MOTOROLA

M12 ONCORE

User's Guide Supplement

Digital DNA™ from Motorola

M12 Oncore

User's Guide Supplement

General Characteristics	Receiver Architecture	• 12 parallel channels • L1 1575.42 MHz • C/A code (1.023 MHz chip rate) • Code plus carrier tracking (carrier aided tracking)
	Tracking Capability	• 12 simultaneous satellites
Performance Characteristics	Dynamics	• Velocity: 515 m/s (1000 knots); >515 m/s at altitudes < 18,000 m • Acceleration: 4 g • Jerk: $5\ m/s^3$ • Vibration: 7.7G per Military Standard 810E
	Acquisition Time (Time To First Fix, TTFF)	• <15 s typical TTFF - Hot (current almanac, position, time, ephemeris) • <45 s typical TTFF - Warm (current almanac, position and time) • <70 s typical TTFF - Cold (No stored information) • <1.0 s internal reacquisition
	Positioning Accuracy	• 100 meters 2dRMS with SA as per DoD specification • Less than 25 meters, SEP without SA
	Timing Accuracy (1PPS)	• < 500 ns with SA on
	Datum	• WGS-84 • One user definable datum
Serial Communication	I/O Messages	• Latitude, longitude, height, velocity, heading, time • Motorola binary protocol at 9600 baud • NMEA 0183 at 4800 baud (GGA, GLL, GSA, GSV, RMC, VTG, ZDA) • Software selectable output rate (continuous or poll) • 3 V digital logic interface • Second COM port for RTCM input
	Power Requirements	• 2.8 to 3.2 Vdc; 50 mVp-p ripple (max)
	"Keep-Alive" BATT Power	• External 1.8 Vdc to 3.2 Vdc, 5µA (typical @2.7 Vdc @ +25°C)
	Power Consumption	• <0.225 W @ 3 V without antenna
Electrical Characteristics	Dimensions	• 40.0 x 60.0 x 10.0 mm [1.57 x 2.36 x 0.39 in.]
	Weight	• Receiver 25 g (0.9 oz.)
	Connectors	• Power/Data: 10 pin (2x5) unshrouded male header on 0.050 inch centers (available in right angle or straight configuration) • RF: right angle MMCX female (subminiature snap-on)
	Antenna	• Active micro strip patch Antenna Module • Powered by Receiver Module at selectable 3 or 5 V
	Antenna to Receiver Interconnection	• Single coaxial cable with 6 dB maximum loss at L1 (active antenna) • Antenna Sense Circuit • Antenna gain range 10 - 26 dB
Environmental Characteristics	Operating Temperature	• -40˚C to +85˚C
	Storage Temperature	• -40˚ to 105˚C
	Humidity	• 95% over dry bulb range of +38˚C to+85˚C
	Altitude	• 18,000 m (60,000 ft.) maximum • > 18,000 m (60,000 ft.) for velocities < 515m/s (1000 knots)
Miscellaneous	Standard Features	• Motorola DGPS corrections at 9600 baud on COM port one • RTCM SC-104 input Type 1 and Type 9 messages for DGPS at 2400, 4800 or 9600 baud on COM port two • NMEA 0183 output • Inverse DGPS support
	Optional features	• Lithium battery backup

2. Basic Description

2.1 Receiver architecture

Channels	12 parallel
Frequency	1575.42 MHz
Code	C/A
Tracking	Carrier aided

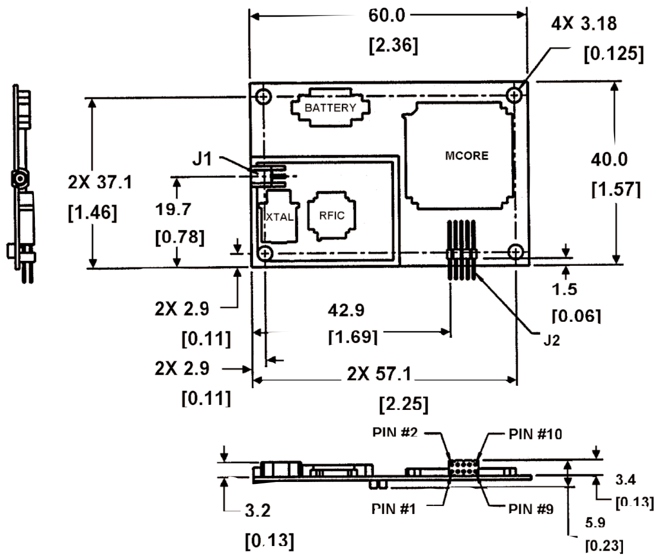
2.2 Description

The highly integrated single board GPS receiver module is optimized specifically for automotive applications. The GPS receiver tracks the NAVSTAR GPS constellation of satellites. The satellite signals received by an active antenna are tracked with 12 parallel channels of L1, C/A code then downconverted to an IF frequency and digitally processed to obtain a full navigation solution of position, velocity, time and heading. The solution is then sent over the serial link via the 10-pin connector.

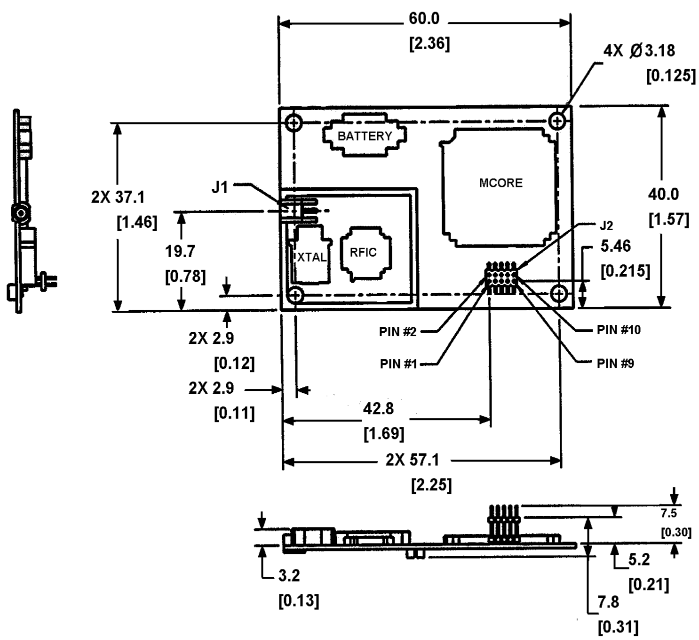
3. Mechanical

3.1 Mechanical Drawings

3.1.1 M12 Oncore with right angle power/data connector



3.1.2 M12 Oncore with straight power/data connector



3.2 Size

Dimensions	40.0 x 60.0 x 10.0 mm

3.3 Weight

< 25 g

3.4 Connectors

Power/Data	Straight: Samtec, FW-05-03-L-D-156-156, 10-pin
	Right Angle: Samtec, ASP62522-01-M, 10-pin
Antenna RF	Sub-miniature MMCX connector type

4. Environmental

4.1 Temperature

Operating	-40°C to +85°C
Storage	-40°C to +105°C

4.2 Relative humidity

Operating	95% over dry bulb range of +38°C to +85°C

4.3 Vibration

0.04 G^2/Hz, 20 Hz to 1000 Hz

7.7 G per Military Standard 810E

5. Electrical

5.1 Pin Outputs

Pin #	Signal	Description
1	TTL TXD1	Transmit 3 V logic
2	TTL RXD1	Receive 3 V logic
3	+3.0 V PWR	+3 V regulated main power
4	1 PPS	One pulse per second signal
5	GROUND	Ground (receiver)
6	BATTERY	Externally applied backup power (1.8 to 3.2 V)
7	Reserved	Not currently used
8	RTCM IN	RTCM input only
9	ANTENNA VOLTAGE	3 V or 5 V antenna input voltage
10	Reserved	Not currently used

5.2 Main power

Voltage	2.8 to 3.2 Vdc regulated
	50 mV maximum peak-to-peak ripple
Power	0.225 W maximum (without antenna)

5.3 Backup power

Voltage	1.8 V to 3.2 V
Current	5 mA typical @ 2.7 V
Retention	Backup power retains date, time, position, satellite data, oscillator learning table and operating mode

5.4 Antenna feed power out of RF connector

Voltage	2.7 V to 3.2 V over current range for 3 V antenna
Current	15 mA to 80 mA
	Flags set in serial data when limits exceeded

5.5 1PPS signal definition

Level	0 V to 3 V
Time mark	Rising edge
Width	200 ms typical

5.6 Serial I/O signal definition

Levels	0 V to 3 V, active low
Baud rate	9600 (Motorola Binary)
	4800 (NMEA)
Parity	None
Data bits	8
Start/stop bits	1

6. RF Characteristics of Receiver

6.1 Dynamic range	27 dB
6.2 Saturation	-110 dBm

7. RF Requirements for Antenna

7.1 General

Frequency	1575.42 MHz (L1)
Bandwidth	± 1.023 MHz
Polarization	Right hand circular
Impedance	50 Ω

7.2	**Gain requirement**	16 dB to 30 dB (at receiver input)
7.3	**Gain Pattern**	+0 dBic minimum at zenith
		-10 dBic minimum at 0° elevation
7.4	**Noise figure**	1.8 dB typical
		2.2 dB maximum
7.5	**VSWR**	1.5:1 typical
		2.5:1 maximum
7.6	**Axial ratio**	3 dB typical at zenith
		6 dB maximum at zenith
7.7	**1 dB compression point**	-14 dBm typical (at antenna output)
7.8	**3 dB frequency bandwidth**	45 MHz maximum
7.9	**25 dB frequency rejection**	± 95 MHz
7.10	**Ground plane**	15 x 15 cm recommended

7.11 Power

Voltage	2.8 V to 3.2 V, or 4.75 V to 5.25 V
	3.0 V typical, or 5.0 V typical
Current	15 mA typical
	25 mA maximum

7.12 Temperature

Operating	-40°C to +85°C
Storage	-40°C to +100°C

8. Performance

8.1 Accuracy

Position	25 m SEP without SA 100 m 2DRMS (95%) with SA 1 to 5 m typical in differential mode
Altitude	156 m RMS (95%)
Velocity	0.02 m/s without SA
Time pulse	UTC ± 500 ns with SA on

8.2 Dynamic limits

Velocity	515 m/s maximum at altitudes > 18000 m
Altitude	-1000 m minimum 18000 m maximum at velocities > 515 m/s
Acceleration	4 G maximum
Jerk	5 m/s^3 maximum

8.3 Startup time (TTFF)

Hot (date, time, position, almanac, ephemeris)	15 s
Warm (date, time, position, almanac, olt)	45 s
Cold (no stored information)	70 s

8.4 Reacquisition time

After 60 s obstruction	3.5 s
Internal	< 1.0 s

8.5 RFI

Jamming resistance	Resistant to narrow band CW jamming at the receiver input of +20dBm at less than 1525 MHz and greater than 1625 MHz for loss of lock with a signal input of –130 dBm
Burnout protection	Protected from damage by RF signals at frequencies100 MHz or more from L1 with received power up to 1 W at the antenna

8.6 EMI

Radiated	Complies with Class B, Part 15 of FCC rules
Conducted	Complies with European CE requirements Tested to IEC 801-4 spec for fast transients at 500 V, 5/50 ns, 5 kHz

9. Features

9.1 Differential operation

Motorola binary corrections on TTL RXD1 (pin 2) at 9600 baud

RTCM SC-104 Type 1 and Type 9 corrections on TTL RXD2 (pin 8) at 2400 or 9600 baud

9.2 NMEA 0183 output

NMEA 0183	Output on TTL TX1 at 4800 baud
Messages supported	GGA, GLL, GSA, GSV, RMC, VTG, ZDA

9.3 User definable datum

One user definable datum may be defined using the @@Ap command. The default datum is WGS-84.

9.4 Antenna sense circuit

The M12 Oncore receiver is capable of detecting the presence of an antenna. The receiver utilizes an antenna sense circuit, which can detect under current (open) and over current (shorted or exceeding maximum limit) conditions. The status of the antenna circuit is reported in the Position/Status/Data Message (@@Ha), the Short Position Message (@@Hb) and the Self-Test Message (@@Ia).

The antenna sense circuit is useful for verifying that the antenna is properly connected to the receiver and is drawing the proper amount of current. The antenna sense status should be checked after installation and monitored regularly.

Undercurrent indication	< 8 mA
Overcurrent indication	> 80 mA

9.5 Real time clock

The real-time clock (RTC) is a standard feature on the M12 Oncore. It is used to minimize the time to first fix (TTFF). The date and time will be retained in the RTC if battery backup power is applied when main power is off.

The user has two options regarding time initialization:

1) Set the date and time **BEFORE** the receiver acquires any satellites

2) Let the receiver automatically set the date and time **AFTER** acquiring the first satellite

Note: The date and time cannot be manually set while the receiver is tracking satellites.

Without battery backup, the receiver will start-up with a default time of 12:00:00. To obtain a faster time to first fix, the time, date and GMT offset should be initialized if both the main power and battery backup power have been disconnected.

