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M12+ Oncore Timer Specific Messages

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The M12+ GPS receiver is now being offered in a precision timing version. The message structure is quite similar to that detailed in the original M12 User's Guide Supplement, but with the timing version there are three new timing specific messages, two messages have been borrowed from the UT+ and four of the older standard M12 messages have had new options added. New/modified messages are as follows:

- @@Ge T-RAIM Select Message *(new)*
- @@Gf T-RAIM Alarm Message *(new)*
- @@Hn T-RAIM Status Message *(new)*
- @@Gc 1PPS Control Message *(new options)*
- @@Gd Position Control Message *(new options)*
- @@Ha 12 Channel Position/Status *(new data)*
- @@Hb 12 Channel Pos/Status (short) *(new data)*
- @@Ay 1PPS Time Offset *(borrowed from UT+)*
- @@AP 1PPS/100PPS Pulse Mode *(borrowed from UT+)*

NOTE

Throughout this note, I will be referring to the M12**+**Timing receiver, although the data contained here is just as applicable for an older M12 receiver so long as the timing firmware has been loaded into the receiver's flash memory. The change from M12 to M12**+** merely refers to a hardware change and has nothing to do with the receiver's intended end use (positioning or precision timing). An older M12 can be loaded with Timing firmware just as easily as an M12+.

Before I get started detailing the new messages I first want to:

- Review the standard M12/M12+ messages that are used by the M12+ Timer, and
- List the standard positioning M12/M12+ messages that have been deleted from the M12+ Timer firmware.

M12+ Timer Messages In Common With M12+ Positioning Receivers

Binary Command	Description
Ag	Satellite Mask Angle
Am	Satellite Ignore List
Ao	Datum ID Code
Ap	User Defined Datum
Aq	Atmospheric Correction Options
As	Position-Hold Position
Aw	Time Mode
Az	1PPS Cable Delay Correction
Bb	Visible Satellite Data
Bd	Almanac Status
Be	Almanac Data
Bo	UTC Offset
Cb	Almanac Data In
Cf	Receiver Default
Cj	Receiver ID
Eq	ASCII Position Message

Standard M12+ Messages Removed from Timing Version

Binary Command	Description
Au	Altitude Hold Height
AM	Position Lock Parameters
AN	Velocity Filter Parameters
AO	Port 2 (RTCM In) Baud Rate
AS	Position Lock Enable
Bh	Pseudo-Range Correction Output
Ce	Pseudo-Range Correction Input
Ci	I/O Format Select (Binary/NMEA)
Ck	Pseudo-Range Input Ack
Hr	Inverse DGPS Pseudo-Ranges
FOR	NMEA/Binary Switch Command
GGA	NMEA GGA Message
GLL	NMEA GLL Message
GSA	NMEA GSA Message
GSV	NMEA GSV Message
RMC	NMEA RMC Message
VTG	NMEA VTG Message
ZDA	NMEA ZDA Message

With that bit of housekeeping out of the way, let's get on with the new stuff. I am more or less going to follow the standard Motorola User's Guide format in describing these timing specific messages, while also adding some little extra pieces of information that might prove useful to those of you dealing with these for the first time.....

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Message formats for the @@Ay and @@AP messages are contained in v3.2 of the GT+/UT+ User's Guide (TRM0003) and will not be repeated here. The description of the @@Ay message begins on page 6.84 of TRM0003, and @@AP begins on page 6.86.

@@Ge - T-RAIM Select Message *(new message)*

This message allows the user to enable or disable the T-RAIM algorithm. The default value is disabled. If the user changes the T-RAIM selection from the default value this change will be remembered through power cycles only if backup power is supplied to receiver RAM.

INPUT COMMAND

- T-Raim Selection

@@GexC<CR><LF>

where:

x = T-RAIM select
- $00 = disable T-RAIM
- $01 = enable T-RAIM
- $FF = request current state

C = Checksum

Message Length: 8 bytes

Example commands in hex format:

Disable T-RAIM:	***$40 $40 $47 $65 $00 $22 $0D $0A***
Enable T-RAIM:	***$40 $40 $47 $65 $01 $23 $0D $0A***
Request current state:	***$40 $40 $47 $65 $FF $DD $0D $0A***

RESPONSE MESSAGE

@@GetC<CR><LF>

where:

t = T-RAIM status
- $00 = disabled
- $01 = enabled

C = Checksum

Message Length: 8 bytes

@@**Gf - T-RAIM Alarm Limit Message** ***(new message)***

This message allows the user to enter the desired T-RAIM alarm limit in multiples of 100's of nanoseconds or query the receiver for the current setting. Default value of the T-RAIM alarm limit is 1000 ns. If the user changes the alarm limit from the default value this change will be remembered through power cycles only if backup power is supplied to receiver RAM.

