GPS-22

GPS Receiver Module

User's Guide

FirstGPS V1.0 Jun 28, 2003

Positioning Accuracy:
3m CEP (50%) or <5m CEP ((90%)
Low Power:
17mA typical -- tracking at 3.3 Volts, full power

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1. Introduction

1.1 Overview

The GPS-22 GPS Receiver is a GPS receiver featuring the revolutionary **FirstGPS™** architecture. This complete enabled GPS receiver module provides high position and speed accuracy performances as well as high sensitivity and tracking capabilities in urban canyon conditions. The solution enables small form factor package. The GPS-22 delivers major advancements in GPS performances, accuracy, integration, computing power and flexibility. It is designed to simplify the embedded system integration process.

This positioning application meets strict needs such as car navigation, mapping, surveying, agriculture and so on. Only clear view of sky and certain power supply are necessary to the unit. GPS-22 communicates with other electronic utilities via compatible dual-channel through TTL and saves critical satellite data in built–in memory backup. With low power consumption, the GPS-22 tracks up to 8 satellites at a time, re-acquires satellite signals in 100 ms and updates position data every second.

1.2 Features

The GPS-22 provides a host of features that make it easy for integration and use.

1. Position accuracy in < 3m CEP (50%) or <5m CEP ((90%) without SA (horizontal)
2. Ultra low power: 17mA typical -- tracking at 3.3 Volts, full power
3. High sensitivity: to -143 dBm tracking, superior urban canyon performances
4. Small form factor and low cost solution
5. Ready-to-plug solution. Easily integrated into existing systems
6. On-board RAM for GPS navigation data
7. PPS output (User may have different interval setting from 1 second to 1 minute.
8. Differential capability utilizes real-time RTCM corrections producing < 1 meter position accuracy.
9. FLASH based program memory: New setting is stored permanently.

1.3 FirstGPS Architecture Highlights

1.3.1 Industry Leading GPS Performance
- Builds on high performance **FirstGPS™** core
- Satellite signal tracking engine to perform GPS acquisition and tracking functions without CPU intervention
- High sensitivity: to -143 dBm tracking, superior urban canyon performances
- Position accuracy: < 3m CEP (50%) without SA (horizontal)
- Warm Start is under 42 seconds (90%)
- Hot Start is under 10 seconds (90%)

1.3.2 Low Power
- Ultra low power integrated circuit design, optimized RF and DSP architectures
- Further power saving thanks to 4 different power down mode

1.4 Application
1. Car Navigation
2. Mapping
3. Surveying
4. Agriculture
5. Palmtop, Laptop, PDA
6. Location Based Services enabled devices
7. Asset management/tracking
8. Handheld receivers

1.5 Technology specifications
1.5.1 Physical Dimension

1. Size: 31.59(W) x 26.59(D) x 11.20(H) (mm)
      1.24"(W) x 1.05"(D) x 0.44"(H)
2. Weight: 25 g
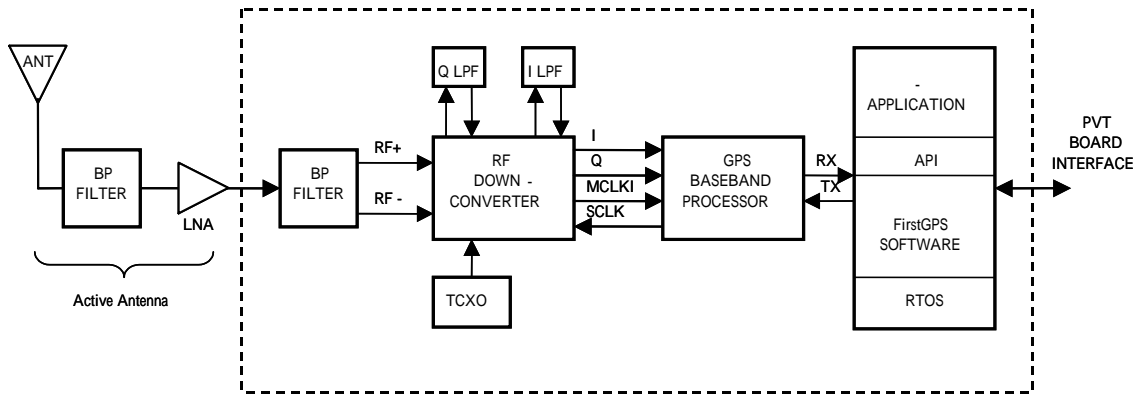Remark: FirstGPS™ is the trademark from Trimble

1.5.2 Environmental Characteristics
1) Operating temperature: -40°C to +85°C (internal temperature)
2) Storage temperature: -55°C to +100°C

1.5.3 Electrical Characteristics
1) Input voltage: +3.0 ~ 3.65 VDC.
2) HFL antenna connector: Active or patch (3.0V antenna is recommended).

