

Message Protocol Specification



Model	CTM15X/200
Revision	Rev 1.7

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Revision Control

Description	Revision	Initials	Date
Release for review	Rev 1.0	mm	25-Feb-10
Updated errors for valid/invalid data in \$POBD messages. Added table for supported OBD-II/J1939 parameters. Updated network parameters to reflect HSPA networks, Message type 30, \$PCTM, Updated Message type 16, \$GLL to reflect correct valid and invalid flags.	Rev1.1	mm	12-Mar-10
Changed document name added FPANIC message for Man Down alerts	Rev1.2	mm	09-March-11
Added optional message types 04 and 117	Rev1.3	mm	26-May-11
Reorganized document, added new messages 139, 140, 141,\$POBDx messages now support upto 8 parameters, added detail on man down pendant acknowledgement, added \$PEVENT message that contains trigger description, added \$PGRT message that defines geo-route violation.	Rev1.4	mm	29-Nov-11
Updated \$PEVENT message, updated \$POBDx messages to reflect \$POBDA thru \$POBDH	Rev 1.5	mm	06-Dec-11
Updated \$PEVENT message, added message type 142, \$PFUELR	Rev.1.6	mm	23-Dec-11
Added Report Messages 141, 151-154	Rev 1.7	rg	20-Jan-12

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1 Overview

The Chameleon CTM series gateway is used in a variety of applications for mobile fleet tracking. The device uses wireless networks to transmit location information to monitoring servers which in turn can display the location of the mobile asset. The CTM device has its own embedded GPS receiver for acquiring a latitude and longitude position. This position information along with other parameters is grouped into reports by the device. The reports are triggered by events on the device. These trigger events typically are based on a combination of time based and specific trigger parameters. This document defines how CTM devices will be configured to send data to a fleet tracking server using standard ASCII format. The CTM-200 also supports some messages in binary format but this document does not cover binary data transfer.

Trigger Event

The trigger is an event that serves as a stimulus for a report.

Trigger Condition
or Event

Possible Trigger Conditions:

GPS- generate triggers based on time interval, distance travelled, max/min speed, heading change
 GPIO – generate triggers based on time interval, state of inputs 1-6 changing, change in device IP address
 IGNITION – generate triggers based on the ignition (white) wire going on/off or changing state
 OBDII-J1939- generate a trigger based on vehicle parameters available via OBD-II/J1939
 POWER UP REPORT-generate a trigger based on the modem powering up
 VOLTAGE LEVEL- generate a trigger based on the device supply voltage
 ACCELERATION/DECELERATION-generate a trigger based on a calculated acceleration or deceleration limit being exceeded.
 MAN DOWN PENDANT- Trigger a report based on a message received from a connected Man Down Pendant.

3rd Party Hardware Devices (Serial port triggers):
 Salt spreaders (Chlorobyte, Bosch-Rexroth, Epoke)
 Swipe Card readers - supports serial and Wiegand



Documentation/Graphs/Report Structure graph/report_structure_graph_Rev5.vsd

Reports

A report is a configuration of how messages are to be delivered.

Report

Reporting Structure:

8 reports available for GPS trigger conditions.
 8 reports available for I/O trigger conditions
 999 reports available for all other trigger conditions

Report Destination:
 Local – Device Serial port or Ethernet port
 Remote – IP address and port, e-mail, SMS

Report Mechanism:
 ASYNC serial (serial port)
 UDP (remote or Ethernet)
 TCP (remote or Ethernet)
 ULCP(binary) (remote or Ethernet)
 e-mail (remote)
 SMS (remote)

Messages

A message is a predefined string of information typically formatted in an NMEA style sentence for easy translation. Various messages exist for various parameters the modem is capable of monitoring. Message type is not linked to the trigger, for example a GPS condition can trigger a report formatted to deliver an OBD-II message

Message 1

Message 2

Message 3

Message 4

Messages:

Maximum of 4 messages per report:

```

03 Modem ID, proprietary NMEA message-$PMID
04 Asset ID, VIN, driver ID (via RFID) $PAID
16 GPS NMEA GLL message-$GPGLL
20 Digital Input States-$SPIND
21 Analog Input #1 status-$PINA
22 Analog Input #2 status-$PINA
23 Analog Input #3 status-$PINA
24 Analog Input #4 status-$PINA
25 Analog Input #5 status-$PINA
26 Analog Input #6 status-$PINA
30 Network status-$PCTM
31 Wireless link TX/RX data count, proprietary NMEA message-$PDATA
32 Store and forward message status, $PNSF
33 Wi-Fi Network status, $PWIFI
40 device phone number, PAD Port/Type, serial port baud- ID=
80 GPS NMEA GGA message-$GPGGA
82 GPS NMEA RMC message-$GPRMC
84 GPS NMEA GSA message-$GPGSA
85 ULCP binary format GPS data message
88 ULCP binary format acceleration/deceleration event data with GPS
89 ULCP binary format odometer data
90 ULCP binary format Modem ID/firmware revision/odometer data
92 ULCP binary format wireless Link TX/RX Data Count with Modem ID
98 ULCP binary format digital input event data with GPS
100 GPS TAIP PV message
101 GPS TAIP LN message
112 ULCP binary format modem ID with GPS
114 GPS with modem ID (based on RMC)-$GPGS
115 NMEA message for Google Earth application (kmiserver)- $PKML
116 Power status, proprietary NMEA message-$PPWR
117 CDMA/EV-DO Network diagnostic report - $PRFI
118 GPS NMEA GSV message-$GPGSV
119 OBD II Group A - $POBDA
120 OBD II Group B - $POBDB
121 OBD II Group C - $POBDC
122 OBD II Group D - $POBDD
123 OBD II Group E - $POBDE
124 OBD II Group F - $POBDF
125 OBD II Group G - $POBDG
126 OBD II Group H - $POBDH
136 Acceleration/Deceleration with Modem ID, - $PACCEL
137 GPS Calculated Odometer with Modem ID, - $PODO
139 GPS Lateral Acceleration with Modem ID, $PLACCEL
140 Calculated total Fuel consumed $PFUEL
141 Calculated total IDLE time $PIDLE
142 Calculated Fuel rate $PFUELR
*** Geo-Route Messages $PGR
*** Event Messages $PEVENT
  