10. Serial I/O Messages

10.1 Solution

Update rate	1 Hz maximum (Selectable 1/s – 1/255s)
Latency	< 1 s
Reported	Position, velocity, time, satellite status, receiver status, antenna status
Reference	WGS-84 or user defined datum

10.2 Resolution

Latitude/longitude	1 milliarcsecond
Height	0.01 m
Velocity	0.01 m/s
Heading	0.1°
Time	1 ns

10.3 Solution quality indicators

Receiver status	3D, 2D, propagation, acquisition
Geometry	HDOP when in 2D mode
	PDOP when in 3D mode
Satellite status	C/No (dB)
	Flag indicating satellite tracking status
	Flag indicating satellite is used in solution

10.4 Initialization

Startup mode	Acquisition based on information available
Battery backup provided	No initialization required
No battery backup	Receiver will be in default condition, entering date, time, position and almanac will speed up acquisition process
Default condition	No serial messages active unless there is a power-on self-test failure

10.5 RTCM Commands

The M12 Oncore accepts RTCM SC-104 Type 1 and Type 9 messages. The messages are input on the second communications port (pin 8) at a user selectable baud rate of 2400, 4800 or 9600. The RTCM messages are buffered and processed independently from the primary communications port.

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10.6 Motorola binary I/O command list

Motorola binary commands can be used to initialize, configure, control and monitor the GPS receiver. The Motorola binary commands are supported on the primary communications port at 9600 baud. The commands supported by the M12 Oncore are listed in the table below, and detailed command descriptions are provided in alphabetical order by binary command on subsequent pages.

Function	Description	Binary Command	Controller Command	Supplement Page #
Satellite	Set Mask Angle	@@Ag	mask	14
Receiver	Satellite Ignore List	@@Am	ignore	16
Setup	Select Datum	@@Ao	datum	18
Setup	Set User Datum	@@Ap	udatum	20
Setup	Atmospheric Correction Mode	@@Aq	ion	22
1PPS	Position-Hold Position	@@As	php	24
Setup	Altitude-Hold Height	@@Au	ahp	26
Time	Time Mode	@@Aw	utc	28
1PPS	1PPS Cable Delay	@@Az	ppsdelay	30
Position	Position Lock Parameters	@@AM	lockp	32
Setup	Velocity Filter	@@AN	filter	34
Setup	RTCM Port Mode	@@AO	p2baud	36
Position	Position Filter Select	@@AQ	pfilter	38
Position	Position Lock Select	@@AS	locke	40
Satellite	Visible Satellite Status	@@Bb	vis	42
Almanac	Almanac Status	@@Bd	alm	44
Almanac	Almanac Data Output	@@Be	almout	46
Ephemeris	Ephemeris Data Input	@@Bf	ephin	48
Almanac	Almanac Data Input	@@Cb	almin	50
Time	UTC Offset Status	@@Bo	utcoff	52
Receiver	UTC/Ionospheric Data Output	@@Bp	utcion	54
DGPS	Pseudorange Correction Input	@@Ce	n/a	56
Receiver	Set-to-Defaults	@@Cf	default	58
NMEA	Switch to NMEA	@@Ci	ioformat	60
Receiver	Receiver ID	@@Cj	id	62
Receiver	UTC/Ionospheric Data Input	@@Co	n/a	64
Position	ASCII Position Message	@@Eq	as8	66
Position	Combined Position	@@Ga	compo	68
Time	Combined Time	@@Gb	comtim	70
1PPS	1PPS Control	@@Gc	ppscon	72
Position	Position Control	@@Gd	holdcon	74
Time	Leap Second Status	@@Gj	leap12	76
Setup	ID Tag	@@Gk	vin	78
Position	Position/Status/Data Message (12Ch)	@@Ha	ps12	80
Position	Short Position Message (12Ch)	@@Hb	psd	86
Setup	Self-Test Message (12Ch)	@@Ia	selftest12	90
Receiver	System Power-On Failure	@@Sz	n/a	92
NMEA	NMEA Messages	n/a	n/a	94-109

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SATELLITE MASK ANGLE

The GPS receiver will attempt to track satellites for which the elevation angle is greater than the satellite mask angle. This parameter allows the user to control the elevation angle that was used for this decision.

Range:	0 to 89 degrees
Default value:	0 degrees

Input Command

SATELLITE MASK ANGLE

Motorola Binary Format

- Poll current mask angle:

@@AgxC<CR><LF>

x	1 out of range byte	$ff
C	checksum	

Message length: 8 bytes

- Change current mask angle:

@@AgdC<CR><LF>

d	degrees	0 .. 89
C	checksum	

Message length: 8 bytes

Response Message

- To either command:

@@AgdC<CR><LF>

d	degrees	0 .. 89
C	checksum	

Message length: 8 bytes

SATELLITE IGNORE LIST

It is useful to have the flexibility to delete particular satellite identification numbers (SVIDs) from the selection process. The GPS receiver includes, in its list of satellites to track, all satellites that are healthy and in the almanac. The user can elect to ignore particular satellites in the almanac by issuing an Ignore Satellite Command. In addition, the user can restore any previously ignored satellite IDs by issuing an Include Satellite Command. This command also affects the satellite Alert-Planning settings. Satellites that have been removed by this command are not included in the produced Alert-Planning output. The user may notice a delay between issuing this command and the actual removal or inclusion of particular satellites.

Default value: All satellite SVIDs included.

Input Command

SATELLITE IGNORE LIST
Motorola Binary Format

- Send Current Satellite Ignore List:

@@AmxxxxxC<CR><LF>

xxxxx	5 bytes	all hex 00
C	checksum	

Message Length: 12 bytes

- Change Satellite Ignore List:

@@AmkssssC<CR><LF>

k	00 fixed binary constant
ssss	32 bit binary field. Each bit represents one SVID. (msb = SVID 32, lsb = SVID 1) 1 = Ignore 0 = Include
C	checksum

Message Length: 12 bytes

Response Message

- To either command:

@@AmkssssC<CR><LF>

k	00 fixed binary constant
ssss	32 bit binary field. Each bit represents one SVID. (msb = SVID 32, lsb = SVID 1) 1 = Ignore 0 = Include
C	checksum

Message Length: 12 bytes

SELECT DATUM

The GPS receiver has one predefined datum in its internal memory and one user definable datum. The datums are referenced by an ID number. The predefined datum is number 49 and the user defined datum is number 50. The user instructs the GPS receiver which datum to use by sending the Select Datum command. The command contains the ID number of the desired datum and the GPS receiver returns the response message which gives the user the ability to validate that the input command was accepted. The user can instruct the GPS receiver to use the user defined datum by sending the Select Datum command set to 50.

Default datum: WGS-84 (ID code 49)

Input Command

SELECT DATUM

Motorola Binary Format

- Poll current datum ID code:

@@AoxC<CR><LF>

x	1 out of range byte	$ff
C	checksum	

Message length: 8 bytes

- Change current datum ID code:

@@AodC<CR><LF>

d	datum ID	49 or 50
C	checksum	

Message length: 8 bytes

Response Message

- To either command:

@@ApdsssffiiffffxxyyzzC<CR><LF>

d		datum ID	49 or 50
sssff		semi-major axis (m)	
	sss	integer part	6,000,000 .. 7,000,000
	ff	fractional part	0 .. 999 (0.0 .. 0.999)
iiffff		inverse flattening	
	ii	integer part	285 .. 305
	ffff	fractional part	0 .. 999,999,999 (0.0 .. 0.999999999)
xx		delta X (0.1 m)	-32,768 .. 32,767 (-3276.8 .. 3276.7)
yy		delta Y (0.1 m)	-32,768 .. 32,767 (-3276.8 .. 3276.7)
zz		delta Z (0.1 m)	-32,768 .. 32,767 (-3276.8 .. 3276.7)
C		checksum	

Message length: 25 bytes

SET USER DATUM

The GPS receiver has one user defined datum stored as ID number 50. The **User Datum** command allows the user to define the constants used for a custom datum. A datum is defined by a semi-major axis, an inverse flattening constant, and an offset from the center of mass of the earth given as delta-X, delta-Y, and delta-Z parameters.

Default values: WGS-84 parameters

Input Command

SET USER DATUM

Motorola Binary Format

- Poll current user defined datum parameters:

@@ApdxxxxxxxxxxxxxxxxxC<CR><LF>

d	desired user datum	50
xxxxxxxxxxxxxxxxx	17 bytes	all hex 00
C	checksum	

Message length: 25 bytes

- Change current user defined datum parameters:

@@ApdsssffiiffffxxyyzzC<CR><LF>

d	datum ID	50
sssff	semi-major axis (m)	
sss	integer part	6,000,000 .. 7,000,000
ff	fractional part	0 .. 999 (0.0 .. 0.999)
iiffff	inverse flattening	
ii	integer part	285 .. 305
ffff	fractional part	0 .. 999,999,999 (0.0 .. 0.999999999)
xx	delta X (0.1 m)	-32,768 .. 32,767 (-3276.8 .. 3276.7)
yy	delta Y (0.1 m)	-32,768 .. 32,767 (-3276.8 .. 3276.7)
zz	delta Z (0.1 m)	-32,768 .. 32,767 (-3276.8 .. 3276.7)
C	checksum	

Message length: 25 bytes

Response Message

- To either command:

@@ApdsssffiiffffxxyyzzC<CR><LF>

d	datum ID	50
sssff		semi-major axis (m)
sss	integer part	6,000,000 .. 7,000,000
ff	fractional part	0 .. 999 (0.0 .. 0.999)
iiffff	inverse flattening	
ii	integer part	285 .. 305
ffff	fractional part	0 .. 999,999,999 (0.0 .. 0.999999999)
xx	delta X (0.1 m)	-32,768 .. 32,767 (-3276.8 .. 3276.7)
yy	delta Y (0.1 m)	-32,768 .. 32,767 (-3276.8 .. 3276.7)
zz	delta Z (0.1 m)	-32,768 .. 32,767 (-3276.8 .. 3276.7)
C	checksum	

Message length: 25 bytes

ATMOSPHERIC CORRECTION MODE

The user has the flexibility of turning the GPS ionospheric and/or tropospheric correction models on or off. The models do a reasonable job of taking out the range error induced by the earth's ionosphere and troposphere by using algorithms and parameters transmitted to the users by the satellites. For some applications, such as differential systems, the atmospheric models should be disabled since the differential corrections include the atmospheric errors.

Default modes: Ionospheric model enabled
Tropospheric model disabled

Input Command

ATMOSPHERIC CORRECTION MODE

Motorola Binary Format

- Poll current Atmospheric Correction Mode:

@@AqxC<CR><LF>

x	1 out of range byte	$ff
C	checksum	

Message length: 8 bytes

- Change current Atmospheric Correction Mode:

@@AqsC<CR><LF>

s	selection	0 = both models disabled
		1 = ionospheric model only enabled
		2 = tropospheric model only enabled
		3 = both models enabled
C	checksum	

Message length: 8 bytes

Response Message

- To either command:

@@AqsC<CR><LF>

s	selection	0 = both models disabled
		1 = ionospheric model only enabled
		2 = tropospheric model only enabled
		3 = both models enabled
C	checksum	

Message length: 8 bytes

POSITION-HOLD POSITION

The user can specify receiver coordinates for timing applications to increase the timing accuracy. This command is used to enter the position to be held. Note that this command will only be executed if the Position Control (@@Gd) position hold is disabled.

The position to be held is specified in the same units and referenced to the same datum (WGS 84) as the initial position coordinates of latitude, longitude and height (to the same resolution). The height parameter is referenced to the GPS reference ellipsoid. Note that all three parameters must be specified. The valid ranges of each parameter are the same as those specified in the Combined Position Message (@@Ga).

Default values: Latitude = 0° (Equator)
Longitude = 0° (Grenwich Meridian)
Height = 0 m (GPS Height)

Input Command

POSITION-HOLD POSITION

Motorola Binary Format

- Poll current Position-Hold Position:

@@AsxxxxxxxxxxxxxC<CR><LF>

xxxxxxxxxxxx	13 out of range bytes	$7fffffff7fffffff7ffffffff
C	checksum	

Message length: 20 bytes

- Change current Position-Hold Position:

@@AsllllooooohhhhtC<CR><LF>

llll	latitude in mas	-324,000,000 .. 324,000,000 (-90° .. 90°)
oooo	longitude in mas	-648,000,000 .. 648,000,000 (-180° .. 180°)
hhhh	height in cm	-100000 .. 1,800,000 (-1,000.00 .. 18,000.00 m)
t	height type	0 = GPS height
C	checksum	

Message length: 20 bytes

Response Message

- To either command:

@@AsllllooooohhhhtC<CR><LF>

llll	latitude in mas	-324,000,000 .. 324,000,000 (-90° .. 90°)
oooo	longitude in mas	-648,000,000 .. 648,000,000 (-180° ..180°)
hhhh	height in cm	-100,000 .. 1,800,000 (-1,000.00 .. 18,000.00 m)
t	height type	0 = GPS height
C	checksum	

Message length: 20 bytes

NOTE: Position-Hold Position is enabled and disabled using the Position Control command (@@Gd).