1.5.4 Functional Block Diagram

1.5.5 Performance
1) Tracks up to 8 satellites.
2) Update rate: 1 second.
3) Acquisition time:

Reacquisition	0.1 sec. (90%)
Hot start	10 sec. (90%)
Warm start	42 sec. (90%)
Cold start	120 sec. (90%)

4) Position accuracy:
   Non DGPS (Differential GPS)

Position	<3m CEP (50%) or <5 m CEP (90%)
Velocity	0.1 meters/second.
Time	1 microsecond synchronized GPS time

   DGPS (Differential GPS)

Position	<1 m, typical
Velocity	0.05 meters/second, typical

5) Dynamic Conditions:

Altitude	18,000 meters(60,000 feet) max
Velocity	515 meters/second (1000 knots) max
Acceleration	4 G, max
Jerk	20 meters/second³, max

1.5.6 Interfaces
1) Dual communication channel through TTL, with user selectable baud rate (2400, 4800-Default, 9600, 19200, 38400, 57600, 115200).
2) NMEA 0183 Version 2.1 ASCII output (GGA, GLL, GSV, GSA, RMC, VTG, ZDA).
3) Real-time Differential Correction input (RTCM SC-104 message types 1, 2 and 9).

2. Operational characteristics

2.1 Initialization

As soon as the initial self-test is complete, the GPS-22 begins the process of satellite acquisition and tracking automatically. Under normal circumstances, it takes approximately 120 seconds to achieve a position fix, 42 seconds if ephemeris data is known. After a position fix has been calculated, information about valid position, velocity and time is transmitted over the output channel.

The GPS-22 utilizes initial data, such as last stored position, date, time and satellite orbital data, to achieve maximum acquisition performance. If significant inaccuracy exists in the initial data, or the orbital data is obsolete, it may take more time to achieve a navigation solution. The FirstGPS™ architecture provides superior performance. However, acquisition performance can be improved as the host system initializes the GPS-22 in the following situation:

1. Moving further than 1,500 kilometers.
2. Failure of Data storage due to the inactive memory power back up.

2.2 Navigation

After the acquisition process is complete, the GPS-22 sends valid navigation information over output channels. These data include:

1) Latitude/longitude/altitude
2) Velocity
3) Date/time
4) Error estimates
5) Satellite and receiver status

The GPS-22 sets the default of auto-searching for real-time differential corrections in RTCM SC-104 standard format, with the message types 1, 2, or 9. It accomplishes the satellite data to generate a differential (DGPS) solution. The host system, at its option, may also command the GPS-22 to output a position whenever a differential solution is available.

