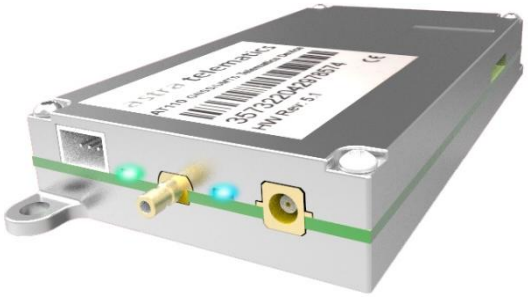
astra telematics



Device Configuration Guide
Generic Command Reference

Version: 7.13

Date: February 2026

Contents

Astra Telematics Command Protocol

All Astra Telematics devices share a common set of configuration commands, which can be used in 4 different modes:

1. Using the device RS232 port
2. SMS to the device GSM voice/SMS telephone number
3. Over the TCP socket from the connected host server
4. Over BLE (subject to BLE option availability on the device)

The commands and behaviour are identical in each case, with very few exceptions. A handful of diagnostic commands are supported only in RS232 or TCP modes, due to the size of the response, they are not practical for use by SMS.

Configuration in RS232 mode using an ASCII Terminal

Custom configuration of the device is best achieved via an RS232 connection to a PC. It is possible to use any ASCII terminal program (e.g. HyperTerminal, Teraterm etc.) to view debug / diagnostics information and enter commands.

Terminal settings are:

BAUD RATE:	115200
DATA BITS:	8
PARITY:	NONE
FLOW CONTROL:	NONE

We recommend TeraTerm, which can be downloaded and used free of charge.

Command Format

All devices use the same command format for all input methods: TCP, SMS and RS232.
Each command will take the following format:

`$AAAA,<arg1>,<arg2>,<argN><CR><LF>`

Where AAAA is the command code and the text enclosed in <> are optional arguments.
`<CR><LF>` represents the carriage return and line feed characters

Note that the <> characters should not be included in your argument.

Response Format

Each command will result in one response, by the same mode as the command was received. For multiple commands see the section Multiple Command Response Format.

The format of an individual response message is as follows:

`$AAAA,<status><CR><LF>`

Where <status> is one of the following values

UN	Unknown Command
OK	Command Completed Successfully
ER	Command Failed (Error)
PR	Password Required

Single Command Examples

```
$DIST,500
$DIST,OK<CR><LF>            valid command, OK

$IPAD,123.456.89.10
$IPAD,OK<CR><LF>            valid command, OK

$IPAD,host name.com
$IPAD,ER<CR><LF>            parameter out of range (invalid hostname)

$FISH,400
$FISH,UN<CR><LF>            unrecognised command
```

Multiple Command Format

In SMS mode it is often convenient to send several commands together in one SMS or packet. It is possible to append multiple commands together as described below.

Example 1

```
$DIST,50<CR>
$GPSQ,100<CR>
```

Example 2 (TCP mode)

```
$DIST,500$APPW,astra$FRED,2
```

Multiple Command Response Format

Multiple commands received at the same time via any mode will result in one response for each command parsed. The responses will be in exactly the same format as those described in the section Single Command - Response.

For Example 2 above, the response would be:

```
$DIST,OK<CR>
$APPW,OK<CR>
$FRED,UN<CR><LF>
```

The first two commands are recognised and successfully executed, whereas the last command is unrecognised.

Sending Commands by SMS or TCP

The commands and formats described above can all be used over SMS or TCP sockets. The response will always be returned by the same mode as the command is received, so commands submitted by SMS will be responded to by SMS to the sender's phone number. Note that the sender's telephone number must be disclosed for the response to succeed.

When sending commands over TCP sockets, please do not include carriage return (CR) or line-feed (LF) characters between commands, these are not necessary and can cause parsing problems.

Prevention of Unauthorised Device Reconfiguration

There is a PIN code feature, which can be used to prevent unauthorised reconfiguration of devices by SMS. Please refer to the $PASS command in the Configuration section of this document.

Device Configuration Parameters & Commands

Mobile Network Communication Settings:

GPRS Access Point Address (APAD)

Access point network address (APN) for the specific SIM service provider being used. This information should be supplied by your network operator or service provider. A list of APNs for most network operators can be found at http://www.taniwha.org.uk/gprs.html

```
$APAD,<apn-primary>[,<apn2>,<apn3>,<apn4>,<apn5>]
```

<apn-primary>	APN address as advised by your SIM provider (mandatory)
<apn2>	APN#2 (optional)
<apn3>	APN#3 (optional)
<apn4>	APN#4 (optional)
<apn5>	APN#5 (optional)

NOTE: From firmware version 7.0.45, in the case of a persistent failure to activate PDP context (get an IP address from the APN server), the device will use APN#2 (where defined), and then APN#3, APN#4 and APN#5, until it succeeds. The APN list will remain as defined, although the device will remember the last successful APN, which will be used after a restart.

To remove a previously defined APN, replace it with a blank using the "NONE" specifier, for example:

$APAD,my-apn,NONE	set primary APN as "my-apn" and 2nd APN option disabled

GPRS Access Point Username (APUN)

APN username or specify "NONE" for a blank username.

```
$APUN,<apn-username>
```

$APUN,NONE	blank username
<apn-username>	APN username as advised by your SIM provider

GPRS Access Point Password (APPW)

APN password or specify "NONE" for a blank password.

```
$APPW,<apn-password>
```

$APPW,NONE	blank password
<apn-password>	APN password as advised by your SIM provider

Radio Access Technology Options (RATC)

Devices which Radio Access Technologies (RAT) are enabled and also set search priorities. This is essential to reduce network registration time, as searching RATs and bands can take up to 1 hour!

`$RATC,<rat-primary>[,<rat-2>[,<rat-3>]]`

`<rat-primary>`	RAT to be used in the search sequence with top priority. 0 = Astra automatic RAT mode[1] 1 = GSM 2 = eMTC 3 = NB-IoT Default is 1
`<rat-n>`	RAT#n to be used in the search sequence with "n" priority. 0 = None 1 = GSM 2 = eMTC 3 = NB-IoT Default is 0 for both RAT2 and RAT3 (i.e. GSM only)

We recommend that RATs are enabled only where compatible network services are available, and hence the default configuration enables GSM only, since eMTC (LTE Cat M1 for example) and NB-IoT are not widely available yet.

Note 1: Added in 7.0.75 Astra automatic RAT mode takes over the RAT selection by selecting a single RAT every 10 minutes that a network connection has been lost.

Other Communication Settings:

LoRa Communication Options (LORA)

For devices with internal or external LoRa communications, its is necessary to define an AppKey, which is supplied by the LoRaWAN host, to allow the device to join a given network.

`$LORA,<lora-enable>,<lora-appkey>`

`<lora-enable>`	0 = LoRa disabled 1 = LoRa enabled
`<lora-appkey>`	LoRa AppKey, which is assigned by the LoRaWAN host to allow the device to join the network. This is 16 bytes in length and should be specified in hexadecimal

example:

`$LORA,1,2B7E151628AED2A6ABF7158809CF4F3C` // enable LoRa with specified AppKey

Dual Mode Communication Priority (COMM)

For devices with internal or external LoRa communications, this configuration allows the priorities to be defined between mobile network communication and LoRa.

`$COMM,<priority>,<timeout-sec>,<timeout-repq>`

`<priority>`	0 = priority to LoRa comms 1 = priority to mobile network comms (GSM / LTE)
`<timeout-sec>`	no comms timeout in seconds. When there are communications issues of any type with the primary comms option (as defined in `<priority>` above), the secondary comms option will be initiated and attempted after `<timeout-sec>` seconds. This timeout is combined with `<timeout-repq>` using OR logic. Either of these criteria will initiate secondary comms.
`<timeout-repq>`	no comms timeout based on the number of queued reports. When there are communications issues of any type with the primary comms option (as defined in `<priority>` above), the secondary comms option will be initiated and attempted when the number of queued (unsent) reports reaches `<timeout-repq>`. This is combined with `<timeout-sec>` using OR logic. Either of these criteria will initiate secondary comms.

example:

`$COMM,0,300,5` // LoRa comms as priority. Mobile network comms will be tried if there are LoRa comms issues for 5 minutes or more, or if the report queue reaches 5 reports or more.

Application Server Settings:

TCP Host IP Address (IPAD)

IP address or hostname for the host server. This is the destination to which the device will send report data. Maximum hostname length is 64 characters. An optional backup host can be configured which the device will use when the primary host becomes unresponsive.

```
$IPAD,<host-ip-addr>,<backup-host-ip-addr>
```

<host-ip-addr>	Host server IP address or hostname
<backup-host-ip-addr>	Host server IP address or hostname to fail over to

TCP Host Port Number (PORT)

The port number for the host server, to be used along with the IP address or hostname specified using IPAD.

```
$PORT,<host-port-num>,<backup-host-port-num>
```

<host-port-num>	Host server port number
<backuphost-port-num>	Host server port number to fail over to

TCP Acknowledgment Timeout (TCPT)

Specifies the maximum number of seconds that the device will wait for the host to send the ACK, in response to the device sending a report or LOGIN. The default value is 10 seconds. A value of zero will disable the acknowledgment feature (not recommended).

From firmware version 7.0.41, an additional option allows the definition of a ping-pong style TCP keepalive. The astra device sends a single byte 02 after <tcp-keepalive-sec> of idle time on the TCP connection, the platform must respond with a single byte 03. This maintains the TCP socket open and confirms if and when the socket may have been closed by the mobile network operator.

```
$TCPT,<tcp-ack-to>[,<tcp-keepalive-sec>]
```

<tcp-ack-to>	TCP acknowledgment timeout (seconds)
<tcp-keepalive-sec>	TCP ping-pong keepalive (seconds)

Communication Mode (MODE)

Specifies the device communication mode, as described in the table below:

<mode>	Communication method
1	RESERVED
2	RESERVED
3	RESERVED
4	GPRS (TCP) LOGIN DISABLED
5	GPRS (UDP)
6	GPRS (TCP) LOGIN ENABLED

The LOGIN option requires that the device sends a packet to identify itself immediately after a new TCP socket is opened, before continuing to send reports. This option can be used with all protocols, but note that some protocol, the packet headers will change based on the MODE LOGIN option (i.e. there will be no IMEI in the packet header), and other protocols will remain unchanged (i.e. the packet headers will include IMEIs regardless of MODE). Please refer to the relevant communication protocol description for more details regarding the LOGIN option.

```
$MODE,<comms-mode>
```

<comms-mode> Communication mode

Reporting Level (REPL)

This bitfield (4 bytes) can be used to enable/disable reporting of specific events based on their reason code. The bits are defined to match the reason bytes in the appropriate protocol. Set the appropriate bit to enable reports based on the associated reason. Please refer to specific protocol documentation and the Report Filtering Application Note for details. A value of 4294967295 will enable all reports.

$REPL,<report-level>

<report-level> Report level bitmask

Reporting Protocol (PROT)

Our devices support various communication protocols, including some legacy protocols, implemented for compatibility with existing systems. To take advantage of all device features and allow integration of new applications in the future, we recommend the use of our modular protocol 'X' for new implementations.

Documentation for each of these protocols is available on request from Astra Telematics, please email support@astratelematics.com for a copy.

<prot>	Reporting protocol	
6	Fixed packet protocol "K"	Legacy - not for new implementations
8	Fixed packet protocol "M"	Legacy - not for new implementations
10	Fixed packet protocol "P"	Private client protocol (obsolete)
14	Fixed packet protocol "V"	Legacy - not for new implementations
16	Modular protocol 'X'	RECOMMENDED (supports all applications)
17	Fixed packet protocol "S"	Private client protocol
19	Modular protocol "Z"	Private client protocol

$PROT,<protocol>,<protocol-mask>

<protocol> Communication protocol, selected from the table above
<protocol-mask> Protocol mask as specified in protocol 'X' description

Please refer to the protocol X documentation for details of module options and appropriate mask settings

Preferred Mobile Network Operators (PMNO)

[from firmware version 7.0.43] Allows modification of the PLMN Preferred Network Operators list, which can be stored on the SIM card to influence network selection priority. This can be useful to steer the device to avoid certain networks in certain scenarios, although in general it is not necessary.

NOTE: PMNO is not a configuration, it it not stored or displayed at an Astra device level, it simply allows access to add and remove mobile network operators to and from the SIM PLMN list. Once written, the modified PLMN will remain with the SIM, not with the Astra device.

SIM cards must support "service no.20" and the "EFPLMNwAcT" file must be present (on the SIM) to allow access to the PLMN list. If these conditions are not met, the command will return an error status.

The number of preferred network operators supported is defined on each SIM card. Generally, the list starts at index 1, corresponding to the highest priority preferred network operator, going down to 20, being the least preferable. In some cases, the list may be longer or shorter than 20. The maximum index value supported by Astra Telematics devices is 255.

