Zodiac Software v3.00

This Software Release Note applies to the following Conexant Global Positioning System (GPS) products:

- Jupiter board (5 V, with various RF connectors), TU30-D410
- Jupiter board (3 V, with various RF connectors), TU30-D400
- Jupiter Flash (5 V, with various RF connectors), TU30-D240
- Jupiter board with dead reckoning software, TU30-D420
- Jupiter board with Hardware Accelerator, TU30-D430
- GPS Sensor, OEM module, TU70-D100
- GPS Sensor with plastic housing and various interfaces, TU70-D200
- Zodiac chipsets that use the Scorpio Baseband Processor (part number 11577-11 and above), the Gemini/Pisces Monopac™ (part number R6732-13 and above), the RF Multi-Chip Module (MCM) (part number CX76502-11 and above), and the Hardware Accelerator (part number CX11239-11 and above).

New Features

Version 3.00 of the Zodiac software baseline incorporates new product features and performance enhancements.

- Supports Conexant's Hardware Accelerator (CX11239).
- Provides accessibility to many new features through the Application Program Interface (API) in Original Equipment Manufacturer (OEM) software builds. Refer to the **.H* files delivered with the software build.
- Supports additional Real-Time Clocks (RTCs): the Dallas DS1302, Philips PCF8563, Ricoh RS5C316A, and Epson RTC4513 and RTC4543 RTCs. Note that a specific software build is required to provide the new RTC support.
- Allows the OEM to install customer ID codes and dates that will be output in the Receiver ID binary message (Message 1011) and the Conexant proprietary Receiver ID NMEA message (RID message). Refer to the files, *OKERNLIO.H* and *OEMKERNL.H*, supplied with the software build.
- Allows custom I/O protocols to be implemented and activated from the NMEA Conexant proprietary Protocol NMEA message (IPRO message) and the binary Protocol Control Message (Message 1331). Note that a specific software build is required to provide the new I/O protocol support. Refer to Tables 12 and 14 for binary Message 1331 and NMEA IPRO message formats, respectively.
- Provides more control of restart operations using the binary Restart Command Message (Message 1303). Refer to Table 11 for the binary Message 1303 format.

Product Performance Enhancements:

For all builds:

- Improved navigation performance and time mark performance with Selective Availability (SA) removed from satellite signals.
- Improved navigation message data collection for better performance when signal blockage occurs.
- Improved factory testing to reduce Time-To-First-Fix (TTFF) and to enable testing using the Hardware Accelerator.
- Improved operation of ground track smoothing for better altitude performance.
- Corrected an infrequent 20 ms offset of the 1 PPS signal.
- Improved power management software to increase navigation accuracy and to reduce power consumption.
- Modified time bias adjustments so they occur anytime the clock bias error grows to greater than 2 km.
- Upgraded cold start algorithm and improved tolerance to blockage during satellite acquisition.
- Corrected errors in the following binary messages:
  - Message 1130 (Serial Port Communication Parameters In Use) responds properly to on-update output requests.
  - Messages 1008 (Best User Measurement) and 1070 (GPS/DR Calibration Output) are consistently output when requested.
  - Message 1136 (EEPROM Status) is restored after being removed from an earlier release.
  - Messages 1070 (GPS/DR Calibration Output), 1075 (DR Factory Calibration Response), 1101 (Global Output Parameters), and 1117 (Power Management Duty Cycle In Use) consistently output correct data when the messages' time and measurement data do not change after the last output.

- Modified navigation algorithms improve first fix accuracy, allow DGPS navigation with only three satellites, provide better estimate errors, and recover faster from position errors caused by loss of satellite signals or severe multipath situations.
- Updated almanac and UTC/Ionospheric information stored in ROM to June, 2000.
- Dilution of Precision (DOP) values provided for actual satellites used in the navigation solution rather than the DOP that could be achieved if all satellites were used. Binary message 1008 (Best User Measurement) and NMEA message GGA (GPS Fix Data) provide this information.
- Modified processing to support dates from the years 1980 to 2079.