3. Hardware interface

3.1 Physical Characters

1. Size: 31.59(W) x 26.59(D) x 11.20(H) (mm)
   1.24"(W) x 1.05"(D) x 0.44"(H)

2. Weight: 25 g

3.1.1 Details Drawing
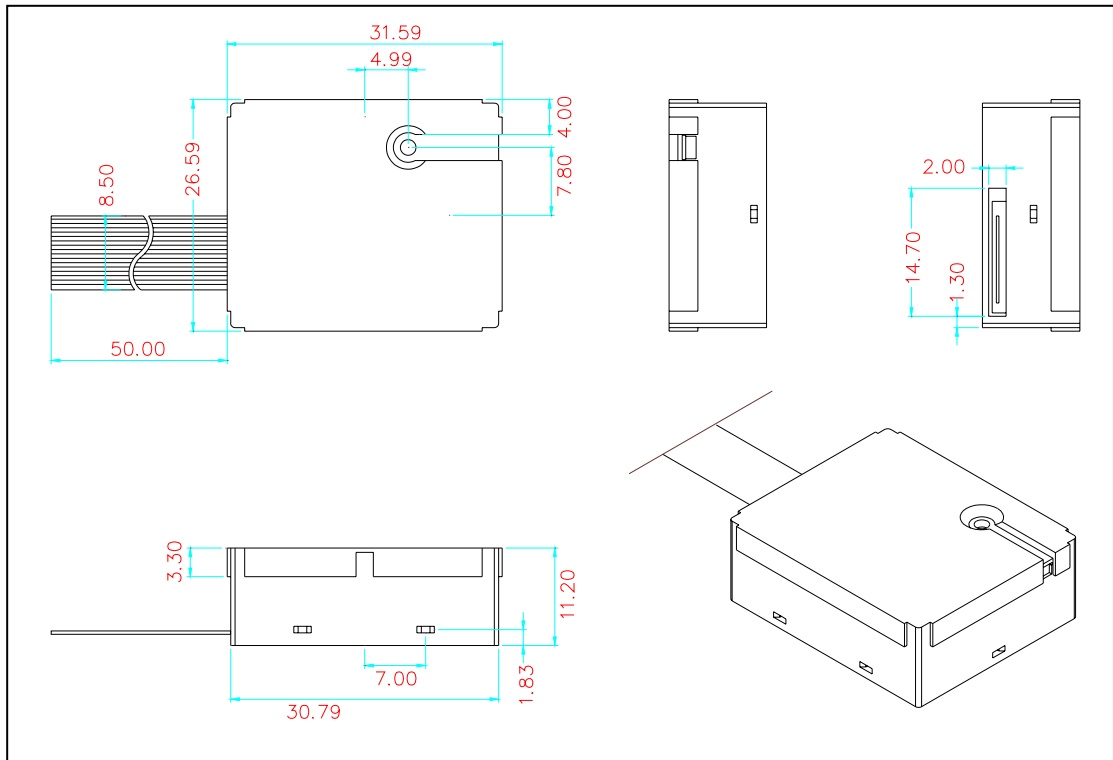
3.2 Pin Definition

PIN	NAME	TYPE	DESCRIPTION
1	GND		Power and Signal Ground
2	ON/OFF	I	ON / Off command line
3	VCC		3.0 to 3.6 Volts DC Input Power Supply
4	USPED	I	9600/4800 Bd UART Speed
5	RXA	I	Serial Receive Data, Port A, GPS NMEA Data
6	VRTCBK		Back-up supply for the RTC
7	TXA	O	Serial Transmit Data, Port A, GPS NMEA Data
8	PPS	O	One Pulse Per Second timing output
9	GND		Power and Signal Ground
10	RESETN		Manual Reset, Active low
11	ALMRDY		1(high): almanac valid; 0 (low): almanac not valid
12	STY1	I	Blinking function, when position fix, output "low". When tracking, output the interval signal "high/low".
13			N.C.
14	STY0		For customer specific version
15			N.C.
16	OSCSTOPN		Stand-by active "low"

1) All I/Os on the Data Interface are related to VCC (3 to 3.6 Volts) and GND levels.

2) **ON/OFF:** control the GPS engine "ON" or "OFF". If this pin is pulled "HIGH" whenever a reset condition occurs or if it is turned "HIGH" during operating, the GPS engine is turned "ON". If this pin is pulled "LOW" whenever a reset condition occurs, the GPS engine is not started. If this pin is turned "LOW" when in operating, the GPS engine is turned "OFF". When ON/OFF is "LOW", the on/off state can be superseded with the **PXEMaRT** manufacturer specific NMEA sentence on RXA, as defined below.

3) **RXA and TXA**: The Serial NMEA data port (RXA and TXA) is an asynchronous serial port (UART).

4) **USPED**: **USPED "HIGH"**: **9600** Baud rate, 8 bit data, no parity check, 1 stop bit and no flow control.
    USPED "LOW": **4800** Baud rate, 8 bit data, no parity check, 1 stop bit and no flow control .
    This setting can be modified with the **PXEMaPT** manufacturer specific NMEA sentence defined later.

5) **PPS:** This is Pulse Per Second highly accurate timing signal generated by the on-board GPS base band processor at 83ms duration. After a reset condition, the default setting for this port is inactive. This setting can be modified with the **PXEMaPS** manufacturer specific NMEA sentence defined below.

6) **RESETN**: The receiver has 2 reset conditions: first, on power-on, thanks to an on-board Power On Reset circuitry; and second an external reset when the **RESETN** pin is "LOW".

7) **VCC**: Main power supply.

