232 compatible full duplex communication channels. Internal memory backup allows the GPS 31/31 SL to retain critical data such as satellite orbital parameters, last position, date and time.

1.2 FEATURES

The GPS 31/31 SL provides a host of features that make it easy to integrate and use.

1) Full navigation accuracy provided by Standard Positioning Service (SPS)

2) Compact design ideal for applications with minimal space

3) High performance receiver tracks up to 8 satellites while providing fast first fix and low power consumption

4) Differential capability utilizes real-time RTCM corrections producing 3-10 meter position accuracy

5) Internal clock and memory are sustained by a memory backup battery or optional external standby power

6) User initialization is not required

7) Navigation mode (2D or 3D) may be configured by the user

8) Two communication channels and user selectable baud rates allow maximum interface capability and flexibility

9) The GPS 31 SL can be permanently configured by the user. Configuration parameters include baud rate, NMEA sentence output, velocity filter setting, and datum selection.

1.3 TECHNICAL SPECIFICATIONS

Specifications are subject to change without notice.

1.3.1 Physical Characteristics

1) Single construction integrated antenna/receiver.

2) Weight: 4.4 oz, (124.5 g), not including cable

3) Size: 2.22" (w) x 3.79" (l) x 1.05" (h), (56.4 mm x 96.3 mm x 26.7 mm)

1.3.2 Environmental Characteristics

1) Operating temperature: -30°C to +85°C (internal temperature)

2) Storage temperature: -40°C to +90°C

1.3.3 Electrical Characteristics

1) Input voltage: 10 to 30 VDC, unregulated.

2) Typically draws 110 mA @ 12 VDC

3) Backup power: Internal 3V Lithium coin cell battery, up to 10 year life

1.3.4 Performance

1) MultiTrac™ technology, tracks up to 8 satellites

2) Update rate: 1 second

3) Acquisition time
   - 15 seconds warm (all data known)
   - 2 minutes cold (initial position, time and almanac known, ephemeris unknown)
   - 7-10 minutes AutoLocate™ (almanac known, initial position and time unknown)
   - 15 minutes search the sky (no data known)

4) Position accuracy:
   Differential GPS (DGPS): 3-10 meters RMS
   Non-differential GPS: 15 meters RMS (100 meters with Selective Availability on)

5) Velocity accuracy: 0.2 m/s RMS steady state (subject to Selective Availability)

6) Dynamics: 999 knots velocity, 3g dynamics

1.3.5 Interfaces

1) Dual channel RS-232 compatible with user selectable baud rate (1200, 2400, 4800, 9600)

2) NMEA 0183 Version 2.0 ASCII output GPGGA, GPGSA, GPGSV, GPRMC, GPVTG, PGRME, PGRMT (GPS 31 SL - PGRMF, PGRMV, LCGLL, LCVTG)

   Inputs

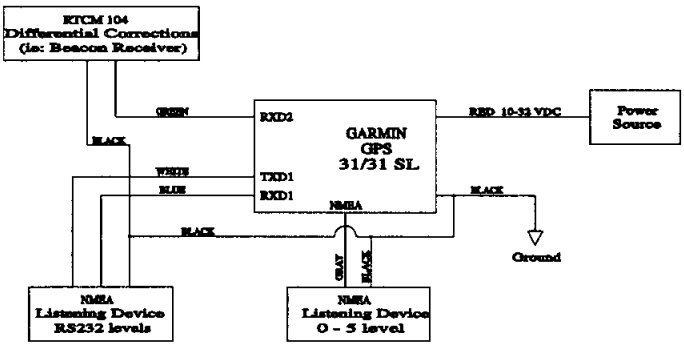
   - Initial position, date and time (not required)
   - 2D/3D, earth datum and differential mode configuration command

   Outputs

   - Position, velocity and time
   - Receiver and satellite status
   - Differential Reference Station ID and RTCM Data age
   - Geometry and error estimates

3) Real-time Differential Correction input (RTCM format)

1.4 APPLICATION



TYPICAL APPLICATION ARCHITECTURE

1.4.1 Application Considerations

1) Interruptions in GPS RF signals can increase the Time To First Fix (TTFF). Antenna location with continuous clear line-of-sight visibility to all directions in the sky yields the best TTFF.

2) GPS signal reception quality can be determined by monitoring the signal to noise ratio fields in the $GPGSV sentence. Typical values will be between 33 to 51 dbHz. Values below 43 dbHz for the highest elevation satellites may indicate a need to re-locate the antenna if marginal performance is noted (long TTFF).