For Dead-Reckoning (DR) builds:

- Modified resolution to Message 1070 (GPS/DR Calibration Output) to allow larger values to be reported. For customers already using the older version of this message, software without these modifications to Message 1070 is also available upon request.
- Eliminated gyro temperature processing software. DR software no longer monitors gyro temperature.
- Faster correction of the DR position when GPS navigation recovers from a blockage.
- Implemented automatic detection of DR sensor failures.
- Changed the sampling rate of the gyro heading to 35 samples per second from 20 samples per second.
- Increased the DR startup speed. DR navigation becomes valid less than four seconds after power-on, provided that:
  - DR navigation was valid when the vehicle power was last turned off
  - the vehicle was stopped at last power off
  - battery backup voltage sustained the SRAM during the power-off time
  - the vehicle remained stopped for three seconds at the next power on.
- Improved DR startup to correct some position errors that could occur with long blockages at startup. Previously, blockages that were long enough to cause the GPS receiver to transition to cold-start mode could result in position jumps once satellites began to be acquired.

Binary Messages in v3.00

The following Conexant binary messages were added to, or modified in, the version 3.00 software baseline. The format for each of these messages is provided in Table 1 through Table 11.

- Message 1008, Best User Measurement. DOPs of satellites actually used now available in all builds.
- Message 1011, Receiver ID. Reports user-specified version information.
- Message 1050, RAM Status. Reports status of RAM at receiver startup. New message.
- Message 1051 DR System Status. Reports DR system failure.
- Message 1070 GPS/DR Calibration Output. Changed scaling factors.
- Message 1092 Hardware Accelerator Status. Reports Hardware Accelerator settings. New message.
- Message 1100, Built-In Test Results. Supports Hardware Accelerator tests.
- Message 1136, EEPROM Status. Incorporates new data IDs.
- Message 1191, Hardware Accelerator Measurement Output. Reports Hardware Accelerator measurements. New message.
- Message 1292, Hardware Accelerator Control Input. Allows operator to control Hardware Accelerator modes. New message.
- Message 1303, Restart Command. Added new options for clearing memory on restart.
- Message 1331, Message Protocl Control. Added new option for OEM message formats.

NMEA Messages in v3.00

The following NMEA messages were modified in the version 3.00 software baseline. The format for each of these messages is provided in Table 12 and Table 13.

- GGA, GPS Fix Data Message. The Horizontal Dilution of Precision (HDOP) values are based on satellites used in the navigation solution.
- IPRO, Conexant Proprietary Protocol Message. Added OEM message protocol option.
- RID, Conexant Proprietary Receiver ID Message. Reports OEM-supplied receiver ID fields.

Table 1. Message 1008: Best User Measurement Message (1 of 2)

Message ID:	1008			**(ONLY ENABLED IN SELECTED VERSIONS BEFORE v2.69)**	
Rate:	Variable; defaults to 1 Hz				
Message Length:	148 words				
Word No.:	**Name:**	**Type:**	**Units:**	**Range:**	**Resolution:**
1-4	Message Header				
5	Header Checksum				
6-7	Set Time	UDI	10 ms ticks	0 to 4294967295	
8	Sequence Number	I		0 to 32767	
9	GPS Week	UI	weeks	0 to 32767	
10-11	GPS Seconds From Epoch	UDI	seconds	0 to 604799	
12-13	GPS Nanoseconds From Epoch	UDI	ns	0 to 999999999	
14	Number of Satellites Used	UI		0 to 12	
15	Used GDOP	UI		0 to 99.99	10^{-2}
16	Used PDOP	UI		0 to 99.99	10^{-2}
17	Used HDOP	UI		0 to 99.99	10^{-2}
18	Used VDOP	UI		0 to 99.99	10^{-2}
19	Used TDOP	UI		0 to 99.99	10^{-2}
Channel Status (n = 1 to 12 channels)					
10 (n-1) + 20.0	Measurement Valid	Bit		1 = valid	
10 (n-1) + 20.1	Ephemeris Available	Bit		1 = ephemeris available	
10 (n-1) + 20.2	Differential GPS Available	Bit		1 = corrections available	
10 (n-1) + 20.3	Measurement Used	Bit		1 = measurement used	
10 (n-1) + 20.4 to 20.9	C/No (dBHz)	Bit (6 bits)		0 to 63	
10 (n-1) + 20.10 to 20.15	PRN Number	Bit (6 bits)		0 to 32 (Note 1)	
10 (n-1) + 21 to 23	Pseudorange	UTI	seconds	0 to 0.16	$2^{-45}/50$
10 (n-1) + 24 to 26	Carrier Phase	UTI	seconds	0 to 0.16	$2^{-45}/50$

Table 1. Message 1008: Best User Measurement Message (2 of 2)