8) **VRTCBK**: This is the back-up supply for the on-board real time clock.

9) **ALMRDY**: When in active mode, this indicates the on-board almanac status. Upon start up and whenever the almanac data are tested invalid or not up-to-date, the output level is "low". If tested valid or up-to-date, the output level is "high"

10) **STANDBYIN**: This input sets the receiver in stand-by mode when its level is "low". Otherwise, the receiver is either in active or power save mode. See below under operating modes for details.

3.3 Operating Modes

Mode	Description	VCC pin	On\Off Pin	Standby pin	Current cons. Type.
Active Mode	Receiver is running, doing acquisition, tracking, position fixes	Powered	High	High	17mA
Power Save Mode	GPS receiver functions are turned OFF, MCU in idle mode, MCU clock is running, RTC is running	Powered	Low (or thru NMEA command)	High	2.2mA
Stand-by Mode	GPS receiver functions are turned OFF, MCU clock is stopped, RTC is running on the Back-up supply	No power	low	low	300μ A
Power Down Mode	GPS receiver functions are turned OFF, MCU clock is stopped, RTC is running on the Back-up supply	No power	low	low	1μ A

4. Software Interface

The GPS-22 interface protocol is based on the National Marine Electronics Association's NMEA 0183 ASC interface specification, which is defined in NMEA 0183, Version 2.1 and the Radio Technical Commission for Maritime Services (RTCM Recommended Standards For Differential Navstar GPS Service, Version 2.1, RTCM Special Committee No.104).

4.1 NMEA Transmitted Messages

The GPS-22 outputs data in NMEA-0183 format as defined by the National Marine Electronics Association (NMEA), Standard.

The default communication parameters for NMEA output are 9600/4800 baud, 8 data bits, stop bit, and no parity.

Table 4-1 NMEA-0183 Output Messages

NMEA Record	Description
GPGGA	Global positioning system fixed data
GPGLL	Geographic position- latitude/longitude
GPGSA	GNSS DOP and active satellites
GPGSV	GNSS satellites in view
GPRMC	Recommended minimum specific GNSS data
GPVTG	Course over ground and ground speed
GPZDA	Date & Time

4.1.1 Global Positioning System Fix Data (GGA)

$GPGGA,161229.487,3723.2475,N,12158.3416,W,1,07,1.0,9.0,M, , , ,0000*18

Table 4-2 GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Time	161229.487		Hhmmss.sss
Latitude	3723.2475		Ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		See Table 5-3
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	Meters	
Units	M	Meters	
Geoid Separation		Meters	
Units	M	Meters	
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*18		
<CR> <LF>			End of message termination

Table 4-3 Position Fix Indicator

Value	Description
0	0 Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3	GPS PPS Mode, fix valid

4.1.2 Geographic Position with Latitude/Longitude (GLL)

Table 4-4 contains the values for the following example:

$GPGLL,3723.2475,N,12158.3416,W,161229.487,A*2C

Table 4-4 GLL Data Format

Name	Example	Units	Description
Message ID	$GPGLL		GLL protocol header
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
UTC Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Checksum	*2C		
<CR> <LF>			End of message termination

4.1.3 GNSS DOP and Active Satellites (GSA)

Table 4-5 contains the values for the following example:

$GPGSA,A,3,07,02,26,27,09,04,15, , , , , ,1.8,1.0,1.5*33

Table 4-5 GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See Table 5-6
Mode 2	3		See Table 5-7
Satellite Used (1)	07		Sv on Channel 1
Satellite Used (1)	02		Sv on Channel 2
……			….
Satellite Used			Sv on Channel 12
PDOP	1.8		Position Dilution of Precision
HDOP	1.0		Horizontal Dilution of Precision
VDOP	1.5		Vertical Dilution of Precision
Checksum	*33		
<CR> <LF>			End of message termination

(1) Satellite used in solution.

