GPS 20x
TECHNICAL SPECIFICATIONS

GARMIN™

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RECORD OF REVISIONS

Revision	Revision Date	Description	ECO #
A	1/14/08	Initial Release	--

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1 INTRODUCTION

1.1 CAUTIONS

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 20x is a precision electronic NAVigation AID (NAVAID), any NAVAID can be misused or misinterpreted, and therefore become unsafe. Use these products at your own risk. To reduce the risk, carefully review and understand all aspects of these Technical Specifications before using the GPS 20x. When in actual use, carefully compare indications from the GPS to all available navigation sources including the information from other NAVAIDs, visual sightings, charts, etc. For safety, always resolve any discrepancies before continuing navigation.

FCC Compliance

This product has been tested and found to comply with Part 15 of the FCC interference limits for Class B digital devices FOR HOME OR OFFICE USE. These limits are designed to provide more reasonable protection against harmful interference in a residential installation, and are more stringent than "outdoor" requirements.

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet that is on a different circuit from the GPS unit.
- Consult the dealer or an experienced radio/TV technician for help.

This product does not contain any user-serviceable parts. Repairs should only be made by an authorized Garmin service center. Unauthorized repairs or modifications could result in permanent damage to the equipment, and void your warranty and your authority to operate this device under Part 15 regulations.

1.2 LIMITED WARRANTY

This Garmin product is warranted to be free from defects in materials or workmanship for one year from the date of purchase. Within this period, Garmin will at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost. This warranty does not cover failures due to abuse, misuse, accident or unauthorized alteration or repairs.

This product is intended to be used only as a travel aid and must not be used for any purpose requiring precise measurement of direction, distance, location, or topography. Garmin makes no warranty as to the accuracy or completeness of map data in this product.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED OR STATUTORY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

IN NO EVENT SHALL GARMIN BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE, OR INABILITY TO USE THIS PRODUCT OR FROM DEFECTS IN THE PRODUCT. Some states do not allow the exclusion of incidental or consequential damages, so the above limitations may not apply to you.

Garmin retains the exclusive right to repair or replace the unit or software or offer a full refund of the purchase price at its sole discretion. SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

To obtain warranty service, contact your local Garmin authorized dealer, or call Garmin Product Support at one of the numbers shown below for shipping instructions and an RMA tracking number. The unit should be securely packed with the tracking number clearly written on the outside of the package. The unit should then be sent, freight charges prepaid, to any Garmin warranty service station. A copy of the original sales receipt is required as the proof of purchase for warranty repairs.

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1.3 OVERVIEW

The GPS 20x includes an embedded receiver and an antenna. The GPS 20x tracks multiple satellites at a time while providing fast time-to-first-fix navigation updates once per second. This generation of GPS sensors includes the capability of FAA Wide Area Augmentation System (WAAS) differential GPS.

The GPS 20x design uses the latest technology and high-level circuit integration to achieve superior performance while minimizing space and power requirements. The hardware capability combined with software intelligence makes the GPS 20x easy to integrate and use.

The GPS 20x requires minimal additional components to be supplied by an OEM or system integrator. A minimum system must provide the GPS with a source of power and a clear view of the GPS satellites. Internal FLASH memory allows the GPS to retain critical data such as satellite orbital parameters, last-known position, date and time. End user interfaces such as keyboards and displays are the responsibility of the application designer.

The GPS 20x interfaces to a computer with an available USB port. Drivers are available for use on Windows® computers. Macintosh® and Linux drivers are not available from Garmin. After the drivers are loaded, the device appears to the Windows operating system as a USB-connected device and appears in Device Manager as a Garmin USB Device.

1.4 FEATURES

- GPS receiver tracks and uses multiple satellites for fast, accurate positioning and velocity estimates.
- Differential DGPS capability using real-time WAAS corrections yields position errors of less than 3 meters.
- Compact design is ideal for applications with minimal space.
- Binary format data output over the USB interface transmits packets once per second. Refer to Appendix B: Garmin Binary Output Format.
- Downloadable Spanner application allows the GPS 20x to output NMEA 0183 sentences. Refer to section 3.1 Transmitted NMEA 0183 Sentences.
- FLASH-based program allows new software revisions through a Web site download.
- Non-volatile memory does not require battery backup.
- Onboard rechargeable backup battery can maintain the real-time clock for up to 10 days.
- Configurable parameters include expected position, current time and date, and preferred position fix type (3D or automatic).