Word No.:	Name:	Type:	Units:	Range:	Resolution:
10 (n-1) + 27 to 28	Carrier Rate	DI	sec/sec	$\pm 2^{-14}$	2^{-45}
10 (n-1) + 29	Phase Bias Count (Note 2)	UI		0 to 65535	
140	GPS Heading Error	UI	degrees	0 to 300	10^{-2}
141	GPS Velocity Error	UI	m/s	0 to 1000	10^{-2}
142 to 143	GPS Position Error	UDI	meters	0 to 320000000	10^{-2}
144	DR Heading Error (Note 3)	UI	degrees	0 to 300	10^{-2}
145	DR Velocity Error (Note 3)	UI	m/s	0 to 1000	10^{-2}
146 to 147	DR Position Error (Note 3)	UDI	meters	0 to 320000000	10^{-2}
148	Data Checksum				

Note 1: 0 = not tracking, 1 to 32 = satellite's PRN.

Note 2: Phase Bias Count is the number of iterations performed by carrier smoothing. The higher this count, the more the pseudorange depends on carrier phase measurements rather than C/A code measurements.

Note 3: DR links only.

Table 2. Message 1011: Receiver ID Message

Message ID:	1011				**(MODIFIED IN v2.69 AND LATER)**
Rate:	Variable (see above)				
Message Length:	59 words				
Word No.:	**Name:**	**Type:**	**Units:**	**Range:**	**Resolution:**
1-4	Message Header				
5	Header Checksum				
6-7	Set Time	UDI	10 ms ticks	0 to 4294967295	
8	Sequence Number	I		0 to 32767	
9-18	Number of Channels (Note 1)	C			%02D
19-28	Software Version (Note 1)	C			%05.2F
29-38	Software Date (Note 1)	C	mm/dd/yy		%02D
39-48	Options List (Note 2)	C			
49	OEM Version (Note 3)	I		0 to 65535	
50	OEM Subversion (Note 3)	I		0 to 65535	
51	OEM Day (Note 3)	UI		0 to 65535	
52	OEM Month (Note 3)	UI		0 to 65535	
53	OEM Year (enter as four digits) (Note 3)	UI		0 to 65535	
54-58	Reserved	UI			
59	Data Checksum				

Note 1: This field contains a 20-character string initialized to 0x00 in all elements, then filled using the C format shown in the resolution column. Sample data for the first three strings is:

Number of Channels 12
Software Version 02.30
Software Date 07/08/99

Note 2: The options list is a bit-encoded configuration word represented as an ASCII four-digit hexadecimal number:

bit 0 minimize ROM usage
bit 1 minimize RAM usage
bits 2-15 reserved

For example, if both bits 0 and 1 are set, the hexadecimal value would be 0x0003, and the Options List would be " 0003".

Note 3: For version 2.69 and later, these values are used to designate custom or standard OEM versions. Word 49 is controlled by Conexant and is set to zero for standard builds; it is set to other values whenever Conexant wants to specify other builds. Words 50 through 53 are set to zero by Conexant but can be set to any value desired by OEMs who wish to change them through the OEM API. Values are stored in tRxId data structure using Data ID InRxId in a call to Put Kernel Data (). See OKERNLIO.H and OEMKERNL.H for definitions.

Table 3. Message 1050: RAM Status Message

Message ID:	1050				
Rate:	Variable				
Message Length:	13 words				
Word No.:	**Name:**	**Type:**	**Units:**	**Range:**	**Resolution:**
1-4	Message Header				
5	Header Checksum				
6-7	Set Time	UDI	10 ms ticks	0 to 4294967295	
8	Sequence Number	I		0 to 32767	
9-10	Failure (Note 1)	Bit		1 = failed item	
11	Word 1 (RESERVED)	I			
12	Word 2 (RESERVED)	I			
13	Data Checksum				

Note 1: The failure words are a bit map with the following items (summary bit is set when any other bit is set). Failure is detected by a failed checksum calculation.