ALTITUDE-HOLD HEIGHT

The user can specify the receiver height for manual altitude-hold applications. Use the Position Control (@@Gd) command to enable or disable the altitude-hold feature. The Altitude-Hold Height is specified in units of meters to a resolution of 0.01 meters. The height is referenced to the GPS reference ellipsoid. The datum for the height is the one selected using the Select Datum command.

Default value: 0 m

Input Command

ALTITUDE-HOLD HEIGHT

Motorola Binary Format

- Poll current Altitude-Hold Height:

@@AuxxxxxC<CR><LF>

xxxx	5 out of range bytes	$7ffffffff
C	checksum	

Message length: 12 bytes

- Change current Altitude-Hold Height:

@@AuhhhhtC<CR><LF>

hhhh	height in cm	-100,000 .. 1,800,000 (-1000.00 to + 18,000.00 m)
t	height type	0 = GPS height
C	checksum	

Message length: 12 bytes

Response Message

- To either command:

@@AuhhhhtC<CR><LF>

hhhh	height in cm	-100,000 .. 1,800,000 (-1000.00 to + 18,000.00 m)
t	height type	0 = GPS height
C	checksum	

Message length: 12 bytes

Note: Altitude-Hold Height is enable and disabled using the Position Control command (@@Gd).

TIME MODE

This command selects the type of time (either GPS or UTC) to be output in the Position/Status/Data and Short Position Messages. The Time Mode command will be used to determine the synchronization point for the 1PPS timing pulse.

Note that if the receiver does not have the UTC parameters portion of the almanac, UTC will be output as being equal to GPS time and a flag denoting the lack of UTC parameters will be set in the Position/Status/Data message (@@Ha).

The receiver will have the UTC parameters once an almanac has been downloaded from the satellites.

Default mode: UTC

Input Command

TIME MODE

Motorola Binary Format

- Poll current Time Mode:

@@AwxC<CR><LF>

x	1 out of range byte	$ff
C	checksum	

Message length: 8 bytes

- Change current Time Mode:

@@AwmC<CR><LF>

m	mode	0 = GPS
		1 = UTC
C	checksum	

Message length: 8 bytes

Response Message

- To either command:

@@AwmC<CR><LF>

m	mode	0 = GPS
		1 = UTC
C	checksum	

Message length: 8 bytes

1PPS CABLE DELAY

The GPS receiver outputs a 1PPS signal, the rising edge of which is placed at the top of the GPS or UTC one second time mark epoch as specified by the Time Mode. The 1PPS Cable Delay command allows the user to offset the 1PPS time mark in one nanosecond increments relative to the measurement epoch.

This parameter instructs the GPS receiver to output the 1PPS output pulse earlier in time to compensate for antenna cable delay. Up to one millisecond of equivalent cable delay can be removed. Zero cable delay is set for a zero-length antenna cable. The user should consult a cable data book for the delay per foot for the particular antenna cable used in order to compute the total cable delay needed for a particular installation.

This parameter also allows the user to adjust the position of the 1PPS to compensate for other system delays.

Range:	0.000 to 0.000999999 s
Default value:	0.000 s
Resolution:	1 ns

Input Command

1PPS CABLE DELAY

Motorola Binary Format

• Poll current 1PPS Cable Delay:

@@AzxxxxC<CR><LF>

xxxx	4 out of range bytes	$ffffffff
C	checksum	

Message length: 11 bytes

• Change current 1PPS Cable Delay:

@@AzttttC<CR><LF>

tttt	time offset in ns	0 .. 999,999 ns (0.0 to 0.000999999 s)
C	checksum	

Message length: 11 bytes

Response Message

• To either command:

@@AzttttC<CR><LF>

tttt	time offset in ns	0 .. 999,999 ns (0.0 to 0.000999999 s)
C	checksum	

Message length: 11 bytes

POSITION LOCK PARAMETERS

This message allows the user to enter a threshold speed (default 0.5 m/sec) and a threshold distance (default 100 meters). The position will be locked if the current speed and distance traveled are both less than their respective thresholds. The parameters will be remembered through power cycles if battery back-up is provided.

Default values: Speed threshold = 0.5 m/s
Distance threshold = 100 m

Input Command

POSITION LOCK PARAMETERS

Motorola Binary Format

- Poll Current Position Lock Paramater:

@@AMxxxxC<CR><LF>

xxxx	4 out of range bytes	$ffffffff
C	checksum	

Message Length: 11 bytes

- Change Current Position Lock Paramaters:

@@AMifddC<CR><LF>

i	integer part of Speed threshold	0…255 m/s
f	fractional part of speed threshold	0…99 cm/s
d	distance threshold	0…65535 m
C	checksum	

Message Length: 11 bytes

Response Message

- To either command:

@@AMifddC<CR><LF>

i	integer part of speed threshold	0…255 m/s
f	fractional part of speed threshold	0…99 cm/s
d	distance threshold	0…65535 m
C	checksum	

Message Length: 11 bytes

VELOCITY FILTER

The Velocity Filter command controls the velocity filtering feature. The velocity filter is useful in marine applications to filter out some of the wave motion in the reported velocity.

The filter is a single order alpha filter, where alpha is the value entered by the user ranging from 10 to 100 in increments of one. Alpha is then used in the filtered velocity solution representing 10% to 100% of the last calculated velocity, the remainder of which uses the previously reported velocity. If a value of 10 is entered for alpha, the maximum filtering will be done. An alpha value this low must be used with caution; the reported velocity will have extreme latency. An alpha value of 100 will result in no filtering, which is the default alpha value.

Default value: 100

Input Command

VELOCITY FILTER

Motorola Binary Format

• Poll current Velocity Filter parameter:

@@ANxC<CR><LF>

x	1 out of range byte	$ff
C	checksum	

Message length: 8 bytes

• Change current Velocity Filter parameter:

@@ANfC<CR><LF>

f	filter parameter	10 .. 100 (max. filtering to no filtering)
C	checksum	

Message length: 8 bytes

Response Message

• To either command:

@@ANfC<CR><LF>

f	filter parameter	10 .. 100 (max. filtering to no filtering)
C	checksum	

Message length: 8 bytes

RTCM PORT MODE

This command allows the user to select the baud rate of the RTCM serial input port (pin 8). The allowable baud rates are 2400, 4800 and 9600. The baud rate of this secondary port is independent of the status of the primary serial port.

Default mode: 9600 baud

Input Command

RTCM PORT MODE

Motorola Binary Format

- Poll current RTCM Port Mode:

@@AObC<CR><LF>

x	1 out of range byte	$ff
C	checksum	

Message length: 8 bytes

- Change current RTCM Port Mode:

@@AObC<CR><LF>

b	RTCM port baud rate	0 = 9600
		1 = 4800
		2 = 2400
C	checksum	

Message length: 8 bytes

Response Message

- To either command:

@@AObC<CR><LF>

b	RTCM port baud rate	0 = 9600
		1 = 4800
		2 = 2400
C	checksum	

Message length: 8 bytes

POSITION FILTER SELECT

This message enables or disables the position filter. The default value will be filter enabled. The selection will be remembered through power cycles if battery back-up is provided.

Default mode: Enabled

Input Command

POSITION FILTER SELECT

Motorola Binary Format

• Poll current Position Filter Selection:

@@AQxC<CR><LF>

x	1 out of range byte	$ff
C	checksum	

Message Length: 8 bytes

• Change current Position Filter Selection:

@@AQsC<CR><LF>

s	selection	0 = Disabled
		1 = Enabled
C	checksum	

Message Length: 8 bytes

Response Message

• To either command:

@@AQsC<CR><LF>

s	selection	0 = Disabled
		1 = Enabled
C	checksum	

Message Length: 8 bytes

POSITION LOCK SELECT

This message enables or disables the position lock feature. The default value will be disabled. The selection will be remembered through power cycles if battery back-up is provided.

Default mode: Disabled

Input Command

POSITION LOCK SELECT

Motorola Binary Format

- Poll Current Position Lock Selec:

@@ASxC<CR><LF>

x	1 out of range byte	$ff
C	checksum	

Message Length: 8 bytes

- Change Current Position Lock Select:

@@ASeC<CR><LF>

e	selection	0 = Disabled
		1 = Enabled
C	checksum	

Message Length: 8 bytes

Response Message

- To either command:

@@ASeC<CR><LF>

e	selection	0 = Disabled
		1 = Enabled
C	checksum	

Message Length: 8 bytes

VISIBLE SATELLITE STATUS

This command requests the results of the most current satellite alert computation. The response message gives a summary of the satellite visibility status showing the number of visible satellites, the Doppler frequency and the location of the currently visible satellites (up to 12 satellites). The reference position for the most recent satellite alert is the current position coordinates. Note that these coordinates may not compare to the GPS receiver's actual position when initially turned on, since the GPS receiver may have moved a great distance since it was last used.

Default mode: Polled

Input Command

VISIBLE SATELLITE STATUS

Motorola Binary Format

- Poll Visible Satellite Status:

@@BbmC<CR><LF>

m	mode	0 = output response message once (polled)
		1 = output response message when visibility data changes
C	checksum	

Message length: 8 bytes

Response Message

- To above command:

@@Bbniddeaasiddeaasiddeaasiddeaasiddeaasiddeaasid deaasiddeaasiddeaasiddeaasiddeaasiddeaasC<CR><LF>

n	number of visible sats	0 .. 12

For each visible satellite, up to n fields contain the following valid data

i	satellite ID	1 .. 32
dd	Doppler in Hz	-5000 .. 5000
e	elevation in degrees	0 .. 90
aa	azimuth in degrees	0 .. 359
s	satellite health	0 = healthy and not removed
		1 = healthy and removed
		2 = unhealthy and not removed
		3 = unhealthy and removed
C	checksum	

Message length: 92 bytes

ALMANAC STATUS

This command requests almanac status information corresponding to the currently used satellite almanac data stored in RAM. The GPS receiver continually captures a complete new almanac to internal RAM while tracking satellites. If an existing almanac is stored in RAM on power-up, satellite visibility information will be available immediately. If no almanac data is stored in RAM on power-up, the receiver will download a new almanac and then compute satellite visibility information.

Almanac data is stored in memory only while main or battery back-up power is applied.

ALMANAC STATUS

Motorola Binary Format

Input Command

- Request Almanac Status Command:

@@BdmC<CR><LF>

m	mode	0 = Output status once (polled) 1 = Output status when RAM almanac data changes (continuous)
C	checksum	

Message Length: 8 bytes

Response Message

- To above command:

@@BdvwtassssrrrrrrrrC<CR><LF>

RAM Almanac Status

v	almanac valid flag	0 = no almanac in receiver 1 = valid almanac in receiver
w	almanac week number (raw)	0 .. 255 (ICD-GPS-200)
t	time of almanac (raw)	0 .. 147 (ICD-GPS-200)
a	number of available SVs	0 .. 32
ssss	SVs in almanac 32 bit binary field, each bit represents one SVID (msb = SVID 32; lsb = SVID 1)	0 = SV not available 1 = SV included
rrrrrrrr	reserved	
C	checksum	

Message Length: 23 bytes

ALMANAC DATA OUTPUT

This command is used to output the almanac data. The user has the option of requesting the almanac data output one time (polled), or each time the almanac data changes (continuously).

The state of the mode parameter is stored in RAM. If the GPS receiver was continuously outputting the almanac data when turned off, and backup power is applied, then it will begin to output this message continuously again when the main power is reapplied. If backup power is not applied during power down, then the GPS receiver will start up in polled only mode.

Almanac data for the GPS satellites is transmitted in words 3 through 10 of subframe 5 (pages 1 through 25), and words 3 through 10 of subframe 4 (pages 2 through 5, 7 through 10, and 25) of the satellite broadcast data message. Refer to the ICD-GPS-200 for a detailed almanac data description.

The GPS receiver outputs the almanac data through a series of output messages, each of which is identified by the particular subframe and page numbers. The data fields of each individual message correspond to words 3 through 10 of the broadcast data. Each word contains 24 data bits.

The entire almanac data output consists of 34 output response messages corresponding to the 25 pages of subframe 5 and the 9 pages in subframe 4 that contain almanac data (pages 2 through 5, 7 through 10, and 25). The total message output for one output request is 1122 bytes including the @@Be prefix and the checksum, carriage return, and line feed for each output. The output message begins with subframe 5 page 1.

The GPS receiver will output about 750 bytes of message data for each one second output opportunity. If selected, the almanac response message is output until the total number of bytes sent in a one-second epoch exceeds 750. The remainder of the almanac message is sent in the next one-second epoch (up to the 750 byte limit per second) until all of the almanac data is output.

If the user issues this command and the GPS receiver does not contain an almanac, then the GPS receiver returns one response message with the subframe and page bytes equal to zero.

Default mode: Polled

Input Command

ALMANAC DATA OUTPUT

Motorola Binary Format

- Request Almanac Data:

@@BemC<CR><LF>

m	mode	0 = output response message once (polled) 1 = output response message when almanac data changes (continuous)
C	checksum	

Message length: 8 bytes

Response Message

- To above command:

@@Cbspxxx...xxxC<CR><LF>

sp	subframe/page	subframe 5 / pages 1 – 25, or subframe 4 / pages 2 – 5, 7 – 10, 25
xxx....xxx	data words	words 3 - 10, each word is 3 bytes long (format per ICD-GPS-200)
C	checksum	

Message length: 33 bytes

NOTE: If an almanac is present in the GPS receiver, then the receiver outputs all of the almanac pages. Otherwise, it returns one output message with all of the message bytes set to zero.