INPUT COMMAND

- T-Raim Alarm Limit

@@GfxxC<CR><LF>

where:

xx = T-RAIM alarm limit $03 .. $2710 = 300 .. 1,000,000 ns
$ffff = request current limit

C = Checksum

Message Length: 9 bytes

Example commands in hex format:

Set Alarm to 300 ns: $40 $40 $47 $66 $00 $03 $22 $0D $0A
Set Alarm to 1400 ns: $40 $40 $47 $66 $00 $0E $2F $0D $0A
Request current limit: $40 $40 $47 $66 $FF $FF $21 $0D $0A

RESPONSE MESSAGE

@@GfaaC<CR><LF>

where

xx = T-RAIM alarm limit $03 .. $2710 = 300 .. 1,000,000 ns

C = Checksum

Message Length: 9 bytes

@@**Hn - T-RAIM Status Message** ***(New message)***

This message allows the user to request output of the T-RAIM status message at a specified rate (polled or repeated every 1 ... 255 seconds.) The default output rate is 0 (polled). The rate will be remembered through power cycles only if the receiver's RAM is supplied with back-up power.

Input Command:

- Request T-RAIM Status

@@HnrC<CR><LF>

where:

r = Output Rate	$00 = One response (polled) $01 ... $FF = response at indicated rate(once per second to once per 255 seconds
C = Checksum	

Message length: 8 bytes

Example commands in hex format:

Polled:	***$40 $40 $48 $6E $00 $26 $0D $0A***
Once per second:	***$40 $40 $48 $6E $01 $27 $0D $0A***

Response Message:

- T-RAIM Status

@@Hnpysrvvvveensffffsffffsffffsffffsffffsffffsffffsf
fffsffffsffffsffffsffffC<CR><LF>

where:

p = pulse status	$00 = OFF $01 = ON
y = 1PPS pulse sync	$00 = pulse synced to UTC $01 = pulse synced to GPS

@@Hn Message ***(continued)***

s = T-RAIM solution status	$00 = OK, solution within alarm limits $01 = ALARM, user specified limit exceeded $02 = Status unknown ***Possible causes: alarm threshold set too low, T-RAIM turned OFF, insufficient SVs tracked***
r = T-RAIM status	$00 = detection and isolation possible $01 = detection only possible $02 = neither possible
vvvv = 32 bits to indicate which SV has been removed by T-RAIM	
ee = time solution one sigma accuracy estimate	0 ... 65535 ns ($0000 ... $FFFF) ***(T-RAIM MUST be enabled for this number to be valid)***
n = negative sawtooth time error of next 1PPS pulse	-127 .. +128 ns ($00 ... $FF) (two's complement)
For each of 12 Channels:	
s = satellite ID	0 .. 37 ($00 .. $25)
ffff = Fractional GPS local time of satellite (in ns)	0 .. 999999999 ns ($00 .. $369AC9FF)
C = Checksum	

Message Length: 78 bytes

@@Gc - 1PPS Control Message *(modified from positioning M12+ message)*

This message allows the user to choose how the 1PPS output by the receiver will behave. Default value is 1PPS on continuously. If the operator has changed this value from the default, the change will be remembered through power cycles only if back-up power is applied to the receiver's RAM.

Although used in the normal M12+ positioning receiver, the allowable command options have been modified for use in the M12+ Timing receiver. For the timing receiver, option '03' (1PPS dependent on T-RAIM status) has been added.