Table 4-6 Mode 1

Value	Description
M	Manual—forced to operate in 2D or 3D mode
A	2D Automatic—allowed to automatically switch 2D/3D

Table 4-7 Mode 2

Value	Description
1	Fix Not Available
2	2D
3	3D

4.1.4 GNSS Satellites in View (GSV)

Table 4-8 contains the values for the following example:

$GPGSV,2,1,07,07,79,048,42,02,51,062,43,26,36,256,42,27,27,138,42*71
$GPGSV,2,2,07,09,23,313,42,04,19,159,41,15,12,041,42*41

Table 4-8 GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages	2		Range 1 to 3
Message Number	1		Range 1 to 3
Satellites in View	07		Range 1 to 12
Satellite ID	07		Channel 1 (Range 1 to 32)

Elevation	79	degrees	Channel 1 (Maximum 90)
Azimuth	048	degrees	Channel 1 (True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
....	....		
Satellite ID	27		Channel 4 (Range 1 to 32)
Elevation	27	degrees	Channel 4 (Maximum 90)
Azimuth	138	degrees	Channel 4 (True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
Checksum	*71		
<CR> <LF>			End of message termination

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.

4.1.5 Recommended Minimum Specific GNSS Data (RMC)

Table 4-9 contains the values for the following example:

$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598, ,*10

Table 4-9 RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	Knots	
Course Over Ground	309.62	Degrees	True
Date	120598		ddmmyy
Magnetic Variation		Degrees	E=east or W=west
Checksum	*10		
<CR> <LF>			End of message termination

4.1.6 Course Over Ground and Ground Speed (VTG)

Table 4-10 contains the values for the following example:

$GPVTG,309.62,T, ,M,0.13,N,0.2,K*6E

Table 4-10 VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course	309.62	Degrees	Measured heading
Reference	T		True
Course		Degrees	Measured heading
Reference	M		Magnetic (1)
Speed	0.13	Knots	Measured horizontal speed
Units	N		Knots
Speed	0.2	Km/hr	Measured horizontal speed
Units	K		Kilometers per hour
Checksum	*6E		
<CR> <LF>			End of message termination

(1) All "course over ground" data are geodetic WGS84 directions.

4.1.7 Time & Date (ZDA)

Table 4-11 contains the values for the following example:

$GPVTG,114523.62,12,04,2001,10,34*6E

Table 4-11 ZDA Data Format

Name	Example	Units	Description
Message ID	$GPZDA		ZDA protocol header
Hour, Min, Sec, Sub Sec	114523.62		Hhmmss.ss
Day	12		Day in UTC, 01to 12
Month	04		Month in UTC, 01 to 12
Year	2001		Year in UTC
Local Zone Hours	10		Local zone hours, +/- 13 hours
Local Zone Minutes	34		Local zone minutes, 0 to +59
Checksum	*6E		
<CR> <LF>			End of message termination

4.2 RTCM Received Data

The default communication parameters for DGPS Input are 9600 baud, 8 data bits, stop bit, and no parity. Position accuracy of less than 5 meters can be achieved with the GPS-22 by using Differential GPS (DGPS) real-time pseudo-range correction data in RTCM SC-104 format, with message types 1, 5, or 9. As using DGPS receiver with different communication parameters, GPS-22 may decode the data correctly to generate accurate messages and save them in battery-back SRAM for later computing.

4.3 Syntax Setting
4.3.1 Basic Manufacturing Default:

Datum: WGS84.
Baud Rate: 9600/4800.
Output: GGA, GSA, GSV, RMC or by demand.

* Details please see paragraph 4.4

4.3.2 Output Setting
4.3.2.1 General Description
The NMEA Standard v2.1 dictates that proprietary NMEA sentences have the following structure:

$Paaaxxxxxxxxxxxxxx*hh

where *aaa* – mnemonic code, XEM in our case; *xxxxxxxx*…– data; *hh* – sentence checksum

Two types of input sentences are defined: **query** and *se*t. **Query** sentences request certain information from the receiver. *Set* sentences allow configuring the receiver with certain configuration parameters or forcing the receiver to perform a specific action. For each type of input sentences, a corresponding output response sentence is defined.
For a **query** sentence, the *response* sentence contains requested data. For a **set** sentence, the *response* sentence contains the status of the action requested in the **set** sentence. Taking these aspects into account, the following is the general structure of the specific NMEA sentence:

$PXEMmaa,x1,x2,x3,x4,….,xN*hh

where *m* – sentence type: 'Q' for 'query', 'S' for 'set', 'R' for 'response'; *aa* – proprietary sentence identifier (see below); *x1…xN* – data parameters (only for *set* and *query response* sentences); *hh* – sentence checksum

NOTE: Each of the data parameters must be preceded with a comma, except for the *aa* sentence identifier, and the checksum which is preceded with a checksum delimiter character '*'.