1.5 TECHNICAL SPECIFICATIONS

Specifications are subject to change without notice.

1.5.1 Physical Characteristics

1.5.1.1 Size

1.7 in. (42.8 mm) long × 1.3 in. (32.4 mm) wide × 0.5 in. (12 mm) in height

1.5.1.2 Weight

1.1 oz (31.7 g)

1.5.1.3 Color

Silver

1.5.1.4 Case Material

Polycarbonate/Acrylonitrile-Butadiene-Styrene (PC/ABS)

1.5.1.5 Cable Length

1 meter

1.5.2 Electrical Characteristics

1.5.2.1 Input Voltage

4.4–5.5 Vdc

1.5.2.2 Input Current

110 mA @ 5.0 Vdc

1.5.2.3 GPS Receiver Sensitivity

-185 dBW minimum

1.5.2.4 Environmental Characteristics

- Operating Temperature: -30°C to +80°C (-22°F to +176°F)
- Storage Temperature: -40°C to +90°C (-40°F to +194°F)

1.5.3 GPS Performance

1.5.3.1 Receiver

WAAS Enabled® GPS receiver continuously tracks and uses multiple satellites to compute and update your position.

1.5.3.2 Acquisition Times

- Reacquisition: Less than 2 seconds
- Hot: Approx. 1 second (all data known)
- Warm: Approx. 38 seconds (initial position, time, and almanac known; ephemeris unknown)
- Cold: Approx. 45 seconds

1.5.3.3 Update Rate

1 record per second

1.5.3.4 Accuracy

- GPS Standard Positioning Service (SPS)
  Position: < 15 meters, 95% typical
  Velocity: 0.1 knot RMS steady state
- WAAS
  Position: < 3 meters, 95% typical
  Velocity: 0.1 knot RMS steady state
- Dynamics: 999 knots velocity (only limited at altitude greater than 60,000 feet), 2g dynamics

1.5.4 Interfaces

1.5.4.1 GPS 20x Electrical Characteristics

USB 2.0 full-speed protocol compatible, as well as USB 1.1 full-speed protocol.

1.5.4.2 Garmin Interface and Garmin USB Protocol

Refer to the *Garmin Device Interface Specification* found in the Garmin Device Interface SDK for information about the Garmin Interface and the Garmin USB Protocol. At the time of this printing, this document is located on the Garmin Web site at: www.garmin.com/support/commProtocol.html.

See Appendix B: Garmin Binary Output Format for additional information concerning access to binary data from the GPS 20x.

Using Spanner (an application that can provide NMEA output via a virtual COM port), the GPS 20x can send NMEA 0183 output sentences. Spanner is available for free on the Garmin web site. To download the software, start at www.garmin.com/oem, select the GPS 20x, and then select **Updates & Downloads**.

Available NMEA 0183 output sentences include GPGGA, GPGSA, GPGSV, GPRMC, and PGRMT (Garmin proprietary sentence). See section 3.1 Transmitted NMEA 0183 Sentences for format descriptions.