EPHEMERIS DATA INPUT

This command will cause the receiver to accept satellite ephemeris data input via communications port 1 (pin 2). The receiver keeps the ephemerides decoded from all satellites in RAM, as long as the 3v BATT voltage is applied to the receiver and the ephemerides are still valid (t-toe < 4 hours).

The input format is identical to the format output by the previous Oncore Receivers using the output ephemeris command. This allows the same ephemeris output file to be used by the receiver for an ephemeris input file. The receiver echoes the input ephemeris data format message so the user can validate the ephemeris data with the new user supplied ephemeris upon completion of the receipt of a valid ephemeris.

Input Command

EPHEMERIS DATA INPUT

Motorola Binary Format

- Input one ephemeris data page:

@@Bfixxx...xxxC<CR><LF>

i	SVID	1 .. 37
xxx ... xxx	ephemeris	sf 1 – 3/words 3 – 10 (72 bytes per sat; format per ICD-GPS-200)
C	checksum	

Message length: 80 bytes

Response Message

- To above command:

@@Ccixxx...xxxC<CR><LF>

i	SVID	1 .. 37
xxx ... xxx	ephemeris	sf 1 – 3/words 3 – 10 (72 bytes per sat; format per ICD-GPS-200)
C	checksum	

Message length: 80 bytes

ALMANAC DATA INPUT

This input data command loads an almanac into the receiver's random access memory (RAM) via the serial port. The entire almanac data message consists of 34 unique formatted messages that correspond to the subframe and page number of the almanac data (see GPS-ICD-200 for format description).

It is not necessary to input an almanac at power up. If backup power has been applied, the almanac will be retained in RAM. If the almanac is not available, it will be downloaded from the satellites. This can take anywhere from 15 to 30 minutes if satellites are tracked continuously. Manually loading an almanac will reduce the TTFF.

The GPS receiver echoes the input almanac data subframe and page numbers of messages received so the user can validate that each almanac slice has been accepted. It is not necessary nor is it recommended to wait for an echo before sending the next data page. The Oncore GPS receiver will collect an entire almanac in local storage, then check the almanac for validity. The receiver will update the internal almanac data with the new user-supplied almanac upon completion of the receipt of a valid almanac.

Any single input message that has an invalid subframe (i.e., not 4 or 5) will reset the almanac collection software so that the local collection of almanac data can begin fresh. Subframe 5 page 1 marks the beginning message and resets the collection process. The data for subframe 5 page 1 must appear first in the string of 34 commands that make up the total almanac input data. The order for the remaining data is not important.

At 9600 baud, the user can insert up to about 1K of data per second into the serial port. Consequently, the user should be aware that the 34 total messages (of 33 bytes each) that make up the almanac data will take longer than one second to input into the receiver.

Input Command

ALMANAC DATA INPUT

Motorola Binary Format

- Input one almanac data page:

@@Cbspxxx...xxxC<CR><LF>

sp	subframe/page	subframe 5 / pages 1 – 25, or subframe 4 / pages 2 – 5, 7 – 10, 25
xxx....xxx	data words	words 3 – 10, each word is 3 bytes long (format per ICD-GPS-200)
C	checksum	

Message length: 33 bytes

Response Message

- To above command:

@@ChspC<CR><LF>

sp	subframe/page	subframe 5 / pages 1 – 25, or subframe 4 / pages 2 – 5, 7 – 10, 25
C	checksum	

Message length: 9 bytes

UTC OFFSET STATUS

This message allows the user to request the UTC offset that is currently being used in the time solution. The value reported is the integer number of seconds between UTC and GPS time. If the offset is zero, the receiver does not currently have the portion of the almanac that contains the UTC parameters. The UTC parameters are broadcast by the satellites as part of the almanac, which is repeated every 12.5 minutes.

The message can be set to output either once (polled), or any time the UTC offset has been updated or changed from its previous value.

Default mode: Polled

Input Command

UTC OFFSET STATUS

Motorola Binary Format

• Request UTC Offset Status Message:

@@BomC<CR><LF>

m	mode	0 = output UTC offset once (polled)
		1 = output UTC offset every time it is updated
C	checksum	

Message length: 8 bytes

Response Message

• To above command:

@@BouC<CR><LF>

u	UTC offset in seconds	-128 ..+127
C	checksum	

Message length: 8 bytes

UTC/IONOSPHERIC DATA OUTPUT

This message allows the user to request UTC and ionospheric data decoded from the Navigation Data Message.

Default mode: Polled

Input Command

UTC/IONOSPHERIC DATA OUTPUT

Motorola Binary Format

- Poll Current UTC/Ionosheric Data:

@@BpmC<CR><LF>

m	mode	0 = output response once (polled) 1 = output response when either UTC or ionospheric data changes
C	checksum	

Response Message

- To above command:

@@CoabcdefghAAAAaaaadtwWnDC<CR><LF>

Ionospheric Data (see ICD-GPS-200, Table 20-X for scale factors)

a	α_0	-128…+127 seconds
b	α_1	-128…+127 seconds/semi-circle
c	α_2	-128…+127 seconds/(semi-circle)^2
d	α_3	-128…+127 seconds/(semi-circle)^3
e	β_0	-128…+127 seconds
f	β_1	-128…+127 seconds/semi-circle
g	β_2	-128…+127 seconds/(semi-circle)^2
h	β_3	-128…+127 seconds/(semi-circle)^3

UTC Data (see ICD-GPS-200, Table 20-IX for scale factors)

AAAA	A_0	-2,147,483,648…+2,147,483,647 seconds
aaaa	A_1	-8,388,608…+8,388,607 seconds/second
d	Δt_{LS}	-128…+127 seconds
t	t_{ot}	0…602,112 seconds
w	WN_t	0…255 weeks
W	WN_{LSF}	0…255 weeks
n	DN	1…7 days
D	Δt_{LSF}	-128…+127 seconds
C	checksum	

Message Length: 29 bytes

PSEUDORANGE CORRECTION INPUT

Enabling this option allows the GPS receiver to accept pseudorange correction messages from a differential master site receiver. The input message is structured to accept pseudorange and pseudorange-rate corrections for up to six satellites. The slave receiver uses the corrections in the input message by associating the satellite ID with the corresponding satellite (channel) that the slave is tracking. The user can specify up to 12 satellite corrections through the use of two back-to-back input commands. Back-to-back commands must be input with no time delay in between.

Input Command

PSEUDORANGE CORRECTION INPUT

Motorola Binary Format

- Input pseudorange corrections (for up to six satellites):

@@CetttippprrdippprrdippprrdippprrdippprrdippprrdC<CR><LF>

ttt	GPS time ref	0 .. 6047999 (0.0 .. 604799.9)
i	SVID	0..37
		0 = not used
		1-37 = SVID
ppp	pseudorange corr	-1,048,576 ..+1,048,576
	0.01 meter resolution	(-10485.76 ..+10485.76)
rr	pseudorange-rate corr	-4096 .. 4096
	0.001 m/s resolution	(-4.096 .. 4.096)
d	issue of data ephemeris	0 .. 255
C	checksum	

Message length: 52 bytes

Response Message

- To above command:

@@CkC<CR><LF>

C checksum

Message length: 7 bytes

SET-TO-DEFAULTS

This command sets all of the GPS receiver parameters to their default values. Execution of this command results in all continuous messages being reset to polled only output and clears the almanac and ephemeris data. The time and date stored in the internal real-time clock will be reset to their default values.

Input Command

SET-TO-DEFAULTS

Motorola Binary Format

- Set the Oncore GPS receiver to default values:

@@CfC<CR><LF>

C checksum

Message length: 7 bytes

Response Message

- To above command:

@@CfC<CR><LF>

C checksum

Message length: 7 bytes

SWITCH TO NMEA

This command switches the serial data format on the primary port from Motorola binary to NMEA 0183. The baud rate of the port is switched from 9600 to 4800 and input commands are recognized in NMEA format only. Note that the default mode of all of the NMEA output messages is off. To initiate NMEA output, the input commands must be utilized.

Input Command

SWITCH TO NMEA

Motorola Binary Format

• Switch to NMEA format:

@@CimC<CR><LF>

m	format	1 = NMEA
C	checksum	

Message length: 8 bytes

Response Message

- There is no response message to this input command.

NOTE: The Motorola DOS controller software does not support NMEA messages.

RECEIVER ID

The GPS receiver outputs an ID message upon request. The information contained in the ID string is self-explanatory. The model number can be used to determine the type of receiver installed.

Input Command

RECEIVER ID

Motorola Binary Format

- Poll Receiver ID string:

@@CjC<CR><LF>

C checksum

Message length: 7 bytes

Response Message

To above command:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
@	@	C	j	(cr)	(lf)	C	O	P	Y	R	I	G	H	T		1	9	9	1	-	1	9	9	x	1
	M	O	T	O	R	O	L	A		I	N	C	.	(cr)	(lf)	S	F	T	W		P	/	N		2
#		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	(cr)	(lf)	S	O	F	T	W	A	3
R	E		V	E	R		#		X	X	X	X	X	X	X	X	X	X	X	(cr)	(lf)	S	O	F	4
T	W	A	R	E		R	E	V		#		X	X	X	X	X	X	X	X	X	X	X	(cr)	(lf)	5
S	O	F	T	W	A	R	E		D	A	T	E			X	X	X	X	X	X	X	X	X	X	6
X	(cr)	(lf)	M	O	D	E	L		#					X	X	X	X	X	X	X	X	X	X	X	7
X	X	X	X	(cr)	(lf)	H	D	W	R		P	/	N		#		X	X	X	X	X	X	X	X	8
X	X	X	X	X	X	X	(cr)	(lf)	S	E	R	I	A	L		#				X	X	X	X	X	9
X	X	X	X	X	X	X	X	X	X	(cr)	(lf)	M	A	N	U	F	A	C	T	U	R		D	A	10
T	E		X	X	X	X	X	X	X	X	X	X	(cr)	(lf)	O	P	T	I	O	N	S		L	I	11
S	T					X	X	X	X	X	X	X	X	X	X	C	(cr)	(lf)							12

UTC/IONOSPHERIC DATA INPUT

As well as being the response to the @@Bp message, this message allows the user to input UTC and ionospheric data into the receiver which is then echoed in the response.

Input Command

UTC/IONOSPHERIC DATA INPUT

Motorola Binary Format

- Change UTC/Ionospheric Data:

@@CoabcdefghAAAAaaaadtwWnDC<CR><LF>

Ionospheric Data (see ICD-GPS-200, Table 20-X for scale factors)

a	α_0	-128…+127 seconds
b	α_1	-128…+127 seconds/semi-circle
c	α_2	-128…+127 seconds/(semi-circle)^2
d	α_3	-128…+127 seconds/(semi-circle)^3
e	β_0	-128…+127 seconds
f	β_1	-128…+127 seconds/semi-circle
g	β_2	-128…+127 seconds/(semi-circle)^2
h	β_3	-128…+127 seconds/(semi-circle)^3

UTC Data (see ICD-GPS-200, Table 20-IX for scale factors)

AAAA	A_0	-2,147,483,648…+2,147,483,647 seconds
aaaa	A_1	-8,388,608…+8,388,607 seconds/second
d	Δt_{LS}	-128…+127 seconds
t	t_{ot}	0…602,112 seconds
w	WN_t	0…255 weeks
W	WN_{LSF}	0…255 weeks
n	DN	1…7 days
D	Δt_{LSF}	-128…+127 seconds
C	checksum	

Message Length: 29 bytes

Response Message

- To above command:

@@CoabcdefghAAAAaaaadtwWnDC<CR><LF>

Ionospheric Data (see ICD-GPS-200, Table 20-X for scale factors)

a	α_0	-128…+127 seconds
b	α_1	-128…+127 seconds/semi-circle
c	α_2	-128…+127 seconds/(semi-circle)^2
d	α_3	-128…+127 seconds/(semi-circle)^3
e	β_0	-128…+127 seconds
f	β_1	-128…+127 seconds/semi-circle
g	β_2	-128…+127 seconds/(semi-circle)^2
h	β_3	-128…+127 seconds/(semi-circle)^3

UTC Data (see ICD-GPS-200, Table 20-IX for scale factors)

AAAA	A_0	-2,147,483,648…+2,147,483,647 seconds
aaaa	A_1	-8,388,608…+8,388,607 seconds/second
d	Δt_{LS}	-128…+127 seconds
t	t_{ot}	0…602,112 seconds
w	WN_t	0…255 weeks
W	WN_{LSF}	0…255 weeks
n	DN	1…7 days
D	Δt_{LSF}	-128…+127 seconds
C	checksum	

Message Length: 29 bytes

ASCII POSITION MESSAGE

The ASCII position output message contains position, time and receiver status information. The ASCII message may be a more convenient interface for certain applications. The units and style of the data is similar to NMEA output.