SECTION 2

2.1 CONNECTION WIRING DESCRIPTION

The GPS 31/31 SL features a stripped and pre-tinned cable assembly for the greatest connection flexibility. The following is a functional description of each wire in the cable assembly.

Red: VIN - Unregulated 10 - 30VDC 200mA (maximum). Typical operating current is 110 mA.

Black: GND - Power and Signal Ground

White: TXD1 - First Serial Asynchronous Output. RS-232 compatible electrical specification. This output normally provides serial data which is formatted per *"NMEA 0183, Version 2.0"*. Switchable to 1200, 2400, 4800 and 9600 BAUD. This output functions in parallel with the NMEA output.

Blue: RXD1 - First Serial Asynchronous Input. RS-232 compatible with maximum input voltage range $-25 < V < 25$. This input may be used to receive serial initialization/ configuration data, as specified in Section 3.1.

Purple: TXD2 - Second Serial Asynchronous Output. Electrically identical to TXD1. Not used.

Green: RXD2 - Second Serial Asynchronous Input. Electrically identical to RXD1. This input may be used to receive serial differential GPS data formatted per *"RTCM Recommended Standards For Differential Navstar GPS Service, Version 2.0"*.

Gray: NMEA - NMEA compatible output. This output provides serial data which is formatted per *"NMEA 0183, Version 2.0"*. Switchable to 1200, 2400, 4800 and 9600 BAUD. This transmitter functions in parallel with TXD1.

Yellow: VAUX - Optional External Backup Power Connection. This is an optional connection. Internal battery capacity is 180 mA hour. Typical current requirement is 65 uA @ 5VDC. If used, a 4VDC to 30 VDC power source is required.

SECTION 3

SOFTWARE INTERFACE

The GPS 31/31 SL interface protocol design is based on the National Marine Electronics Association's NMEA 0183 ASCII interface specification, which is fully defined in *"NMEA 0183, Version 2.0"* (copies may be obtained from NMEA, P.O. Box 50040, Mobile, AL, 36605, U.S.A.) and the Radio Technical Commission for Maritime Services' *"RTCM Recommended Standards For Differential Navstar GPS Service, Version 2.0, RTCM Special Committee No. 104"* (copies may be obtained from RTCM, P.O. Box 19087, Washington, D.C., 20036, U.S.A.). The GPS 31/31 SL interface protocol, in addition to transmitting navigation information as defined by NMEA 0183, transmits additional information using the convention of GARMIN proprietary sentences.

The following sections describe the data format of each sentence transmitted and received by the GPS 31/31 SL. The baud rate selection and RTCM differential GPS input are also described.

3.1 NMEA RECEIVED SENTENCES

The subsequent paragraphs define the sentences which can be received on RXD1 by the GPS 31/31 SL. These sentences are echoed upon receipt to provide handshaking that the appropriate information was received by the GPS 31/31 SL.

hh = 1 byte checksum

3.1.1 Almanac Information (ALM) (GPS 31 Rev. 1.30 or later and all GPS 31 SLs)

$GPALM,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,<10>,<11>,<12>,<13>,<14>,<15>*hh<CR><LF>

The $GPALM sentence can be used to initialize the sensor board's stored almanac information if battery back-up has failed.

<1> Total number of ALM sentences to be transmitted by the sensor board during almanac download. This field can be null or any number when sending almanac to the sensor board.
<2> Number of current ALM sentence. This field can be null or any number when sending almanac to the sensor board.
<3> Satellite PRN number, 01 to 32.
<4> GPS week number.
<5> SV health, bits 17-24 of each almanac page.
<6> Eccentricity
<7> Almanac reference time.
<8> Inclination angle.
<9> Rate of right ascension.
<10> Root of semi major axis.
<11> Omega, argument of perigee.
<12> Longitude of ascension node.
<13> Mean anomaly
<14> afo clock parameter
<15> af1 clock parameter

3.1.2 Initialization Information ($PGRMI GARMIN proprietary format)

The $PGRMI sentence provides information used to initialize the sensor board set position and time used for satellite acquisition. Receipt of this sentence by the board set causes the software to restart the satellite acquisition process. The GPS 31 will echo this sentence. The GPS 31 SL will echo the sentence if the data is accepted. If the data is unreasonable then the $PGRMI sentence is sent containing current values used in each of the fields.