Network operators are defined by their numeric Home Network Identity (HNI) code, which is a combination the Mobile Country Code (MCC) and Mobile Network Code (MNC) for the operator. A complete list can be found here:

https://www.mcc-mnc.com/

For example, the MCC for the UK is 234 and the MNC for O2 UK is 10, hence the complete HNI for O2 UK will be defined as "23410". Note that many network operators have multiple MNCs.
Note that changes to the SIM card PLMN list will be applied only after a restart of the communications module. That can be achieved using $DIAG,2

`$PMNO,<index>,<mode>,[<mcc-mnc>,<rat>]`

<index>	entry number in the list
<mode>	0 : delete 1 : add
<mcc-mnc>	home network identify number (HNI), MCC + MNC, typically 5 or 6 digits
<rat>	radio access technology 1 : GSM (default) 2 : GSM_compact 3 : UTRAN 4: E-UTRAN

Notes:

Specify an index number and mode 0 to delete an entry, in which case the <mcc-mnc> is not required

Only one $PMNO command can be sent at once, to enter multiple networks, a guard-time of 10s is necessary between commands

To apply the modified PLMN list to the device, a network de-registration is required, hence the device will go offline approx. 60s after receipt of the last $PMNO command

Networks may be allowed to be added to the list and written to the SIM, even if the <mcc-mnc> is not valid, or is not supported on the SIM's available operator list

<rat> is for future implementations, currently unsupported

examples:

$PMNO,1,1,23410 $PMNO,OK	add O2 UK as highest priority preferred network operator
$PMNO,2,1,23415 $PMNO,OK	add Vodafone UK as 2nd highest priority network operator
$PMNO,3,1,23430 $PMNO,OK	add EE UK to the list as 3rd priority
$PMNO,3,0 $PMNO,OK	delete PLMN entry no.3
$PMNO,255,0 $PMNO,OK	delete entire PLMN list
$PMNO,0,0 $PMNO,ER	ERROR: delete PLMN entry out of index
$PMNO,1,1,23410 $PMNO,ER	ERROR: SIM doesn't allow user-defined PLMN list
$PMNO,24,1,23430 $PMNO,ER	ERROR: Add PLMN entry out of index

There is no option to display PMNO / PLMN lists, because PMNO is not an Astra device configuration, it merely allows the SIM PLMN list to be modified.

GSM Network Operator Selection (COPS)

When using a SIM which allows roaming, the GSM / LTE module uses its own algorithms and criteria to search, select and register with network operators. For GSM services, these criteria are based on on circuit-switched services, which is not ideal for our purposes, given than our devices use packet switched services (i.e. GPRS). This is rarely a problem, since network operators almost universally offer both services together. There are rare cases where this has proved to be a problem and hence this option allows an Astra proprietary manual network selection mode, which is based on the availability of packet switched service. In the absence of packet switched service on the given network, the device will search available operators and register with an alternative network, where available.

With multi-RAT devices (those which support multiple radio access technologies, 2G, 3G, 4G and NBIoT), automatic network selection can also be problem, due to complex roaming agreements, which often allow certain services and deny others.

In both of the above cases, astra devices have the option to intervene in operator selection at the application level.

`$COPS,<mode>`

`<mode>`	`0`: automatic `1`: manual `3`: hybrid

Automatic mode

Relies 100% on the mobile communications module's built-in network search and selection feature.

Manual mode

Always use Astra's manual search and selection at application level.

Hybrid mode

Uses the modem automatic mode unless connectivity has been lost for over 3 minutes, at which point the astra device will attempt a manual network registration to restore connectivity before reverting back to automatic.

Reporting Interval / Event Settings:

Distance Reporting Interval (DIST)

Distance based reporting interval in metres. This feature can be disabled by setting DIST to zero. Default is 5000m.

```
$DIST,<distance-m>
```

<distance-m>	Distance reporting interval in metres

Heading Reporting Threshold (HEAD)

Heading based reporting threshold in degrees. This feature can be disabled, by setting HEAD to zero. Default is 45 degrees.

```
$HEAD,<hdg-deg>
```

<hdg-deg>	heading change threshold in degrees

Journey Timed Message Interval (JSEC)

The in-journey timed reporting interval may be entered in seconds using the JSEC command. Setting JSEC to zero will disable time-based reports whilst in-journey (ignition ON). Default is 120 seconds.

```
$JSEC,<in-jny-sec>
```

<in-jny-sec>	In-journey timed reporting interval in seconds

Stationary Timed Message Interval (STIM)

Stationary timed reporting interval in minutes. Setting STIM to zero will disable time-based reports whilst stationary. An optional 2nd parameter allows the GNSS module to be left in low power mode on a timed wake from low power mode to reduce power consumption. The default STIM is 60 minutes, with GNSS enabled on wake from sleep.

```
$STIM,<stim-mins>,<disable-gps>
```

<stim-mins>	Stationary timed reporting internal in minutes
<disable-gps>	Set to disable GNSS on timed wake in low-power mode

Idle Mode Timed Message Interval (ITIM)

Timed reporting interval whilst the vehicle is idling, in minutes. Idling mode is initiated after a period of stationary time (see IDLE parameter) whilst the ignition is on. Setting the ITIM to zero will disable time based idle mode journey reports. The default value is 5 minutes.

```
$ITIM,<itim-mins>
```

<itim-mins>	Idle timed reporting internal in minutes

Idle Mode Threshold (IDLE)

A vehicle is defined as being in idling mode when it has been stationary for a specific length of time whilst the ignition is on. Idling mode ends once the vehicle starts moving again. This parameter defines the length of time (in seconds) that a vehicle must be stationary before idling mode is initiated. The default value is 180 seconds.

$IDLE,<idle-secs>,<count-from>

<idle-secs>	Idle mode threshold in seconds
<count-from>[1]	0: count idle time whenever speed is zero & ignition ON 1: count idle time only after <idle-sec> threshold has expired

Note 1: from firmware version 7.0.67

Report Schedule (RSCD)

Schedule reports to be sent at up to 6 different specific times per-day. This setting will override $STIM and stationary reports will only be sent at the times defined.

$RSCD,<enabled>,[<time-1>,<time-2>,<time-3>,<time-4>,<time-5>,<time-6>]

<enabled>	Use $RSCD times? 1 = Yes, $STIM setting will not be used 0 = No, reset schedule, use $STIM for the reporting interval
<time-x>	A time to send a scheduled report (24hr format e.g. 18:30) STRICT 24hr format e.g. 00:00/09:00/23:59

Example (send a report at 6AM, 2.30PM and 8PM):

$RSCD,1,06:00,14:30,20:00

Example (disable & reset the report schedule and use $STIM)

$RSCD,0

Note:
When setting the schedule, all existing entries in the schedule will be discarded. For example, if you have configured reports for 9AM and 9PM with: $RSCD,1,09:00,21:00 and would like to change it to 10AM and 9PM, you need to use: $RSCD,1,10:00,21:00

Over-speed Speed Threshold (OSST)

The device can be configured to report over-speed events, which are defined as exceeding a given speed for a given amount of time. The OSST parameter defines the over-speed threshold in kmh. In order to trigger an over-speed event, the vehicle must travel in excess of OSST kmh for a period of OSHT seconds (see below). Further over-speed events cannot be triggered until OSIT seconds have elapsed and vehicle speed has fallen below the OSST threshold. A value of zero for OSST will disable over-speed events/reports. Default is 120kmh.

$OSST,<speed-kmh>

<speed-kmh>	Over-speed threshold in kmh

Over-speed Hold Time (OSHT)

Defines the period of time (in seconds) that a vehicle must exceed OSST kmh to trigger an over-speed event. Default is 30 seconds.

$OSHT,<hold-time-secs>

<hold-time-secs>	Over-speed minimum hold time in seconds

Over-speed Inhibit Time (OSIT)

Defines the minimum time between over-speed events. Once an over-speed event has occurred, further over-speed events cannot be triggered until OSIT seconds have elapsed. Default is 120 seconds.

$OSIT,<inhibit-time-secs>

<inhibit-time-secs> Over-speed inhibit time in seconds

Initiate "FastTrack" Mode (FTRK)

FastTrack mode is used when detailed and near-live reporting is required for a short period of time. The legacy version, without arguments, triggers a 1 minute period of reporting at 5 second intervals. From version 7.0.59, the extended version of FastTrack mode allows specific reporting criteria and duration to be defined, as described below.

$FTRK enable "fast-track" legacy mode, reporting every 5s for 1 minute

$FTRK,<duration-min>,<metres>,<seconds>,<degrees>

<duration-min> FastTrack mode duration, in minutes
<metres> FastTrack mode distance reporting interval, in metres (max. 65535)
<seconds> FastTrack mode timed reporting interval, in seconds (max. 65535)
<degrees> FastTrack mode heading change threshold, in degrees (max. 180)

Journey Detection Settings:

Ignition Mode (IGNM)

Defines the method used to determine whether the vehicle is in-journey or stationary:

IGNM	Start/Stop Reports	Default Power Down?	Ignition Input
0	based on movement	NO	Not required
1	based on digital 1 input	NO	WHITE WIRE
2	based on digital 1 input	YES	WHITE WIRE
3	based on external voltage	NO	Not required
4	from CANBus data	NO	OBD or FMS

`$IGNM,<ignition-source>[,<low-power-mode>,<on-voltage-mv>]`

`<ignition-source>` Ignition detection mode, from the table above
`<low-power-mode>` Set to enable low-power mode (sleep whilst stationary)
`<on-voltage-mv>` Used with <ignition-source> 3 to define the ignition ON voltage

Power down mode is automatically enabled when <ignition-source> is set to 2. In other <ignition-source> modes, <low-power-mode> is disabled by default, but it can be enabled by specifying a value of 1 when setting the <ignition-source>.

When IGMN=3 the device will detect that the vehicle engine is running from the increase in external voltage. If the external voltage is >= <on-voltage-mv>, the device will consider the ignition ON. If <on-voltage-mv> is set to 0, the device will attempt to automatically calibrate the on voltage, if using with auto-calibration, please refer to the installation guide for the device and read about IGNM3 calibration. The default value for <on-voltage-mv> is 13100 (13.1V).

The minimum value for <on-voltage-mv> is 10000 (10V).
The maximum value for <on-voltage-mv> is 30000 (30V).

STOP Report Delay (STPD)

When IGNM is set to zero (see above), the device will determine journey START and STOP events from motion (GNSS and accelerometer based). A STOP event will occur after the vehicle has remained stationary for a pre-determined time. The length of stationary time necessary to trigger a STOP report is dictated by the STPD parameter.

When IGNM is set to three a STOP event will occur after the vehicle external voltage has dropped for a pre-determined time. The length of time of the drop in voltage level necessary to trigger a STOP report is dictated by the STPD parameter. If the voltage rises before the time in STPD is reached the vehicle is considered to still be in the same journey. This is useful for vehicles with auto start-stop.

`$STPD,<stop-time-secs>`

`<stop-time-secs>` Stationary time to trigger a STOP event in seconds

Movement Based Journey Criteria (MBJC)

Defines the criteria used to determine a journey start condition when movement based ignition detection is used

```
$MBJC,<speed-threshold>[,<speed-timeout>,<distance-threshold>,<distance-timeout>]
```

<speed-threshold>	Speed in km/h to trigger a journey start (3-255)
<speed-timeout>	Speed timeout in seconds (1-255)
<distance-threshold>	Distance in m moved to trigger a journey start (1-255)
<distance-timeout>	Distance timeout in seconds (1-255)

Either of the speed threshold or distance threshold can be used to determine a journey start. When the vehicle is travelling faster than <speed-threshold> for <speed-timeout> seconds a journey is started. Or, when the vehicle location has moved further than <distance-threshold> metres away from the previous stop location for more than <distance-timeout> seconds, a journey is started.

Default:

```
$MBJC,20,5,200,5
```

Low-Power Settings:

Low Power Mode Configuration (LPWC)

Defines the options for low-power mode, implemented from 7.0.51:

```
$LPWC,<lp-mode-enable>[,<gps-fix-to-sec>,<gps-date-to-sec>,
<timed-wake-no-gps>,<ign-off-pd-delay-sec>,<max-wake-period-s>]
```

<lp-mode-enable> [1]	0: disable low-power mode 1: enable low-power mode
<gps-fix-to-sec> [2]	GPS valid fix timeout in seconds
<gps-date-to-sec> [2]	GPS valid date timeout in seconds
<timed-wake-no-gps> [3]	0: update GPS on timed wake 1: no GPS on timed wake
<ign-off-pd-delay-sec> [1]	delay between ignition off and power-down, in seconds
<max-wake-period-s>	for battery powered devices to set maximum wake period

Notes:

1. <lp-mode-enable> is identical to the $IGNM option to enable low-power mode
2. minimum timeouts are all 1 second
3. <timed-wake-no-gps> is identical to the $STIM option to disable GPS on timed wake

Low-power mode enables power-saving options for use when a vehicle is parked (ignition off), to save drain on the vehicle battery, or to preserve the astra device internal battery. When low-power mode is enabled, the device will enter power-down (sleep) mode after ignition off, and will wake on the following events:

- Expiry of STIM stationary timed update interval (minutes)
- Change in external voltage status
- Ignition ON
- Motion detected, according to MEMS

Whilst the device is powered down, all modules and peripherals (GSM, GPS, CANBus, BLE etc.) are completely powered off and communications are unavailable, until one of the above events triggers a wake.

These low-power mode configuration options allow tuning of the options and timeouts which determine important compromises between battery life and GPS performance, for example.

On a timed wake (i.e. STIM minutes after powering down), the device typically will not have moved, since ignition status has not changed and motion detection has not been triggered, hence the option to disable GPS on these reports is a useful way to conserve battery life, particularly on autonomous (battery-only) devices, such as the AT500. Typically, a timed report without GPS requires less than 20 seconds, whilst waiting for GPS may take many minutes, up to the maximum defined by <gps-fix-to-sec>.