Default mode: Polled

Input Command

ASCII POSITION MESSAGE

Motorola Binary Format

- Request ASCII Position Message:

@@EqmC<CR><LF>

m	mode	0 = output response message once (polled) 1..255 = response message output at indicated rate (continuous) 1 = once per second 2 = once every two seconds 255 = once every 255 seconds
C	checksum	
	Message length: 8 bytes	

Response Message

- To above command:

@@Eq,mm,dd,yy,hh,mm,ss,dd,mm.mmmm,n,ddd,mm.mmmm,w, shhhhh.h,sss.s,hhh.h,m,t,dd.d,nn,rrrr,aa,CCC<CR><LF>

Date		
mm	month	01 .. 12
dd	day	01 .. 31
yy	year	99 .. 19
UTC Time		
hh	hours	00 .. 23
mm	minutes	00 .. 59
ss	seconds	00 .. 60
Latitude		
dd	degrees	00 .. 90
mm.mmmm	minutes	00 .. 59.9999
n	direction	N = North, S = South
Longitude		
ddd	degrees	000 .. 180
mm.mmmm	minutes	00 .. 59.9999
w	direction	W = West, E = East
Height		
s	sign of height	+/-
hhhhh.h	height in meters	-1000.0 .. 18,000.0
Velocity		
sss.s	speed in knots	000.0 .. 999.9
hhh.h	heading in degrees	000.0 .. 359.9
Receiver status		
m	fix mode	0 = autonomous 1 = differential
t	fix type	0 = no fix 1 = 2D fix 2 = 3D fix 3 = propagate mode
dd.d	dilution of precision (DOP)	00.0...99.9 HDOP if 2D, PDOP if 3D
nn	number of satellites in use	00...37
rrrr	reference station ID	0000..1023
aa	age of differential data in s	00..60
CCC	checksum	000...255

Message length: 96 bytes

COMBINED POSITION

This message allows the user to enter an initial position estimate. The parameters will be remembered through power cycles if battery back-up is provided.

Default Values: Latitude = 0^0

Longitude = 0^0

Height = 0m (GPS Height)

Default mode: Polled

Input Command

COMBINED POSITION

Motorola Binary Format

- Poll Combined Position Message:

@@GaxxxxxxxxxxxxxC<CR><LF>

xxxxxxxxxxxxx	13 out of range bytes	$ffffffffffffffffffffffffffffffffff
C	checksum	

Message Length: 20 bytes

- Change current Position values:

@@GaaaaaoooohhhhtC<CR><LF>

aaaa	latitude in mas	-324,000,000 ..+324,000,000 (-90° to + 90°)
oooo	longitude in mas	-648,000,000 ..+648,000,000 (-180° to + 180°)
hhhh	height	-100,000 .. 1,800,000 cm (-1000 to 18000 m)
t	height type	0 = GPS, 1 = MSL
C	checksum	

Message Length: 20 bytes

Response Message

- To either input command:

@@GaaaaaoooohhhhtC<CR><LF>

aaaa	latitude in mas	324,000,000 .. +324,000,000 milliarcseconds (-90° to + 90°)
oooo	longitude in mas	-648,000,000 ..+648,000,000 milliarcseconds (-180° to + 180°)
hhhh	GPS height in cm	-100,000 .. 1,800,000 cm (-1000 to 18000 m)
t	height type	0 = GPS, 1 = MSL
C	checksum	

Message Length: 20 bytes

COMBINED TIME

This message allows the user to enter an initial time estimate. The parameters will be remembered through power cycles if battery back-up is provided.

Default Values: 12:00:00 1/1/99
GMT offset = 0:00

Input Command

COMBINED TIME

Motorola Binary Format

- Poll Current Time Parameters:

@@GbxxxxxxxxxxC<CR><LF>

xxxxxxxxxx	10 out of range bytes	$ffffffffffffffffffff

Message Length: 17 bytes

- Change current Time Parameters:

@@GbmdyyhmsshmC<CR><LF>

Date

m	month	1…12
d	day	1…31
yy	year	1982…2100

Time

h	hours	0…23
m	minutes	0…59
s	seconds	0…59
s	signed byte of GMT offset	00 = positive, ff = negative
h	hour of GMT offset	0…+23
m	minutes of GMT offset	0…59
C	checksum	

Message Length: 17 bytes

Response Message

- To above command:

@@GbmdyyhmsshmC<CR><LF>

Date

m	month	1…12
d	day	1…31
yy	year	1982…2100

Time

h	hours	0…23
m	minutes	0…59
s	seconds	0…59
s	signed byte of GMT offset	00 = positive, ff = negative
h	hour of GMT offset	0…+23
m	minutes of GMT offset	0…59
C	checksum	

Message Length: 17 bytes

1PPS CONTROL

This message allows the user to choose how the 1PPS output in the receiver will behave. The selection will be remembered through power cycles if battery back-up is provided.

Default mode: Continuous

Input Command

1PPS CONTROL

Motorola Binary Format

- Poll Current 1PPS Setting:

@@GcxC<CR><LF>

x	1 out of range byte	$ff
C	checksum	

Message Length: 8 bytes

- Change Current 1PPS Setting:

@@GcpC<CR><LF>

p	1PPS control	0 = 1PPS disabled 1 = 1PPS on continuously 2 = pulse active only when tracking at least one satellite
C	checksum	

Message Length: 8 bytes

Response Message

- To either input command:

@@GcpC<CR><LF>

p	1PPS control	0 = 1PPS disabled 1 = 1PPS on continuously 2 = pulse active only when tracking at least one satellite
C	checksum	

Message Length: 8 bytes

POSITION CONTROL

This message allows the user to choose in which positioning mode the receiver will operate. The selection will be remembered through power cycles if battery back-up is provided.

Default mode: Disabled

Input Command

POSITION CONTROL

Motorola Binary Format

- Poll Current Position Control Setting:

@@GdxC<CR><LF>

x	1 out of range byte	$ff
C	checksum	

Message Length: 8 bytes

- Change Current Position Control Setting:

@@GdcC<CR><LF>

c	control type	0 = no hold or normal positioning
		1 = enable position hold
		2 = enable altitude hold
C	checksum	

Message Length: 8 bytes

Response Message

- To either input command:

@@GdcC<CR><LF>

c	control type	0 = no hold or normal positioning
		1 = enable position hold
		2 = enable altitude hold
C	checksum	

Message Length: 8 bytes

LEAP SECOND STATUS

This command polls the receiver for leap second status infomation decoded from the Navigation Data message. The output response provides specific date and time information pertaining to any future leap second addition or subtraction. Present and future leap second values are also output rounded to the nearest integer value. This command has only a polled response, thus it must be requested each time leap second information is desired.

Leap seconds are occasionally inserted in UTC and generally occur on midnight UTC June 30 or midnight UTC December 31. The GPS control segment typically notifies GPS users of pending leap second insertions to UTC several weeks before the event.

When a leap second is inserted, the time of day will show a value of 60 in the seconds field. When a leap second is removed, the date will roll over at 58 seconds.

Input Command

LEAP SECOND STATUS

Motorola Binary Format

- Poll Current Leap Second Pending States:

@@GjC<CR><LF>

C	checksum

Message Length: 7 bytes

Response Message

- To above comand:

@@GjpfyymdiffffhmsC<CR><LF>

p	present leap second value	
f	future leap second value	
yy	year of the future leap second application	
m	month of the future leap second application	
d	day of the future leap second application	
i	integer part of current UTC offset (seconds)	
ffff	fraction part of current UTC offset (nanoseconds)	
h	hour of the leap second application	0...23
m	minute of the leap second application	0...59
s	second of the leap second application	0...60
C	checksum	

Message Length: 21 bytes

ID TAG

This message sets or defaults the ID tag. The ID tag shall be remembered through power cycles if battery back-up is provided.

If all six ASCII characters or ID tag are pluses (+), the ID tag will be the receiver serial number read out of the manufacturing data block. If all six are spaces, the ID tag will remain unchanged. Any other combination of ASCII characters (from 0x20 to 0x7e) will be construed as a new ID tag. Any out of range character will also cause the ID tag to remain unchanged.

The ID tag is also output in the 12-channel Position/Status/Data Message (@@Ha). status message.

Default value: Receiver Serial Number

Input Command

ID TAG

Motorola Binary Format

- Poll current ID tag:

@@GkvvvvvvC<CR><LF>

vvvvvv	ASCII ID tag	6 ASCII space characters (0x20)
C	checksum	

Message Length: 13 bytes

Change current ID Tag:

@@GkvvvvvvC<CR><LF>

vvvvvv	ASCII ID tag	++++++ (0x2B) = receiver serial number
		6 characters 0x20 to 0x7e
C	checksum	

Message Length: 13 bytes

Response Message

- To above Command:

GkvvvvvvC<CR><LF>

vvvvvv	ASCII ID tag	6 characters 0x20 to 0x7e
C	checksum	

Message Length: 13 bytes

POSITION/STATUS/DATA MESSAGE (12 CHANNEL)

This message provides position and channel related data to the user at a specified update rate. The output rate will be remembered through a power cycle if battery back-up is provided.

Default mode: Polled

Input Command

POSITION/STATUS/DATA MESSAGE (12 CHANNEL)

Motorola Binary Format

- Request Position/Status/Data 12 Channel Output:

@@HarC<CR<LF>

r	Output Rate	0 = output response msg once (polled)
		1...255 = response msg output at indicated rate (continuous)
		1 = Once per second
		2 = Once every 2 seconds
		255 = Once every 255 seconds
C	checksum	

Message Length: 8 bytes

Response Message

- To above command:

@@Hamdyyhmsffffaaaaoooohhhhmmmmaaaaoooohhhhmmmm VVvvhhddntimsidd (repeat imsidd for remaining 11 channels) ssrrccooooTTushmvvvvvvC<CR><LF>

Date

m	month	1…12
d	day	1…31
yy	year	1980…2079

Time

h	hours	0…23
m	minutes	0…59
s	seconds	0…60
ffff	fractional seconds	0…999999999 nanoseconds

Position (Filtered or Unfiltered Following Filter Select)

aaaa	latitude in mas	-324000000…324000000 (-90^0 to + 90^0)
oooo	longitude in mas	-648000000…648000000 (-180^0 to + 180^0)
hhhh	GPS height in cm	-100000…+1800000 (-1000 to +18000m)
mmmm	MSL height in cm	-100000…+1800000 (-1000 to +18000m)

Position (Always Unfiltered)

aaaa	latitude in mas	-324000000…324000000 (-90^0 to + 90^0)
oooo	longitude in mas	-648000000…648000000 (-180^0 to + 180^0)
hhhh	GPS height in cm	-100000…+1800000 (-1000 to +18000m)
mmmm	MSL height in cm	-100000…+1800000 (-1000 to +18000m)

Speed/Heading

VV	3D speed in cm/s	0…51400 (0.0 to 514 m/s)
vv	2D speed in cm/s	0…51400 (0.0 to 514 m/s)
hh	2D heading	0…3599 tenths of degrees (0.0 to 359.9^0)

Response Message (Continued)

POSITION/STATUS/DATA MESSAGE (12 CHANNEL)

Motorola Binary Format

Geometry

dd	current DOP(0.1 res)	0…999 (0.0 to 99.9 DOP)
	(PDOP for 3D fix, HDOP for 2D fix, 0 No Fix)	

Satellite Data

n	number of visible satellites	0…12
t	number of tracked satellites	0…12

Channel Data

i	SVID	0…37
m	mode	0…8
s	signal strength	0…255
i	IODE	0…255
dd	channel status (16 bits)	
(msb)	Bit 15:	Reserved
	Bit 14:	Reserved
	Bit 13:	Reserved
	Bit 12:	Reserved
	Bit 11:	Used For Time
	Bit 10:	Differential Corrections Available
	Bit 9:	Invalid Data
	Bit 8:	Parity Error
	Bit 7:	Used For Position Fix
	Bit 6:	Satellite Momentum Alert Flag
	Bit 5:	Satellite Anti-Spoof Flag Set
	Bit 4:	Satellite Reported Unhealthy
	Bits 3-0:	Satellite Accuracy as follows
		(per para 20.3.3.3.1.3 ICD-GPS-200)

0000	(0)	0.00	<URA<=2.40
0001	(1)	2.40	<URA<=3.40
0010	(2)	3.40	<URA<=4.85
0011	(3)	4.85	<URA<=6.85
0100	(4)	6.85	<URA<=9.65
0101	(5)	9.65	<URA<=13.65
0110	(6)	13.65	<URA<=24.00
0111	(7)	24.00	<URA<=48.00
1000	(8)	48.00	<URA<=96.00
1001	(9)	96.00	<URA<=192.00
1010	(10)	192.00	<URA<= 384.00
1011	(11)	384.00	<URA<=768.00
1100	(12)	768.00	<URA<=1536.00
1101	(13)	1536.00	<URA<=3072.00
1110	(14)	3072.00	<URA<=6144.00
1111	(15)	6144.00	<URA*

*No accuracy prediction is available – unauthorized users are advised to use the SV at their own risk)

POSITION/STATUS/DATA MESSAGE (12 CHANNEL)

Motorola Binary Format

ss	receiver status		
(msb)	Bit 15-13:	111 = 3D Fix	
		110 = 2D Fix	
		101 = Propagate Mode	
		100 = Position Hold	
		011 = Acquiring Satellites	
		010 = Bad Geometry	
		001 = Reserved	
		000 = Reserved	
	Bit 12-10:	Reserved	
	Bit 9:	Fast Acquisition Position	
	Bit 8:	Filter Reset To Raw GPS Solution	
	Bit 7:	Cold Start (no almanac, almanac out of date or have almanac but time or position unknown)	
	Bit 6:	Differential Fix	
	Bit 5:	Position Lock	
	Bit 4:	Autosurvey Mode	
	Bit 3:	Insufficient Visible Satellites	
	Bit 2-1:	Antenna Sense	00 = OK
			01 = OC
			10 = UC
			11 = NV
	Bit 0:	Code Location	0 = EXTERNAL
			1 = INTERNAL
rr	Reserved		

Oscillator and Clock Parameters

cc	clock bias	-32768…32767 ns
oooo	oscillator offset	0…250000 Hz
TT	temperature	-110…250 half-degrees C (-55.0…+125.0^{0}C)

Response Message (Continued)

POSITION/STATUS/DATA (12 CHANNEL)

Motorola Binary Format

UTC Parameters

u	Bit 7:	UTC mode	1 = enabled 0 = disabled
	Bit 6:	UTC offset	1 = decoded 0 = NOT decoded
	Bits 5 – 0:	Present UTC offset value, range –32…+31; from GPS time* (ignore if Bit 6 = 0).	