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

<1> Latitude, ddmm.mmm format (leading zeros must be transmitted)

<2> Latitude hemisphere, N or S

<3> Longitude, dddmm.mmm format (leading zeros must be transmitted)

<4> Longitude hemisphere, E or W

<5> Current UTC date, ddmmyy format

<6> Current UTC time, hhmmss format

<7> GPS 31 - Not used
GPS 31 SL - Acquisition command, R - Restart, A- Start Autolocate. Normally autolocate begins approximately 7 minutes after the board is powered up and has failed to obtain a fix. Autolocate can be started immediately on receipt of this command. This command is helpful if initial time and/or position is known to be significantly inaccurate. The Restart command is not needed during normal operation.

3.1.3 Configuration Information ($PGRMC GARMIN proprietary format)

The $PGRMC sentence provides information used to configure the GPS 31/31 SL operation. This information will default to automatic fix mode, World Geodetic System 1984 (WGS-84) earth datum and automatic differential mode when more than 15 minutes have elapsed without power in the GPS 31. The GPS 31 SL will store this information in non-volatile memory and will be used for all subsequent power cycles. This sentence is echoed by the GPS 31. The GPS 31 SL will echo the sentence if the data is accepted. If the data is unreasonable then the $PGRMC sentence is sent containing current values used in each of the fields. Receipt of $PGRMCE will also cause the board to sent $PGRMC will current values.

$PGRMC,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9><10>,<11>, <12>*hh<CR><LF>

<1> Fix mode, A=automatic, 2=2D exclusively (host system must supply altitude), 3=3D exclusively

<2> Altitude above/below mean sea level, -1500.0 to 18000.0 meters

<3> Earth datum index. If the user datum index (96) is specified, fields <4> through <8> must contain valid values. Otherwise, fields <4> through <8> must be null. Refer to Appendix A for a list of earth datums and the corresponding earth datum index.

<4> User earth datum semi-major axis, 6360000.0 to 6380000.0 meters (.001 meters resolution)

<5> User earth datum inverse flattening factor, 285.0 to 310.0 (10^{-9} resolution)

<6> User earth datum delta x earth centered coordinate, -5000.0 to 5000.0 meters (1 meter resolution)

<7> User earth datum delta y earth centered coordinate, -5000.0 to 5000.0 meters (1 meter resolution)

<8> User earth datum delta z earth centered coordinate, -5000.0 to 5000.0 meters (1 meter resolution)

<9> Differential mode, A = automatic (output DGPS data when available, non-DGPS otherwise), D = differential exclusively (output only differential fixes)

<10> GPS 31 - Not used. Null field
GPS 31 SL NMEA Baud Rate, 1 = 1200, 2 = 2400, 3 = 4800, 4 = 9600

<11> Velocity filter (GPS 31 - Rev. 1.31 or later; GPS 31 SL - All revs), 1 = Automatic filter, 2-255 = Filter time constant (10 = 10 second filter)

<12> Not used.

All configuration changes take effect after receipt or a valid value except baud rate (GPS 31 SL only) which takes effect on the next power cycle or external reset event. Null fields in the configuration sentence indicate no change in the particular configuration parameter.

3.1.4 Output Sentence Enable/Disable ($PGRMO GARMIN proprietary format)

The $PGRMO sentence provides the ability to enable and disable specific output sentences. The GPS 31 will default to all output sentences enabled upon system power-up.

The GPS 31 SL will retain user configured sentence selection for all subsequent power cyles.

$PGRMO,<1>,<2>*hh<CR><LF>

<1> Target sentence description (e.g., PGRMT, GPGSV, etc.)

<2> Target sentence mode, where:
0 = disable specified sentence
1 = enable specified sentence
2 = disable all output sentences
3 = enable all output sentences (except GPALM)

The following notes apply to the PGRMO input sentence:

1) If the target sentence mode is '2' (disable all) or '3' (enable all), the target sentence description is not checked for validity. In this case, an empty field is allowed (e.g., $PGRMO,,3), or the mode field may contain from 1 to 5 characters.

2) If the target sentence mode is '0' (disable) or '1' (enable), the target sentence description field must be an identifier for one of the sentences being output by the GPS 31/31 SL.

3) If either the target sentence mode field or the target sentence description field is not valid, the PGRMO sentence will have no effect.

4) $PGRMO, GPALM, 1 will cause the GPS 31/31 SL to transmit all stored almanac information. All other NMEA sentence transmission will be temporarily suspended.