Devices with external power connections will consume almost zero current from the external source (typically the vehicle battery), using their internal back-up battery during power-down. This mode can be maintained for typically 12 to 45 days, until the device back-up battery requires charging, in which case the device will start to recharge during timed wake cycles.

Note that astra devices will not enter low-power mode under the following circumstances:

- RTC not set (from either mobile network via NITZ or from valid GPS)
- BLE device connected
- Battery charging in Qi wireless mode

GNSS Configuration:

GNSS Constellation Selection (GNSS)

Defines which of the available major GNSS options to enable, implemented from 7.0.51:

```
$GNSS,<gps-enable>[,<glonass-en>,<galileo-en>,<beidou-en>]
```

<gps-enable>	0: disable GPS	1: enable GPS
<glonass-enable>	0: disable Glonass	1: enable Glonass
<galileo-enable>	0: disable Galileo	1: enable Galileo
<beidou-enable>	0: disable BeiDou	1: enable BeiDou

Notes:

1. At least one major GNSS platform must be enabled
2. BeiDou is available only on EVA-M8M based devices
3. Changes in GNSS configuration are applied from boot-up

GNSS Minimum Acceptable Quality (GPSQ)

Defines the minimum acceptable quality threshold for a GNSS fix, based on the estimated GNSS position accuracy. The value for GPSQ is a percentage, allowed values are from 0 to 100. The default value is 50%, which corresponds to an estimated position error of 50m. A value of 100% specifies near perfect GNSS results with an estimated error of 2m or less. A value of 1% for GPSQ specifies the lowest acceptable quality, based on an estimated error of 100m. A value of zero disables GNSS fix quality filtering, such that the device will use an 3D fix that the GNSS receiver determines as "autonomous" (i.e. valid).

3 optional arguments allow more advanced optimisation of acceptable fix validity filtering.

```
$GPSQ,<location-accuracy>[,<min-sv-count>,<min-sv-elevation>,><fixes-to ignore>]
```

<location-accuracy>	Index to specify location quality filtering (0 – 100)
<min-sv-count>	Minimum allowed SV count
<min-sv-elevation>	Minimum allowed SV elevation angle above horizon
<fixes-to ignore>	Number of valid fixes to ignore after initial GNSS power-up

Default:

```
$GPSQ,75,4,5,10
```

NMEA enable (NMEA)

Enable NMEA GNSS output on the serial port. A value of 1 enables $GPRMC NMEA sentences and zero disables them (see DBUG to enable/disable other serial output). Default is 1.

$NMEA,0	Disable NMEA output on debug RS232 port
$NMEA,1	Enable NMEA $GPRMC output on debug RS232 port
$NMEA,2	Enable output ALL NMEA sentences on debug RS232 port

Driver ID Settings:

Driver ID Configuration (DRIC)

Configure driver ID options.

```
$DRIC,<driver-id-source>,<reminder>,<confirm>,<report-all>,<immobilise>,
<validity-to-secs>,<auth-to-secs>,<imob-output-state>,
<server-authorisation>,<allow-manual-imob-override>,
<reminder-to-sec>,<progress-indicator>,
<combined-reminder+progress>
```

<driver-id-source>[1]	0: none, 1: iButton, 2: RFID, 3: Bluetooth, 4: CR002 (1-wire card reader)
<reminder>[2,3]	Set to 1 to enable a reminder buzzer when ignition is turned ON until a driver ID is presented
<confirm>[3]	Set to 1 to enable an indicator (short pulse) whenever an ID is read
<report-all>	Set to 1 to enable to enable an event/report each time an ID is presented
<immobilise>[1]	Set to 1 to enable the immobiliser output to disable the vehicle until an ID is presented. The immobiliser will be re-asserted 30 seconds after the end of the journey or the expiry of <validity-timeout-secs>

<validity-to-secs>	Driver ID will be attached to all journey START and STOP reports until validity expires. This can be useful for applications which involve many short journeys / stops, to avoid the need to present ID every time. If set to 0, the ID will become invalid at the next STOP report, and must be presented for every journey start (for reminder and immobiliser purposes). Default is 0.
<auth-to-secs>	When immobiliser option is enabled, the driver ID must be presented before the vehicle engine is started. If no Driver ID was seen for *auth-timeout-secs* the immobiliser will be activated. Default is 30. Minimum is 10
<imob-output-state>	The state of the digital output when immobilisation is active. 0 = OFF for immobilisation, secure mode - relay contacts NO 1 = ON for immobilisation, failsafe mode - relay contacts NC Default is 1 (failsafe mode)
<server-authorisation>	This controls whether a driver ID must be authorised by the server using the DRID commands described in the following section. 0 = no driver ID check required, accept any ID for immobilisation 1 = server authorisation required for immobilisation 2 = use local whitelist / blacklist without server authorisation
<manual-imob-override>	this option is no longer supported (new immobiliser priorities from firmware version 7.0.23)
<reminder-to-sec>	Timeout on reminder buzzer in seconds. Set to zero for an indefinite timeout. Default is 0.
<progress-indicator>[2,3]	Set to 1 to enable a progress indicator when the Driver ID is being authenticated by the server
<combined-rem+prog>[2,3]	Set to 1 to enable both the reminder and the DRID progress indicator to be combined on a single digital output

Note 1: these options require the use of a digital output. $DRIC will return an error if the device does not have sufficient digital outputs to support all enabled options.

Note 2: <reminder>, <drid-progress-indicator>, and <combined-rem+prog> functions are mutually exclusive. Ensure that only one of these options is set at any one time.

Authorised Driver ID Implementation (DRID)

This feature allows the driver ID to be linked to the immobiliser, such that only authorised drivers may start the vehicle. Each time a new ID is read (i.e. not currently in the whitelist), the device will query the host server for approval to accept the new ID. This process should take no more than 10 seconds. IDs approved by the host will be added to the device's whitelist and when presented again in the future, they will be immediately authorised by the device.

The device will store a list of up to 100 approved driver IDs (whitelist) and up to 50 declined IDs (blacklist).

IDs that are declined, will be added to the blacklist and will not allow the vehicle to be started. If a blacklisted ID is presented again in the future, the device will re-request approval on every occasion. IDs previously approved can be removed from the whitelist by the host.
If the device has no communication with the host server, whitelisted IDs will allow the vehicle to be started and blacklisted IDs will not allow the vehicle to be started. Unknown IDs will be temporarily allowed to start the vehicle and approval will be requested as soon as communications resume. If declined at that point, the vehicle will be immobilised.

If the whitelist becomes full and a new iButton is authorised, the oldest iButton will be removed from the list. The oldest iButton is based on the last time that the IDs were presented, so regularly used IDs should never be removed from the whitelist.

The device can re-request authorisation from the server of all IDs in the whitelist periodically.
In the command descriptions the <family-code>, <serial-number> and <source> are formatted as follows:

Argument	Format
<family-code>	iButton family code, fixed length, 2 hexadecimal digits, in ascii format (leading zeros), e.g. 0F. This field will only be populated if the source is an iButton, otherwise it will zero
<serial-number>	ID serial number, variable length, typically 12 – 16 hexadecimal digits (maximum 8 bytes)
<source>	Source of the ID, fixed length, 2 decimal digits 01=iButton, 02=Mifare card, 03=Bluetooth, 04=PicoPass Card

The following table describes the commands. The first command is from device to host whilst the rest are from host to device.

Command	Description
$DRID,<model>,CHECK,<imei>,<family-code>,<serial-number>,<source>	Device requests driver ID authorisation from host
$DRID,APPROVE,<family-code>,<serial-number>	approve ID
$DRID,DECLINE,<family-code>,<serial-number>	decline ID
$DRID,ADD,<family-code>,<serial-number>	add an ID to the whitelist
$DRID,REMOVE,<family-code>,<serial-number>	remove ID from the whitelist
$DRID,CLEAR	delete both whitelist and blacklist
$DRID,CLEAR,WHITE	delete whitelist
$DRID,CLEAR,BLACK	delete blacklist
$DRID,BLOCK,<family-code>,<serial-number>	add ID to blacklist
$DRID,VERIFY,<hours>	set the device whitelist verification period (0-65535). 0 disables the request

DRID Examples:

iButton (6 byte ID + family code) – Approved:

```
$DRID,AT110,CHECK,351777042187300,01,00000000125408C9,01      query
$DRID,APPROVE,01,00000000125408C9                             response
```

MiFare card (8-byte ID) – Approved:

```
$DRID,AT240V8,CHECK,351777042187300,00,000000009B200F2E,02    query
$DRID,APPROVE,,000000009B200F2E                               response
```

Bluetooth (6-byte ID)- Declined:

```
$DRID,AT00V3,CHECK,351777042187300,00,0000FF254A2A548E,03     query
$DRID,DECLINE,,0000FF254A2A548E                               response
```

NOTES ON CARD ID BYTE ORDER AND HANDLING OF FAMILY CODE WITH 1-WIRE DEVICES (INCL. CR002)

ID Printed on MiFare card: EE0B5BFA
Read via 1-wire protocol as: iButton FC:[01] ID:[0000fa5b0bee] CRC:[dc]

Note the reversed byte order.

The correct $DRID command is therefore:

$DRID,ADD,01,FA5B0BEE// Leading zeros are not required, they can be used, or not.

Driver Behaviour Related Settings:

Acceleration & Deceleration Event Thresholds (ACMX & DCMX)

Report events can be triggered on specified thresholds of acceleration and deceleration (i.e. braking). ACMX specifies the acceleration threshold in m/s/s * 10, integer format. Default is 35. DCMX specifies the deceleration threshold in m/s/s * 10, integer format. Default value is 40.

```
$ACMX,<accel-mss>
$DCMX,<accel-mss>
```

<accel-mss>	Accel / decel threshold in m/s/s * 10

Example:

$ACMX,35	set accel threshold at 3.5 m/s/s
$DCMX,45	set decel threshold at 4.5 m/s/s

Cornering Event Thresholds (ACMY & DCMY)

Report events can be triggered on specified thresholds of cornering force. ACMY and DCMY specify the cornering threshold in m/s/s * 10, integer format. Default value is 50.

```
$ACMY,<cornering-mss>
$DCMY,<cornering-mss>
```

<cornering-mss>	Cornering threshold in m/s/s * 10

Example:

$ACMY,35	set cornering accel threshold at 3.5 m/s/s
$DCMY,45	set cornering decel threshold at 4.5 m/s/s

Collision Event Threshold (COLN)

This parameter defines the acceleration/deceleration threshold (on any axis) to be classified as a collision event. COLN specifies the threshold in m/s/s * 10, integer format. Default value is 100 (10 m/s/s).

```
$COLN,<collision-mss>
```

<collision-mss>	Collision threshold in metres per second per second * 10

example:

$COLN,125	set cornering accel threshold at 12.5 m/s/s

Device Orientation (ORTN)

This parameter defines the device installation orientation in order to allow corrections to be applied to the accelerometer X/Y data to ensure data is correctly orientated with the vehicle axis. When ORTN is specified correctly (as per the table below) X data will correspond to vehicle acceleration and deceleration and Y will correspond to cornering forces (+ve Y corresponding to a left turn and -ve Y for right hand turns). Default is 0.

```
$ORTN,<orientation>
```

<orientation>	Device Installation Position
0	Unspecified
1	Device (label) facing sky, connector facing to LHS
2	Device (label) facing sky, connector facing FORWARD
3	Device (label) facing sky, connector facing to RHS
4	Device (label) facing sky, connector facing to REAR
5	Device (label) facing front or rear, connector facing to LHS
6	Device (label) facing LHS or RHS, connector facing FORWARD
7	Device (label) facing front or rear, connector facing to RHS
8	Device (label) facing LHS or RHS, connector facing to REAR
9	Device (label) facing LHS or RHS, connector facing UP or DOWN
10	Device (label) facing front or rear, connector facing UP or DOWN
11	Device (label) facing LHS or RHS, connector facing UP or DOWN
12	Device (label) facing front or rear, connector facing UP or DOWN

Pass Through Data Mode Related Settings:

PTDM Host IP Address (IPAD2)

Host IP address or hostname to be used in Pass Through Data Mode. Maximum hostname length is 64 characters. Please refer to the appropriate application note for further details.

```
$IPAD2,<ptdm-ip-addr>
```

`<ptdm-ip-addr>` PTDM server IP address or hostname

PTDM Host Port Number (PORT2)

Port number to be used in Pass Through Data Mode. Please refer to the appropriate application note for further details.

```
$PORT2,<ptdm-port>
```

`<ptdm-port>` PTDM port number

Pass Through Data Mode (PTDM)

Pass through data mode enable. Set this parameter to 1 to enable Pass Through Data Mode. Please refer to the appropriate application note for further details. Default is 0.

```
$PTDM,<mode>,<baud-rate>,<packet-timeout-ms>,<packet-max-size>,
<packet-terminator>,<device-login>,<rs232-port>,<tcp-socket>,
<add-terminator>,<packet-headers>,<ack-enable>,<auto-off-time>
```

Field	Description	Range
<mode>	PTDM mode	0 Disabled 1 Enabled 2 Garmin FMI 3 incl. CONNECT message 4 Transcan
<baud-rate>	RS232 baud rate	4800 9600 19200 38400 57600 115200 230400 460800 921600
<packet-timeout-ms>	Packet assembler timeout	0 – 65535 ms
<packet-max-size>	Packet assembler max. packet size	1 – 1024 (incl. header and terminator)
<packet-terminator>	Packet assembler termination character options	0 no terminator 1 Send on <CR> 2 Send on <LF> 3 Send on <CR><LF>
<device-login>	Enable a device login (IMEI) when a TCP socket is opened	0 no login 1 login enabled
<rs232-port>	Select RS232 Port	0 RS232 Port 1 1 RS232 Port 2
<tcp-socket>	Select TCP socket to use for PTDM	0 Use IPAD / PORT 1 Use IPAD2 / PORT2

Field	Description	Range	
<add-terminator>	specify additional termination characters to add to packets in both directions	0 1 2 3	no additional terminator Add <CR> Add <LF> Add <CR><LF>
<packet-headers>	Enable #PTDA: packet headers	0 1	no packet headers packet headers enabled
<ack-enable>	Option to ACK packets sent in both directions	0 1	ACK disabled ACK 05 byte is sent in response to packets received in both directions
<auto-off-time>	Optional pass through data mode disable timer	0 1-65535	PTDM mode runs continuously Defines a limited time (minutes) to run PTDM mode, after which PTDM will automatically disable (<mode> will be set to 0)

Please refer to the Pass-Through Data Mode Applications Note for more details on these options.