```

2 Triggers or Events

Trigger events are pre-configured in the CTM device based on customer required parameters. Trigger events are:

Triggers or events	Description	Event Label
GPS	8 available conditions, can be triggered on time, speed (low speed, high speed), distance travelled, heading change.	GPSx
Input Condition	8 available conditions, time based, alarm based on input states of 6 inputs, up to 2 inputs can be compared in each condition. IP change trigger	GPIOx
Ignition	8 available conditions, triggers on ignition going off, on or transition.	IGNx
OBDII or J1939	8 available conditions. Time based, or based on a valid OBDII or J1939 parameter being =,>,< the reported value from the vehicle ECU	OBDx
Power Up	8 available conditions, triggers on the device being powered up.	PUPx
Voltage	8 available conditions, trigger when a supply voltage is below, above or a supply threshold is passed.	VCCx
Acceleration	8 available conditions, triggers when an acceleration, deceleration or lateral acceleration threshold has been met.	ACCELx
Geo Route	In Zone or Out of Zone trigger, or alarm triggers based on crossing of zone threshold.	GEOx
Data	Triggers when a pre-configured threshold is exceeded.	DATAx
Man Down	Triggers when Man-Down Accessory device generates an event (CTM-200 must be configured to listen for traffic and optional WPAN Gateway must be installed)	MANDOWNx
Boomtracker	Triggers when short range wireless asset tracker accessory comes within range of CTM-200 (CTM-200 must be configured to listen for traffic and optional WPAN Gateway must be installed).	BOOMx
Proximity Card/RFID/I-Button	Triggers when a compatible RFID device sends a message to the CTM-200 via external peripheral, RFID reader, etc. (uses modified message 114, \$PGPS for payload)	RFIDx
External Equipment	Triggers when supported external equipment sends data to CTM-200 serial port. Typical External equipment include salt spreader, weigh systems, etc. (uses modified message 114, \$PGPS for payload)	EXTz

Some of the above events contain payloads that define details of the trigger.

For cases where multiple conditions can exist the x will define which condition triggered (1 thru 8), ie, gpscond 1 2 30 50 would cause GPS1 to be included as the event message.

For external equipment z would define the type of external equipment, ie EXT1 is for chlorobyte saltspreader.

Triggers or events can be associated to reports by enabling event tracking. When event tracking is enabled a \$PEVENT message will be appended to existing reports that are triggered by that event so integrators can easily determine which event triggered a report.

See section 5.3.23 for complete description of this \$PEVENT message

3 Reports

A report is the mechanism by which messages are delivered.

Reports typically will be configured to use the UDP protocol, but can also be TCP.

All reports will be sent to a defined IP address and Port #. Each UDP packet will contain the required messages to define what mobile device the messages are being received from. Each report to the Fleet Tracking server can contain 4 messages in a single UDP packet. Each report should contain a minimum of message 03 in each report or a message that contains the unique device ID in order to identify the incoming data packet. Message 03 defines the ID of the mobile device.

4 Messages

Messages are contained in reports to the Fleet Tracking server. The messages will use standard NMEA formatting for message construction. The messages can be arranged in any order but will be part of a single UDP packet or TCP packet.

4.1 NMEA Message Format

ASCII	Description
\$	Start character
ABC... or PABC	Message type. Messages starting with P are non-standard proprietary.
<string>,<string>	Message body. Multiple strings are separated with commas.
*	Message terminator
hh	Message checksum
<CR><LF>	Carriage return, line feed

4.2 Primary Messages

4.2.1 Message type 03 (Required)

Proprietary NMEA message containing the gateway's **serial number (ESN or IMEI)** and **ID**. Note that the default **ID** is the gateway's **serial number (ESN or IMEI)**

Message format is:

\$PMID,xxxxxxxxxx,yyyyyyyyyy*hh<CR><LF>

Where:

xxxxxxxxxxxxxx is the gateway's unique 11-digit ESN (CDMA/EV-DO devices only) or 15-digit IMEI (GSM/GPRS/HSPA devices only)

yyyyyyyyyyyyyy is the gateway's ID as set by the user (maximum 15 characters)

hh is the message checksum

Example:

`$PMID,09604890968,09604890968*10`

Note: If the device's unique (**xxxxxxxxxxxxxx**) field is blank the device name (**yyyyyyyyyyyyyy**) should be used for identification.

4.3 Optional Messages

4.3.1 Message Type 04, \$PAID

Proprietary NMEA message containing the following asset IDs:

- **ESN or IMEI**
- **modem ID**
- **vehicle identification number (VIN)** obtained via OBD
- **driver's ID** obtained via a swipe card reader

Note that the default **modem ID** is the modem's **ESN**

Message format is:

\$PAID,xxxxxxxxxxxxxx,yyyyyyyyyyyyyy,nnnnnnnnnn,dddd,v*hh<CR><LF>

Where:

xxxxxxxxxxxxxx is the modem's unique 11 digit ESN or 15digit IMEI

yyyyyyyyyyyyyy is the modem's ID as set by the user (maximum 15 characters)

nnnnnnnnnn is the vehicle's VIN consisting of 11 characters

dddd is the driver's ID

v is the validity of the Driver's ID

V indicates a **valid** ID card when compared against the on-board approved card list

F indicates an **invalid** ID card when compared against the on-board approved card list
hh is the message checksum

Example:

```
$PAID,09606257577,09606257577,AGV-SIMULATOR 1.5,039-30390,F*69
$PAID,09606257577,09606257577,AGV-SIMULATOR 1.5,039-30351,V*74
```

4.3.2 Message Type 16, \$GPGLL

This is a standard NMEA message containing GPS latitude and longitude information and time.