3.2 NMEA TRANSMITTED SENTENCES

The subsequent paragraphs define the sentences which can be transmitted on TXD1 by the GPS 31/31 SL.

3.2.1 Sentence Transmission Rate

3.2.1.1 GPS 31

Sentences are transmitted with respect to the user selected baud rate. At 9600 and 4800 baud, sentences are transmittedevery second. At 2400 baud, sentences are transmitted every two seconds and at 1200 baud, every four seconds. GPALM and PGRMT transmission rates are defined in Sections 4.2.3 and 4.2.10, respectively.

3.2.1.2 GPS 30 SL

Sentences are transmitted with respect to the user selected baud rate.

Regardless of the selected baud rate, the information transmitted by the GPS 31 SL is referenced to the one-pulse-per-second output pulse immediately preceeding the GPRMC sentence.

The GPS 31 SL will transmit each sentence (except where noted in particular transmitted sentence descriptions) at a periodic rate based on the user selected baud rate and user selected output sentences. The sensor board will transmit the selected sentences contiguously. The contiguous transmission starts at a GPS second boundary. The length of the transmission can be determined by the following equation and tables:

$$\text{Length of transmission} = \frac{\text{total characters to be transmitted}}{\text{characters transmitted per sec}}$$

Baud	characters_transmitted_per_sec
1200	120
2400	240
4800	480
9600	960

Sentence	max_characters
GPGGA	72
GPGSA	65
GPGSV	140
GPRMC	70
GPVTG	34
PGRME	36
PGRMT	47
PGRMV	26
PGRMF	79
LCGLL	36
LCVTG	34

The factory set defaults will result in a once per second transmission at the NMEA specification transmission rate of 4800 baud.

3.2.2 Transmitted Time

The GPS 31/31 SL outputs UTC (Coordinated Universal Time) date and time of day in the transmitted sentences. Prior to the initial position fix, the date and time of day are provided by the on-board clock. After the initial position fix, the date and time of day are calculated using GPS satellite information.

The GPS 31/31 SL uses information obtained from the GPS satellites to add or delete UTC leap seconds and correct the transmitted date and time of day. The transmitted date and time of day for leap second correction follow the guidelines in *"National Institute of Standards and Technology Special Publication 432 (Revised 1990)"* (for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402, U.S.A.).

When a positive leap second is required, the second is inserted beginning at 23h 59m 60s of the last day of a month and ending at 0h 0m 0s of the first day of the following month. The minute containing the leap second is 61 seconds long. The GPS 31/31 SL would have transmitted

this information for the leap second added December 31, 1989 as follows:

Date	Time
311289	235959
311289	235960
010190	000000

If a negative leap second should be required, one second will be deleted at the end of some UTC month. The minute containing the leap second will be only 59 seconds long. In this case, the GPS 31/31 SL will not transmit the time of day 23h 59m 59s for the day from which the leap second is removed.

3.2.3 Global Positioning System Almanac Data (ALM)

(GPS 31 Rev. 1.30 or later and all GPS 31 SL revs)

$GPALM,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,<10>,<11>,<12>,<13>,<14>,<15>*hh<CR><LF>

Almanac sentences are not normally transmitted. Almanac transmission can be initiated by sending the sensor board a $PGRMO,GPALM,1 command. Upon receipt of this command, the sensor board will transmit available almanac information on GPALM sentences. During the transmission of almanac sentences other NMEA data output will be temporarily suspended.

<field information> can be found in section 4.1.1.

3.2.4 Global Positioning System Fix Data (GGA)

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

<1> UTC time of position fix, hhmmss format
<2> Latitude, ddmm.mmmm format (leading zeros will be transmitted)

<3> Latitude hemisphere, N or S
<4> Longitude, dddmm.mmmm format (leading zeros will be transmitted)
<5> Longitude hemisphere, E or W
<6> GPS quality indication, 0 = fix not available, 1 = Non-differential GPS fix available, 2 = Differential GPS (DGPS) fix available
<7> Number of satellites in use, 00 to 08 (leading zeros will be transmitted)
<8> Horizontal dilution of precision, 1.0 to 99.9
<9> Antenna height above/below mean sea level, -9999.9 to 99999.9 meters
<10> Geoidal height, -999.9 to 9999.9 meters
<11> Differential GPS (RTCM-SC104) data age, number of seconds since last valid RTCM transmission (null if non-DGPS)
<12> Differential Reference Station ID, 0000 to 1023 (leading zeros will be transmitted, null if non-DGPS)