CANBus Related Settings

CANBus Configuration (CANC)

Allows configuration of the CANBus to suit the vehicle, installation and application.

`$CANC,<silent-mode>,<bit-rate>,<ext-CAN-ID>,<interface-type>,<fuel-type>`

The silent mode option operates as described in the following table:

<silent-mode>	Description
0	silent mode OFF - uses dominant ACK bits. Device will acknowledge received messages. (default)
1	silent mode ON - uses recessive ACK bits. Device will not acknowledge received messages

The bit rate index is in the range 0-2 and represents an actual bit rate as given in the following table:

<bit-rate>	Bit rate
0	125 kbit/s
1	250 kbit/s (default)
2	500 kbit/s

The extended CAN ID option selects 11 bit or 29 bit CAN identifiers as follows:

<ext-CAN-ID>	Description
0	Standard 11 bit identifiers / J1979 OBD (default)
1	Extended 29 bit identifiers / J1939 FMS

Note: this parameter has no effect when using $GCAN and the Astra Generic CAN <interface-type>

The interface type is set as follows:

<interface-type>	Description
0	CANBus disabled (default)
1	FMS
2	OBD
3	Proprietary Protocol (custom / vehicle-specific)
4	NMEA2k
5	Astra Generic CAN Definition (must be defined using $CANG)

The fuel type is set as follows:

<fuel-type>	Description
0	Fuel type AUTO DETECT (default)
1	Fuel type PETROL
2	Fuel type DIESEL

CANBus Generic (CANG)

Allows configuration of the CANBus to listen for and react to user-defined CAN frames.

Please refer to our application note "CANBus Generic CAN ($CANG)" for more details.

```
$CANG,<index>,<CAN-id>,<CAN-id-mask>,<CAN-id-is-extended>,<mux-start-bit>,<mux-bit-width>,<mux-value>,<event-mask>
```

Parameter	Description
index	allows up to 20 CAN IDs of interest to be defined using index values 1-20
CAN-id	The 11-29bit CAN ID, use 0 to disable this entry Note: This is a RAW CAN ID, not a J1939 PGN. Please refer to our application note "CANBus Generic Can ($CANG)" for more details
CAN-id-mask	An up to 32-bit bitmask to be applied to the CAN ID when selecting from the bus, use 0 to disable masking and match only the as-is defined *CAN*-id If not 0, the packet will only be handled if: (CANID Received & *CAN-id-mask*) == *CAN-id*
CAN-id-is-extended	is the ID an extended ID? 0 => No, the ID is an 11-bit standard ID 1 => Yes, the ID is a 29-bit extended ID
mux-start-bit	MUX start bit (0-63)
mux-bit-width	MUX bit width (0-16), use 0 to disable MUX referencing
mux-value	MUX value of interest (up to 16-bit), specified MUX bits must match this value for the packet to be handled
event-mask	A 64-bit bitmask which is cross-referenced (bitwise) to the payload bytes to trigger an event if any bits present in this mask have changed since the last report, if no events are configure/triggered at the time a report is generated, the latest payload will be included

All parameters are in decimal format

NOTE: To use $CANG, you must appropriately configure the following $CANC parameters:

```
<silent-mode>
<bit-rate>
<interface-type> => 5 (Astra Generic CAN Definition)
```

CANBus Event Mask (CANM)

FMS CANBus events can be configured to generate reports using the following command:

```
$CANM,<canbus-event-mask>
```

where the mask bits are set to 1 to enable event triggers and cleared to disable event triggers. The mask bits are described in the following table:

<canbus-event-mask>	**Bit**	**Default**
Brake switch – pedal released	0	0
Brake switch – pedal depressed	1	0
Cruise control – switched on	2	1
Cruise control – switched off	3	1
PTO – Off / Disabled	4	1
PTO – Set	5	1
PTO – Not Available	6	1
Vehicle Direction – Forward	7	1
Vehicle Direction – Reverse	8	1
Vehicle Speed – Overspeed	9	1
Vehicle Speed – No Overspeed	10	1
Reserved	11	0
Reserved	12	0
Reserved	13	0
Reserved	14	0
Reserved	15	0

The default CANM setting is 2044.

FMS/OBD Event Thresholds

The CANBus event reporting thresholds can be configured by setting the relevant parameters using the commands described below:

Engine Load Event Configuration (ELEC)

```
$ELEC,<el-high-threshold>,<el-high-hold-timeout>,<el-high-inhibit-timeout>
```

Parameter	Description
engine-load-high-threshold	when reached or exceeded will generate a report. A value of 0 disables event reporting for this threshold.
engine-load-high-hold-timeout	the time (in seconds) for which the engine load must exceed the engine-load-high-threshold setting in order for an event to be reported
engine-load-high-inhibit-timeout	the time (in seconds) following an engine load high event, during which another event cannot be reported

The engine load is reported on a scale of 0-125 percent of the operational range of FMS and 0-100 for OBD.

RPM Event Configuration (RPEC)

```
$RPEC,<rpm-high-threshold>,<rpm-high-hold-timeout>,<rpm-high-inhibit
timeout>
```

Parameter	Description
rpm-high-threshold	when reached or exceeded, will generate a report. A setting of 0 disables event reporting for this threshold.
rpm-high-hold-timeout	the time (in seconds) for which the reported RPM must exceed the rpm-high-threshold setting in order for an event to be reported
rpm-high-inhibit-timeout	the time (in seconds) following RPM high event for which another event cannot be reported

The RPM is reported divided by 32 on a scale of 0-250 (to represent 0-8000 rpm) for FMS and 0-255 (0-8160) for OBD.

Throttle Position Event Configuration (TPEC)

```
$TPEC,<rpm-high-threshold>,<rpm-high-hold-timeout>,<rpm-high-inhibit-
timeout>
```

Parameter	Description
throttle-high-threshold	when reached or exceeded, will generate a report. A setting of 0 disables event reporting for this threshold.
throttle-high-hold-timeout	the time (in seconds) for which the reported throttle position must exceed the throttle-high-threshold setting in order for an event to be reported
throttle-high-inhibit-timeout	the time (in seconds) following a throttle high event for which another event cannot be reported

The throttle position is reported on a scale of 0-100%.
To summarise, the ranges for the event threshold parameters are given in the table below:

Parameter	Minimum	default value	Maximum
engine-load-high-threshold	1	90	125
engine-load -hold-timeout (secs)	1	30	65535
engine-load -inhibit-timeout (secs)	1	60	65535

Parameter	Minimum	default value	Maximum
rpm-high-threshold	1	4000	8000
rpm-hold-timeout (secs)	1	30	65535
rpm-inhibit-timeout (secs)	1	60	65535
throttle-high-threshold	1	75	100
throttle-hold-timeout (secs)	1	30	65535
throttle-inhibit-timeout (secs)	1	60	65535

Bluetooth BLE Related Settings

BLE Configuration (BLEC)

Allows configuration of BLE connection and security. Please refer to our application note "Using BLE with Astra Devices" for more details.

$BLEC,<ble-enable>,<ble-store-bonding>,<adv-min-int-ms>,<adv-max-int-ms>,<adv-channels>,<rsdk-enable>,<auth-time-min>,<security-level>,<ble-name-prefix>

<ble-enable>[1]	0 = disable BLE 1 = enable BLE 2 = enable BLE only when mobile communications are offline (for diagnostics)
<ble-bondings>	0 = don't store bondings 1 = store bondings & clear on reboot 2 = store bondings & restore on reboot
<adv-min-int-ms>	min advertising interval in milliseconds
<adv-max-int-ms>	max advertising interval in milliseconds
<adv-channels>	advertising channels (bitfields); 7 = all channels bit 0 = channel 37 bit 1 = channel 38 bit 2 = channel 39
<rsdk-enable>	1 = enable RSDK security 0 = disable RSDK security
<auth-time-min>	0 = disable timeout (indefinite) Time in minutes to allow an authorised device to send BLE commands, when not using RSDK. When RDSK is enabled, the authorisation timeout is defined with each RSDK expiry time (see below)
<security-level>[2]	0 = no security (no pairing required) 1 = unauthenticated pairing with encryption 2 = authenticated pairing with encryption 3 = authenticated LE Secure Connections pairing with encryption
<ble-name-prefix>[3]	prefix for BLE name, in ascii, up to 8 characters Default prefix will be the device model name, e.g. "AT241"

1 disabling BLE will return an error if BLE-based sensors are enabled with $SNSR. First delete the sensor configurations and then BLE may be disabled
2 implemented from Astra firmware version 7.0.39.xx / BLE firmware 2.13 and later
3 implemented from Astra firmware version 7.0.40.xx

.

Default: $BLEC,1,1,100,200,7,0,65535,3,[model name]

e.g. on AT241 the defaults will be:

Default: $BLEC,1,2,100,200,7,0,0,3,AT241

1. Authentication of connected BLE devices is achieved using a Revocable Secure Digital Key or RSDK, which is defined using the command:

   `$RSDK,<mode>,<rsdk>,<expiry-min>`

`<mode>`	action: ADD, REMOVE, DISPLAY, CLEAR (entire list)
`<rsdk>`	32 byte RSDK in ascii coded hex (RSDK < 32 bytes will be padded with leading zeroes)
`<expiry-min>`	expiry time of the RDSK in minutes 0 = disable expiry timeout (default)

   Max RSDK list size: 10

   RSDKs for authorised users are sent to the device from the host server. Once stored, a user may connect to the Astra device using BLE, as defined in the following section. Once authenticated and bonded with the Astra device, the user may send Astra $ commands to the device.

   example – add an RSDK to the device list:

   `$RSDK,ADD,101112131415161718191A1B1C1D1E1F000102030405060708090A0B0C0D0E0F`

   Note 1: since no expiry time has been specified in the command, the default value of 0 will apply, which means that the RSDK will never expire

   Note 2: each Astra device has a local list of up to 10 RSDKs. Expired RSDKs will be automatically deleted, as and when they expire. In case the list gets full, recently used RSDKs will take priority and the new RSDK will overwrite the one which has been unused for the longest time.

2. Astra device BLE name will be the device model followed by the last 7 digits of the device IMEI, for example:

   AT241-1234567

Input / Output Configuration:

Set Digital Output (SDIG)

Allows manual setting and re-setting digital outputs.

```
$SDIG,<output-num>,<state-to-set>
```

<output-num>	digital output number (1-5)
<state-to-set>	1 for closed / ON and 0 for open / OFF

Examples:

$SDIG,2,1	switch output 2 ON
$SDIG,3,0	switch output 3 OFF

Note that the SDIG command forces an unconditional assignment of the specified digital output state, and hence should not be used with any digital output assigned to an immobiliser function which may stop the vehicle mid-journey.

From version 7.0.28, the $SDIG command allows a pulsed operation, as follows:

```
$SDIG,<output-num>,<state-to-set>,<set-time-ms>,<pulse-reps>,
<unset-time-ms>
```

<output-num>	digital output number to be switched (1 – 5)
<state-to-set>	state to set output (0 – 1)
<set-time-ms>	duration of the set time in milliseconds (10 – 65535)
<pulse-reps>	pulse cycle repetitions (1 – 255)
<unset-time-ms>	duration of the unset time in milliseconds (10 – 65535)

SDIG pulsed operation examples:

$SDIG,2,1,500	switch output 2 ON for 500mS (and then OFF)
$SDIG,3,1,150,5,75	switch output 3 ON for 150mS, OFF for 75ms, repeat 5 times
$SDIG,5,1,300,2	switch output 5 ON for 300mS, OFF for 100ms*, repeat 2 times

* where a repetition is specified without an <unset-time-ms>, a default unset time of 100mS will be used.