2 MECHANICAL CHARACTERISTICS

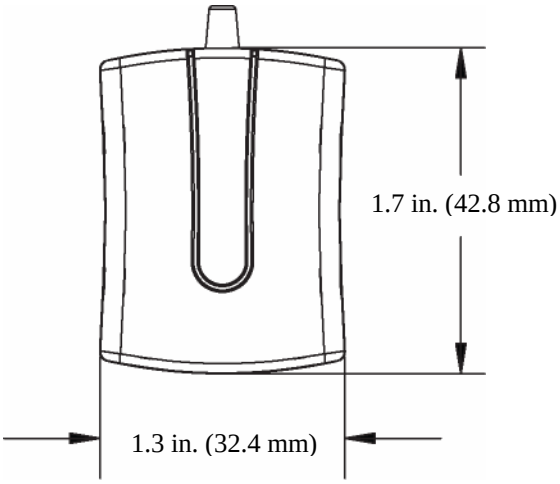

Figure 1. GPS 20x Top Case Dimensions

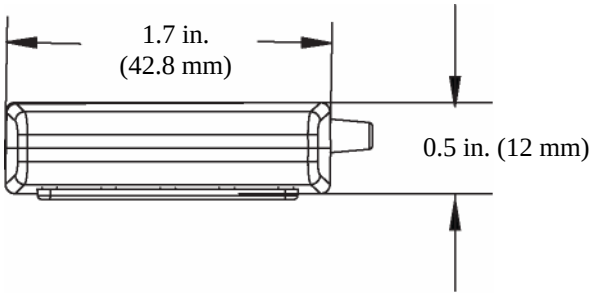

Figure 2. GPS 20x Side View

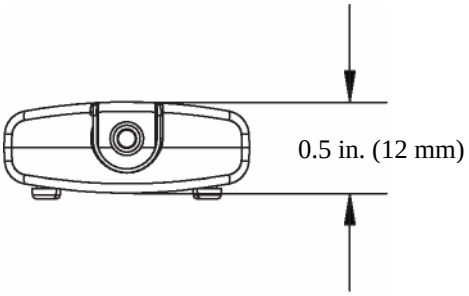

Figure 3. GPS 20x End View

3 GPS 20x SOFTWARE INTERFACE

The GPS 20x transmits using the Garmin USB interface. The Garmin USB interface is discussed in the *Garmin Device Interface Specification* found in the Garmin Device Interface SDK located on the Garmin Web site at: www.garmin.com/support/commProtocol.html.

You can configure the GPS 20x to transmit binary data information over the USB interface. Refer to Appendix B: Garmin Binary Output Format.

3.1 TRANSMITTED NMEA 0183 SENTENCES

The following paragraphs define the sentences that can be transmitted by the GPS 20x using Spanner (an application that can provide NMEA output via a virtual COM port). Spanner is available for free on the Garmin web site. To download the software, start at www.garmin.com/oem, select the GPS 20x, and then select **Updates & Downloads**.

3.1.1 Sentence Transmission Rate

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

The GPS sensor will transmit each sentence once per second. The sentences are not configurable.

Sentence	Maximum Characters
GPRMC	74
GPGGA	82
GPGSA	66
GPGSV	70
PGRMT	50

Table 1: NMEA 0183 Output Sentence Order and Size

The maximum number of fields allowed in a single sentence is 82 characters including delimiters. Values in the table include the sentence start delimiter character "$" and the termination delimiter <CR><LF>.

3.1.2 Transmitted Time

The GPS sensor outputs Coordinated Universal Time (UTC) date and time of day in the transmitted sentences. Before the initial position fix, the on-board clock provides the date and time of day. After the initial position fix, the date and time of day are calculated using GPS satellite information and are synchronized with the measurement pulse output.

The GPS sensor 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, one second is inserted at the beginning of the first hour (0h 0m 0s) of the day that the positive leap is occurring. The minute containing the leap second is 61 seconds long. The GPS sensor would have transmitted this information for the leap second added December 31, 1998 as follows:

$GPRMC,235959,A,3851.3651,N,09447.9382,W,000.0,221.9,071103,003.3,E*69

$GPRMC,000000,A,3851.3651,N,09447.9382,W,000.0,221.9,081103,003.3,E*67

$GPRMC,000000,A,3851.3651,N,09447.9382,W,000.0,221.9,081103,003.3,E*67

$GPRMC,000001,A,3851.3651,N,09447.9382,W,000.0,221.9,081103,003.3,E*66

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 sensor will not transmit the time of day 0h 0m 0s (the "zero" second) for the day from which the leap second is removed.

