OPERATING THE MOTOROLA GPS ENGINES IN NMEA-0183 MODE

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BACKGROUND:

National Marine Electronics Association (NMEA) mode is an ASCII serial communication protocol operating at 4800 8N1. It was standardized in 1983 to provide a serial communication between marine electronic devices. Data is grouped in fields and fields are separated by commas. The first field (0) identifies what is Talking and what the Address Data is being sent. The start identifier is $ (hex24) and the sentence ending is <CR><LF> (hex 0D and 0A). The sentence is 80 characters max. Example:

Field # 0 1 2 3 4 5 6 7

$GPGGA,---,---,---,---,----,---,---,<CR><LR>

$ = Start GP = Talker ID GGA = Address Data type ,--- = fields <CR><LF> = ending

Data type format is fixed with the field contents comma delimited in a standard fixed format for each Address Data type.

For the Motorola GPS engines the NMEA Talker Ids are:

GP = This is a marine electronics equipment that provides GPS data.

PMOTG = proprietary Motorola to commands.

and the Address Data being sent are:

*GGA = GPS Fix Data

*GLL = Geographic Position, Latitude/Longitude

GSA = GPS DOP and Active Satellites

GSV = GPS Satellites in View

*RMC = Recommended Minimum Specific GPS/Transit Data

VTG = Track Made Good and Ground Speed (useful in some mapping programs)

ZDA = Time and Date (no mechanism to set local zone; it's set at 00:00)

* Most used sentences

COMMUNICATING WITH THE ONCORE:

The ONCORE GPS engines have three serial communication protocols 1) Motorola Proprietary Binary format (MPB) at 9600 8N1; 2) NMEA-0183 format at 4800 8N1 and 3) LORAN format at 1200 8N1. The factory default setting is MPB format with the engine in Idle Mode (not navigating).

Pin out of the ONCORE is important to review as follows: | 2 4 6 8 10 | ↑ board edge.

| 1 3 5 7 9 |

Where pin 8 = TTL-TXD; pin 9 = TTL-RXD and pin 10 = ground.

To connect to PC you will need to convert TTL to RS232 and use a DB9M with pin 2 to TXD; pin 3 to RXD and pin 5 to ground (DCE port convention). ONCORE interface boards are available from TAPR web site.

The easiest method to communicate with the ONCORE is with the DOS program from Motorola called PC Controller and referencing the ONCORE Users Guide, which are provided with the $1200 development kit system. The ONCORE User's Guide is available for $50. PC Controller gives complete control over the GPS engine in MPB format.

In NMEA format, a very limited set of control functions exist ($PMOTG commands). The PC Controller software only functions in the MPB format and, therefore, is useless for the NMEA format. Generic DOS terminal programs like ProComm can control the ONCORE in both MPB format and NMEA format, this is because of the CHAT mode. The CHAT mode permits data transfer, as a data burst, upon typing (enter). The generic Windows terminal program works for NMEA by uploading an ASCII file, but not for MPB format (which requires binary commands).

Do the following to get from MPB format to NMEA format:

- Use a DOS terminal program like ProComm at 9600 8N1 and select CHAT mode. CHAT permits typed data to be sent in a burst at (enter). The data must be sent in one event and not character by character.

- To get the ONCORE out of the MPB IDLE MODE (default non navigating) use the following MPB format commands:

  In the CHAT box type @@**Cg**(Alt + numeric pad number 1)(Alt + numeric pad number 37)(enter). Looks like **(@@Ci☺%)** This is now FIX MODE

  In the CHAT box type @@**Ea**(Alt + numeric pad number 5)(Alt + numeric pad number 33)(enter). Looks like **(@@Ea♣)** This is now fix data every 5 seconds (1)(37) **(@@Ea☺%)**is every second. Now you see MPB format at 9600 at 5 or 1 second intervals.

- To get the ONCORE into NMEA format use the following MPB format commands:

  In the CHAT box type @@**Ci**(Alt + numeric pad number 1)(Alt + numeric pad number 43)(enter). Looks like **(@@Ci☺+).** If you used the 5 or 1 second update, you will now see no up date, because you are in NMEA, 4800 8N1. Switch ProComm baud rate to 4800 8N1.

- Now you are in NMEA 4800 8N1 format and to see data use the following NMEA format command:

  In the CHAT box type **$PMOTG,GGA,0001(enter)** and you will get the GGA NMEA sentence every second; 0005 for every 5 seconds; 0010 for every 10 seconds and 0 to poll once then stops. The ONCORE's have a non-volatile memory for each format, which means by removing power and reapplying or changing formats, it will operate at the last command sent.