Typical pulse timing tolerance is ±10mS

Configure Digital Outputs (CDOP)

Where an output is controlled in response to an event, the digital output used can be configured using this command. CDOP is a simplified form of CDIG which can be used to set only one function instead of setting all outputs at once.

```
$CDOP,<output-number>,<application>[,<option1>,<option2>,<option3>]
```

The application options are numbered as follows:

<application>	Description
0	Not assigned
1	Immobiliser
2	Reminder (driver ID)
3	Confirm (driver ID)
4	Driver Behaviour - yellow
5	Driver Behaviour - orange
6	Driver Behaviour - red
7	Progress Indicator (driver ID)
8	Combined reminder & progress indicator on a single output
9	Motion Detection (options 1 and 2 apply) from firmware 7.0.50
10	Geofence (options 1-3 apply) from firmware 7.0.64
11	CC001 power on/off control from firmware 7.0.73
12	Alcohol Tester Immobiliser from firmware 7.0.77

Examples:

`$CDOP,3,1,0`	Use digital output 3 for immobiliser (secure mode, relay NO contacts)
`$CDOP,2,3`	Use digital output 2 for driver ID confirm
`$CDOP,1`	Display the application assigned to digital output 1
`$CDOP`	Display the available options for all applications

option for <application> 1, Immobiliser function:

<option1>	Immobiliser state logic 0 = OFF for immobilised state, secure mode / relay contacts NO 1 = ON for immobilised state, failsafe mode / relay contacts NC Default is 1 (failsafe mode)

options for <application> 9, Motion Detection function:

<option1>	duration in seconds to activate output (1-255)
<option2>	0: continuous activation 1: pulsed activation

options for <application> 10, Geofence breach function:

<option1>	duration of the output ON time in milliseconds (10–65535)
<option2>	pulse cycle repetitions (1–255)
<option3>	duration of the output OFF time in milliseconds (10–65535)

options for <application> 11, CC001 Power ON/OFF Control:

<option1>	power ON logic 0: power on always

1: power on only when ignition is active

options for <application> 12, Alcohol Tester Immobiliser function:

<option1>	Immobiliser state logic 0 = OFF for immobilised state, secure mode / relay contacts NO 1 = ON for immobilised state, failsafe mode / relay contacts NC Default is 1 (failsafe mode)

Default settings for CDOP are device dependent.

Note: applications can be assigned to only one digital output. If an application has been assigned to a digital output and then later assigned to a different one, the previous assignment will be set to zero (not assigned).

Please refer to the driver behaviour application note and DB001 data sheet for details of driver behaviour features.

Configure Digital Inputs (CDIP)

The digital inputs can be de-bounced over a period of time configured using the command

```
$CDIP,<digital1-db-secs>,<digital-plus-db-secs>
```

<digital1-db-secs>	Debounce seconds for digital input 1
<digital-plus-db-secs>	Debounce seconds for all other digital inputs

The ignition input de-bounce period is specified separately from other inputs using <digital1-db-secs>. The de-bounce period for all other outputs is specified using <digital2-plus-db-secs>. A value of 0 disables input state de-bouncing. The maximum allowed period is 5 seconds.

Default settings for CDIP are:

<digital1-db-secs>	1
<digital2-plus-db-secs>	0

Serial Port Configuration (SRAL)

Assign an application to one of the RS232 serial ports and specify an optional baud rate. If the baud rate is omitted, the device will assign the default baud rate according to the application, as specified in the table below.

```
$SRAL,<port-number>,<application>,<baud-rate>
```

<port-number>	can be 1 or 2, depending on the number of RS232 ports available on the appropriate device
<application>	see table below for available applications
<baud-rate>	baud rate (if not specified, the defaults below will apply)

<application>	*Description*	*Default Baud Rate*
0	NONE	N/A
1	DEBUG (default)	115200
2	PTDM	9600
3	CR001 CARD READER	9600
4	MP2 CARD READER	19200
5	BSEN15430 GRITTER	9600
6	REDFORGE GRITTER	9600
7	CARRIER REFRIGERATOR	9600
8	ECON 3-BYTE GRITTER	9600
9	ECON 1-GRAM GRITTER	9600
10	HEGEMON TRAILER TAG	9600
11	SCHMIDT GRITTER	19200
12	NINEBOT ES4 KICK-SCOOTER	19200
13	ASI BAC 55 MOTOR CONTROLLER	115200
14	INCA EMULATOR	9600
15	STM32WLE5JC-based LoRa COMMS	9600
16	CM2010 mobility scooter controller	9600
17	ALC-30x Alcohol Tester	9600
18	E610 Speed Limiter	9600

Example:

`$SRAL,2,3` RS232 port 2 for use with CR001 card reader (default baud rate)

NOTE: please refer to our communication protocol documentation for details of supported applications. All applications are supported by our modular protocol X, by enabling the appropriate module, using the $PROT command.

Immobilise (IMOB)

Set digital output for purposes of vehicle immobilisation, giving the option of making the activation conditional on vehicle ignition status and speed to ensure safe immobilisation. When this command is used, the output will remain ON (vehicle disabled) until $IMOB,0 is received to clear the immobilise condition.

If $IMOB is used with no argument, the default mode 3 is used (conditional on ignition OFF and speed = zero). If the driver ID based immobilise option is enabled (see DRIC command), $IMOB with no argument uses mode 4 (immediate and unconditional).

`$IMOB,<mode>,<delay-sec>`

<mode>	**IMOB Conditions**
0	Clear immobilisation mode and set immobiliser output to enable vehicle use
1	Activate output switch when vehicle ignition is OFF
2	Activate output switch when vehicle is stationary
3	Activate output switch when vehicle is stationary AND ignition is OFF
4	Activate output switch immediately and unconditionally (DEFAULT)

`<delay-sec>` specifies an optional delay, after all conditions are met, before the immobiliser is activated. This field should be left blank if no delay is required.

IMOB may be used whilst DRIC or IMOS immobiliser functions are active, in which case the immobiliser state will be changed until the next DRIC/IMOS event. For example, the specified IMOS on-time / off-time, an ignition ON event, or an ignition OFF event.

Automatic Immobilisation Schedule (IMOS)

Automatic immobilisation can be scheduled individually for each day of the week using this command.

`$IMOS,<day>,<on-time-hr>,<off-time-hr>,<on-time-min>,<off-time-min>`

Field	Description	Range
<day>	Day of week since Sunday 0 = Sunday 1 = Monday 2 = Tuesday 3 = Wednesday 4 = Thursday 5 = Friday 6 = Saturday 7 = Apply same settings to every day	0-7
<on-time-hr>	Vehicle enabled time: hour of day, local time	0-23
<off-time-hr>	Vehicle disabled time: hour of day, local time	0-23
<on-time-min>	Vehicle enabled time: minutes after the hour	0-59
<off-time-min>	Vehicle disabled time: minutes after the hour	0-59

Notes:

- The output used must be assigned to <immobiliser> using the CDOP command
- IMOS will never allow a vehicle to be immobilised mid-journey, whilst the ignition is on
- <on-time> and <off-time> can be defined for each day of the week
- Specify <day>=7 to set the same <on-time> and <off-time> to all days of the week
- <on-time> and <off-time> are defined to the nearest hour using 24 hour clock
- <on-time> and <off-time> are always specified in your local time, the device will adjust times appropriately based on the timezone set with $TMZN
- Set <on-time> = <off-time> to disable auto immobilise schedule for any given day

The output will be turned OFF after the specified <on-time-hr>,<on-time-min> for any given day of the week. The output will be turned ON after the specified <off-time-hr>,<off-time-min> for any given day of the week, and will remain ON until the specified <on-time-hr>,<on-time-min> for the following day. The state of the output can be over-ridden by the use of the SDIG or IMOB commands, which will force the state as specified until the next scheduled <on-time-hr>,<on-time-min> or <off-time-hr>,<off-time-min>.

ADC Configuration (ADCC)

ADC1 and ADC2 will be sampled at regular intervals. Each sample is a 12-bit value. The average over a specified number of samples will be inserted in the next report. If a sample changes by more than a specified percentage of the input voltage range from the previous reading then this will cause a report to be sent.

The format of the ADCC command is as follows:

```
$ADCC,<event-threshold-%-change>,<avg-samples>,<avg-sample-interval>
```

Field	Description	Range
<event-threshold-%-change>	Percentage change of the analogue reading from one sample to the next that will cause a report to be sent. Percentage is the change compared to the full-scale input range	0-100 Default 0 0 to disable this feature
<avg-samples>	Number of most recent samples that is used to calculate the average reading	1-100 Default 10
<avg-sample-interval>	Number of seconds between each sample	1-255 Default 5

Configure Power Monitoring (CPWR)

This command sets the conditions for sending external power alarms.

```
$CPWR,<volt-level>,<low-volt-delay>,<no-volt-delay>,<power-down>
```

`<volt-level>` Voltage to trigger low external voltage condition (floating point)
`<low-volt-delay>` Delay before reporting low external voltage, in seconds (255 max.)
`<no-volt-delay>` Delay before reporting no external voltage, in seconds (255 max.)
`<power-down>` Power down when no external voltage
- 0: no power down
- 1: complete power down, wake on fixed 24 hour timer[1]
- 2: complete power down, wake on according to $STIM timer[1]
- 3: power down all except comms, wake on data / SMS received[1]

Note 1: additionally, wake criteria always include restoration of external voltage & motion detected.

If the external voltage falls below `<volt-level>` for `<low-volt-delay>` seconds, an event is triggered and reported. If external power is disconnected (below 5.0V) for `<no-volt-delay>` seconds, an alert is raised and reported. These alerts may be notified by SMS by defining a mobile phone alert number (see $ALRM).

The <power-down> option (from firmware 7.0.48) allows the device to enter sleep mode whenever the external voltage is disconnected. When enabled, the device will enter sleep mode `<no-volt-delay>` seconds after power has been lost, and will wake on the usual criteria, power being restored, ignition ON, motion or stationary report interval timer.

The default settings are:

```
$CPWR,11.5,30,30,1
```

Sensor Configuration (SNSR)

The SNSR command can be used to configure the device to accept and report data from different wireless/wired sensors. For example, a Bluetooth temperature sensor may be fitted alongside the

device; if the sensor is supported, it must be configured here. The device can be configured with up to 6 sensors. Please refer to the Using BLE sensors with Astra Devices application note for a detailed example of setting up a BLE sensor. Supported from firmware 7.0.67.

`$SNSR,<sensor-number>,<sensor-type>[,<option-1>]`

`<sensor-number>`	sensor index, 1-6
`<sensor-type>`	sensor type from the table below
`<option-1>`	addition configuration, depending on the sensor type, according to the table below

<sensor-type> options:

<sensor_type>	Description	<option-1>
0	Disabled	0
1	TH100 Temperature	BLE MAC Address
2	TH100 Humidity	BLE MAC Address
3	RuuviTag Temperature[1]	BLE MAC Address
4	RuuviTag Humidity[1]	BLE MAC Address
5	ADS02 Alcohol Solubility	BLE MAC Address
6	BM01 Heart Rate	BLE MAC Address
7	BM01 Respiratory Rate	BLE MAC Address
8	BM01 Human Present	BLE MAC Address
9	BM01 Human Distance	BLE MAC Address

Examples:

`$SNSR,1,1,E4:25:04:36:A6:F7` Set sensor #1 to a TH100 to be used for temperature with ID E4:25:04:36:A6:F7

`$SNSR,OK`

`$SNSR,2,2,E4:25:04:36:A6:F7` Set sensor #2 to a TH100 to be used for humidity with ID E4:25:04:36:A6:F7

`$SNSR,OK`

`$SNSR,1` Display the configuration of sensor #1

`$SNSR` Display the configuration of all 6 sensors

`$SNSR,1,0,0` Disable and de-configure sensor #1
`$SNSR,OK`

Note 1: The order of sensors in SNSR will be reflected in the order of sensors encoded in Protocol X module #33

Note 2: To use BLE sensors, the device must have BLE enabled using the $BLEC command. If you attempt to configure a BLE sensor without BLE enabled, $SNSR will return $SNSR,ER.

Note 3: RuuviTag sensors are supported from firmware 7.0.75

Beacons Database (BCNS)

The BCNS command-set can be used to efficiently manage the device's on-board database of BLE beacon definitions. This command-set also allows for the configuration of companion-tracking parameters. Supported from firmware 7.0.77.