• QUERY sentence: to send a *query* sentence, no data fields are transmitted. The following format is used:
  $PXEMQaa*hh

- RESPONSE sentence to QUERY: for a *query* sentence, a *response* sentence with all fields is transmitted. The following format is used:
  $PXEMRaa,x1,x2,x3,x4,….,xN*hh

- SET sentence: to send a *set* sentence, x1…xN must contain valid values. The following format is used:
  $PXEMSaa,x1,x2,x3,x4,….,xN*hh

- RESPONSE sentence to SET: for a *set* sentence, a status *response* sentence is transmitted. The following format is used:
  $PXEMRaa,s*hh

where *s* is the status of the requested action: 'A' if the action was successful; 'V' otherwise.

The following proprietary NMEA sentence identifiers are implemented:

4.3.2.2 DI – Diagnostic Message (optional)

This sentence outputs a diagnostic string. It is used to report various error conditions. This is a response-only sentence.

$PXEMRDI,ccccccc*hh   where ccccccc is a diagnostic string up to 50 characteristics.

4.3.2.3 NM – Sentence Mask and Automatic Output Rate

This sentence configures the application to automatically output standard NMEA sentences at a specified time interval.

$PXEMaNM,xxxx,xx*hh

Name	Example	Units	Description
Message ID	$PXEMaNM		Proprietary NM protocol header, a-mode (S = set; R = response)
Mask	0008		xxxx Output sentence mask, hex value (see Notes below)
Rate	01	sec	xx Automatic output sentence rate (00 to 99)
<CR><LF>			End of message termination

Notes:

xxxx is a hexadecimal value representing a 2-byte bit-mask where a specific bit sets or clears automatic output of a particular NMEA sentence according to the table below. The mask is derived by combining all bits which represents the NMEA sentences which will be automatically output. For example, to automatically output GGA, GSA, ZDA, and RMC, the bits 0, 4, 5, and 8 are set to 1 in a 2-byte mask, resulting in a hex value 0x131 (0x1+0x10+0x20+0x100). This value is sent as an ASCII string '0131' in the *xxxx* field of the NM sentence.

NMEA   xxxx

Sentence	Bit#	Field value
GGA	0	0001
GLL	1	0002
VTG	2	0004
GSV	3	0008
GSA	4	0010
ZDA	5	0020
RMC	8	0100
TF	9	0200

Example:
$PXEMSNM,0008,01*6E   (set)
$PXEMSNM,a*6E   (response to set: a – action status: A = success; V=failure)

4.3.2.4 PS – Pulse-Per-Second Configuration

This sentence sets the pulse-per-second (PPS) output on or off. This is a set-only sentence.

$PXEMaPS,x*hh

Name	Example	Units	Description
Message ID	$PXEMaPS		Proprietary PS protocol header, a-mode (S = set; R = response)
On/Off	1		PPS output switch (1 = ON; 0 = OFF)
<CR><LF>			End of message termination

Example:
$PXEMSPS,1*6E   (set)
$PXEMSPS,a*6E   (response to set: a – action status: A = success; V=failure)

4.3.2.5 PT – Port Configuration

This sentence configures the application serial port communication parameters.

$PXEMaPT,xxxxxx,x,a,x*hh

Name	Example	Units	Description
Message ID	$PXEMaPT		Proprietary PT protocol header, a-mode (S = set; R = response)
Baud rate	009600		xxxxxx Baud rate (115200, 057600, 038400, 019200, 009600, 004800, 002400)
Data Length	8		X # of data bits (7 or 8)
Parity	N		Parity (N = None; O = Odd; E = Even)
Stop bit	1		# of stop bits (1 or 2)
<CR><LF>			End of message termination

Example:
$PXEMSPT,009600,8,N,1*6E   (set)
$PXEMSPT,a*6E   (response to set: a – action status: A = success; V=failure)

4.3.2.6 RT – Reset the Receiver / Start-Stop FirstGPS™

This sentence forces the receiver to perform a software reset. It also allows starting up and shutting down the **FirstGPS™** library without performing a full software reset. This is a set-only sentence.