Message format is:

```
$GPGLL,IIII.IIII,a,yyyyy.yyyy,b,hhmmss.ss,v*hh<CR><LF>
```

Where:

IIII.IIII is the position latitude in degrees, minutes and decimal minutes

a is N(orth) or S(outh)

yyyyy.yyyy is the position longitude in degrees, minutes and decimal minutes

b is E(ast) or W(est)

hhmmss.ss is the UTC time in hours, minutes, seconds, and decimal seconds

v is the data validity flag: A = valid current data, B = valid stored data, V = invalid current data, W = invalid stored data

hh is the message checksum

Example:

```
$GPGLL,4915.3927,N,12259.8049,W,223636.00,A*18
```

4.3.3 Message Type 20, \$PIND

Proprietary NMEA message containing the digital state of the six inputs on the CTM device.

Message format is:

```
$PIND,abcdef,nnnn*hh
```

Where:

abcdef is the current digital state of inputs 1 through 6: **0 = low; 1 = high**

nnnn is the counter for the number ticks from **input 1**; Counter max 65535; Max tick frequency is 40Hz

hh is the message checksum

Example:

```
$PIND,000000,2*21
```

4.3.4 Message Type 21 to 26, \$PINA

Proprietary NMEA message containing the analog state of the specified input on the CTM device.

Message format is:

\$PINA,n,x.xx*hh

Where:

n is the analog input number with range 1 through 6.

x.xx is the current analog value of input n in volts

hh is the message checksum

Example:

```
$PINA,1,0.00*39
$PINA,2,0.00*3A
$PINA,3,0.00*3B
$PINA,4,0.00*3C
$PINA,5,0.00*3D
$PINA,6,0.00*3E
```

4.3.5 Message Type 30, \$PCTM

Proprietary NMEA message containing the current CDMA/HSPA network status.

Message format is:

\$PCTM,-xxxBm,-yydBm,zzzz,b,s,r,nnn.nnn.nnn.nnn*hh<CR><LF>

Where:

xxx is the current EV-DO network signal strength, or HSPA network signal strength (firmware version R1.3.0 and above only)

yyy is the current 1xRTT network signal strength (CDMA only; not available for HSPA where value always set to -0dBm)

zzzz is the current System ID (SID) (CDMA only; not available for HSPA where value always set to 0)

b is the band class (CDMA only; not available for HSPA where value always set to 0): 0 = 800MHz, 1 = 1900MHz

s is the service flag:

CDMA: 0 = unknown, 1 = 1xRTT; 2 = EV-DO(revision 0) 3 = EV-DO(revision A)

HSPA (firmware version R1.3.0 and above only): 0 = no service, 1 = GPRS, 2 = EDGE, 3 = UMTS, 4 = HSDPA, 5 = HSUPA, 6 = HSPA+

r is the registered flag: 0 = not registered, 1 = registered.
nnn.nnn.nnn.nnn is the modems assigned IP address.
hh is the message checksum

Note: If used with Store and Forward the network status parameters will be invalid.

Example:

```
$PCTM,-87dBm,-100dBm,16422,1,3,1,96.1.5.204*0B
```

4.3.6 Message Type 31, \$PDATA

Proprietary NMEA message containing the values of data transmitted and received over the wireless data link. The total data usage in MB can be determined by adding the reported value of data transmitted with the reported value of data received.

Message format is:

```
$PDATA,xxxxxxxxxxxxxxxxxxxxx,yyyyyyyyyyyyyyyyyyy,zzzzzzzzzzzz*hh<CR><LF>
```

Where:

xxxxxxxxxxxxxxxxxxxxx is the amount of data transmitted over the wireless link (MB)

yyyyyyyyyyyyyyyyyyy is the amount of data received over the wireless link (MB)

zzzzzzzzzzzz is the modem's name as set by the user (maximum 15 characters)

hh is the message checksum

Example:

```
$PDATA,0,9,09604204991*59
```

4.3.7 Message Type 33, PWIFI

Proprietary NMEA message containing the current Wi-Fi wireless network status.

Note: If used with Store and Forward the network status parameters will be invalid.

Wi-Fi network message format

```
$PWIFI,ttt,ssid,ap:ap:ap:ap:ap:ap,txdBm,lq,-rxdBm,-nodBm,nnn.nnn.nnn.nnn*hh
```

Where:

ttt is the Wi-Fi technology

ssid is the ESSID of the access point

ap:ap:ap:ap:ap:ap is the access point MAC address

tx is the TX power

lq	is the link quality
rx	is the RX signal strength
no	is the noise level
nnn.nnn.nnn.nnn	is the current IP address of modem's WAN interface
hh	is the message checksum

Example:

```
$PWIFI,IEEE802.11ng,cypress,00:24:A5:AD:61:4F,18dBm,70/70,-22dBm,n/a
dBm,192.168.100.202*53
```

4.3.8 Message Type 40, ID=

This is a proprietary ASCII message containing the modem's phone number, PAD port, serial port baud rate and PAD type.

Message format is:

ID=pppppppppppp,nnnnn,bbbbbb,ttt

Where:

pppppppppppp is the modem's phone number

nnnnn is the PAD port number

bbbbbb is the serial port's baud rate

ttt is the PAD type, UDP or TCP

Example:

```
ID=15148282538,5005,9600,UDP
```

4.3.9 Message Type 80, \$GPGGA

Standard NMEA message containing time, GPS latitude and longitude, satellite status information and altitude.

Message format is:

\$GPGGA,hhmmss.ss,IIII.IIII,a,yyyyy.yyyy,b,c,d,ee.e,sffff,M,,M,,0000*hh<CR><LF>

Where:

hhmmss.ss is the UTC time in hours, minutes, seconds, and decimal seconds

IIII.IIII is the position latitude in degrees, minutes and decimal minutes

a is N(orth) or S(outh)

yyyyy.yyyy is the position longitude in degrees, minutes and decimal minutes

b is E(ast) or W(est)
c is the GPS quality: 0 = not valid; 1 = valid
d is the number of satellites in use (range 0 to 12)
ee.e is the Horizontal Dilution of Precision (HDOP)
s is sign + or – for altitude above or below mean sea level
ffff is the altitude in metres
hh is the message checksum

Example:

```
$GPGGA,000512.00,4910.9588,N,12254.6560,W,1,8,01.1,-00015,M,,M,,0000*5C
```

4.3.10 Message Type 82, \$GPRMC

Standard NMEA message containing time, GPS latitude and longitude, speed, altitude and heading information.

