astra telematics

Application Note: Driver Behaviour Features

Scope
AT200, AT220A, AT220B, AT240, AT210, AT110

Overview
Our GPS/GPRS vehicle tracking devices provide driver behaviour data based on an on-board 3D MEMS accelerometer. This document explains some important aspects of installation and configuration relating to these features.

Related Documents
The following documents are recommended reading to accompany this document:

- AT200, AT220, AT240, AT210 & AT110 User Guides
- AT200, AT220, AT240, AT210 & AT110 Installation Guides
- DB001 Driver Behaviour Indicator data sheet
- Astra Communications Protocol K
- Astra Communications Protocol M

The first two documents can be obtained from:

http://www.gps-telematics.co.uk/downloads.htm

The Protocol Description documents are available on request by emailing support@gps-telematics.co.uk

Compatibility
Driver behaviour data as described in this document is supported by devices specified in the Scope section above, when protocol K,M or V reporting is selected.

Driver Behaviour Data
All protocols specified above provide the following data which relates to driver behaviour:

- instantaneous speed (i.e. at time of report)
- maximum journey speed (i.e. since start of journey)
- overspeed events
- acceleration (X axis, positive values, maximum since last report)
- deceleration (X axis, negative values maximum since last report)
- cornering force (Y axis, positive and negative, maximum since last report)
- up/down forces (Z axis, positive and negative, maximum since last report)
- idling time (total since start of journey)
- idling events (location and time of idling start/stops)

Speed Data
The speed data is based on GPS speed and requires no calibration. Is it important however that the device is mounted with the correct orientation and with the clearest possible 'view' of the sky. The speed aspect of GPS data is most susceptible to interference and errors, hence a poor device location will often manifest itself in erratic and incorrect speed data.

Idling Time

A vehicle is defined as 'idling' if the device ignition input is high and the speed (indicated by GPS) is zero. Idling time is accrued on a second by seconds basis at any time that this condition is true. Idling events can we triggered and reported after a defined period of continuous idling, which allows the location of long idling periods to be identified. See the configuration section for details of the parameters relating to idling.

Acceleration Data

Data from the built in accelerometer provides a measure of a driver's acceleration, braking and cornering behaviour. The raw data from the accelerometer requires calibration in order that the X axis data represents acceleration (positive) and deceleration (negative) and the Y axis data represents left (positive) and right (negative) cornering.

The Y axis should always be correct if the AT220 is correctly oriented for GPS sky side (please refer to the Installation Guide for the appropriate device for guidance on correct orientation for GPS sky side).

Once calibrated, the data is normalised such that X represents acceleration/deceleration, Y represents lateral forces (i.e. cornering) and Z is up/down (less the effects of gravity). Each field is reported with maximum and minimum levels either since the last report or for the entire journey. During a journey, the max/min values attained since the last report are provided. At the end of the journey (i.e. JOURNEY STOP bit is set in the REASON bytes) the max/min values for the entire journey. Data is reported in m/s^2 x 10 are used.

Acceleration Calibration - effects of gravity

The accelerometer will measure the forces of gravity, mostly in the Z axis, but any slight tilt of the device will result is some gravity forces being measured on the X and Y axes too. These forces are measured whilst the after initial installation, whilst the vehicle is stationary and then subtracted from further reading to zero out the effects of gravity. This calibration takes place after the first IGNITION OFF event following power up. If necessary, a recalibration can be forced using the $DIAG,7 command

Acceleration Calibration - device orientation

The accelerometer data must also be calibrated such that X and Y axis data correctly represents acceleration, deceleration and cornering. This depends on the orientation of the device in the vehicle. The location/orientation of the device connector (with respect to the vehicle) should be noted in the installation notes and the ORTN parameter set appropriately. See the User Guide for the appropriate device for details of the ORTN parameter.

Accelerometer Data - device installation aspects

It is important the device is well secured to the vehicle such that it cannot move at all, as any rattle, shakes and wobbles will severely affect the accelerometer reading and corrupt the acceleration, deceleration and cornering data.

Accelerometer Data - what does it mean?

Our devices report acceleration data in m/s^2 to a resolution of 0.1 m/s^2. There is no specific standard on what values represent 'normal' or 'bad' driving. It is the responsibility of the client or system developer to interpret the data and determine how to use it and at what levels to categorise specific styles of driving related to specific types of vehicles. Astra Telematics suggest that this data is used to compare drivers of similar vehicle types and assess good and bad practice on the basis of the comparisons.

astra telematics

DB001 Driver Behaviour Indicator

The DB001 driver behaviour indicator is an optional accessory that can be used with our AT240 and AT110 devices to give feedback on driver behaviour performance, in-vehicle, in real-time. The DB001 is mounted on the top of the dashboard, in view of the driver. LEDs indicate progressive driver behaviour status at configurable thresholds, based on speed, acceleration, deceleration and cornering. For further details, please refer to the DB001 data sheet.

CONFIGURATION

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, 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).

Correct settings for ORTN are device dependent, so please refer to the User Guide for the appropriate device for details.

Idle Mode Timed Message Interval (ITIM)
This parameter defines the maximum time interval between position update reports when a vehicle is idling. Idling mode is initiated after a period of stationary time (see IDLE parameter) whilst the ignition is on. Setting the Idle Mode Timed Message Interval to zero will disable time based idle mode journey reports.

Idle Mode Threshold (IDLE)
A vehicle is defined as being in Idle Mode when a vehicle is stationary for a specific length of time whilst the ignition is on. Idle Mode ends once the vehicle starts moving again. This parameter defines the length of time (in seconds) that a vehicle must be stationary before Idle Mode is initiated. Note that Idle mode start reports, timed reports and end reports are sent to the host application, hence an excessively low value for IDLE can result in increased reporting. The default value for IDLE is 180 seconds.

Over-speed Speed Threshold (OSST)
The AT220 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.

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.

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.

Acceleration and Deceleration Maximum 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 is 40.

Example:

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

Cornering Maximum 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 ACMY and DCMY is 50.

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 is 100.