Bit	Failure	Bit	Failure
0	Summary	8	Gyro Bias Error (DR only)
1	Position	9	DR Speed Scale Factor (DR only)
2	Position Error	10	DR Speed Scale Factor Error (DR only)
3	Heading	11	RTC
4	Heading Error	12	Ephemeris Data (not implemented)
5	Gyro Scale Factor (DR only)	13	Almanac Data (not implemented)
6	Gyro Scale Factor Error (DR only)	14-31	Reserved
7	Gyro Bias (DR only)		

Table 4. Message 1051: DR System Status Message

Message ID:	1051				**(ONLY AVAILABLE IN DR BUILDS)**
Rate:	Variable				
Message Length:	11 words				
Word No.:	**Name:**	**Type:**	**Units:**	**Range:**	**Resolution:**
1-4	Message Header				
5	Header Checksum				
6-7	Set Time	UDI	10 ms ticks	0 to 4294967295	
8	Sequence Number	I		0 to 32767	
9	Gyro Failure (Note 1)	Bit			
10	DR Speed Failure (Note 2)	Bit			
11	Data Checksum				

Note 1: The gyro failure word is a bit map with the following items (summary bit is set when any other bit is set):

Bit	Failure
0	Summary
1	Large Turn Rate Error
2	Long Period of High Turn Rate
3-15	Reserved

Note 2: The DR speed failure word is a bit map with the following items (summary bit is set when any other bit is set):

Bit	Failure
0	Summary
1	DR speed = 0 when GPS speed > 1
2	DR speed is > 0 when GPS speed = 0
3	Large Speed Error
4-15	Reserved

Table 5. Message 1070: GPS/DR Calibration Output Message

Message ID:	1070				**(ONLY AVAILABLE IN DR BUILDS)**
Rate:	Variable; defaults to off (intended for query or on-update mode)				
Message Length:	19 words				
Word No.:	**Name:**	**Type:**	**Units:**	**Range:**	**Resolution:**
1-4	Message Header				
5	Header Checksum				
6-7	Set Time	UDI	10 ms ticks	0 to 4294967295	
8	Sequence Number	I		0 to 32767	
9.0	Data Invalid: Gyro Temperature (RESERVED)	Bit		0 = valid	
9.1	Data Invalid: Speed Scale Factor	Bit		0 = valid	
9.2	Data Invalid: Heading Rate Scale Factor	Bit		0 = valid	
9.3	Data Invalid: Heading Rate Bias	Bit		0 = valid	
10	Gyro Temperature (RESERVED)	I	degrees C	–40 to +85	10^{-2}
11	Speed Scale Factor (Note 1)	I		–1 to +16	2^{-11}
12	Speed Scale Factor Standard Deviation	UI		0 to +16	2^{-12}
13	Heading Rate Scale Factor (Note 2)	I		–1 to +16	2^{-11}
14	Heading Rate Scale Factor Standard Deviation	UI		0 to +16	2^{-12}
15	Heading Rate Bias (Note 2)	I	deg/s	–180 to +180	$180^* 2^{-15}$
16	Heading Rate Bias Standard Deviation	UI	deg/s	0 to 180	$180^* 2^{-16}$
17-18	Reserved				
19	Data Checksum				

Note 1: Calibrated speed = measured speed/(1 + scale factor).

Note 2: For scale factor S, bias B, and uncalibrated DR measurements M*, the calibrated measurement M = (M* – B)/(1+S).

Table 6. Message 1092: Hardware Accelerator Status Message

Message ID:	1092			**(ONLY AVAILABLE IN HARDWARE ACCELERATOR BUILDS)**	
Rate:	Variable				
Message Length:	29 words				
Word No.:	**Name:**	**Type:**	**Units:**	**Range:**	**Resolution:**
1-4	Message Header				
5	Header Checksum				
6-7	Set Time	UDI	10 ms ticks	0 to 4294967295	
8	Sequence Number	I		0 to 32767	
9	Hardware Accelerator Mode (Note 1)	I		0 = off 1 = fast acquire 2 = on	
10	EnableLowC/No (Note 2)	I	dB-Hz	1 = 32 (default) 2 = 30	
11-28	Reserved				
29	Data Checksum				

Note 1: The receiver's "off" mode runs as a GPS receiver without any Hardware Accelerator operation. "Fast acquire" mode uses the Hardware Accelerator to acquire signals in the acquisition phase, but uses normal tracking loops for all navigation and reacquisition. The receiver's "on" mode uses the Hardware Accelerator to acquire signals, transitions to tracking loops to obtain the navigation message, then uses the Hardware Accelerator to navigate, shutting down the RF section except when sampling. In the receiver's "on" mode, the receiver periodically returns to tracking loops when required to download new ephemerides or almanacs, or when required to reduce any errors that have built up in the navigation solution. While the receiver's "on" mode is the most power efficient tracking mode, the resulting measurements are typically noisier than tracking loop results due to the absence of carrier smoothing.