GMT Offset

s	signed byte of GMT offset	00 = positive, ff = negative
h	hour of GMT offset	0…+23
m	minute of GMT offset	0…59
vvvvvv	ID tag	6 characters (0x20 to 0x7e)
C	checksum	Message Length: 154 bytes

* Represents UTC time offset from GPS time. Offset is rounded to the nearest integer value

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SHORT POSITION MESSAGE (12 CHANNEL)

This is a shortened position message provided to the user at a specified update rate. The selected rate will be remembered through a power cycle if battery back-up is provided.

Default mode: Polled

Input Command

SHORT POSITION/ MESSAGE (12 CHANNEL)

Motorola Binary Format

- Request Short Position Data Message:

@@HbrC<CR<LF>

r	Output Rate	0 = output response msg once (polled)
		1...255 = response msg output at indicated rate (continuous)
		1 = Once per second
		2 = Once every 2 seconds
		255 = Once every 255 seconds
C	checksum	

Message Length: 8 bytes

Response Message

- To above command:

@@HbmdyyhmsffffaaaaoooohhhhmmmmVVvvhhddntssrrvvv vvvC<CR><LF>

Date		
m	month	1…12
d	day	1…31
yy	year	1980…2079
Time		
h	hours	0…23
m	minutes	0…59
s	seconds	0…60
ffff	fractional seconds	0…999999999 ns
Position (Filtered or Unfiltered Following the Filter Select)		
aaaa	latitude in mas	-324000000…324000000 (-90° to + 90°)
oooo	longitude in mas	-648000000…648000000 (-180° to + 180°)
hhhh	GPS height in cm	-100000…+1800000 (-1000 to +18000m)
mmmm	MLS height in cm	-100000…+1800000 (-1000 to +18000m)
Speed/Heading		
VV	3D speed in cm/s	0…51400 (0.0 to 514 m/s)
vv	2D speed in cm/s	0…51400 (0.0 to 514 m/s)
hh	2D heading	0…3599 tenths of degrees (0.0 to 359.9°)

SHORT POSITION/ MESSAGE (12 CHANNEL)

Motorola Binary Format

Geometry

dd	current DOP (0.1 res)	0…999 (0.0 to 99.9 DOP) (PDOP for 3D fix, HDOP for 2D fix, 0 otherwise)

Satellite Data

n	number of visible satellite	0…12	
t	number of tracked satellite	0…12	
ss	receiver status		
(msb)	Bit 15-13:	111 = 3D Fix	
		110 = 2D Fix	
		101 = Propagate Mode	
		100 = Position Hold	
		011 = Acquiring Satellites	
		010 = Bad Geometry	
		001 = Reserved	
		000 = Reserved	
	Bit 12-10:	Reserved	
	Bit 9:	Fast Acquisition Position	
	Bit 8:	Filter Reset To Raw GPS Solution	
	Bit 7:	Cold Start (no almanac, almanac out of date or have almanac but time or position unknown)	
	Bit 6:	Differential Fix	
	Bit 5:	Position Lock	
	Bit 4:	Autosurvey Mode	
	Bit 3:	Insufficient Visible Satellites	
	Bit 2-1:	Antenna Sense	00 = OK
			01 = OC
			10 = UC
			11 = NV
	Bit 0:	Code Location	0 = EXTERNAL
			1 = INTERNAL
rr	Reserved		
vvvvvv	ID tag	6 characters (0x20 to 0x7e)	
C	checksum		

Message Length: 54 bytes

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SELF-TEST MESSAGE (12 CHANNEL)

The GPS receiver user has the ability to perform an extensive self-test. The tests that are accomplished during the commanded self-test are as follows:

- Antenna connection
- RTC communication and time
- Temperature sensor
- RAM
- FLASH ROM
- Correlator IC

The output of the self-test command is a 24-bit field, where each bit of the field represents Pass/Fail condition for each parameter tested. When the self-test is initiated, the next output message may not be the response. The self-test may take up to ten seconds to execute. Once the self-test is complete, the acquisition process starts all over as if the receiver were first powered on. The date, time, position, almanac and ephemeris information is all retained.

Input Command

SELF-TEST MESSAGE (12 CHANNEL)

Motorola Binary Format

- Request Self-Test:

@@IaC<CR><LF>

C checksum

Message Length: 7bytes

Response Message

- To above command:

@@IasssC<CR><LF>

sss self test results

(msb) Bit 23-22 antenna sense

00 = OK
01 = OC
10 = UC
11 = NV

Bit 21: RTC comm & time
Bit 20: temperature sensor
Bit 19: spare
Bit 18: RAM
Bit 17: ROM
Bit 16: 1 KHz presence
Bit 15: spare
Bit 14: Temperature Sensor Data Checksum
Bit 13: Oscillator Data Checksum
Bit 12: Manufacturing Data Checksum
Bit 11: channel 12 correlation test
Bit 10: channel 11 correlation test
Bit 9: channel 10 correlation test
Bit 8: channel 9 correlation test
Bit 7: channel 8 correlation test
Bit 6: channel 7 correlation test
Bit 5: channel 6 correlation test
Bit 4: channel 5 correlation test
Bit 3: channel 4 correlation test
Bit 2: channel 3 correlation test
Bit 1: channel 2 correlation test
Bit 0: channel 1 correlation test

C checksum

Message Length: 10 bytes

SYSTEM POWER-ON FAILURE

Immediately after power-up, the Oncore's ROM is tested. If this test does not pass, the Oncore firmware will not execute its positioning algorithms. Rather, it will continuously output this message at a 10 second rate. Receipt of this message indicates that the receiver will need to be repaired and/or reprogrammed. This feature keeps the receiver from being utilized when the ROM is, for some reason, compromised and therefore, unreliable. This feature helps to protect the integrity of the application.

Output Command

SYSTEM POWER-ON FAILURE

Motorola Binary Format

@@SzcC<CR><LF>

c	constant equal to 0
C	checksum

Message length: 8 bytes

GPGGA (GPS FIX DATA)

This command enables the GPGGA GPS Fix Data message and determines the rate at which the information is transmitted. The periodic rate field (yyyy) instructs the receiver either to output this message once (polled), or to output this message at the indicated update rate (continuously). Once the receiver is set to continuous output, the continuous flow can be stopped by sending a one-time (polled) output request. The receiver will output the response one final time, and then terminate any further message outputs. The value of the periodic rate is retained through a power cycle only if battery backup power is applied.

If the receiver has just powered up and has yet to compute a position fix (GPS quality indicator field (q) is zero), then the time (hhmmss.ss) and HDOP (y.y) fields will be nulled. If the receiver is not currently computing a position fix sometime after the first fix, (GPS quality indicator field (q) is zero), the time field (hhmmss.ss) will be frozen and the HDOP field (y.y) will be nulled. If the receiver is not using differential GPS (GPS quality indicator field (q) is not two), then the age of differential data (t.t) and differential reference station ID (iiii) fields will be nulled.

NOTE: Height reported in the GPGGA message is GPS height, and the geoidal separation field (g.g) will always be null since the M12 Oncore does not contain this information.

Default mode: Disabled

Input Command

GPGGA (GPS FIX DATA)

NMEA-0183 Format

• Set response message rate:

```
$PMOTG,GGA,yyyyCC<CR><LF>
```

yyyy	update rate	0 .. 9999 seconds
CC	optional checksum	

Response Message

• To above command:

```
$GPGGA,hhmmss.ss,ddmm.mmmm,n,dddmm.mmmm,e,q,ss,
y.y,a.a,z,g.g,z,t.t,iiii*CC<CR><LF>
```

hhmmss.ss	UTC of position fix	
hh	hours	00 .. 24
mm	minutes	00 .. 59
ss.ss	seconds	00.000 .. 59.99
ddmm.mmmm,n	latitude	
dd	degrees	00 .. 90
mm.mmm	minutes	00.000 .. 59.999
n	direction	N = North
		S = South
dddmm.mmmm,e	longitude	
ddd	degrees	000 .. 180
mm.mmm	minutes	00.00 .. 59.9999
e	direction	E = East
		W = West
q	GPS status indicator	0 = GPS not available
		1 = GPS available
		2 = GPS differential fix
ss	number of sats being used	0 .. 12
y.y	HDOP	
a.a,z	antenna height	
a.a	height	
z	units	M = meters
g.g,z	geoidal separation	
g.g	height	
z	units	M = meters
t.t	age of differential data	
iiii	differential reference station ID	0000 . . 1023
CC	checksum	

GPGLL (GEOGRAPHIC POSITION-LATITUDE/LONGITUDE)

This command enables the GPGLL Geographic Position-Latitude/Longitude message and determines the rate at which the information is transmitted. The periodic rate field (yyyy) instructs the receiver either to output this message once (polled), or to output this message at the indicated update rate (continuously). Once the receiver is set to continuous output, the continuous flow can be stopped by sending a one-time (polled) output request. The receiver will output the response one final time, and then terminate any further message outputs. The value of the periodic rate is retained through a power cycle only if battery backup power is applied.

If the receiver has just powered up and has yet to compute a position fix (GPS quality indicator (q) is zero), then the time field (hhmmss.ss) will be nulled. If the receiver is not computing a position fix sometime after the first fix (GPS quality indicator (q) is zero), then the time field (hhmmss.ss) will be frozen.

Default mode: Disabled

Input Command

GPGLL (GEOGRAPHIC POSITION-LATITUDE/LONGITUDE)

NMEA-0183 Format

• Set response message rate:

```
$PMOTG,GLL,yyyyCC<CR><LF>
```

yyyy	update rate	0 .. 9999 seconds
CC	optional checksum	

Response Message

• To above command:

```
$GPGLL,ddmm.mmmm,n,dddmm.mmmm,e,hhmmss.ss,a*CC<CR><LF>
```

ddmm.mmmm,n		latitude	
	dd	degrees	00 .. 90
	mm.mmmm	minutes	00.000 .. 59.9999
	n	direction	N = North
			S = South
dddmm.mmmm,e		longitude	
	ddd	degrees	00 ..180
	mm.mmmm	minutes	00.000 .. 59.9999
	e	direction	E = East
			W = West
hhmmss.ss		UTC of position fix	
	hh	hours	00 ..24
	mm	minutes	00 .. 59
	ss.ss	seconds	00.00 .. 59.99
	a	status	A = valid
			V = invalid
CC	checksum		

GPGSA (GPS DOP AND ACTIVE SATELLITES)

This command enables the GPGSA GPS DOP and Active Satellites message and determines the rate at which the information is transmitted. The periodic rate field (yyyy) instructs the receiver either to output this message once (polled), or to output this message at the indicated update rate (continuously). Once the receiver is set to continuous output, the continuous flow can be stopped by sending a one-time (polled) output request. The receiver will output the response one final time, and then terminate any further message outputs. The value of the periodic rate is retained through a power cycle only if battery backup power is applied.

If the receiver is not computing a position fix (mode field (b) is one), then the xDOP fields (p.p, q.q, r.r) will be nulled. If the receiver is computing a 2-D position fix (mode field (b) is two), then the PDOP field (p.p) and the VDOP field (r.r) will be nulled. Only satellite IDs used in the solution are output; the remaining satellite ID fields will be nulled.