Note 1: A maximum of 1000 beacon database entries can be configured

Clearing the database:

`$BCNS,CLEAR` Clear the entire database

`$BCNS,CLEAR,OK`

Reading the database checksum:

`$BCNS,CSUM` Read the database checksum

`$BCNS,CSUM,0x12345678`

Reading an individual database entry by index:

`$BCNS,GET,0` Read the first database entry

`$BCNS,0,1,AABBCCDDEEFF,410` Height beacon type (1) read at index 0 with MAC AABBCCDDEEFF, height of 410cm

Deleting an individual database entry by index:

`$BCNS,DEL,8` Delete the 9th entry in the database (from zero)

`$BCNS,DEL,OK,8`

Deleting multiple database entries by their indexes:

`$BCNS,DELMANY,123,8,9,10` Delete the 9th 10th and 11th entry in the database (from zero) with a <tx-id> of 123

`$BCNS,DELMANY,OK,123` Delete many request with <tx-id> of 123 successfully acknowledged

Setting an individual database entry at a given index:

`$BCNS,SET,<index>,<beacon-type>,<mac>,<metadata…>`

`<index>`	sensor index, 0-999
`<beacon-type>`	beacon type from the table below
`<mac>`	beacon MAC address **strictly as a 12-character string**
`<metadata…>`	variable depending on the corresponding beacon type, see table below

<beacon-type> / <metadata> options:

<sensor_type>	Description	<metadata>
0	None	
1	Height Beacon	<height-cm> - corresponding height in centimetres

Example:

`$BCNS,SET,0,1,AABBCCDDEEFF,410` Set the first sensor in the database to a height beacon with MAC AA:BB:CC:DD:EE:FF and a corresponding height of 410cm (4.1m)

`$BCNS,SET,OK,0`

Setting multiple database entries at once in bulk:
`$BCNS,SETMANY,<tx-id>,<index-x>,<beacon-type-x>,<mac-x>,<metadata…-x>[,…]`

`<tx-id>`	transmission identifier, uint32, populate as desired to differentiate responses when managing multiple SETMANY operations simultaneously
`<index-x>`	sensor index, 0-999
`<beacon-type-x>`	beacon type from the table below
`<mac-x>`	beacon MAC address strictly as a 12-character string
`<metadata…-x>`	variable depending on the corresponding beacon type, see table below

Note 2: A maximum of 20 entries can be provided in one execution of this command

<beacon-type> / <metadata> options:

<sensor_type>	Description	<metadata>
0	None	
1	Height Beacon	<height-cm> - corresponding height in centimetres

Example:

`$BCNS,SETMANY,123,0,1,AABBCCDDEEFF,410,2,1,112233445566,200`
Set the first sensor in the database to a height beacon with MAC AA:BB:CC:DD:EE:FF and a corresponding height of 410cm (4.1m) and set the third sensor in the database to a height beacon with MAC 11:22:33:44:55:66 and a corresponding height of 200cm (2m)

`$BCNS,SETMANY,OK,123` Set many request with <tx-id> of 123 successfully acknowledged

Configuring other parameters relevant to beacons:
`$BCNS,CONFIG,<min-speed>,<candidate-count>,<confirm-count>,<miss-timeout>,<depart-timeout>,<rssi-close>,<poll-interval>`

`<min-speed>` Minimum speed to consider moving (m/s)
- Range: 0-50
- Default: 3 (≈7mph)
- Purpose: Only count beacon sightings as meaningful when the vehicle is moving above this speed

`<candidate-count>` Sightings at speed to become companion candidate
- Range: 0-100
- Default: 1

- Purpose: Number of times beacon must be seen while moving to become a potential companion

<confirm-count> Sightings at speed to confirm as companion

- Range: 0-100
- Default: 3
- Purpose: Number of times beacon must be seen while moving to become a potential companion- Purpose: Only count beacon sightings as meaningful when the vehicle is moving above this speed

<miss-timeout> Seconds without seeing beacon before it enters "departing" state

- Range: 0-3600
- Default: 120
- Purpose: Time before a confirmed companion is marked as departing

<depart-timeout> Seconds without seeing beacon before fully removing from tracking

- Range: 0-3600
- Default: 240
- Purpose: Time before a departing companion is no longer considered a companion

<rssi-close> RSSI threshold for instant companion candidate (dBm, negative value)

- Range: -127 to 0
- Default: -65
- Purpose: Strong signal while moving makes beacon immediate candidate (e.g., towed beacon very close)

<poll-interval> How often to update companion tracking states (seconds)

- Range: 1-300 (5 minutes max)
- Default: 5
- Purpose: Frequency of checking for timeout conditions and state transitions

<report-interval> How often to send periodic beacon reports (seconds)

- Range: 0 – disabled or 60-7200
- Default: 600
- Purpose: Automatic beacon status reports at regular intervals

Example:

$BCNS,CONFIG,3,1,1,240,360,-70,3,600
Make detection very aggressive & sticky
(consider sightings at >= 3m/s applicable. Require only 1 applicable sighting before fully confirming as a companion, only remove as a confirmed companion after 6 minutes of not being seen)

$BCNS,CONFIG,3,1,3,120,180,-60,5,600
DEFAULT: Make detection moderately aggressive & less sticky
(consider sightings at >= 3m/s applicable. Require 3 applicable sightings before fully confirming as a companion, only remove as a confirmed companion after 3 minutes of not being seen)

Other Settings:

Alarm Phone Number (ALRM)

This is destination number for alarm text messages sent via SMS. The number should be entered in international format (e.g. +447979123456). Alarm text messages are sent for external power loss and low external power (supply input less than the level defined by CPWR).

```
$ALRM,<alarm-tel>
```

<alarm-tel>	Alarm SMS mobile telephone number

Roaming Enable (ROAM)

This parameter can be used to disable network roaming, as a means of controlling data network costs. A value of zero will disable network roaming. The ROAM default value is 1.

```
$ROAM,<roam-enable>
```

<roam-enable>	Network roaming enable (1) / disable (0)

SMS Monthly Usage Limit (SMSL)

This parameter can be used to control SMS costs by setting a monthly limit on the number of SMS which may be sent from the device. A value of zero will disable outgoing SMS completely! Default SMSL is 50.

```
$SMSL,<sms-limit>
```

<sms-limit>	Maximum allowed monthly SMS usage

Geofences (GEOF)

Device based geofences can be configured with the GEOF command, which has 5 arguments as follows:

```
$GEOF,<index>,<type>,<radius>,<latitude>,<longitude>
```

Field	Description	Range
<index>	geofence index	1 - 100
<type>	geofence type	0 disabled 1 alarm on entry 2 alarm on exit 3 alarm on both
<radius>	geofence radius in metres	20 - 65535
<latitude>	geofence latitude, WGS84 decimal degrees	-90.0 to +90.0
<longitude>	geofence longitude, WGS84 decimal degrees	-180.0 to +180.0

Entering the command with index argument only will echo back the existing geofence settings.

Debug Level (DBUG)

Set the level of debug information displayed in the RS232 serial output as defined in the following table. Default is 2. From version 7.0.47 there is a second argument which allows debug to be enabled / disabled according to the task, default is all enabled, 65535.

$DBUG,<debug-level>,<task-debug_mask>

<debug-level>	0: no debug 1: debug errors and exceptions only 2: standard level debug 3: extended debug 4: detailed debug 5: developer mode debug (incl. Protocol X raw data)
<task-debug_mask>	bitmask which allows debug to be enabled by task, as follows: bit 0: communications bit 1: modem bit 2: events bit 3: GNSS bit 4: accelerometer bit 5: CANBus bit 6: iButton / 1-wire bit 7: RS232 SRAL applications bit 8: BLE bit 9: FFS bit 10: Low-power bits 11-15 : RESERVED

OTA Programming PIN Code (PASS)

OTA PIN code feature, which can be used to prevent unauthorised reconfiguration by SMS mode. The PIN code is specified using the PASS command. The PASS code can be set by RS232, SMS, BLE or TCP mode commands, but if PASS is non-zero, the correct current PASS code must be supplied before the new value. By default, PASS is set to zero, which disables OTA PIN code requirement. If PASS is set to any other value, the correct value must be specified with each OTA command. The PASS parameter can be up to 5 digits and must be the first command in the sequence.

e.g. to change distance reporting, when current PASS code is set to 12345:

```
$PASS,12345$DIST,1500
```

e.g. to change PASS code from 12345 to 5678:

```
$PASS,12345$PASS,5678
```

Only commands which change parameters require the PIN code. The PIN code is never required for the following commands:

$ATSW
$BOOT
$DIAG
$IMEI
$NACK
$PARA
$POLL
$POSN
$SDIG
$SHDN
$SHOW
$SSMS
$TEST

Tow Alert Parameters (TOWP)

A tow alert (i.e. report with REASON bit set indicating tow alert event) is generated whenever speed or a change of location are detected whilst the vehicle ignition is off. This is detected using GNSS speed and location alone. Note that motion detected by the accelerometer (whilst the vehicle is in the same location) is defined by $MOVM and $MEMS commands, and generates a different event. The sensitivity of tow alert detection can be changed by editing the various decision thresholds using the TOWP command. The format of the command is as follows

```
$TOWP,<distance-metres>,<speed-kmh>,<speed-seconds>,<not-used>,
<not-used>,<distance-seconds>
```

Field	Description	Range	
<distance-metres>	distance travelled from the last ignition off position	0 100–65535	no distance check default=500
<speed-kmh>	speed which must be exceed <speed-seconds> to trigger an alert	0 20 – 65535	no speed check default=50 minimum 20
<speed-seconds>	time for which the speed must be above <speed-kmh>	1– 65535	default=10
<not-used>	Not supported from firmware 7.0.43		
<not-used>	Not supported from firmware 7.0.43		
<distance-seconds>	the number of seconds that distance must breach <distance-metres> in successive GNSS fixes	0 – 255	default=10

Accelerometer Motion Detection Threshold (MEMS)

From firmware 7.0.35.xx MEMS has been extended with more precise inertial detection:
Defines the accelerometer-based motion detection criteria, used for waking the device from sleep and tow alert detection, amongst other things. The accelerometer has three modes for detecting motion:

single click
double click
inertial

single click detection mode:
motion will be detected when acceleration measured on the selected axes exceeds the specified <threshold> and returns below it within the value set for <time-limit>. In this mode, <latency>,<window>,<interial-threshold>, and <interial-duration> are irrelevant.

double click detection mode:
once the first click has been recognized, the second click detection procedure starts. Motion is deemed to have been detected only if the second click occurs after the defined <latency> time, but before the <window> time has expired.

inertial detection mode:
motion will be detected when acceleration on any axis exceeds <inertial-threshold> for <inertial-duration>. In this mode, <threshold>, <time-limit>, <latency>, and <window> are irrelevant.

NOTE: All MEMS arguments must be entered in hexadecimal

The MEMS command has the following format:

```
$MEMS,<det-mode>,<threshold>,<time-limit>,<latency>,<window>,<inertial-
threshold>,<inertial-duration>
```

<det-mode>	0 inertial detection mode 0x15 single click detection mode 0x2A double click detection mode
<threshold>	The <threshold> parameter specifies the X, Y and Z axis thresholds in 7 bits, from 0 to 0x7F, each bit corresponding to approx. 15mg of acceleration (i.e. 2G divided by 128). The most sensitive setting is therefore 1, and the least sensitive is 0x7F.
<time-limit>	Defines the maximum time interval that can elapse between the start of the click-detection procedure, from 0 to 0xFF. The value of <time-limit> is then multiplied by 0.5ms to give a range from 0 to 127.5ms.
<latency>	Defines the time interval that starts after the first click detection where the click-detection procedure is disabled, in cases where the device is configured for double-click detection. The <latency> is defined in milliseconds, from 0 to 0xFF, and should be lower than the <window> interval.
<window>	Defines the maximum interval of time that can elapse after the end of the latency interval in which the click-detection procedure can start, in cases where the device is configured for double-click detection. The <window> is defined in milliseconds, from 0 to 0xFF, and should be higher than the <latency> interval.
<inertial-threshold>	The <inertial-threshold> parameter defines the X, Y, Z axis thresholds in 7 bits, from 0 to 0x7F, each bit corresponding to about 16mg of acceleration. The most sensitive setting is therefore 1, and the least sensitive is 0x7F. Set non-zero to enable inertial interrupt mode.
<inertial-duration>	Defines the minimum duration of inertial interrupt before the inertia-detection can start. The <inertial-duration> is defined in ms x 20, from 0 to 0x7F. Set non-zero to enable inertial interrupt mode.

If you are using inertial interrupts, you will only need the last 2 parameters non-zero. The other parameters will be ignored:

`$MEMS,0,0,0,0,0,<inertial-threshold>,<inertial-duration>`

Example (using single click mode):

`$MEMS,15,20,FF,1,1`

Example (using inertia mode):

`$MEMS,0,0,0,0,0,2,3`

Configures single click detection on all axes, threshold of 0.5g, time limit: 127.5ms, latency: 1ms and window: 1ms (in this example, latency and window are irrelevant, since we are using single click detection).

The default settings are:

`$MEMS,0,5,ff,1,1,10,5` (inertial mode: 160mg for 100ms)

For more detailed options, please refer to the LIS2DH12 data sheet and ST application note AN5005.

Movement Event Criteria (MOVM)

From firmware version 7.0.43 there is a new event and reason for motion events whilst a vehicle is parked (ignition off). This differs from a towing event (see TOWP) in that the vehicle is in the same location, but motion has been detected by the accelerometer, according to the thresholds defined in $MEMS.

Note that an ignition OFF event is necessary to 'arm' motion events, which will start 180 seconds after an ignition OFF, to allow time for the driver / rider to leave the vehicle, and avoid false alarms. Once armed, if motion is detected, there is a 45s ignition-on delay before reporting a movement whilst parked event. If the ignition is turned on within 45s, the event is cancelled. If ignition is still off after 45s, then the event is reported.

`$MOVM,<accel-hits>,<window-sec>`

`<accel-hits>`	number of accelerometer events (according to MEMS) to occur within the defined <window-sec> to cause a movement event. A value of zero for <accel-hits> will disable motion detection events and reports.
`<window-sec>`	length of detection window in seconds
`<delay-sec>`	reporting delay in seconds (allows time for ignition on to avoid alert)

The default settings are:

`$MOVM,3,30,20`	(3 hits within a 30s window, 20s delay before reporting)

Device Time Zone (TMZN)

Set the device's time-zone, for use with $IMOS and $RSCD features.

`$TMZN,<timezone-number>`

`<timezone-number>`	0 – UTC / GMT
	1 – London/Europe (UK)
	2 – Central European Time (e.g. Madrid)
	3 – Western European Time (e.g. Canary Islands)

The default settings are:

`$TMZN,1`	(London/Europe (UK) Time)

Utility and Engineering Commands

Delete All Geofences (GEOD)

Individual geofences can be deleted by setting <type> to zero. The GEOD command provides a convenient way of deleting all geofences.

$GEOD	delete all device-based geofences

Restore Factory Default Settings (FACT)

Resets all parameters to factory defaults (or client defaults) as built into the device firmware. When using this command, please wait at least 5 seconds before reconfiguring the device by issuing further commands.