INPUT COMMAND

- 1PPS Control

@@GcxC<CR><LF>

where:

c = control mode
- $00 = disable 1PPS
- $01 = enable 1PPS continuously (default)
- $02 = enable 1PPS only when tracking at least one satellite
- $03 = enable 1PPS only when T-RAIM algorithm confirms time solution error is within user defined limits
- $ff = query current 1PPS mode

C = Checksum

Message Length: 8 bytes

Example commands in hex format:

Disable 1PPS entirely:	***$40 $40 $47 $63 $00 $24 $0D $0A***
Enable 1PPS continuously:	***$40 $40 $47 $63 $01 $25 $0D $0A***
Enable Auto-Survey:	***$40 $40 $47 $63 $02 $26 $0D $0A***
Enable Auto-Survey:	***$40 $40 $47 $63 $03 $27 $0D $0A***
Request current 1PPS Mode:	***$40 $40 $47 $63 $FF $DB $0D $0A***

@@Gc - 1PPS Control Message *(continued)*

RESPONSE MESSAGE

@@GcxC<CR><LF>

where:

c = control mode	$00 = 1PPS disabled $01 = 1PPS on continuously $02 = 1PPS on when tracking at least one SV $03 = 1PPS on when T-RAIM conditions are satisfied
C = Checksum	

Message Length: 8 bytes

@@**Gd - Position Control Message** ***(modified from positioning M12+ message)***

This message allows the user to choose which positioning mode the receiver will operate in. Default value is no hold, (normal positioning.) If the operator has changed this value from the default, the change will be remembered through power cycles only if back-up power is applied to the receiver's RAM.

Although used in the normal M12+ positioning receiver, the allowable command options have been modified for use in the M12+ Timing receiver. For the timing receiver option '02' (2D positioning) has been deleted and option '03' (auto-survey) has been added.

INPUT COMMAND

- Position Control

@@GdcC<CR><LF>

where:

c = control mode
- $00 = enable normal positioning
- $01 = enable position-hold
- $03 = enable auto-survey
- $ff = query current positioning mode

C = Checksum

Message Length: 8 bytes

Example commands in hex format:

Enable Normal Positioning:	***$40 $40 $47 $64 $00 $23 $0D $0A***
Enable Position-Hold:	***$40 $40 $47 $64 $01 $22 $0D $0A***
Enable Auto-Survey:	***$40 $40 $47 $64 $03 $20 $0D $0A***
Request current Positioning Mode:	***$40 $40 $47 $64 $FF $DC $0D $0A***

RESPONSE MESSAGE

@@GdcC<CR><LF>

where

c = control mode
- $00 = normal positioning enabled
- $01 = position-hold enabled
- $03 = auto-survey enabled

C = Checksum

Message Length: 8 bytes

@@Ha - POSITION/STATUS/DATA MESSAGE (12 CHANNEL)

Don't get too concerned here. There are no big changes to the @@Ha message that will require current M12/M12+ users to rewrite thousands of lines of code. A couple of the unused data bits in the 16 bit **Channel Status** and **Receiver Status** words have been assigned to designate when individual channels are in Narrow Band search mode, or when the receiver itself is in Narrow Band tracking mode.

Channel Status: There is one 16 bit channel status word in each of the 12 Channel Data data structures. Up till now, bit 12 has been unused, but with the timing firmware this bit will now be a '1' for each channel that is in Narrow Band search mode. This mode improves the ability of the receiver to acquire GPS satellite signals in an electrically noisy environment (such as a cellular base station.)

At this point, this is merely a status indicator. The operator has no direct control over which mode (wide band or narrow band) the channels are in, this being entirely under the control of the receiver's firmware.

Receiver Status: Bit 10 of the 16 bit **Receiver Status** word will report as a '1' whenever the receiver is in Narrow Band tracking Mode. This mode improves the ability of the receiver to maintain signal tracking in an electrically noisy environment (cellular base station.)

Again, merely for status reporting. No direct control by the operator. If bit 10 spends much of its time in the '0' state, it's probably safe to assume that you have antenna system and/or interference problems.

@@Hb - SHORT POSITION/STATUS/DATA MESSAGE (12 CHANNEL)

Same basic change as listed previously for the @@Ha message except that the @@Hb message only contains the **Receiver Status** word.

Receiver Status: Bit 10 of the 16 bit **Receiver Status** word will report as a '1' whenever the receiver is in Narrow Band tracking Mode. This mode improves the ability of the receiver to maintain signal tracking in an electrically noisy environment (cellular base station.)

No direct control by the operator.

As with the status bit in the @@Ha message, this status bit should prove helpful in troubleshooting installations that are proving troublesome (poor tracking, excessive dropouts and flywheeling, etc.) If this status bit spends much of its time in the '0' state, it's probably safe to assume that you have antenna system and/or interference problems.