Message format is:

```
$GPRMC,hhmmss.ss,v,llll.llll,a,yyyyy.yyyy,b,ccc.c,ddd.d,ddmmyy,,*hh<CR><LF>
```

Where:

hhmmss.ss is the UTC time in hours, minutes, seconds, and decimal seconds
v is the data validity flag: A = valid current data, B = valid stored data, V = invalid current data, W = invalid stored data
llll.llll is the position latitude in degrees, minutes and decimal minutes
a is N(orth) or S(outh)
yyyyy.yyyy is the position longitude in degrees and decimal degrees
b is E(ast) or W(est)
ccc.c is the horizontal velocity in knots
ddd.d is the heading in degrees (relative to true north)
ddmmyy is the day, month and year
hh is the message checksum

Example:

```
$GPRMC,001207.00,A,4911.2236,N,12254.4779,W,012.3,201.0,170109,,*2D
```

4.3.11 Message Type 84, \$GPGSA

Standard NMEA message containing GPS receiver mode, ID of satellites used in the fix, and Dilution of Precision (DOP) values.

Message format is:

\$GPGSA,a,b,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,p.p,h.h,v.v,*hh<CR><LF>

Where:

a is the receiver mode: A = automatic; M = manual (select 2D or 3D)

b is fix mode: 1 = fix not available; 2 = 2D; 3 = 3D.

xx is the ID of each satellite used in the fix (unused are 00)

p.p is the Percent DOP value

h.h is the Horizontal DOP value

v.v is the Vertical DOP value

hh is the message checksum

Example:

`$GPGSA,A,1,11,11,20,23,32,16,00,00,00,00,00,00,03.1,02.4,02.0*03`

4.3.12 Message Type 114, \$PGPS

Proprietary NMEA message based on the NMEA **\$GPRMC** message with the addition of altitude, number of satellites in use, and the modem's user settable name.

Message format is:

\$PGPS,hhmmss.ss,v,IIII.IIII,a,yyyyy.yyyy,b,ccc.c,ddd.d,ddmmyy,seeee,f,gggggggggggggggg*hh<CR><LF>

Where:

hhmmss.ss is the UTC time in hours, minutes, seconds, and decimal seconds

v is the data validity flag: A = valid current data, B = valid stored data, V = invalid current data, W = invalid stored data

IIII.IIII is the position latitude in degrees, minutes and decimal minutes

a is N(orth) or S(outh)

yyyyy.yyyy is the position longitude in degrees and decimal degrees

b is E(ast) or W(est)

ccc.c is the horizontal velocity in knots

ddd.d is the heading in degrees (relative to true north)

ddmmyy is the day, month and year

s is sign + or – for altitude above or below mean sea level

eeee is the altitude in meters

f is the number of satellites in use (range 0 to 8)

gggggggggggggggg is the modem name (padded with zeros at the beginning if < 15 characters)

hh is the message checksum

Example:

`$PGPS,224820.00,A,4915.3897,N,12259.8031,W,000.0,000.0,200409,+00007,6,09604890968*4F`

Note: For certain 3rd party equipment (proximity card reader, peripheral equipment such as spreader controllers, weight reading systems). The ID of the card or data payload will be appended to Message 114. In the below message the ID of 039-30391 has been appended to message 114. “V” indicates the card is valid when compared with an internal “approved card list” stored on the modem. “F” indicates an invalid card.

```
$PGPS,171134.00,A,4915.3868,N,12259.8049,W,000.0,000.0,170609,+00004,5,09604890958,039-30391,V*33
```

Salt spreader controller connected to CTM gateway, message 114 is appended to existing report with the payload of the spreader controller appended to message 114,
(131213141516171819202122232425262728293031)

```
$PGPS,000000.00,V,0000.0000,N,00000.0000,E,000.0,000.0,000000,+00000,0,131213141516171819202122232425262728293031*7E
```

4.3.13 Message Type 116, \$PPWR

Proprietary NMEA message providing the devices current supply voltage (Vcc), ignition status (on or off), and the internal temperature.

Message format is:

\$PPWR,vv.vv,i,tt*hh<CR><LF>

Where:

vv.vv is the modem supply voltage in volts.

i is the ignition status: 0 = off; 1 = on.

tt is the modem’s internal temperature in degrees Celsius.

hh is the message checksum

Example:

```
$PPWR,14.12,1,43*37
```

4.3.14 Message Type 117, \$PRFI

Proprietary NMEA message containing CDMA network information to assist in network diagnostics.

Note: parameters for this command are only available for specific data cards/modules.

Message format is:

\$PRFI,aaaa,rdBm,tdBm,b,c,e,s*hh<CR><LF>

Where:

aaaaa is the network System ID (SID)
r is the current EVDO RSSI value
t is the current TX power adjust value
b is the band class: 0 = 800MHz; 1 = 1900MHz
c is the current center channel number
e is the current Ec/Io value
s is the current Slot Cycle Index (SCI)
hh is the message checksum

Example:

```
$PRFI,16422,-81dBm,-0dBm,1,255,8,2*22
```

4.3.15 Message Type 118, \$GPGSV

Standard NMEA message containing the number of satellites in view, their ID, elevation, azimuth, and SNR value.

Up to four satellites can be contained in a single GSV string so up to three strings are possible to cover up to 12 satellites.