$GPRMC,235959,A,3851.3650,N,09447.9373,W,000.0,000.0,111103,003.3,E*69

$GPRMC,000001,A,3851.3650,N,09447.9373,W,000.0,000.0,121103,003.3,E*6A

$GPRMC,000002,A,3851.3650,N,09447.9373,W,000.0,000.0,121103,003.3,E*69

3.1.3 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 (WAAS) fix available, 6 = Estimated
<7>	Number of satellites in use, 00 to 12 (leading zeros will be transmitted)
<8>	Horizontal dilution of precision, 0.5 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>	Null (Differential GPS)
<12>	Null (Differential Reference Station ID)

3.1.4 GPS DOP and Active Satellites (GSA)

$GPGSA,<1>,<2>,<3>,<3>,<3>,<3>,<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 12 transmitted (leading zeros will be transmitted)
<4>	Position dilution of precision, 0.5 to 99.9
<5>	Horizontal dilution of precision, 0.5 to 99.9
<6>	Vertical dilution of precision, 0.5 to 99.9

3.1.5 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 12 (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 (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. GSV will be repeated as necessary to output all satellites in view (up to 12 satellites). Unused satellite fields will be truncated when less than four satellites are in the last GSV sentence.

3.1.6 Recommended Minimum Specific GPS/TRANSIT Data (RMC)

$GPRMC,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,<10>,<11>,<12>*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 must be transmitted)
<4>	Latitude hemisphere, N or S
<5>	Longitude, dddmm.mmmm format (leading zeros must be transmitted)
<6>	Longitude hemisphere, E or W
<7>	Speed over ground: 000.0 to 999.9 knots (leading zeros will be transmitted)
<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)
<12>	Mode indicator (only output if NMEA 0183 version 2.30 active), A = Autonomous, D = Differential, E = Estimated, N = Data not valid

3.1.7 Sensor Status Information (PGRMT)

The Garmin Proprietary sentence $PGRMT gives information concerning the status of the GPS sensor. 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 (variable length field, for example, “GPS 20x VER 2.05”)
<2>	No Effect (This field is not used on this model and is included only for backwards compatibility)
<3>	No Effect (This field is not used on this model and is included only for backwards compatibility)
<4>	No Effect (This field is not used on this model and is included only for backwards compatibility)
<5>	No Effect (This field is not used on this model and is included only for backwards compatibility)
<6>	No Effect (This field is not used on this model and is included only for backwards compatibility)
<7>	No Effect (This field is not used on this model and is included only for backwards compatibility)
<8>	No Effect (This field is not used on this model and is included only for backwards compatibility)
<9>	No Effect (This field is not used on this model and is included only for backwards compatibility)

APPENDIX A: EARTH DATUM LIST

The following is a list of the Garmin GPS 20x Earth datum indices and the corresponding earth datum name (including the area of application):

0 ADINDAN–Ethiopia, Mali, Senegal, Sudan

9 AUSTRALIAN GEODETIC 1984–Australia, Tasmania Island

10 ASTRO DOS 71/4–St. Helena Island

11 ASTRONOMIC STATION 1952–Marcus Island

12 ASTRO B4 SOROL ATOLL–Tern Island

13 BELLEVUE (IGN)–Efate and Erromango Islands

14 BERMUDA 1957–Bermuda Islands

15 BOGOTA OBSERVATORY–Colombia

16 CAMPO INCHAUSPE–Argentina

17 CANTON ASTRO 1966–Phoenix Islands

18 CAPE CANAVERAL–Florida, Bahama Islands

19 CAPE–South Africa

20 CARTHAGE–Tunisia

21 CHATHAM 1971–Chatham Island (New Zealand)

22 CHUA ASTRO–Paraguay

23 CORREGO ALEGRE–Brazil

24 DJAKARTA (BATAVIA)–Sumatra Island (Indonesia)

25 DOS 1968–Gizo Island (New Georgia Islands)

26 EASTER ISLAND 1967–Easter Island

27 EUROPEAN 1950–Austria, Belgium, Denmark, Finland, France, Germany, Gibraltar, Greece, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland

28 EUROPEAN 1979–Austria, Finland, Netherlands, Norway, Spain, Sweden, Switzerland

29 FINLAND HAYFORD 1910–Finland

30 GANDAJIKA BASE–Republic of Maldives

31 GEODETIC DATUM 1949–New Zealand

32 ORDNANCE SURVEY OF GREAT BRITAIN 1936–England, Isle of Man, Scotland, Shetland Islands, Wales

33 GUAM 1963–Guam Island

34 GUX 1 ASTRO–Guadalcanal Island

35 HJORSEY 1955–Iceland

36 HONG KONG 1963–Hong Kong

37 INDIAN–Bangladesh, India, Nepal

38 INDIAN–Thailand, Vietnam

39 IRELAND 1965–Ireland

40 ISTS O73 ASTRO 1969–Diego Garcia

41 JOHNSTON ISLAND 1961–Johnston Island

42 KANDAWALA–Sri Lanka

43 KERGUELEN ISLAND–Kerguelen Island

44 KERTAU 1948–West Malaysia, Singapore

45 L.C. 5 ASTRO–Cayman Brac Island

46 LIBERIA 1964–Liberia

47 LUZON–Mindanao Island

48 LUZON–Phillippines (excluding Mindanao Island)

49 MAHE 1971–Mahe Island

50 MARCO ASTRO–Salvage Islands

51 MASSAWA–Eritrea (Ethiopia)

52 MERCHICH–Morocco

53 MIDWAY ASTRO 1961–Midway Island

54 MINNA–Nigeria

55 NORTH AMERICAN 1927–Alaska

56 NORTH AMERICAN 1927–Bahamas (excluding San Salvador Island)

57 NORTH AMERICAN 1927–Central America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua)

58 NORTH AMERICAN 1927–Canal Zone

59 NORTH AMERICAN 1927–Canada (including Newfoundland Island)

60 NORTH AMERICAN 1927–Caribbean (Barbados, Caicos Islands, Cuba, Dominican Republic, Grand Cayman, Jamaica, Leeward Islands, Turks Islands)