Note 2: User-specified tracking limit. The user can set the limit on how low the signal level should be tracked. Tracking low C/No signals requires additional processing and additional power consumption. This setting does not affect fast acquisition, only tracking.

Table 7. Message 1100: Built-In Test Results Message

Message ID:	1100				
Rate:	Variable				
Message Length:	20 words				
Word No.:	**Name:**	**Type:**	**Units:**	**Range:**	**Resolution:**
1-4	Message Header				
5	Header Checksum				
6-7	Set Time	UDI	10 ms ticks	0 to 4294967295	
8	Sequence Number	I		0 to 32767	
9	ROM Failure (Note 1, 2)	UI		(Note 2)	
10	RAM Failure (Note 1, 3)	UI		1 = failure	
11	EEPROM Failure (Note 4)	UI		0 to 2	
12.0	Dual Port RAM Failure (Note 5)	Bit		1 = failure	
12.1	Hardware Accelerator Failure (Note 1, 6)	Bit		1 = failure or not present	
12.2-12.15	Not used (set to 0)				
13	Digital Signal Processor (DSP) Failure (Note 1, 7)	UI		(Note 6)	
14	Real-Time Clock (RTC) Failure (Note 1)	UI			
15	Serial Port 1 Receive Error Count	UI		0 to 65535	
16	Serial Port 2 Receive Error Count	UI		0 to 65535	
17	Serial Port 1 Receive Byte Count	UI		0 to 65535	
18	Serial Port 2 Receive Byte Count	UI		0 to 65535	
19	Software Version	UI		0.00 to 65535	10^{-2}
20	Data Checksum				

Note 1: A value of zero indicates a test has passed. A non-zero value indicates a device failure. Missing devices will be reported as failures. Therefore, the OEM's BIT pass/fail should ignore words for components that are not in the system under test.

Note 2: Each 32 kword ROM segment is tested by checksum. If a segment fails, a bit is set in this word. Bit 0 is set if the first segment fails, bit 1 is set if the second segment fails, etc.

Note 3: RAM is tested using a non-destructive write/read of the value 0xA5A5 5A5A. Any word that fails causes the failure word to be set to 1.

Note 4: EEPROM is tested by reading data blocks and verifying checksums. If EEPROM is not installed, or does not respond, the result is set to 1. If any checksum fails, the result is set to 2.

Note 5: Dual port RAM testing is not implemented. This result will always be reported as passing (0).

Note 6: Added Hardware Accelerator BIT in version 2.59.

Note 7: A total of six tests are performed on each channel. If any channel fails any test, a bit is set in this word. Bit 0 is set for channel 1, bit 1 is set for channel 2, bit 2 is set for channel 3, etc.

Table 8. Message 1136: EEPROM Status Message

Message ID:	1136				
Rate:	Variable				
Message Length:	18 words				
Word No.:	**Name:**	**Type:**	**Units:**	**Range:**	**Resolution:**
1-4	Message Header				
5	Header Checksum				
6-7	Set Time	UDI	10 ms ticks	0 to 4294967295	
8	Sequence Number	I		0 to 32767	
9.0	Device Not Present	Bit		1 = not present	
9.1-9.15	Reserved				
10-11	Almanac Failure (Note 1)	Bit			
12-13	Failure (Note 2)	Bit		(Note 2)	
14-15	Almanac Status (Note 1)	Bit		(Note 1)	
16-17	Status (Note 2)	Bit		(Note 2)	
18	Data Checksum				

Note 1: The Almanac Failure and Almanac Status words are 32-bit bit maps where the LSB = PRN 1 and the MSB = PRN 32.

Note 2: The Failure and Status words are bit maps with values as follows:

0 = Status	16 = DGPS control
1 = Position	17 = Host port protocol selection
2 = UTC/Iono corrections	18 = Auxiliary port protocol selection
3 = Frequency standard cubic parameters	19 = Host port enabled messages
4 = Host port communication configuration	20 = Reserved (auxiliary port enabled messages)
5 = Auxiliary port communication configuration	21 = User datums
6 = Memory options	22 = Frequency/temperature table
7 = Solution validity criteria	23 = Reserved
8 = Power management selections	24 = Frequency standard calibration data
9 = Selected datum	25 = Nav configuration data
10 = Platform class	26 = DR navigation parameters (DR software only)
11 = Cold start control	27 = Gyro temperature table (DR software only)
12 = Elevation mask angle	28 = Reserved
13 = Satellite candidate list	29 = Reserved
14 = Antenna selection	30 = Reserved
15 = User entered altitude	31 = Data is being updated