Message format is:

```
$GPGSV,m,n,vv,i1,e1,a1,s1,i2,e2,a2,s2,i3,e3,a3,s3,i4,e4,a4,s4,*hh<CR><LF>
```

Where:

m is the total number of GSV messages in this sequence: 1 to 3
n is the sequence number of this message: 1, 2 or 3
vv is the number of satellites in view
i1-4 is the satellite ID
e1-4 is the satellite elevation in degrees
a1-4 is the satellite azimuth in degrees true
s1 is the satellite SNR in dB
hh is the message checksum

Example:

```
$GPGSV,3,1,09,11,08,210,41,25,13,222,39,20,76,229,46,23,54,281,32*73
$GPGSV,3,2,09,31,39,054,,32,62,149,46,16,24,132,36,04,18,316,*7E
$GPGSV,3,3,09,13,21,271,30,00,00,000,,00,00,000,,00,00,000,*76
```

4.3.16 Message Type 119-126, (\$POBDA - \$POBDH)

Proprietary NMEA message containing OBD II information captured from a vehicle. There are 8 available messages for reporting OBD II/J1939 data, each message can return information on up to 8 parameters based on this table OBDII/J1939 parameters.

Message format is:

\$POBDA,v,px=xxxxxx,[px=xxxxxx],.....[px=xxxxxx],[px=xxxxxx]*hh<CR><LF>

\$POBDB,v,px=xxxxxx,[px=xxxxxx],.....[px=xxxxxx],[px=xxxxxx]*hh<CR><LF>

.....

.....

\$POBDG,v,px=xxxxxx,[px=xxxxxx],.....[px=xxxxxx],[px=xxxxxx]*hh<CR><LF>

\$POBDH,v,px=xxxxxx,[px=xxxxxx],.....[px=xxxxxx],[px=xxxxxx]*hh<CR><LF>

Note: the number and type of **px** values are based on the configuration of pobda thru pobdh commands.

Where:

v is the data validity flag: A = valid current data, B = valid stored data, V = invalid current data, W = invalid stored data

px=xxxxx is the parameter ID **px** followed by the value of the parameter **xxxxx**

hh is the message checksum

Example:

\$POBDA, A, p216=64565, p25=1255, p217=47600.23, p218=265*79

Where:

p216 Calculated Odometer value

p25 Calculated Engine Hours

p217 Calculated Total Fuel

p218 Calculated Total Idle

4.3.17 Message Type 136, \$PACCEL

Proprietary NMEA message containing hard acceleration/deceleration information obtained from GPS velocity or on board accelerometer data. This NMEA message is designed to be sent whenever the hard acceleration/deceleration thresholds are exceeded.

Message format is:

\$PACCEL,hhmmss.ss, llll.llll,a,yyyyy.yyyy,b,vvv.v,uuu.u,ddmmyy,gggggggggg*hh<CR><LF>

Where:

hhmmss.ss is the UTC time in hours, minutes, seconds, and decimal seconds

llll.llll is the position latitude in degrees, minutes and decimal minutes

a is N(orth) or S(outh)
yyyyy.yyyy is the position longitude in degrees, minutes and decimal minutes
b is E(ast) or W(est)
vvv.v is the velocity in km/h
uuu.u is the acceleration/deceleration in km/h/s
ddmmyy is the day, month and year
gggggggggg is the modems user settable name
hh is the message checksum

Example:

```
$PACCEL,225623.00,4915.3907,N,12259.8040,W,000.0,000.0,200409,09604890968*06
```

4.3.18 Message Type 137, \$PODO

Proprietary NMEA message containing information about the odometer, or the total distance travelled, obtained via GPS position data.

Message format is:

```
$PODO,hhmmss.ss,ooooooo,ddmmyy,gggggggggggg*hh<CR><LF>
```

Where:

hhmmss.ss is the UTC time in hours, minutes, seconds, and decimal seconds
ooooooo is the odometer value in km
ddmmyy is the day, month and year
gggggggggg is the modems user settable name.
hh is the message checksum

Example:

```
$PODO,225623.00,27,200409,09604890968*0F
```

4.3.19 Message Type 139, \$PLACCEL

Proprietary NMEA message containing lateral acceleration/deceleration information obtained from the CTM-200's accelerometer data. This NMEA message is designed to be sent whenever the lateral acceleration threshold is exceeded.

Message format is:

```
$PLACCEL,hhmmss.ss,IIII.IIII,a,yyyyy.yyyy,b,vvv.v,uuu.u,ddmmyy,gggggggggg*hh<CR><LF>
```

Where:

hhmmss.ss is the UTC time in hours, minutes, seconds, and decimal seconds

llll.llll is the position latitude in degrees, minutes and decimal minutes

a is N(orth) or S(outh)

yyyyy.yyyy is the position longitude in degrees, minutes and decimal minutes

b is E(ast) or W(est)

vvv.v is the velocity in km/h

uuu.u is the lateral acceleration in km/h/s

ddmmyy is the day, month and year

gggggggggg is the modems ID

hh is the message checksum

Example:

```
$PLACCEL,172244.00,4915.3932,N,12259.8008,W,000.0,105.9,270511,0000000000*4B[0x0D][0x0A]
```

In the above example the recorded lateral acceleration value is 105.9 km/hr/sec, or 3.00 m/s²

4.3.20 Message Type 140, \$PFUEL

Proprietary NMEA message containing vehicle fuel consumption information obtained from the CTM-200's OBDII/J1939/GPIO.

This NMEA message is a cumulative message that logs total fuel consumed based on data from OBDII/J1939/GPIO.

Message format is:

```
$PFUEL,hhmmss.ss,t,ffffff.ff,ooooooo,ddmmyy,gggggggggggg*hh<CR><LF>
```

Where:

hhmmss.ss is the UTC time in hours, minutes, seconds, and decimal seconds

t is the fuel mode, ie ECU parameter or GPIO used to calculate fuel value.

ffffff.ff is the total fuel in liters.

ooooooo is the odometer value in Km (taken from the GPS odometer value)

ddmmyy is the day, month and year .

gggggggggggg is the modems user settable name.

hh is the message checksum

Example:

```
$PFUEL,224342.00,4,2.58,159,161111,354155040009270*46
```

In the above example the accumulated fuel is 2.58 L

The total fuel is also exposed via a parameter value **p217**

4.3.21 Message Type 141, \$PIDLE

Proprietary NMEA message containing vehicle idling information obtained from the CTM-200's OBDII/J1939/Ignition sense/GPS data.

This NMEA message is a cumulative message that logs idle events based on pre-configured parameters being met.