Default mode: Disabled

Input Command

GPGSA (GPS DOP AND ACTIVE SATELLITES)

NMEA-0183 Format

• Set response message rate:

$PMOTG,GSA,yyyyCC<CR><LF>

yyyy	update rate	0 .. 9999 seconds
CC	optional checksum	

Response Message

• To above command:

$GPGSA,a,b,cc,dd,ee,ff,gg,hh,ii,jj,kk,mm,nn,oo,
p.p,q.q,r.r*CC<CR><LF>

a	sat acquisition mode	M = manual (forced to operate in 2D or 3D mode)
		A = automatic (auto switch 2D/3D)
b	positioning mode	1 = fix not available
		2 = 2D
		3 = 3D
cc, dd, ee, ff, gg, hh, ii, jj, kk, mm, nn, oo	SVIDs used in solution (null for unused fields)	
p.p	PDOP	1.0 .. 9.9
q.q	HDOP	1.0 .. 9.9
r.r	VDOP	1.0 .. 9.9
CC	checksum	

GPGSV (GPS SATELLITES IN VIEW)

This command enables the GPGSV GPS Satellites in View message and determines the rate at which the information is transmitted. The periodic rate field (yyyy) instructs the receiver either to output this message once (polled), or to output this message at the indicated update rate (continuously). Once the receiver is set to continuous output, the continuous flow can be stopped by sending a one-time (polled) output request. The receiver will output the response one final time, and then terminate any further message outputs.

If the receiver is not tracking the satellite, the SNR field (ss) will be nulled. Further, an entire group — satellite ID field (ii), elevation field (ee), azimuth field (aaa), and SNR field (ss) — will be nulled if not needed.

NOTE: The SNR field (ss) is the same as the C/No value in the Position/Status/Data Message and the Short Position Message.

Default mode: Disabled

Input Command

GPGSV (GPS SATELLITES IN VIEW)

NMEA-0183 Format

• Set response message rate:

```
$PMOTG,GSV,yyyyCC<CR><LF>
```

yyyy	update rate	0 .. 9999 seconds
CC	optional checksum	

Response Message

• To above command:

```
$GPGSV,t,m,n,ii,ee,aaa,ss,ii,ee,aaa,ss,ii,ee,aaa,
ss,ii,ee,aaa,ss*CC<CR><LF>
```

t		number of messages	1 .. 4
m		message number	1 .. 4
n		total number of satellites in view	
For each visible satellite (four groups per message)			
	ii	satellite PRN number	
	ee	elevation (degrees)	0 .. 90
	aaa	azimuth (degrees True)	0 .. 359
	ss	SNR (dB)	0 .. 99
CC	checksum		

GPRMC
(RECOMMENDED MINIMUM SPECIFIC GPS/TRANSIT DATA)

This command enables the GPRMC Recommended Minimum Specific GPS/Transit Data message and determines the rate at which the information is transmitted. The periodic rate field (yyyy) instructs the receiver either to output this message once (polled), or to output this message at the indicated update rate (continuously). Once the receiver is set to continuous output, the continuous flow can be stopped by sending a one-time (polled) output request. The receiver will output the response one final time, and then terminate any further message outputs. The value of the periodic rate is retained through a power cycle only if battery backup power is applied.

If the receiver has just powered up and has yet to compute a position fix (status field (a) is be invalid), then the time (hhmmss.ss) and date (ddmmyy) fields will be nulled. If the receiver is not computing a position fix sometime after the first fix (status field (a) is invalid), then the time (hhmmss.ss) and date (ddmmyy) fields will be frozen. If the receiver is not computing a position fix (status field (a) is invalid), then the speed over ground (z.z) and track made good (y.y) fields will be nulled.

NOTE: The magnetic variation field (d.d) will always be null since the M12 Oncore does not have this information.

Default mode: Disabled

Input Command

GPRMC
(RECOMMENDED MINIMUM SPECIFIC GPS/TRANSIT DATA)
NMEA-0183 Format

• Set response message rate:

```
$PMOTG,RMC,yyyyCC<CR><LF>
```

yyyy	update rate	0 .. 9999 seconds
CC	optional checksum	

Response Message

• To above command:

```
$GPRMC,hhmmss.ss,a,ddmm.mmmm,n,dddmm.mmmm,w,z.z,
y.y,ddmmyy,d.d,v*CC<CR><LF>
```

hhmmss.ss	UTC of position fix	
hh	hours	00 .. 24
mm	minutes	00 .. 59
ss.ss	seconds	00.00 .. 59.99
a	status	A = valid V = invalid
ddmm.mmmm,n	latitude	
dd	degrees	00 .. 90
mm.mmmm	minutes	00.000 .. 59.9999
n	direction	N = North S = South
dddmm.mmmm,w	longitude	
ddd	degrees	00 .. 180
mm.mmmm	minutes	00.000 .. 59.9999
w	direction	E = East W = West
z.z	speed over ground (knots)	0.0
y.y	track made good (reference to true North)	0.0 .. 359.9
ddmmyy	UTC date of position fix	
dd	day	01 .. 31
mm	month	01 .. 12
yy	year	00 .. 99
d.d	magnetic variation (degrees)	0.0 .. 180.0
v	variation sense	E = East W = West
CC	checksum	

GPVTG (TRACK MADE GOOD AND GROUND SPEED)

This command enables the GPVTG Track Made Good and Ground Speed message and determines the rate at which the information is transmitted. The periodic rate field (yyyy) instructs the receiver either to output this message once (polled), or to output this message at the indicated update rate (continuously). Once the receiver is set to continuous output, the continuous flow can be stopped by sending a one-time (polled) output request. The receiver will output the response one final time, and then terminate any further message outputs.

If the receiver is not computing a position fix, all numeric fields (a.a, c.c, e.e, g.g) will be nulled.

NOTE: The magnetic track (c.c) will always be null since the M12 Oncore does not have this information.

Default mode: Disabled

Input Command

GPVTG (TRACK MADE GOOD AND GROUND SPEED)

NMEA-0183 Format

• Set response message rate:

```
$PMOTG,VTG,yyyyCC<CR><LF>
```

yyyy	update rate	0 .. 9999 seconds
CC	optional checksum	

Response Message

• To above command:

```
$GPVTG,a.a,b,c.c,d,e.e,f,g.g,h*CC<CR><LF>
```

a.a	track	
b	units	T = degrees true
c.c	track	
d	units	M = degrees magnetic
e.e	speed	
f	units	N = knots
g.g	speed	
h	units	K = km/hr
CC	checksum	

GPZDA (TIME AND DATE)

This command enables the GPZDA Time and Date message and determines the rate at which the information is transmitted. The periodic rate field (yyyy) instructs the receiver either to output this message once (polled), or to output this message at the indicated update rate (continuously). Once the receiver is set to continuous output, the continuous flow can be stopped by sending a one-time (polled) output request. The receiver will output the response one final time, and then terminate any further message outputs.

Currently, there is no mechanism to set the local zone description in the NMEA I/O format, and the receiver operates as if the GMT offset is set to 00:00.

Default mode: Disabled

Input Command

GPZDA (TIME AND DATE)

NMEA-0183 Format

• Set response message rate:

`$PMOTG,ZDA,yyyyCC<CR><LF>`

yyyy	update rate	0 .. 9999 seconds
CC	optional checksum	

Response Message

• To above command:

`$GPZDA,hhmmss.ss,dd,mm,yyyy,xx,yy*CC<CR><LF>`

hhmmss.ss	UTC time	
hh	hours	0 .. 23
mm	minutes	0 .. 59
ss.ss	seconds	0 .. 59.99
dd	day	1 .. 31
mm	month	1 .. 12
yyyy	year	
xx	local zone hours	–13 .. 13
yy	local zone minutes	0 .. 59
CC	checksum	

SWITCH TO BINARY

This utility command switches the serial data format on the primary port from NMEA 0183 to Motorola binary. The baud rate of the port is switched from 4800 to 9600 and input commands are recognized in Motorola binary format only.

Input Command

SWITCH TO BINARY

NMEA-0183 Format

• Switch to Binary format:

```
$PMOTG,FOR,xCC<CR><LF>
```

x	format	0 = Motorola binary
CC	optional checksum	

Response Message

• There is no response message to this input command.

NOTE: The Motorola DOS controller software does not support NMEA messages.

11. Receiver/Controller Command Descriptions

11.1 Receiver Command Descriptions

Motorola Receiver Commands may be used to initialize, configure, control and monitor the GPS receiver while using the controller software command line interface. Each mnemonic receiver command is translated to the appropriate Motorola Binary command and sent to the receiver.

Note: Checksums are calculated by the controller software and should not be added to the mnemonic command string.

RECEIVER COMMANDS

Description	Binary Command	Controller Command	Supplement Page #
Satellite Mask Angle	@@Ag	mask	111
Satellite Ignore List	@@Am	ignore	111
Select Datum	@@Ao	datum	111
Set User Datum	@@Ap	udatum	112
Ionospheric/Tropospheric Correction	@@Aq	ion	112
Position – Hold Position	@@As	php	113
Altitude – Hold Height	@@Au	ahp	113
UTC Time Correction Select	@@Aw	utc	113
1PPS Cable Delay	@@Az	ppsdelay	114
Position Lock Parameters	@@AM	lockp	114
Velocity Filter	@@AN	filter	114
RTCM Port Mode	@@AO	p2baud	115
Position Filter Enable	@@AQ	pfilter	115
Position Lock Enable	@@AS	locke	115
Visible Satellite Status	@@Bb	vis	116
Almanac Status	@@Bd	alm	116
Almanac Data Output	@@Be	almout	117
Ephemeris Data Input	@@Bf	ephin	117
UTC Offset Status	@@Bo	utcoff	118
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Almanac Data Input	@@Cb	almin	119
Set-to-Defaults	@@Cf	default	119
Switch to NMEA	@@Ci	ioformat	120
Receiver ID	@@Cj	id	120
ASCII Position Output	@@Eq	as8	121
Combined Position	@@Ga	compo	121
Combined Time	@@Gb	comtim	122
1PPS Control	@@Gc	ppscon	122
Position Control	@@Gd	holdcon	123
Leap Second Status	@@Gj	leap12	123
ID Tag	@@Gk	vin	123
Position/Status/Data Message (12 Channel)	@@Ha	ps12 1 f ps12 1 u ps12 1 a ps12 0	124
Short Position Message (12 Channel)	@@Hb	psd	124
Oscillator Learning Table	@@Hq	olt	125
Self-Test (12 Channel)	@@Ia	selftest12	125

COMMAND DESCRIPTIONS

Satellite Mask Angle
mask

Function	Controls the minimum elevation angle at which the 12 Channel Oncore receiver tracks satellites.
Syntax	mask (dd)
Example	mask 10 <ENTER>
Notes	The elevation angle at which satellite tracking occurs is 0…89 degrees.
See Also	None
Binary Equivalent	@@Ag

Satellite Ignore List
ignore

Function	Deletes particular satellites by ID number from the 12 Channel Oncore receiver selection process.
Syntax	ignore ([SVID#])
Example	ignore 3 5 17 <ENTER>
Notes	Issuing this command the first time ignores the selected satellites. To undo the selection, issue the same command again.
See Also	None
Binary Equivalent	@@Am

Select Datum
datum

Function	This command allows you to select which datum the Oncore receiver uses in performing position and velocity calculations.
Syntax	datum ([id]) id 49 .. 50
Example	datum 49<ENTER>
Notes	The WGS-84 datum is referenced by ID number 49. The user defined datum is referenced by ID number 50.
See Also	Set User Datum (udatum)
Binary Equivalent	@@Ao

Set User Datum
udatum

Function	Defines the user-defined datum stored in datum ID number 50.
Syntax	udatum (id sma if dx dy dz) id 50 sma semi major axis if inverse flattening constant dx delta x dy delta y dz delta z
Example	udatum 50 6378206.4 294.9786982 –7 162 188<ENTER>
Notes	Defines the constants used for a custom datum. These five parameters uniquely define a reference ellipsoid.
See Also	None
Binary Equivalent	@@Ap

Ionospheric/Tropospheric Correction
ion

Function	Switches the GPS ionospheric and/or tropospheric correction models on or off.
Syntax	ion ([0 | 1 | 2 | 3]) 0 = both models disabled 1 = ionospheric model only enabled 2 = tropospheric model only enabled 3 = both models enabled
Example	ion 0<ENTER>
Notes	Default mode = 1 Ionospheric model enabled Tropospheric model disabled
See Also	None
Binary Equivalent	@@Aq

Position-Hold Position **php**

Function	Inputs the coordinates of the position to be held by the Oncore receiver.
Syntax	php (lat lon hgt g) lat (–) dd mm ss.sss lon (–) ddd mm ss.sss hgt (–) mmmmm.mm g GPS height
Example	php 33 27 54.207 -111 54 08.444 350.000 g <ENTER>
Notes	
See Also	Position Control (@@Gd)
Binary Equivalent	@@As

Altitude-Hold Height **ahp**

Function	Sets the height for use with the altitude-hold feature.
Syntax	ahp (hhhhh.hh g) hhhhh.hh –1000.00 to 18,000.00 meters g GPS Height
Example	ahp 350.98 g<ENTER>
Notes	The height is specified in meters to a resolution of 0.01 m. The altitude entered is referenced to the GPS height (height above the reference ellipsoid being used).
See Also	Position Control (@@Gd)
Binary Equivalent	@@Au