Table 9. Message 1191: Hardware Accelerator Measurement Output Message (1 of 2)

Message ID:	1191			**(ONLY AVAILABLE IN HARDWARE ACCELERATOR BUILDS)**	
Rate:	Variable				
Message Length:	117 words				
Word No.:	**Name:**	**Type:**	**Units:**	**Range:**	**Resolution:**
1-4	Message Header				
5	Header Checksum				
6-7	Set Time	UDI	10 ms ticks	0 to 4294967295	
8	Sequence Number	I		0 to 32767	
9.0	Doppler Parameters Are Valid	Bit		1 = valid	
9.1	Code Phase and SNR Parameters Are Valid	Bit		1 = valid	
9.2	GPS XO Parameters Are Valid	Bit		1 = valid	
9.3	GPS Reference Time is Valid	Bit		1 = valid	
9.4	Command Execution is Complete	Bit		1 = complete	
9.5	Failed: Hardware Accelerator Not Responding	Bit		1 = failed	
9.6	Abort: Command Did Not Complete Normally	Bit		1 = aborted	
9.7	Continuous Tracking Mode is Valid	Bit		1 = valid	
9.8-9.15	Reserved				
10-11	GPS Reference Time Integer (Note 1)	UDI	seconds	604799	
12-13	GPS Reference Time Fraction (Note 1)	UDI	ns	0 to 999999999	
14-15	Measurement T20 (Note 2)	UDI	seconds	0 to 42949672.95	10^{-2}
16-17	Measurement Offset (Note 3)	UDI	seconds	0 to 1048575	32/(Fo * 137)
18	XO Error (Note 4)	I	ppm	–32768 to +327.67	10^{-2}
19	XO Error Uncertainty (Note 4, 5)	UI	ppm	0 to 655.35	10^{-2}
20	Number of Visable Satellites (Note 6)	I	VisSats	0 to 32	
Channel Data (Note 7)					
21 + n*8	Satellite PRN (Note 8)	I	PRN No.	0 to 12	
22 + n*8	Doppler Estimate (Note 9)	I	Hz	–6553.6 to +6553.5	2×10^{-1}
23 + n*8	Doppler Uncertainty Estimate (Note 5, 9)	UI	Hz	0 to 65535	10^{-1}
24, 25 + n*8	Code Phase (Note 10, 11)	UDI	C/A Chips	0 to 1022.999	10^{-3}
26 + n*8	Code Phase Uncertainty (Note 5, 10, 11)	UI	C/A Chips	0 to 10	10^{-3}
27 + n*8	SNR (Note 11)	UI	ratio	0 to 65535	
28 + n*8	C/No	I	dB-Hz	–3276.8 to +3276.7	10^{-1}
117	Data Checksum				

Table 9. Message 1191: Hardware Accelerator Measurement Output Message (2 of 2)

Note 1:	The GPS time (integer and fractional parts) at the beginning of the Hardware Accelerator data capture interval. This value is only valid if bit 9.3 is set.
Note 2:	The GPS time of the T20 (20 ms internal clock) following the start of the Hardware Accelerator data capture interval.
Note 3:	The offset from the start of the Hardware Accelerator data capture to the next T20 epoch measured with 137*Fo/32 = 44 MHz clock, where Fo is defined as the GPS 10.23 MHz reference frequency.
Note 4:	This value is valid only if bit 9.2 is set.
Note 5:	Uncertainties are single-sided. They should be applied as a ± value.
Note 6:	Limited by measurement buffer size in the Measurement Engine/Navigation Engine interface. This will equal the number of satellites actually detected and measured, up to the limit. Contents of any other buffers are not valid.
Note 7:	n = 0 to 11 for channels 1 to 12.
Note 8:	A value of zero indicates that no satellite is being reported in this block, and that all following words in this block (for this value of n), through C/No, do not contain valid data. The Hardware Accelerator can generate all gold codes from the GPS set including WAAS codes. Future implementations could expand the range of valid values accordingly.
Note 9:	A value of zero for Doppler uncertainty indicates that the uncertainty could not be estimated and should be treated as unknown. This value is valid only if bit 9.0 is set.
Note 10:	A value of zero for code phase uncertainty indicates that the uncertainty could not be estimated and should be treated as unknown. Units for Code Phase and Code Phase Uncertainty are in C/A chips. There are 1023 chips in the complete cycle, which limits the range of these values to 0 to 1022.999. One C/A chip represents 1 cycle of a 1.023 MHz signal, therefore corresponding to a wavelength of 293 m.
Note 11:	This value is valid only if bit 9.1 is set.