61 NORTH AMERICAN 1927–Mean Value (CONUS)

62 NORTH AMERICAN 1927–Cuba

63 NORTH AMERICAN 1927–Greenland (Hayes Peninsula)

64 NORTH AMERICAN 1927–Mexico

65 NORTH AMERICAN 1927–San Salvador Island

66 NORTH AMERICAN 1983–Alaska, Canada, Central America, CONUS, Mexico

67 NAPARIMA, BWI–Trinidad and Tobago

68 NAHRWAN–Masirah Island (Oman)

69 NAHRWAN–Saudi Arabia

70 NAHRWAN–United Arab Emirates

71 OBSERVATORIO 1966–Corvo and Flores Islands (Azores)

72 OLD EGYPTIAN–Egypt

73 OLD HAWAIIAN–Mean Value

74 OMAN–Oman

75 PICO DE LAS NIEVES–Canary Islands

76 PITCAIRN ASTRO 1967–Pitcairn Island

77 PUERTO RICO–Puerto Rico, Virgin Islands

78 QATAR NATIONAL–Qatar

79 QORNOQ–South Greenland

80 REUNION–Mascarene Island

81 ROME 1940–Sardinia Island

82 RT 90–Sweden

83 PROVISIONAL SOUTH AMERICAN 1956–Bolivia, Chile, Colombia, Ecuador, Guyana, Peru, Venezuela

84 SOUTH AMERICAN 1969–Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Venezuela, Trinidad and Tobago

85 SOUTH ASIA–Singapore

86 PROVISIONAL SOUTH CHILEAN 1963–South Chile

87 SANTO (DOS)–Espirito Santo Island

88 SAO BRAZ–Sao Miguel, Santa Maria Islands (Azores)

89 SAPPER HILL 1943–East Falkland Island

90 SCHWARZECK–Namibia

91 SOUTHEAST BASE–Porto Santo and Madeira Islands

92 SOUTHWEST BASE–Faial, Graciosa, Pico, Sao Jorge, and Terceira Islands (Azores)

93 TIMBALAI 1948–Brunei and East Malaysia (Sarawak and Sabah)

94 TOKYO–Japan, Korea, Okinawa

95 TRISTAN ASTRO 1968–Tristan da Cunha

96 User defined earth datum

97 VITI LEVU 1916–Viti Levu Island (Fiji Islands)

98 WAKE-ENIWETOK 1960–Marshall Islands

99 WORLD GEODETIC SYSTEM 1972

100 WORLD GEODETIC SYSTEM 1984

101 ZANDERIJ–Surinam

102 CH-1903–Switzerland

103 Hu-Tzu-Shan

104 Indonesia 74

105 Austria

106 Potsdam

107 Taiwan–modified Hu-Tzu-Shan

108 GDA–Geocentric Datum of Australia

109 Dutch

APPENDIX B: GARMIN BINARY OUTPUT FORMAT

In Binary Output mode, GPS 20x will transmit packets once per second. The records must be enabled by commands to the unit. Refer to the *Garmin Device Interface Specification* found in the Garmin Device Interface SDK for details on how to form and parse Garmin packets over USB. At the time of this printing, this document is located on the Garmin Web site at: www.garmin.com/support/commProtocol.html. The ID of each command should be 10 decimal to signify that the record is a command. The data portion of the packet should be one of the following:

Function	Command (base 10)
Position Record On	49
Position Record Off	50

Note that the satellite data information is also enabled when the position record is enabled.

USB packets contain a header with a USB transport ID, a record ID, and the size of the record data in bytes. Immediately following the header is the record data payload. Refer to the *Garmin Device Interface Specification* found in the Garmin Device Interface SDK for details on how to form and parse Garmin USB packets.

USB Packet:

- 0x## 0x00 0x00 0x00 (USB transport ID, 1 byte unsigned, 4 bytes reserved)
- 0x## 0x## 0x00 0x00 (Record ID, 2 bytes unsigned, 4 bytes reserved)
- 0x## 0x## 0x## 0x## (Number of data bytes in record, 4 bytes unsigned)
- record data payload

All unused reserved bytes in the header must be zero.

The data bytes of each packet contain the record specified by the record ID. A description of each record follows.

Satellite Data Record

The satellite data has a record ID of 0x72 with 84 (0x54) data bytes. The data bytes contain data for 12 satellites as described below.

```
typedef        struct
    {
    uint8      svid; //space vehicle identification (1–32 and 33–64 for WAAS)
    uint16     snr;     //signal-to-noise ratio
    uint8      elev; //satellite elevation in degrees
    uint16     azmth;   //satellite azimuth in degrees
    uint8      status;  //status bit-field
    } cpo_sat_data;
```

The status bit field represents a set of booleans described below:

Bit	Meaning when bit is one (1)
0	The unit has ephemeris data for the specified satellite.
1	The unit has a differential correction for the specified satellite.
2	The unit is using this satellite in the solution.

This pattern is repeated for 12 satellites for a total of 12 X 7 bytes = 84 (0x54) bytes.

The USB Packet for the Satellite Record looks like:

- 0x14 0x00 0x00 0x00 (USB Transport ID, 1 byte unsigned, 4 bytes reserved)
- 0x72 0x00 0x00 0x00 (Record ID, 2 bytes unsigned, 4 bytes reserved)
- 0x54 0x00 0x00 0x00 (Number of data bytes, 4 bytes unsigned)
- 12 cpo_sat_data records

Position Record

The Position Record has a record identifier of

```
typedef struct
     {
     float      alt;
     float      epe;
     float      eph;
     float      epv;
     int        fix;
     double     gps_tow;
     double     lat;
     double     lon;
     float      lon_vel;
     float      lat_vel;
     float      alt_vel;
     float      msl_hght;
     int        leap_sec;
     long       grmn_days;
     } cpo_pvt_data;
```

alt	Ellipsoid altitude (meters)
epe	Estimated position error (meters)
eph	Position error, horizontal (meters)
epv	Position error, vertical (meters)
fix	0 = no fix; 1 = no fix; 2 = 2D; 3 = 3D; 4 = 2D differential; 5 = 3D differential; 6 and greater = not defined
gps_tow	GPS time of week (sec)
lat	Latitude (radians)
lon	Longitude (radians)
lon_vel	Longitude velocity (meters/second)
lat_vel	Latitude velocity (meters/second)
alt_vel	Altitude velocity (meters/second)
msl_hght	Height (mean sea level) (meters)
leap_sec	UTC leap seconds
grmn_days	Garmin days (days since December 31, 1989)

For the latest free software updates (excluding map data) throughout the life of your Garmin products, visit the Garmin Web site at www.garmin.com.

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