3.2.5 GPS DOP and Active Satellites (GSA)

$GPGSA,<1>,<2>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,,,,,<4>,<5>,<6>*hh<CR><LF>

<1> Mode, M = manual, A = automatic
<2> Fix type, 1 = not available, 2 = 2D, 3 = 3D
<3> PRN number, 01 to 32, of satellite used in solution, up to 8 transmitted (leading zeros will be transmitted)
<4> Position dilution of precision, 1.0 to 99.9
<5> Horizontal dilution of precision, 1.0 to 99.9
<6> Vertical dilution of precision, 1.0 to 99.9

3.2.6 GPS Satellites in View (GSV)

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

<1> Total number of GSV sentences to be transmitted
<2> Number of current GSV sentence

<3> Total number of satellites in view, 00 to 08 (leading zeros will be transmitted)
<4> Satellite PRN number, 01 to 32 (leading zeros will be transmitted)
<5> Satellite elevation, 00 to 90 degrees (leading zeros will be transmitted)
<6> Satellite azimuth, 000 to 359 degrees, true (leading zeros will be transmitted)
<7> Signal to noise ratio (C/No) 00 to 99 dB, null when not tracking (leading zeros will be transmitted)

NOTE: Items <4>,<5>,<6> and <7> repeat for each satellite in view to a maximum of four (4) satellites per sentence. Additional satellites in view information must be sent in subsequent sentences. These fields will be null if unused.

3.2.7 Recommended Minimum Specific GPS/ TRANSIT Data (RMC)

$GPRMC,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,<10>, <11>*hh<CR><LF>

<1> UTC time of position fix, hhmmss format
<2> Status, A = Valid position, V = NAV receiver warning
<3> Latitude, ddmm.mmmm format (leading zeros will be transmitted)
<4> Latitude hemisphere, N or S
<5> Longitude, dddmm.mmmm format (leading zeros will be transmitted)
<6> Longitude hemisphere, E or W
<7> Speed over ground, 0.0 to 999.9 knots
<8> Course over ground, 000.0 to 359.9 degrees, true (leading zeros will be transmitted)
<9> UTC date of position fix, ddmmyy format
<10> Magnetic variation, 000.0 to 180.0 degrees (leading zeros will be transmitted)
<11> Magnetic variation direction, E or W (westerly variation adds to true course)

3.2.8 Track Made Good and Ground Speed with GPS Talker ID (GPVTG)

The GPVTG sentence reports track and velocity information with a checksum:

$GPVTG,<1>,T,<2>,M,<3>,N,<4>,K*hh<CR><LF>

<1> True course over ground, 000 to 359 degrees (leading zeros will be transmitted)
<2> Magnetic course over ground, 000 to 359 degrees (leading zeros will be transmitted)
<3> Speed over ground, 00.0 to 99.9 knots (leading zeros will be transmitted)
<4> Speed over ground, 00.0 to 99.9 kilometers per hour (leading zeros will be transmitted)

3.2.9 Estimated Error Information ($PGRME GARMIN proprietary format)

The $PGRME sentence reports estimated position error information.

$PGRME,<1>,M,<2>,M,<3>,M*hh<CR><LF>

<1> Estimated horizontal position error (HPE), 0.0 to 9999.9 meters
<2> Estimated vertical position error (VPE), 0.0 to 9999.9 meters
<3> Estimated position error (EPE), 0.0 to 9999.9 meters

3.2.10 Status Information ($PGRMT GARMIN proprietary format)

The $PGRMT sentence gives information concerning the status of the GPS 31/31 SL. This sentence is transmitted once per minute regardless of the selected baud rate.

$PGRMT,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>*hh<CR><LF>

<1> Product, model and software version, this is a variable length field. (NOTE: Since the GPS 31/31 SL utilizes a GPS 20/20 SL sensor board, the GPS 20/20 SL model description will appear in this field.)
<2> Rom checksum test, P = pass, F = fail
<3> Receiver failure discrete, P = pass, F = fail
<4> Stored data lost, R = retained, L = lost
<5> Real time clock lost, R = retained, L = lost
<6> Oscillator drift discrete, P = pass, F = excessive drift detected
<7> Data collection discrete, C = collecting almanac data, null if not collecting almanac data
<8> Unit temperature in degrees C
<9> GPS 30 SL only: Configuration data, R = retained, L = lost

3.2.11 Geographic Position with LORAN Talker ID (LCGLL) (GPS 31 SL only)

The LCGLL sentence reports position information

$LCGLL,<1>,<2>,<3>,<4>,<5>,<CR><LF>

<1> Latitude, ddmm.mm format (leading zeros will be transmitted)
<2> Latitude hemisphere, N or S
<3> Longitude, dddmm.mm format (leading zeros will be transmitted)
<4> Longitude hemisphere, E or W
<5> UTC time of position fix, hhmmss format

3.2.12 Track Made Good and Ground Speed with LORAN Talker ID (LCVTG) (GPS 31 SL only)

The LCVTG sentence reports track and velocity information.