Message format is:

\$PIDLE,hhmmss.ss,t,iiiiiii , ddmmyy,gggggggggggggg*hh<CR><LF>

Where:

hhmmss.ss is the UTC time in hours, minutes, seconds, and decimal seconds

t is the idle mode, ie ECU parameter or GPS and ignition to calculate idle time.

iiiiiii is the total idle time in minutes, rounded to the nearest minute.

ddmmyy is the day, month and year .

gggggggggggggg is the modems user settable name.

hh is the message checksum

Example:

`$PIDLE,235239.00,1,4,171111,354155040009270*62`

In the above example the accumulated idle time is 4 minutes

The idle time is also exposed via a parameter value **p218**

4.3.22 Message Type 142,\$PFUELR

Proprietary NMEA message containing vehicle fuel rate information obtained from the CTM-200's OBDII/J1939/GPIO/GPS.

This NMEA message is a fuel rate message that calculates fuel rate based on the delta between total fuel value and odometer and factored to L/100Km.

This message requires active data from Vehicle ECU via CAN OBDII/J1939 or GPIO interface.

\$PFUELR,hhmmss.ss,t,rrr.rr,ooooooo,ddmmyy,gggggggggggggg*hh<CR><LF>

Where:

hhmmss.ss is the UTC time in hours, minutes, seconds, and decimal seconds.

t is the fuel mode, ie ECU parameter,GPIO used to calculate fuel value.

rrr.rr is the fuel rate in liters/100Km. rrr.rr will be ERR when odometer delta is 0.

ooooooo is the odometer value in Km. ooooooo will be ERR when any odometer parameter is not available. (p24 is the most accurate odometer (if available). Ie, priority list: p24 > p23 > GPS odometer)

Ddmmyy is the day, month and year.

gggggggggggggggg is the modems user settable name.

hh is the message checksum.

Example:

```
$PFUELR,225623.00,1,8.9,27542,201011,09604890968*0F
$PFUELR,225653.00,1,ERR,ERR,201011,09604890968*6E
```

Fuel rate is also be made available as a parameter **p219**

4.3.23 Message Type 151 to 154, \$PMBM

Proprietary NMEA message displaying data from MODBUS Slave 1 to 4.

Message format is:

\$PMBM,n,v,r,c,dt,d1,d2,d3,...,dc*hh<CR><LF>

Where:

n = 1 to 4 the MODBUS Slave device ID

v is the data validity flag: A = valid current data, V = invalid current data

r = 1 to 65536 the start register address

c = 1 to 50 the number of registers to be read

dt = 0 single bit, discrete output

dt = 1 single bit, discrete input

dt = 2 2 bytes, 16-bit register input

dt = 3 4 bytes, 32-bit integer input

dt = 4 4 bytes, 32-bit float input

dt = 5 2 bytes, 16-bit register output

dt = 6 4 bytes, 32-bit integer output

dt = 7 4 bytes, 32-bit float output

d1~dc data values from the MODBUS Slave device, the data type is defined by dt

r, c, and dt are from **cmd mbusm poll n**

iiiiiii.ddd format will be used for float data type. The length of integer part is variable.

If Message Type 151, 152, 153, or 154 is used without polling MODBUS slaves, its validity flag will be V and all data values will be zero.

\$PMBM,1,V,0,0,0*hh<CR><LF>

\$PMBM,2,V,0,0,0*hh<CR><LF>

\$PMBM,3,V,0,0,0*hh<CR><LF>

\$PMBM,4,V,0,0,0*hh<CR><LF>

See `mbusm add`, `mbusm cond`, `mbusm data`, `mbusm del`, `mbusm excond`, `mbusm excreport`, `mbusm poll`, `mbusm report` for configuration.

Available on CTM-200 only. Firmware version 2.0.4.2702 and later

4.3.24 Geo Route Message

Proprietary NMEA message containing Geo Route information based on stored routes on CTM Gateway.

This NMEA message is appended to a pre-configured report number

\$PGRT,ddmmyy,hhmmss.ss,v,MSG,rr,II.IIIII,yyy.yyyyy,ddd.d,ccc.c,MODEMID*hh

Where:

ddmmyy day month year

hhmmss.ss UTC time in hours, minutes, seconds, and decimal seconds

v GPS validity flag (A = valid, V = invalid) when message was sent

MSG ALRMA - Alarm when allowed area violation counter reached set threshold

ALRMR - Alarm when restricted area violation counter reached threshold

AOUT - when vehicle has exited an allowed area

AIN - when vehicle has entered an allowed area

ROUT - when vehicle has exited a restricted area

RIN - when vehicle has entered a restricted area

rr Route number (1-32) triggering message. 0 if vehicle was not found in any allowed routes.

II.IIIII latitude in decimal degrees ((-)dd.dddddd)

yyy.yyyyy longitude in decimal degrees ((-)ddd.dddddd)

ddd.d heading in degrees (relative to true North)

ccc.c Speed (knots)

MODEMID Modem ID

hh NMEA checksum

Example:

```
$PGRT,101111,173834.00,A,AIN,1,49.253613,-122.997253,000.6,153.0,354155040009270*2A
$PGRT,101111,173514.00,A,AOUT,0,49.253792,-122.997681,000.5,150.0,354155040009270*6E
$PGRT,101111,173514.00,A,RIN,1,49.253792,-122.997681,000.5,150.0,354155040009270*35
$PGRT,101111,173834.00,A,ROUT,0,49.253613,-122.997253,000.6,153.0,354155040009270*71
$PGRT,101111,173554.00,A,ALRMR,1,49.253765,-122.997597,000.5,148.0,354155040009270*21
$PGRT,101111,173634.00,A,ALRMA,0,49.253696,-122.997513,000.4,133.0,354155040009270*3A
```

4.3.25 Event Message

Proprietary NMEA message containing identifying the trigger or event that generates the report.

This NMEA message is appended to a pre-configured report number.