$FACT	Load factory default device configuration

Position on Demand (POLL)

The device will send an update report to the host server in response to a variety of user-configurable events. The POLL command can be used to request an update when there is no event to report.

$POLL	Create an immediate event, reason "POLLED" and send a report

Firmware Update (LOAD)

Device firmware can be updated over GPRS/UMTS with this command. The firmware files must first be loaded onto a webserver in the correct format. Please contact Astra Telematics for support and assistance on remote firmware updates.

```
$LOAD,<host-ip-address>,<port-number>,<pathname>,<filename>
```

Reboot (BOOT)

Trigger a device reboot.

$BOOT	Reboot device

Firmware Version (ATSW)

Returns the device firmware version

$ATSW	Returns device firmware version

Example response:

```
$ATSW,7.0.33.0
```

IMEI Query (IMEI)

Returns the device IMEI

$IMEI	Returns device IMEI

Example response:

```
$IMEI,123456789012345
```

Status Check (STAT)

This legacy command is still supported, but we recommend use of the more user-friendly $TEST command, which has an easily readable response format.

Status Check (TEST)

This command is useful to diagnose device connection / installation issues. We recommend that it is used after each installation, to verify power, ignition, CANBus and signal availability. We also recommend use of $TEST to diagnose devices that go offline unexpectedly. Details of the $TEST feature can be found later in the document or in the Remote Device Test application note.

Parameter Check (PARA)

See Appendix

Position Check (POSN)

A device location can be queried from a mobile phone etc. using the POSN command. The reply will be formatted as a link to google maps, which can be viewed directly from a mobile telephone handset.

```
$POSN,<map-type>,<zoom>
```

<map-type>	'm' = map, 'k' = satellite, 'h' = hybrid
<zoom>	1-20, 20=maximum zoom in, 1=maximum zoom out

The parameters are optional. The $POSN command alone will give a position link with map view at zoom level 10.

Format of the POSN response:

```
POSN:<IMEI>
DD/MM/YYYY HR:MIN:SEC
http://maps.google.co.uk/?q=device@<latitude>,<longitude>&t=<map-type>&z=<zoom>
```

Erase Stored Reports (ELOG)

Erase stored reports from non-volatile (flash memory). If no argument is specified, all reported will be deleted, otherwise the specified number will be deleted (oldest first).

```
$ELOG[,<num-reports>]
```

<num-reports>	optional, number of reports to delete

Examples:

$ELOG	Delete all reported stored in non-volatile memory
$ELOG,99	Delete the oldest 99 reports from non-volatile memory

Non-volatile Set (NVST)

Initialise the device-based running hours and odometer, which are saved in the device non-volatile storage. Note that these values are not read from the vehicle, but calculated and maintained in the device, based on GPS journey distance and a calculation of total time that the vehicle ignition is ON.

```
$NVST,<lifetime-odometer-km>,<lifetime-running-hrs>
```

If the NVST command is submitted without parameters, both values are initialised to zero.

Disable Acknowledgment (NACK)

Suppress the response to a given command (SMS/TCP mode)

Examples:

$DIST,500	Device will reply $DIST,OK
$DIST,500$NACK	Delete will act on command but will not reply

Serial Port Baud Rate (BAUD)

Configure the baud rate of the device RS232 debug serial port. Also see SRAL command. Default is 115200.

$BAUD,9600	Set RS232 debug port BAUD rate to 9600

Display Settings (SHOW)

Display settings in readable ASCII format, RS232 mode. For TCP/SMS modes, please use $PARA.

Send SMS (SSMS)

Send an SMS text message.

$SSMS,<gsm-number>,<message>

This command is intended to engineering purposes, typically to check/confirm GSM telephone number for unknown SIMs. The implementation does not provide any message buffering or communication retries etc. and hence it is not recommended for operation applications.

Device Shutdown (SHDN)

This sets the device to sleep mode and turns off the immobiliser output for a specified number of minutes or indefinitely.

$SHDN,<minutes>

Where <minutes> is in the range 1 to 65535. The <minutes> parameter is optional and if it is omitted the shutdown is indefinite. In the case of indefinite shutdown, the device will wake up on a change of state of external power or ignition.

Send LOGIN packet (LOGN)

When MODE is set to 6, the device will send a LOGIN packet each time a new TCP socket is opened. Thereafter, the LOGIN packet will not be resent unless specifically requested using $LOGN command or if/when the socket gets closed and has to be re-opened.

Linger Request for TCP socket (LNGR)

For use with devices in low-power mode, which typically close the socket for power-saving immediately after receiving an ACK for report delivery. In case the host server may have commands queued, the linger request option can be used to force the device to keep the TCP socket open and suspend power-down for <linger-s> seconds.

$LNGR,<linger-s>

We advise that this command is sent in the same packet as the 06 ACK, or else send before the ACK.

Diagnostics (DIAG)

Engineering diagnostics utilities:

$DIAG,<option>[,<parameters>]

Option	Description
1	GNSS reboot
2	Modem reboot
3	Recalibrate accelerometer - immediate and unconditional
4	Load default settings, including comm defaults; equivalent to 300 followed by 301
5	Ignition (mode 3) recalibrate
6	Show external voltage and battery status
7	Recalibrate accelerometer – waits for ignition off
8	Display GSM network information. Output: <network-operator>;<HLR><BSIC><MNC><LAC><Cell_ID>
9	Display device information. Output: <Device>:<HW-model>;<HW-version>;<FW-version>;<MCU Revision ID>;<MCU Device ID>
10	Display NV variables
11	Close sockets
12	Modem off graceful
13	GPS off
14	GPS on
15	Power-down all tasks
16	Release all tasks
17	Debug out the next reason for not sleeping
18	Debug out stacks
19	Debug out flash map
20	Debug out accelerometer data
21	Go to sleep for parameter2 seconds
22	Last app watchdog name
24	Reset NV variables
25	Set pseudo-ignition off (parameter2 = 0) or on (parameter2 != 0)
26	IGNM info_commd->parameters_i
27	Set Roll / Fall event degrees
28	Settings for Accelerometer to recalibrate automatically When Ignition is off, and device is stationary, if accelerometer readings show a large value greater than set threshold, accelerometer is recalibrated automatically. $DIAG,28,<accel_thresh>,<accel_timeout>,<accel_sleep_timeout>, <accel_constant_thresh>
29	Show GPS version
40	Reboot BLE module
41	Check expired RSDKs
42	Reset RSDK last auth device association
50	Set GPIO
51	Clear GPIO
60	Read GPIO
61	Read ADCs
62	Show battery / ADC debug
70	Show whitelist
71	Check driver ID against whitelist
80	Read flash size
99	CrossWorks tasking library profile
101	CAN bus parameter repeat rate measurements
102	CAN bus report data
103	CAN bus raw data
104	Diagnostics from CAN bus task queue (raw data): 0=None, 1=IDs only, 2=IDs + data
105	OBD testing

Option	Description
106	CAN bus restart auto-detect
107	Request PIDs supported bitmasks
108	Request raw PGN data
109	Reset total fuel used
110	Set fuel tank capacity for OBD fuel used calculation purposes to parameter2 (0 to 1000)
111	Enter despatch mode (device powers down until connected to power)
112	FMS fuel level number of samples in rolling average
113	Set fuel theft decrease percent
120	Set odometer value to parameter2
121	Set rogue odometer True
122	Display settings checksum. Ouput: $DIAG,122,<checksum>
123	Initiate a CANBus scan, this will monitor the CANBus for unique IDs and after the specified time has elapsed they will be printed to the terminal along with the initial data and observed frequency. Usage: $DIAG,123,<time_ms> <time_ms> must be >= 5000 and <= 120000
200	Send AT command to modem
201	Modem M2M locate request
300	Load factory defaults
301	Load com factory defaults
302	GPS request config LNA
303	GPS request read config
400	Resync RTC by GPS
401	Set RTC year,month,day,hour,minute,second
9000	Delete unlock key
9001	Delete HW info
9002	Delete run-once code
9003	Delete settings
9004	Delete NV
9005	Delete reports
9006	Delete com settings

$DIAG,28 parameters:

Field	Description	Range
<accel_thresh>	Threshold in milli-g used to check if accelerometer axis reading is too high	Default 5 milli-g
<accel_timeout>	Timeout in seconds after which the accelerometer will be recalibrated when an axis reading is continuously greater than the threshold	Default 60
<accel_sleep_timeout>	Timeout in seconds, if no accel recalibrate threshold cross events happen within this time device is allowed to go to sleep	Default 5
<accel_constant_thresh>	Accel readings have to be within this range to confirm device is stationary for recalibration to happen	Default 25 milli-g

Over the Air Device Test (TEST)

The $TEST command can be sent by SMS, RS232 or TCP. We recommend that this command is used after every installation, before the installer leaves the vehicle / site.

The format of the $TEST response starts with TEST: and is followed by:

Line	Description	Comments
1	Device model	e.g. AT241
2	Firmware version number	e.g. 7.0.69.0
3	IMEI	15 digits, e.g.357322042745742
4	Network operator name	e.g. Vodafone
5	External input voltage	In Volts followed by percentage of power present over last 7 days, e.g. PWR:12.5V (99%)
6	Battery level (charging status)	As a percentage, e.g. BAT:100% followed by (CH) or (NC)
7	GNSS status (% availability)	OK, ERR, ND or JAM followed by percentage, e.g. GPS:OK (95%)
8	GPRS status (% availability)	OK, ERR or N/A
9	APN connection status	OK, ERR or N/A
10	TCP socket status	OK, ERR or N/A + current socket state (OPEN) or (CLOSED)
11	TCP ack status	OK, ERR or N/A + (NAK) or (TO) in the case of ERR
12	Ignition inactivity	OK or ERR, e.g. IGN:OK + current state (ON) or (OFF)
13	CAN bus Inactivity*	OK or ERR, e.g. CAN:OK (CAN bus based protocols only)
14	Immobilisation output state	ON, OFF or N/A if no digital output assigned to immobiliser
15	Number of queued reports	0 – 9999

*CAN bus activity error only supported on devices with CANBus hardware support

Example 1: device with no errors/problems:

```
TEST:AT202
7.0.64.0
357322042745742
O2 UK
PWR:12.5V (100%)
BAT:100% (NC)
GPS:OK (95%)
GPRS:OK (98%)
APN:OK
SKT:OK (OPEN)
ACK:OK
IGN:OK (OFF)
IMOB:OFF
REPQ:0
```

Example 2: device with an external power issue (not permanent):

```
TEST:AT241
7.0.67.0
357322045896451
O2 UK
PWR:12.5V (24%)
BAT:74% (CH)
GPS:OK (95%)
GPRS:OK (98%)
APN:OK
SKT:OK (OPEN)
ACK:OK
IGN:OK (ON)
CAN:N/A
IMOB:OFF
REPQ:0
```

Notes on $TEST status results:

GPS N/A after power-up, until the first fix has been acquired
ND if no data has been received from the GPS module (i.e. hardware fault)
OK thereafter, if GPS is available, or has been available in the last 5 minutes
ERR if GPS has been unavailable for more than 5 minutes

GPRS ERR at first power up, or whenever the device has no packet-switched network service
OK when the device has packet-switched network service

APN N/A at first power-up
N/A until the device tries to communicate
N/A if the device has no packet-switched network service, which is a prerequisite
OK when the device has activated a pdp context (connected to the APN/internet)
ERR when the device has tried to activate a pdp context, but failed

TCP N/A at first power-up
N/A until the device tries to communicate
N/A if the device has no GPRS network service or has an APN error (no internet)
OK when the device has opened a TCP socket to specified IPAD/PORT
ERR when the device has attempted to open a TCP socket, but failed

ACK N/A at first power-up
N/A until the device has successful status for all previous communication steps
OK when the device has sent a report and received an ACK from the host server
ERR when the device has sent a login ot report, but not received an ACK within TCPT seconds. In the case of an ERR response, the reason is given in brackets, either (TO) for timeout or (NAK) if the device has received a NAK from the host server

IGN ERR if no change of state of ignition has been detected since power-up
ERR if no change of state of ignition has been detected in the last 24 hours
OK if a change of state of ignition has been detected in the last 24 hours
(ignition method will depend on IGNM setting)

CAN N/A at power up, until the device has seen ignition ON
OK when CAN bus data has been received in the last 20 seconds, whilst the ignition is ON
ERR when CAN bus data has not been received within the last 20 seconds, whilst the ignition is ON, or if no CAN bus data was received during the last ignition On period

IMOB N/A if no digital output has been assigned to the immobiliser application
ON when the immobiliser has been assigned, and is currently active
OFF when the immobiliser has been assigned, and is currently inactive (note that the immobiliser logic is define using the DRIC command, to determine whether active corresponds to the output switch being ON or OFF

REPQ Number of reports stored in non-volatile flash memory

Guidance for Resolution of $TEST Errors

GNSS Error or poor GNSS availability (low % GNSS availability)

A GNSS ERROR indicates that no fix has been returned for a fixed timeout period. Could be an indication of a device/antenna fault or simply that the vehicle is parked in covered area (e.g. underground car park). Persistent GNSS errors and low availability are most often caused by installation issues, poor device location, incorrect orientation or vehicle issues such as interference or athermic glass windscreens.

GPS status 'ND' indicates that no data is being received from the GPS module, indicating a likely hardware fault.