Table 10. Message 1292: Hardware Accelerator Control Input Message

Message ID:	1292			**(ONLY AVAILABLE IN HARDWARE ACCELERATOR BUILDS)**	
Rate:	Variable				
Message Length:	27 words				
Word No.:	**Name:**	**Type:**	**Units:**	**Range:**	**Resolution:**
1-4	Message Header				
5	Header Checksum				
6	Sequence Number	I		0 to 32767	
7	Hardware Accelerator Mode (Note 1)	I		0 = off 1 = fast acquisition 2 = on	
8	Enable Low C/No (Note 2)	I	dB-Hz	1 = 32 (default) 2 = 30	
9-26	Reserved				
27	Data Checksum				

Note 1: Hardware Accelerator Mode off means the system does not use the Hardware Accelerator. Fast Acquisition means to use the Hardware Accelerator to find satellites, then transition to tracking loops for all navigation. Hardware Accelerator Mode on uses the Hardware Accelerator for fast acquisition, then uses tracking loops only as required to recover the ephemerides and almanacs from satellite navigation messages, and when needed to reduce position errors. Otherwise, Hardware Accelerator on mode creates satellite measurements using the Hardware Accelerator with significant power savings as a result. The positions computed from the Hardware Accelerator measurements are not smoothed by carrier phase, and are therefore noisier than positions determined from tracking loop measurements.

Note 2: Sets signal level for tracking signals in ON mode. Lower signal levels require additional time and memory. This setting does not affect fast acquisition, only tracking.

Table 11. Message 1303: Restart Command Message

Message ID:	1303				
Rate:	As required - maximum rate approximately 0.2 Hz				
Message Length:	8 words				
Word No.:	**Name:**	**Type:**	**Units:**	**Range:**	**Resolution:**
1-4	Message Header				
5	Header Checksum				
6	Sequence Number	I		0 to 32767	
Invalidation Control (7.0-7.15)					
7.0	Invalidate RAM (Note 1)	Bit		1 = invalidate	
7.1	Invalidate EEPROM (Note 2)	Bit		1 = invalidate	
7.2	Invalidate RTC (Note 3)	Bit		1 = invalidate	
7.3	Reserved				
7.4	Invalidate Ephemerides in RAM (Note 4)	Bit		1 = invalidate	
7.5	Invalidate Frequency Standards in EEPROM (Note 5)	Bit		1 = invalidate	
7.6-7.14	Reserved				
7.15	Force Cold Start (Note 6)	Bit		1 = force	
8	Data Checksum				

Note 1: 1 = invalidate all RAM address space before restart.

Note 2: 1 = invalidate all data in the EEPROM device (if present) before restart.

Note 3: 1 = invalidate all data in the RTC device (if present) before restart.

Note 4: Clear ephemerides in RAM, which forces the receiver to re-collect data from satellites. A restart with only this bit set would generally be considered a warm start, assuming time and position were still valid in the receiver.

Note 5: Only valid if bit 7.1 is also set. Limits EEPROM invalidation to the data areas containing frequency characteristics only (frequency standard cubic parameters, frequency/temperature table, and frequency standard calibration data). This is used during factory test where configuration data should not be altered but crystal characterization needs to be done.

Note 6: 1 = force a cold start reset by clearing RAM and ignoring, but not clearing, the stored position in EEPROM. This provides cold start testing with the valid time. If cold start testing without time is desired, then the invalidate RTC bit (7.2) should also be set.

Table 12. Message 1331: Message Protocol Control Message

Message ID:	1331				
Rate:	As required - maximum rate 1 Hz				
Message Length:	9 words				
Word No.:	**Name:**	**Type:**	**Units:**	**Range:**	**Resolution:**
1-4	Message Header				
5	Header Checksum				
6	Sequence Number	I		0 to 32767	
7	Reserved (Data Stream Select)	I		0 = host 1 = auxiliary	
8	Protocol Type (Note 1)	I		0 = binary 1 = NMEA 2 = RTCM SC-104 3 = OEM	
9	Data Checksum				
Note 1: RTCM SC-104 is not a valid protocol for the host data stream. OEM option only available in special builds. Contact Conexant technical support.					