Time Mode **utc**

Function	References the time sent as part of the Position/Data/Message to GPS or UTC time.
Syntax	utc ([d | e]) d disable (GPS time) e enable (UTC)
Example	utc e <ENTER>
Notes	The satellite 1PPS output signal is referenced in the Oncore receiver to UTC or GPS time based on this command.
See Also	None
Binary Equivalent	@@Aw

COMMAND DESCRIPTIONS

1PPS Cable Delay
ppsdelay

Function	Instructs the Oncore receiver to output the 1PPS output pulse earlier in time to compensate for antenna cable delay.
Syntax	ppsdealy ([0.0...0.000999999])
Example	ppsdelay 0.000000051<ENTER>
Notes	Delay is in seconds.
See Also	None
Binary Equivalent	@@Az

Position Lock
lockp

Function	Sets a threshold speed (DEFAULT 0.5 m/s) and threshold distance (DEFAULT 100m)
Syntax	lockp (I f d) I — Integer part of speed threshold — 0…255m/s f — fractional part of speed threshold — 0…99cm/s d — distance threshold — 0…65535m
Example	lockp 50 25 300 <ENTER>
Notes	The position will be locked if the current speed and distance traveled are both less than their respective thresholds.
See Also	None
Binary Equivalent	@@AM

Velocity Filter
filter

Function	Used to control the amount of velocity filtering.
Syntax	filter ([f]) f — 10 .. 100
Example	filter 50<ENTER>
Notes	None
See Also	None
Binary Equivalent	@@AN

RTCM Port Mode
p2baud

Function	Sets the baud rate of the RTCM input port.
Syntax	p2baud ([2 | 4 | 9]) 2 = 2400 4 = 4800 9 = 9600
Example	p2baud 4<ENTER>
Notes	RTCM corrections can be input directly on the second comm port of the receiver on pin 5. The baud rate of this port is independent of the status of the primary serial port.
See Also	None
Binary Equivalent	@@AO

Position Filter Enable
pfilter

Function	Enables or disables the position filter
Syntax	pfilter ([0 | 1]) 0 = disabled 1 = enabled
Example	pfilter 0<ENTER>
Notes	None
See Also	None
Binary Equivalent	@@AQ

Position Lock Enable
locke

Function	Enables or disables the position lock feature.
Syntax	locke ([0 | 1]) 0 = disabled 1 = enabled
Example	locke 1<ENTER>
Notes	None
See Also	None
Binary Equivalent	@@AS

COMMAND DESCRIPTIONS

Visible Satellite Status
vis

Function	Outputs satellite information from most recent almanac in RAM.
Syntax	vis ([0 | 1]) 0 = output response message once (polled) 1 = output response message when visibility data changes
Example	vis 1<ENTER>
Notes	Press F1 to view the satellite visibility list.
See Also	None
Binary Equivalent	@@Bb

Almanac Status
alm

Function	Requests the almanac status information corresponding to the currently used satellite almanac data.
Syntax	alm ([0 | 1]) 0 = output status once (polled) 1 = output status when RAM almanac changes (continuous)
Example	alm 1<ENTER>
Notes	Press F3 to view the almanac status.
See Also	None
Binary Equivalent	@@Bd

COMMAND DESCRIPTIONS

Almanac Data Output **almout**

Function	Outputs current almanac data contained within the Oncore receiver.
Syntax	almout ([0 | 1]) *0* = outputs almanac once *1* = outputs almanac upon change
Example	almout 0<ENTER>
Notes	The Oncore receiver outputs the almanac as thirty-four 33-byte messages. Running the command record alm prior to the Almanac Data Output command stores data in Motorola binary format in a file with extension ".alm". Use the run command to input the stored almanac data to a receiver. Press F4 to view the Almanac data screen.
See Also	Input Almanac Data Input (@@Cb) Record GPS Data (record)
Binary Equivalent	@@Be

Ephemeris Data Input **ephin**

Function	Used to input ephemeris data one satellite at a time. The entire ephemeris data set is input by using the run command.
Syntax	ephin svid byte1 byte2..byte73
Example	ephin 3<ENTER>
Notes	Use the run command with a filename with the .eph extension to input the entire latest ephemeris data set in one step.
See Also	None
Binary Equivalent	@@Bf

UTC Offset
utcoff

Function	Outputs the current number of integer seconds between UTC and GPS time.
Syntax	utcoff ([0 | 1]) 0 = outputs message one time only (polled) 1 = outputs message when UTC offset information changes
Example	utcoff 1<ENTER>
Notes	If the response to this message is zero, the UTC information is not present in the receiver.
See Also	None
Binary Equivalent	@@Bo

UTC/Ionospheric Data
utcion

Function	Requests UTC and ionospheric information from the navigation message (subframe 4 page 18).
Syntax	utcion ([0 | 1]) 0 = output response once (polled) 1 = output response when either UTC or ionospheric data changes
Example	utcion 1 <ENTER>
Notes	None
See Also	None
Binary Equivalent	@@Bp

Almanac Data Input

almin

Function	Manually enters an almanac data message into the Oncore receiver.
Syntax	almin (subframe page byte1, byte2..byte 34)
Example	almin..............<ENTER>
Notes	Inputs an almanac to the Oncore receiver. The almanac consists of 34 subframe or page messages. A better method of inputting an almanac is to use the run xxxxxxxx.alm command to output an almanac stored in a receiver file by the Almanac Data Output and Record GPS Data commands.
See Also	Almanac Data Output (@@Be) Record GPS Data (record)
Binary Equivalent	@@Cb

Set-To-Defaults

default

Function	Sets all the Oncore receiver parameters to the factory default values.
Syntax	default
Example	default<ENTER>
Notes	IMPORTANT: Upon executing this command, the current almanac loaded in RAM is automatically deleted. Before using this command, make sure you have made backup copies (on a separate diskette) of your own almanac file and/or the almanac file that was provided with the receiver. The almanac must then be reloaded after using the default command.
See Also	None
Binary Equivalent	@@Cf

Switch to NMEA
ioformat

Function	Switches the primary port to NMEA format with a baud rate of 4800.
Syntax	ioformat ([1]) 1 = NMEA
Example	ioformat 1<ENTER>
Notes	None
See Also	None
Binary Equivalent	@@Ci

Receiver ID
id

Function	Commands the Oncore receiver to output an ID message which contains receiver copyright, version and revision information.
Syntax	id
Example	id<ENTER>
Notes	To view the ID message, turn off (or slow down) all periodic messages.
See Also	None
Binary Equivalent	@@Cj

ASCII Position Output
as8

Function	The ASCII position output message has a comma separated\ format with values and units similar to NMEA messages. This command controls the output of the ASCII Position Message.
Syntax	as8 ([0 .. 255]) 0 = outputs message one time only 1 .. 255 = outputs message at specified update interval (seconds)
Example	as8 1<ENTER>
Notes	This message provides position, velocity, time, and receiver status. The record command can be used to record output files of this format with the .as8 extension by entering record as8. Press Shift-F5 to view the output from this message.
See Also	None
Binary Equivalent	@@Eq

Combined Position
compo

Function	Sets the initial latitude, longitude and height coordinates of the 12 Channel Oncore receiver
Syntax	compo (lat lon hgt g) lat (-)dd mm ss.sss lon (-)ddd mm ss.sss hgt (-)hhhhh.hh g GPS height
Example	compo 33 24 49.417 –111 58 34.824 364.7 g<ENTER>
Notes	If the receiver is computing a 2D or 3D fix, the receiver ignores the changed latitude and longitude and responds with the current latitude and longitude. If the receiver is computing a 3D fix, the receiver ignores the change height and responds with the current height.
See Also	None
Binary Equivalent	@@Ga

Combined Time
comtim

Function	Changes the current date, time and GMT offset of the 12 Channel Oncore receiver. If the date or time is not specified, this command requests that the receiver output the current date and time.
Syntax	comtim (MM DD YY hh mm ss [- | + |] hh mm)

MM	month
DD	day
YY	year
hh	hour
mm	minutes
ss	seconds
hh	hour of GMT offset
mm	minute of GMT offset

Example: comtim 9 29 00 23 23 23 –7 0 <ENTER>

date	9/29/2000
time	23:23:23
GMT Offset	-7:00 hours

Notes	If the receiver has acquired at least one satellite, the receiver ignores the changed time and date and responds with the current time and date. The receiver output time is either GMT or local time, depending on the setting of the GMT offset parameter.
See Also	None
Binary Equivalent	@@Gb

1PPS Control
ppscon

Function: Controls how the 1PPS output in the receiver will behave.

Syntax: ppscon ([0 | 1 | 2])

0	=	1PPS disabled
1	=	1PPS on continuously
2	=	pulse active only when tracking at least one satellite

Example	ppscon 1 <ENTER>
Notes	None
See Also	None
Binary Equivalent	@@Gc

COMMAND DESCRIPTIONS

Position Control
holdcon

Function	Sets the positioning mode for the receiver.
Syntax	holdcon ([0 | 1 | 2 |]) 0 = no hold or normal positioning 1 = enable position hold 2 = enable altitude hold
Example	holdcon 1<ENTER>
Notes	None
See Also	None
Binary Equivalent	@@Gd

Leap Second Pending
leap12

Function	Used to determine if there is a pending leap second correction
Syntax	leap12
Example	leap12 <ENTER>
Notes	This is a polled-only output message. If a correction is pending, the direction of the correction is indicated.
See Also	None
Binary Equivalent	@@Gj

ID Tag
vin

Function	Sets or defaults the ID tag.
Syntax	vin ([++++++]) ++++++ ID tag will be receiver serial number 6 spaces No change Any other combination of 6 ASCII characters (from 0x20 to 0x7e0will be construed as a new ID tag. Any out of range character will cause the ID tag to remain unchanged.
Example	vin ++++++<ENTER>
Notes	None
See Also	Position/Status/Data Message (@@Ha)
Binary Equivalent	@@Gk

COMMAND DESCRIPTIONS

Position/Status/Data Message
ps12

Function	Outputs the Position/Status/Data Message.
Syntax	ps12 ([r f | r u | r a | 0]) r 1-255 seconds – output at indicated rate f filtered position output at indicated rate (following the filter select) u unfiltered position output at indicated rate (following the filter select) a always unfiltered position output at indicated rate 0 polled once
Example	ps12 1 f <ENTER>
Notes	None
See Also	None
Binary Equivalent	@@Ha

Short Position Message
psd

Function	Outputs a shortened position message.
Syntax	psd (rate) rate Output rate 0 = polled once 1…255 = output at indicated rate
Example	psd 1<ENTER>
Notes	None
See Also	None
Binary Equivalent	@@Hb

COMMAND DESCRIPTIONS

Oscillator Learning Table
olt

Function	Requests the output of the oscillator learning table.
Syntax	olt
Example	record olt<ENTER> olt<ENTER> record olt c<ENTER>
Notes	The oscillator learning table will not be displayed on the DOS controller screen. View this message by requesting olt after opening an *.olt file with record olt.
See Also	None
Binary Equivalent	@@Hq

Self-Test Message
selftest12

Function	Causes the receiver to perform a self-test.
Syntax	seltest12
Example	selftest12 <ENTER>
Notes	None
See Also	None
Binary Equivalent	@@Ia

11.2 Controller Command Descriptions

Motorola Controller Commands may be used to configure the controller software while using the command line interface. Controller Commands have no Motorola Binary equivalent.

Description	Binary Command	Controller Command	User Guide Page #
Controller ID	N/A	cid	127
Run Command	N/A	run	127
Set Reference Point	N/A	refpt	127
DOS Shell	N/A	dos	128
Exit to DOS	N/A	quit	128
Record GPS Data	N/A	record	128

Controller ID
cid

Function	Displays the PC controller software copyright and version/revision information.
Syntax	cid
Example	cid<ENTER>
Notes	None

Run Command
run

Function	This command inputs the contents of the specified file instead of accepting input from the keyboard.
Syntax	run [filename]
Example	run testfile.dta<ENTER>

Set Reference Point
refpt

Function	Enters a reference point or a waypoint to be used to calculate north, east, and vertical offsets between the receiver-calculated position and this known reference position.
Syntax	refpt (lat lon hgt g)
Example	refpt 33:27:54.207 –111:54:08.444 350.00 g <ENTER> g indicates GPS height
Notes	None
See Also	None

COMMAND DESCRIPTIONS

DOS Shell
dos

Function	This command temporarily exits the controller to execute a DOS command.
Syntax	dos
Example	dos<ENTER>
Notes	To return to the controller, type: exit<ENTER>
See Also	None

Exit to DOS
quit

Function	Closes all open files, saves the current reference point, closes the program and exits to DOS.
Syntax	quit
Example	quit<ENTER>
Notes	None
See Also	None

Record GPS Data
record

Function	This command controls the opening and closing of files for storing data.
Syntax	record [alm | as8 | bin | evt | p12] (c)
Example	record bin<ENTER> record bin c
Notes	The file is opened by using the record command and files type. The file is closed by repeating the record command and file type followed by a "c" or by invoking the quit command, which closes all open files. All data stored in the files is stored in either comma-separated variable (CSV) format, Motorola binary format, or ASCII text, depending on the file type. The bin option stores all data from the receiver in binary format. This command opens or closes the file; it does not invoke the command requesting the required data.
See Also	None