A 'JAM' status indicates that the GNSS receiver has detected CW interference which could be cause by the use of a GNSS jamming device in close proximity, typically within 5-10m (i.e. in the vehicle itself).

GPRS Error

This means that the device has no packet-switched service. Can be simply due to network coverage/service, but persistent GPRS ERROR is an indication that the SIM card is not enabled for packet-switched services. We suggest that you discuss with your SIM provider and consider trying a SIM refresh or replacing the SIM.

APN Error

This is usually caused by incorrect APN access point settings (APAD, APUN and APPW). Please check the correct settings with your network/SIM provider and configure the device accordingly using the commands:

```
$APAD,<apn-address>
$APUN,<apn-username>
$APPW,<apn-password>
```

Where <apn-address>, <apn-username> and <apn-password> are the APN settings for the network operator or service provider, appropriate to the SIM being used in the device.

TCP Socket Error

The modem has failed to open a socket on the specified IP address and port number. Can be caused by incorrect TCP address settings (IPAD, PORT), a fault at the host server or even wider internet problems. If necessary, re-configure the IPAD & PORT using the commands:

```
$IPAD,<ip-or-hostname>
$PORT,<port-number>
```

TCP acknowledgment Error

This indicates that the *device* can proceed all the way to open a socket and deliver a login or report packet, but does not get the normal acknowledgment response from the host TCP application. This often happens when the device (IMEI) is unrecognised by the host server. Ensure that the device is correctly provisioned on your application/software, correct type, protocol and that the 15-digit IMEI matches the one on your system. In the case of an ACK error state, the response includes (TO) or (NAK), indicating either timeout or NAK received.

Ignition Input Inactivity Error

This error is set when no ignition events have been detected for more than 24 hours. This is usually caused by poor/incorrect installation. Consider using an alternative ignition mode with the following commands:

`$IGNM,0`	use GNSS speed / accelerometer data for journey mode detection
`$IGNM,3`	use external voltage for journey mode detection

CAN Bus Inactivity Error

This error is set when no CAN bus data has been received for 60 seconds or more, whilst the vehicle ignition is ON (i.e. device digital input 1 is HIGH). Whist the ignition is off, the status will be based on the presence of CAN bus data during the last ignition ON period.

Immobilisation Issues

If status shows as 'N/A', the immobiliser application is not assigned to any digital output. Please refer to the CDOP command in the user guide for the appropriate device, for details of how to assign applications to digital outputs.

The ON/OFF status refers to the physical status of the device output, which may relate to immobiliser status ON or OFF, based on the immobiliser logic defined in the DRIC command.

Reports Stored in Non-Volatile Memory Queue

When there are communications issues, either with the device itself, or with the host server, reports cannot be successfully sent and will be stored in non-volatile flash memory. Each device will hold several thousand reports until they can be successfully sent, and acknowledgment received from the server. This number indicates the quantity of reports stored and awaiting transmission. Device comms errors (possibly caused by configuration) or server issues must be resolved, in order for the device to be able to successfully send the reports. Please check for comms related errors in the $TEST reply and resolve using the guidance on the previous page. Also conform correct device configuration and server operational status / availability.

Appendix

$TEST M2M Version

The $TEST OTA device self-test is intended for use with mobile phone handsets, and hence the response is formatted in a user-friendly readable format. For machine-to-machine applications, a semi-colon delimited version is available. Add an argument as below to specify the m2m formatted response:

```
$TEST,1
```

Example response:

```
TEST:AT200;7.0.18.0;357322042745742;O2 UK;PWR:12.5V (100%);BAT:100%
(NC);GPS:OK(95%);GPRS:OK(98%);APN:OK;SKT:OK;ACK:OK;IGN:OK(OFF);CAN:N/A;IMOB
:OFF;REPQ:0
```

Response content is identical, except for the delimiters. Note however, that the m2m response is a common format for all device models, and hence CAN status will be included, even when used with devices that do not support CAN bus.

Parameter Check ($PARA) SMS Version – Response Format

PARA:	Fixed packet header
Software version number	Floating point number
ALRM SMS alarm recipient number	International format telephone number
IPAD primary TCP IP address	TCP IP address
PORT primary TCP port number	TCP port number - integer
IPAD2 TCP IP address for PTDM mode	TCP IP address
PORT2 TCP port number for PTDM mode	TCP port number - integer
APAD access point address	Text string
APUN access point username	Text string
APPW access point password	Text string
DIST distance report value (metres)	Integer
HEAD heading change report value (degrees)	Integer
JTIM in-journey timed reporting interval (minutes)	Integer
STIM stationary timed report interval (minutes)	Integer
ITIM idling timed report interval (minutes)	Integer
IDLE idle mode start threshold (seconds)	Integer
STPD stop report delay (seconds)	Integer
OSST overspeed threshold (km/h)	Integer
OSHT overspeed hold time (sec)	Integer
OSIT overspeed inhibit time (sec)	Integer
MODE GSM reporting mode	Integer
PROT,[MASK] reporting protocol	Integer [mask included only for protocol X]
PROT report module mask	Integer
REPL reporting level	Integer
SMSL maximum monthly SMS usage	Integer
IGNM ignition mode	Integer
GPSQ minimum GNSS quality	Integer
ROAM network roaming enable	integer
TCPT TCP mode timeout (seconds)	Integer
IBTN iButton Mode	Integer
CLID cell-ID mode	Integer
PTDM pass through data mode enable	Integer
GSM network operator name	Text string (max 12 chars)
GSM own telephone number	Text string (max 15 chars)
Protocols M, V and X only:	
ACMX max accel event threshold	Integer
DCMX max decel event threshold	Integer
ACMY max cornering event threshold	Integer
DCMY max cornering event threshold	Integer
COLN collision event threshold	Integer
Protocols V and X only:	
RPEC RPM event threshold	Integer
RPEC RPM event hold time	Integer
RPEC RPM event inhibit time	Integer
TPEC throttle event threshold	Integer
TPEC throttle event hold time	integer
TPEC throttle event inhibit time	Integer
ELEC engine load event threshold	Integer
ELEC engine load event hold time	Integer
ELEC engine load event inhibit time	Integer
CANC silent mode	Integer
CANC bit rate	Integer
CANC extended IDs	Integer

Parameter Check ($PARA,1) TCP Version – Response Format

From firmware version 7.0.22, there is an optional format to query all parameters over TCP only, with a response format which is similar to the way in which the configuration is displayed at boot-up, starting with a header, followed by comms configs, and then other configs.

Maximum packet size is 1024 bytes, and if the configs exceed that, there will be a 2nd packet, indicated by the PKT field in the header (1/2 will mean packet 1 or 2, for example)

CFG-VER will update whenever the format of the config changes.

Each packet end is indicated with END-OF-PKT

The end of the complete file is indicated with END-OF-FILE

This format is supported in TCP mode only, due to the length of the response, SMS mode is not supported.

Example:

```
$PARA-TCP<CR><LF>
HW:AT240V8<CR><LF>
FW:7.0.22.0<CR><LF>
CFG-VER:1.1<CR><LF>
GSM:+441234567890<CR><LF>
NET:O2 UK<CR><LF>
ICCID: 89373022100010327945<CR><LF>
PKT:1/2<CR><LF>
$APAD,m2mdata<CR><LF>
$APUN,user<CR><LF>
$APPW,password<CR><LF>
$IPAD1,193.108.82.111<CR><LF>
$MODE,6<CR><LF>
$PORT1,90<CR><LF>
$TCPT,30<CR><LF>
$PROT,16,2495<CR><LF>
$ACMX,35<CR><LF>
$ACMY,50<CR><LF>
$ADCC,0,10,5<CR><LF>
$ALRM,NONE<CR><LF>
$CANC,0,1,1,1<CR><LF>
$CANM,2044<CR><LF>
$CDOP,1,3<CR><LF>
$CDOP,2,2<CR><LF>
$CDOP,3,1<CR><LF>
$CDOP,4,0<CR><LF>
$CDOP,5,0<CR><LF>
$CDIP,1,0<CR><LF>
$CLID,0,10<CR><LF>
$COLN,100<CR><LF>
$CPWR,11.5,30,30<CR><LF>
$DCMX,40<CR><LF>
$DCMY,50<CR><LF>
$DBUG,2<CR><LF>
$DIST,5000<CR><LF>
$DRIC,0,0,0,0,0,7200,30,1,0,0,0,0,0<CR><LF>
$ELEC,30,60,90<CR><LF>
$GPSQ,50,3,5<CR><LF>
```

$HEAD,45<CR><LF>
$IDLE,180<CR><LF>
$IGNM,1,0<CR><LF>
$IMOS,0,0,0<CR><LF>
$IMOS,1,0,0<CR><LF>
$IMOS,2,0,0<CR><LF>
$IMOS,3,0,0<CR><LF>
$IMOS,4,0,0<CR><LF>
$IMOS,5,0,0<CR><LF>
$IMOS,6,0,0<CR><LF>
$IPAD2,<CR><LF>
$ITIM,5<CR><LF>
$JSEC,120<CR><LF>
$TMZN,1<CR><LF>
$RSCD,1,09:00,18:00<CR><LF>
$NMEA,1<CR><LF>
$ORTN,0<CR><LF>
$OSHT,30<CR><LF>
$OSIT,120<CR><LF>
$OSST,120<CR><LF>
$PORT2,0<CR><LF>
$PTDM,0,9600,100,1024,0<CR><LF>
$REPL,4294967295<CR><LF>
END-OF-PKT<CR><LF>

[second packet]
$PARA-TCP<CR><LF>
PKT:2/2<CR><LF>
$ROAM,1<CR><LF>
$RPEC,30,60,4000<CR><LF>
$SMSL,50<CR><LF>
$SRAL,1,1,115200,2,0,9600<CR><LF>
$STIM,60,0<CR><LF>
$STPD,60<CR><LF>
$TPEC,30,60,75<CR><LF>
$TOWP,500,60,10,3,10,10<CR><LF>
END-OF-PKT<CR><LF>
END-OF-FILE<CR><LF>

Note: <CR><LF> indicate the ascii characters for CARRIAGE RETURN and LINE FEED

Device - Command Compatibility

	AT110	AT111	AT200	AT202	AT210	AT211	AT240	AT241	AT242	AT400	AT402	AT500
ACMX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ACMY	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ADCC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
ALRM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
APAD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
APPW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
APUN	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ATSW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BAUD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
BLEC	x	x	x	x	x	✓	✓	✓	✓	✓	✓	✓
BOOT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CANC	✓	✓	x	✓	x	x	✓	✓	✓	✓	✓	x
CANM	✓	✓	x	✓	x	x	✓	✓	✓	✓	✓	x
CDIP	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
CDOP	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
CLID	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
COLN	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CPWR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
COPS	x	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	✓
DBUG	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DCMX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DCMY	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DIAG	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DIST	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DRIC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
DRID	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
ELEC	✓	✓	x	✓	x	x	✓	✓	✓	✓	✓	x
ELOG	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FACT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FTRK	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GEOD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GEOF	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GPSQ	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
HEAD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IDLE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
IGNM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
IMEI	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IMOB	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
IMOS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
IPAD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IPAD2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ITIM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
JSEC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
LOAD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
LOGN	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
LORA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
MEMS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MODE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MOVM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NACK	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NMEA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
NVST	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ORTN	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
OSHT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
OSIT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

astra telematics

	AT110	AT111	AT200	AT202	AT210	AT211	AT240	AT241	AT242	AT400	AT402	AT500
OSST	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PARA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PASS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PMNO	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
POLL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PORT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PORT2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
POSN	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PROT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PTDM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
RATC	x	✓	x	✓	x	✓	x	✓	✓	x	✓	✓
REPL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ROAM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RPEC	✓	✓	x	✓	x	x	✓	✓	✓	✓	✓	x
SDIG	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
SHDN	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SHOW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SMSL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SNSR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SRAL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
SSMS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
STAT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
STIM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
STPD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
TCPT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TEST	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TOWP	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x
TPEC	✓	✓	x	✓	x	x	✓	✓	✓	✓	✓	x

Abbreviations

ADC	Analogue to Digital Converter
ASCII	American Standard Code for Information Interchange (computer character set)
BLE	Bluetooth Low Energy
BT	Bluetooth (Classic)
CAN	Controller Area Network
DC	Direct Current
FET	Field Effect Transistor
GIS	Geographic Information System
GPRS	General Packet Radio Service (part of GSM)
GPS	Global Positioning System
GNSS	Global Navigation Satellite System
GSM	Global System for Mobile communication
HSPA	High Speed packet Access
IP	Internet Protocol (part of TCP/IP)
LED	Light Emitting Diode
LPWAN	Low Power Wide Area Network
LTE	Long Term Evolution (mobile network communications standard)
MEMS	Micro Electro-Mechanical System
NMEA	National Marine Electronics Association (defined a GPS output format)
OTA	Over the Air (remote configuration of devices)
PC	Personal Computer
PCB	Printed Circuit Board
PLMN	Public Land Mobile Network
PDU	Protocol Description Unit (describes a binary SMS format)
RFID	Radio Frequency Identification
SIM	Subscriber Identity Module
SMS	Short Message Service
SMSC	Short Message Service Centre
SV	Satellite Vehicle
TCP	Transmission Control Protocol (part of TCP/IP)
UDP	User Datagram Protocol
UMTS	Universal Mobile Telecommunication Service
WGS84	World Geodetic System 1984 (global co-ordinate system used by GNSS)