$PXEMaRT,a*hh

Name	Example	Units	Description
Message ID	$PXEMaRT		Proprietary RT protocol header, a-mode (S = set; R = response)
Command	S		C = cold sofrware reset W = warm software reset H = hot sofrware reset S = start the FirstGPS™ library X = shut down the FirstGPS™ library
<CR><LF>			End of message termination

Example:
$PXEMSRT,W*6E   (set)
$PXEMSRT,a*6E   (response to set: a – action status: A = success; V=failure)

4.3.2.7 VR – Version Information (optional)

This sentence obtains software versions for the measurement platform (MPM) firmware, FirstGPS™ API, FirstGPS™ Library, native RTOS, and native processor (CPU). This is a query-only sentence.

Note: A complete VR sentence returns only the version of a particular product component one at a time (either MPM firmware, API, library, RTOS or CPU). The sentence must include the component type for which to obtain the version for any given query.

$PXEMaVR,a,cccccc,xx,xx,xx,xx,xx,xxxx*hh

Name	Example	Units	Description
Message ID	$PXEMaVR		Proprietary VR protocol header, a-mode (Q = set; R = response)
Component type	A		M = measurement platform (MPM) firmware A = FirstGPS^{TM} API N = FirstGPS^{TM} Library R = native RTOS U = native processor (CPU)
Name	abcdef		Variable length field; may be up to 17 characters long
Maj version	04		Major version number (00 to 99)
Min version	02		Minor version number (00 to 99)
Beta version	03		Beta version number (00 to 99)
Month	10		Month of the release (01 to 12)
Day	27		Day of the release (01 to 31)
Year	2002		Year of the release
<CR><LF>			End of message termination

Example:
$PXEMSVR,R*6E   (set)
$PXEMSVR,R,nucleus,04,03,10,27,2000*6E   (response to query)

4.3.2.8 TR – Transparent Mode
With this type of sentence an API function call as defined in the Standard and Advanced API Function Calls documents are passed thru the NMEA interface. This can be a query, set, and response type of sentence.

$PXEMaTR,c..c,x..xx, .., x..x*hh

Example:
$PXEMSTR,navGerBbAddr,%,s79&*6E   (set)
$PXEMRVR,6E   (response to)

4.4 DEFAULT Setting Details
4.4.1 Pulse Per Second Signal

PPS output: OFF

4.4.2 Receiver configuration

Receiver Mode	Automatic (2D/3D)	Automatic switch between 2D and 3D position fix depending on number of SV in view
Dynamics Code	Automobile	
DGPS Mode	DGPS Off	
Max Oscillator Offset	6.5e-6	Limit the search range during cold start. Must be larger than TCXO tolerance+stability+aging, for ex. 1+2.5+3=6.5
Elevation Mask (in degrees)	5	SVs for which elevation is lower are ignored to compute the solution
Signal Level Mask (AMU)	2	SVs for which signal strength is lower are ignored to compute the solution
DOP Mask	12	Max Dilution Of Precision to accept the solution
PDOP Switch	6	Max Position DOP

4.4.3 FILTER configuration
Kalman Filter

4.4.4 OFFSET configuration

Offset	0 ppm
Window	-1 ppm

4.4.5 NMEA configuration

Output interval	1 second
NMEA sentences	GGA /GSA/GSV/RMC

4.4.6 APPlication settings

Protocol Output Port	9600 bauds, 8 bits data, 1 start, 1 stop, no parity
Number of channels	8
Week epoch	1024
	(The offset number of 1024 week periods since 6 January 1980. Setting to 1024 includes all dates between August 22, 1999 and March 2019.)

4.5 Application Information
4.5.1 Antenna recommendation

Power supply voltage	2.7 - 3.6 V
Frequency range	1,575.42+/-1.023MHz
LNA Gain	27 dB at 3.0 V
LNA NF	1.1 dB at 3.0 V
Antenna and LNA total Gain	25 dBi Max at 3.0 V

5. Earth Datums

5.1 Earth Datums

The GPS-22 is built in earth datum with WGS84.

6.   Ordering Information

6.1 Products Options
6.1.1 GPS Receiver Module
GPS-22 Standard with 50mm flat 16-pin Cable

6.2 Accessories
A-10302 MCX, Active Antenna, 2M
A-10305 MCX, Active Antenna, 5M
56501 Connecting Cable, Screw type MCX + HFL connector + 15mm cable.

7. Warranty

The GPS-22 series products are warranted to be free from defects in material and functions for one year from the date of purchase. Any failure of this product within this period under normal conditions will be replaced art no charge to the customers.