Event messages are enabled by the **cmd autopevent** command:

cmd autopevent 1 enables automatic \$PEVENT messages

cmd autopevent 0 disables automatic \$PEVENT messages

\$PEVENT,hhmmss.ss,v,ddmmyy,xxxxxxxxxxx,yyyyyy*hh<CR><LF>

Where:

hhmmss.s is the UTC time in hours, minutes, seconds, and decimal seconds

v is the data validity flag: A = valid current data, B = valid stored data, V = invalid current data, W = invalid stored data

ddmmyy day month year

xxxxxxxxxxx is the gateway's unique 11 or 15 digit ESN or IMEI number

Note: For non-cellular devices (Wi-Fi) the gateway unique ID is generated automatically from the LAN1 MAC address.

yyyyyy is the Event abbreviation and condition trigger value (if any)

(GPSx, GPIOx, IGNx, OBDx, PUPx, VCCx, ACCELx, GEOx, DATAx, MANDOWNx, BOOMx, RFIDx, EXTz)

triggers or events	event label	event detail
GPS	GPSx	one or more of: d> dist , a> b , hchg> c , t> timer , accel> b , decel< b
Input Condition	GPIOx	one or more of: inputalm= a , ipchg=< IP >, t> timer
Ignition	IGNx	one of: ON or OFF
OBDII-J1939	OBDx	one or more of: in ab where a is input number 1 to 6 and b is A =analog or D =digital:(one of c<HIGH, c>LOW, c~HIGH (digital), or c<dV, c>dV, c~d (analog)), ipchg=< IP >, t> timer
Powerup	PUPx	
Voltage Level	VCCx	one of: a.aaV > b.bbV , a.aaV < b.bbV
Acceleration	ACCELx	one or more of: accel> b , latacca> b , latdeca< b
GeoRoute	GEOx	one of: AIN a , AOUT a , RIN a , ROUT a , ALRMA a , ALRMR a
Data	DATAx	
ManDown	MANDOWNx	
BoomTracker	BOOMx	
RFID	RFIDx	
Ext. Equip.	EXTz	

For cases where multiple conditions can exist the **x** will define which condition triggered (1 thru 8), ie, gpscond 1 2 30 50 would cause GPS1 to be included as the event message. For external equipment **z** would define the type of external equipment, ie EXT1 is for chlorobyte saltspreader.

For GPIO events:

- digital values are based on the voltage value dropping below 2 V or going above 3V, these values are fixed and cannot be changed.
- ~ indicates a transition from LOW to HIGH or HIGH to LOW trigger for both Digital and Analog

hh is the message checksum

Message containing OBD condition 1 where the trigger is when p1 > 50 (cmd obdcond 1 1 0 60 'p1>50.00'):

```
$PEVENT,164125.00,A,061211,356215040095550,OBd1:p1:83.00>50.00*68
```

cmd obdcond 1 1 0 60 'p1>50.00' 'p2>250.00' would display a \$PEVENT message:

```
$PEVENT,165215.00,A,061211,356215040095550,OBd1:p1:70.00>50.00,p2:1260.00>250.00*3D
```

triggers or events	Event Label	Example
GPS	GPSx	\$PEVENT,004733.00,A,091211,355782040000402,GPS1:t>30*6C
Input Condition	GPIOx	\$PEVENT,002155.00,A,091211,355782040000402,GPIO1:t>30*39 (triggers on time based reporting, every 30 sec) \$PEVENT,192953.00,A,191211,355782040000402,GPIO2:in5D:0.00<LOW*4E (input 5, digital triggered when voltage 0.00 dropped below 2.0 V) \$PEVENT,193240.00,A,191211,355782040000402,GPIO2:in3A:10.23>8.00V*63 (input 3, analog triggered when 10.23 volts exceeded set value of 8.00 V) \$PEVENT,193308.00,A,191211,355782040000402,GPIO2:in5D:0.93<LOW,in3A:10.23>8.00V*72 (input 5 digital triggered low when 0.93V dropped below 2V, input 3 analog triggered when 10.23 volts exceeded 8.0 V) \$PEVENT,193433.00,A,191211,355782040000402,GPIO2:in5D:3.74>HIGH,in3A:10.23>8.00V*2F \$PEVENT,193522.00,A,191211,355782040000402,GPIO2:in5D:3.41>HIGH,in3A:0.06<8.00V*1C \$PEVENT,193555.00,A,191211,355782040000402,GPIO2:in5D:3.70~HIGH,in3A:5.02<8.00V*5F \$PEVENT,193603.00,A,191211,355782040000402,GPIO2:in5D:0.04~HIGH,in3A:5.02<8.00V*5F \$PEVENT,193800.00,A,191211,355782040000402,GPIO2:in5D:3.80>HIGH,in3A:0.00~8.00V*58 \$PEVENT,193811.00,A,191211,355782040000402,GPIO2:in5D:3.80>HIGH,in3A:10.23~8.00V*68 \$PEVENT,002940.00,A,091211,355782040000402,GPIO4:ipchg=10.142.21.139*11
Ignition	IGNx	\$PEVENT,001850.00,A,091211,355782040000402,IGN1:OFF*61 \$PEVENT,001854.00,A,091211,355782040000402,IGN2:ON*28 \$PEVENT,001850.00,A,091211,355782040000402,IGN3:OFF*63
OBDII-J1939	OBDx	\$PEVENT,001703.00,A,091211,355782040000402,OBd2:p1:255.00>100.00,p2:8168.00>100
Powerup	PUPx	\$PEVENT,000912.00,A,091211,355782040000402,PUP1*07
Voltage Level	VCCx	\$PEVENT,000641.00,A,091211,355782040000402,VCC1:7.90<9.00V*5A \$PEVENT,003520.00,A,091211,355782040000402,VCC2:10.97>10.00V*55 \$PEVENT,000641.00,A,091211,355782040000402,VCC3:7.90<9.50V*5D
Acceleration	ACCELx	\$PEVENT,000101.00,A,091211,355782040000402,ACCEL1:accel035.3>001.0*78 \$PEVENT,000035.00,A,091211,355782040000402,ACCEL2:decel-37.0<-01.0*7D \$PEVENT,235941.00,A,081211,355782040000402,ACCEL3:latacc001.0>001.0*07
GeoRoute	GEOx	\$PEVENT,235700.00,A,081211,355782040000402,GEO1:AOUT0*12 \$PEVENT,235735.00,A,081211,355782040000402,GEO1:AIN1*5C \$PEVENT,235804.00,A,081211,355782040000402,GEO1:RIN32*72