NMEA SENTENCE STRUCTURES FOR MOTOROLA GPS ENGINES:

Presentation here is **PMOTG,xxx** command with **GPxxx** response and GPxxx format Any field where data is not available, that field will be nulled, the commas remain to delimit the fields.

$PMOTG,GGA,yyyy<CR><LF> where yyyy= update rate 0..9999 sec
$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>
HrMinSec(UTCofFix), DegMin.Min,N/SLat,DegMin.Min,E/WLon,Quality (0=non,1=GPS,2=DGPS),#SatsUsed,HDOP,Antenna Height,M(in meters),GeoidalSeparation,M(in meters),Age of DGPS,DGPS-ID*Checksum<CR><LF> If no DGPS the last two fields will be (,,) nulled.

$PMOTG,GLL,yyyy<CR><LF> where yyyy= update rate 0..9999 sec
$GPGLL,ddmm.mmmm,n,dddmm.mmmm,e,hhmmss.ss,a*CC<CR><LF>
DegMin.Min,N/SLat,DegMin.Min,E/WLon,HrMinSec(UTCofFix),Status(A=valid,V=invalid)*

Checksum<CR><LF>

$PMOTG,GSA,yyyy<CR><LF> where yyyy= update rate 0..9999 sec
$GPGSA,a,b,cc,dd,ee,ff,gg,hh,ii,jj,kk,mm,nn,oo,p.p,q.q,r.r*CC<CR><LF>
SatAcquisition(M=manual,A=automatic;2D or 3D),PosMode(1=non,2=2D,3=3D),SatIDs(null for unused),PDOP,HDOP,VDOP*Checksum<CR><LF>

$PMOTG,GSV,yyyy<CR><LF> where yyyy= update rate 0..9999 sec
$GPGSV,t,m,n,ii,ee,aaa,ss,ii,ee,aaa,ss,ii,ee,aaa,ss,ii,ee,aaa,ss*CC<CR><LF>
Total#Msgs(1..3),Msg#(1..3),(Each Visible Sat)SatPRN#,Elevation,Azimuth,SNR,(four groups per message)*Checksum<CR><LF>

$PMOTG,RMC,yyyy<CR><LF> where yyyy= update rate 0..9999 sec
$GPRMC,hhmmss.ss,a,ddmm.mmmm,n,dddmm.mmmm,w,z.z,y.t,ddmmyy,d.d,v*CC<CR><LF>
HrMinSec(UTC),Status(A=valid,V=invalid),DecMin.Min,N/SLat,DecMin.Min,E/WLon,Speed over ground(Knots),Track Made Good(Ref to N),DayMonthYear(UTC of Fix)MagneticVariation, VariationSense(E/W)*Checksum<CR><LF>

$PMOTG,VTG,yyyy<CR><LF> where yyyy= update rate 0..9999 sec
$GPVTG,a.a,b,c.c,d,e.e,f,g.g,h*CC<CR><LF>
TrackDegrees ,T(true),TrackDegrees,M(magnetic),Speed,N(knots),Speed,K(Km/hr)* Checksum<CR><LF>

$PMOTG,ZDA,yyyy<CR><LF> where yyyy= update rate 0..9999 sec
$GPZDA,hhmmss.ss,dd,mm,yyyy,xx,yy*CC<CR><LF>
HrMinSec(UTC),Day,Month,Year,(local zone hours -13..13),(local zone minutes 0..59)* Checksum<CR><LF>

$PMOTG,FOR,x<R><LF>
Change to MPB(x=0), NMEA(x=1) or LORAN(x=2) format

USES FOR NMEA SENTENCES:

NMEA sentences are becoming very popular to the general public and HAM Radio operators. These sentences (GGA,GLL,and RMC) have the Lat/Lon information, time and other useful information for integration into mapping programs. Many of the inexpensive mapping programs from DeLorme, Precision Mapping and many others are now including GPS input for on-map tracking of your mobile position. Some of these will display the VTG sentence in a window. HAM Radio operators have there own mapping program called APRS, which also has GPS input. Several HAM products are now using GPS engines installed , such as TNC's (PacComm) and the MIC-E for transmitting a burst position data at the end of a voice transmission (TAPR) and the Totally Accurate Clock (TAC) which uses a GPS for very accurate time standard (TAPR).

WEB SITES OF INTEREST

WEB sites are always changing and hard to keep up to date, therefore, use your search engines for NMEA and/or GPS and find what interests you. Some WEB sites that should be stable are:

www.nmea.org
www.tapr.org