$LCVTG,<1>,T,<2>,M,<3>,N,<4>,K<CR><LF>

<1> True course over ground, 000 to 359 degrees (leading zeros will be transmitted)
<2> Magnetic course over ground, 000 to 359 degrees (leading zeros will be transmitted)

<3> Speed over ground, 00.0 to 99.9 knots (leading zeros will be transmitted)
<4> Speed over ground, 00.0 to 99.9 kilometers per hour (leading zeros will be transmitted)

3.2.13 GPS Fix Data Sentence ($PGRMF GARMIN proprietary format) (GPS 31 SL only)

$PGRMF,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,<10>,<11>,<12>,<13>,<14>,<15>*hh<CR><lf>

<1> GPS week number (0-1023)
<2> GPS seconds (0 - 604799)
<3> UTC date of position fix, ddmmyy format
<4> UTC time of position fix,hhmmss format
<5> GPS leap second count
<6> Latitude, ddmm.mmmm format (leading zeros will be transmitted)
<7> Latitude hemisphere, N or S
<8> Longitude,dddmm.mmmm format (leading zeros will be transmitted)
<9> Longitude hemisphere, E or W
<10> Mode, M = manual, A = automatic
<11> Fix type, 0 = no fix, 1 = 2D fix, 2 = 3D fix
<12> Speed over ground, 0 to 999 kilometers/hour
<13> Course over ground, 0 to 359 degrees, true
<14> Position dilution of precision, 0 to 9 (rounded to nearest integer value)
<15> Time dilution of precision, 0 to 9 (rounded to nearest integer value)

3.2.14 3D Velocity Information ($PGRMV GARMIN proprietary format) (GPS 31 SL only)

The $PGRMV sentence reports three-dimensional velocity information

$PGRMV,<1>,<2>,<3>*hh<CR><LF>

<1> True east velocity, -999.9 to 9999.9 meters/ seconds
<2> True north velocity, -999.9 to 9999.9 meters/ second

<3> Up velocity, -999.9 to 9999.9 meters/second

3.3 BAUD RATE SELECTION

3.3.1 GPS 31

Baud rate selection is performed by the GPS 31 prior to the first sentence being transmitted. To ensure the GPS 31 selects the correct baud rate, the RXD2 (and RXD1, if applicable) input signals should remain at the appropriate baud rate selection levels until the first sentence istransmitted. After the first sentence is transmitted, the host system is free to use the RXD1 and RXD2 inputs to transmit initialization and configuration sentences to the GPS 31 at the selected baud rate.

Baud rate selection is accomplished by proper connection of RXD1 (blue) and RXD2 (green) to a voltage greater than 3 vdc. Note that the absolute maximum voltage that should be applied to these inputs is +25 vdc. If using the main supply voltage to perform baud rate selection, make sure the voltage is less than 25 vdc to avoid damaging the GPS 31.

Baud	RXD1 Blue	RXD2 Green
1200	NC/0V	3V-15V
2400	3V-15V	3V-15V
4800	NC/0V	NC/0V
9600	3V-15V	NC/0V

3.3.2 GPS 31 SL

Baud rate selection on the GPS 31 SL is done via the $PGRMC sentence. Refer to Section 4.1.3.

3.4 RTCM RECEIVED DATA

Position accuracy of 3-10 meters can be achieved with the GPS 31/31 SL by using Differential GPS (DGPS) real-time pseudo-range correction data in RTCM SC-104 format. These corrections can be received by the GPS 31/31 SL on RXD2. Correction data at speeds of 300, 600, 1200, 2400, 4800 or 9600 baud can be utilized, as the GPS 31/31 SL automatically detects the incoming baud rate. For details on the SC-104 format, refer to *RTCM Paper 134-89/SC 104-68* by the Radio Technical Commission for Maritime Services.

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190-00103-00 Rev. C