Data	DATAx	\$PEVENT,235441.00,A,081211,355782040000402,DATA1*4C
ManDown	MANDOWNx	\$PEVENT,234413.00,A,081211,000000000000,MANDOWN1*06
BoomTracker	BOOMx	\$PEVENT,234413.00,A,081211,000000000000,BOOM1*05
RFID	RFIDx	\$PEVENT,234008.00,A,081211,000000000000,RFID1*41
Ext. Equip.	EXTz	\$PEVENT,234413.00,A,081211,000000000000,EXT1*05

4.4 Man Down System Messages

Man Down messages are triggered by any message received from a Cypress Solutions Man Down Pendant. The following message is appended to an existing report:

\$PPEN,AAAAAAAAAAAAAAAA,BB,XXXXXX*hh<CR><LF>

Where:

AAAAAAAAAAAAAAAA is the Pendant/Device ID - 64 bit unique hex ID of Pendant

BB is the Sequence number

XXXXXX is the message payload see table below

hh is the message checksum

Examples:

\$PPEN,ID,SEQ,PANIC*hh<CR><LF>

ID = pendant's ID, SEQ=sequence number, PANIC = Alert notification ("Man Down") message

\$PPEN,ID,SEQ,DRVID*hh<CR><LF>

ID = pendant's ID, SEQ=sequence number, DRVID = Device id message

PPEN Outgoing message	Description
ON	Pendant sends this message every time it transitions from off to on state.
OFF	Pendant sends this message every time it transition from on to off state.
DRVID	ID message
PANIC	Panic message (push button activated)
MPANIC	Panic message (lack of motion activated)
FPANIC	Panic message (fall detection)
CPANIC	Cancel panic message
OUTOFRANGE	Gateway generates "out of range" message when associated Pendant moves out of coverage area. Controlled by AT^SESSIONALERT command
BACKINRANGE	Gateway generates "back in range" message when associated Pendant

back into coverage area. Controlled by AT^SESSIONALERT command
--

Man Down messages rely on device acknowledgement or server acknowledgement. For device acknowledgement the CTM-200 will ACK the incoming man-down message. For server acknowledgement the server application needs to generate a correct packet and send it back to the CTM-200. If no ACK packet is received the pendant notifies the operator that the man down message was not acknowledged. This configuration is configured by “**cmd wpan acktype n**”

The CTM-200 will understand messages in the PPQ format and will relay/query the pendant.

```
$PPQ,PAN,AAAAAAAAAAAAAAAA,BB,XXXXXX*hh<CR><LF>
```

Where:

AAAAAAAAAAAAAAAA is the Pendant/Device ID

BB is the Sequence number

XXXXX is the message payload (see examples below)

hh is the message checksum

Examples:

```
$PPEN,0013A200402CB498,13,PANIC*03
```

The acknowledgment that the CTM-200 expects from the server is as follows:

```
$PPQ,PAN,0013A200402CB498,13,ACK*36
```

The 16-digit hex number following the PPEN message is the Pendant ID and is unique to each Pendant.

4.5 Marine Asset Tracker (short range wireless asset tracker accessory)

The Marine Asset Tracker is a short range wireless tracking device with integrated GPS receiver and compass. The Marine Asset Tracker is designed to communicate with the CTM gateway using short range 2.4 Ghz (802.15.4) protocol. Marine Asset Trackers constantly scan for CTM gateways they can connect to. When in range the Marine Asset Tracker uploads its information using a proprietary message format.

The Marine Asset Tracker message will append the message payload to a report. The format for the message is:

```
$PWPAN,ID,HeaderPayload*hh<CR><LF>
```

Where:

ID = 64-bit hex address of the device that sent the message
 HeaderPayload = 3-byte header and 25 byte length payload formatted as hex digits.

Example:

```
$PWPAN,0013A200404B9592,04AB00339B9945348F3FC616E09F23F9291400700025052
12C5BD357*50
```

The Marine Asset Tracker must receive an acknowledgement message from the Gateway after sending a \$PWPAN message or the message will be stored on board the Tracker as it assumes the Gateway did not receive the last message. The format of the acknowledgement message is:

\$PPQ,WPAN,ID,HeaderPayload*hh<CR><LF>

Where:

ID = 64-bit hex address of the endpoint device

HeaderPayload = 3-byte header and variable length payload formatted as hex digits, see Header section above for description of the format of the 3 bytes.

Payload in this case is ACK indicating acknowledgement, the hexadecimal representation for ACK is 41434B (A=41, C=43, K=4B)

Example:

```
$PPQ,WPAN,0013A200404B9592,04A90041434B*79
```

(Refer to the Marine Asset Tracker Manual for complete description of message formats)

4.6 Proximity Card (RFID Readers)

The RFID is appended to the \$PGPS (message 114) and message 114 is appended to an already configured report. In the below message the ID of 039-30391 has been appended to message 114. "V" indicates the card is valid when compared with an internal "approved card list" stored on the modem. "F" indicates an invalid card.

```
$PGPS,171134.00,A,4915.3868,N,12259.8049,W,000.0,000.0,170609,+00004,5,0960489
0958,039-30391,V*33
```

4.7 External Equipment

Salt spreader controller connected to CTM gateway, message 114 is appended to existing report with the payload of the spreader controller appended to message 114,
(131213141516171819202122232425262728293031)

```
$PGPS,000000.00,V,0000.0000,N,00000.0000,E,000.0,000.0,000000,+00000,0,131213141516171819202122232425262728293031*7E
```

5 Technical Support/Warranty:

**Cypress Solutions Service
Support Group**

1.877.985.2878 or 604.294.4465

9.00am to 5.00pm PST

support@cypress.bc.ca