Table 13. GGA Message: GPS Fix Data Message

Message ID:	GGA (while receiver is in Navigation Mode – Note 1)			
Rate:	Variable; defaults to 1 Hz			
Fields:	14			
Field No.:	**Symbol:**	**Field Description:**	**Field Type:**	**Example:**
	$_ _GGA	Start of sentence and address field		$GPGGA
1	POS_UTC	UTC of Position (hours, minutes, seconds, decimal seconds)	hhmmss.ss	222435
2	LAT	Latitude	llll.ll	3339.7334
3	LAT_REF	Latitude Direction (N = north, S = south)	a	N
4	LON	Longitude	yyyyy.yy	11751.7598
5	LON_REF	Longitude Direction (E = east, W = west)	a	W
6	GPS_QUAL	GPS Quality Indicator (Note 2)	x	2
7	NUM_SATS	Number of Satellites in Use, 00 to 12 (may be different from the number in view)	xx	06
8	HDOP	Horizontal Dilution of Precision (HDOP)	x.x	1.33
9	ALT_MSL	Antenna Altitude Above/Below Mean Sea Level (geoid) (Note 3)	x.x	27.0
10	M	Units of Antenna Altitude (meters)	M	M
11	GEOID_SEP	Geoidal Separation (Note 4)	x.x	-34.4
12	M	Units of Geoidal Separation (meters)	M	M
13	DGPS_AGE	Age of Differential GPS Data (Note 5)	x.x	7
14	STA_ID	Differential Reference Station ID (0000 to 1023) (Note 6)	xxxx	0000
	CKSUM	Checksum	*hh	*41
	<CR><LF>	Sentence terminator		<CR><LF>

Note 1: When the navigation solution is invalid, fields 1 through 5 and 8 through 14 are null. Field 7 also has special meaning (see Note 3).

Note 2: GPS quality indicator:

0 = Fix not available or invalid
1 = GPS fix
2 = Differential GPS fix

Note 3: The geodetic altitude can be computed from the mean sea level altitude by adding the geoidal separation (word 11).

Note 4: Geoidal separation is the difference between the WGS-84 Earth ellipsoid and mean sea level (geoid).

Note 5: Time in seconds since the last SC104 Type 1 or Type 9 update; null field when DGPS is not used.

Note 6: This field is null when DGPS is not used.

Sample Message:

```
$GPGGA,222435,3339.7334,N,11751.7598,W,2,06,1.33,27.0,M,-34.4,M,7,0000*54
```

Table 14. IPRO Message: Conexant Proprietary Protocol Message

Message ID:	IPRO			
Rate:	As required			
Fields:	2			
Field No.:	**Symbol:**	**Field Description:**	**Field Type:**	**Example:**
	$PRWIIPRO	Start of sentence and address field		$PRWIIPRO
1	RES	Reserved		
2	PRO_TYPE	Protocol Type (RBIN = Conexant binary, OEM = OEM-defined))	cccc	RBIN
	CKSUM	Checksum (optional)	*hh	
	<CR><LF>	Sentence terminator		<CR><LF>

Sample Message:

```
$PRWIIPRO,,RBIN
```

Table 15. RID Message: Conexant Proprietary Receiver ID Message

Message ID:	RID			**(MODIFIED IN v2.69 AND LATER)**
Rate:	Variable (see above)			
Fields:	5			
Field No.:	**Symbol:**	**Field Description:**	**Field Type:**	**Example:**
	$_ _ _ _RID	Start of sentence and address field		$PRWIRID
1	NUM_CHN	Number of Channels	xx	12
2	SW_VER	Software Version	x.x	00.90
3	SW_DATE	Software Date	cccccccc	12/25/95
4	OPT_LST	Options List (Note 1)	hhhh	0003
5	OEM_VER	OEM Version Information (Note 2)	hhhh hhhh mm/dd/yyyy	0000 0001 01/31/2000
	CKSUM	Checksum	*hh	*40
	<CR><LF>	Sentence terminator		<CR><LF>

Note 1: The options list is a bit-encoded configuration word represented as a four-digit hexadecimal number:

bit 0 minimize ROM usage
bit 1 minimize RAM usage
bits 2-15 reserved

Note 2: From version 2.69 and up, this field is used to report OEM version and subversion numbers, and OEM software date. Refer to Message 1011, words 49-53, for a complete description of these values, along with information on setting them through the OEM Application Programming Interface (API).

Sample Message:

```
$PRWIRID,12,00.90,12/25/95,0003,0000 0001 01/31/2000*40
```