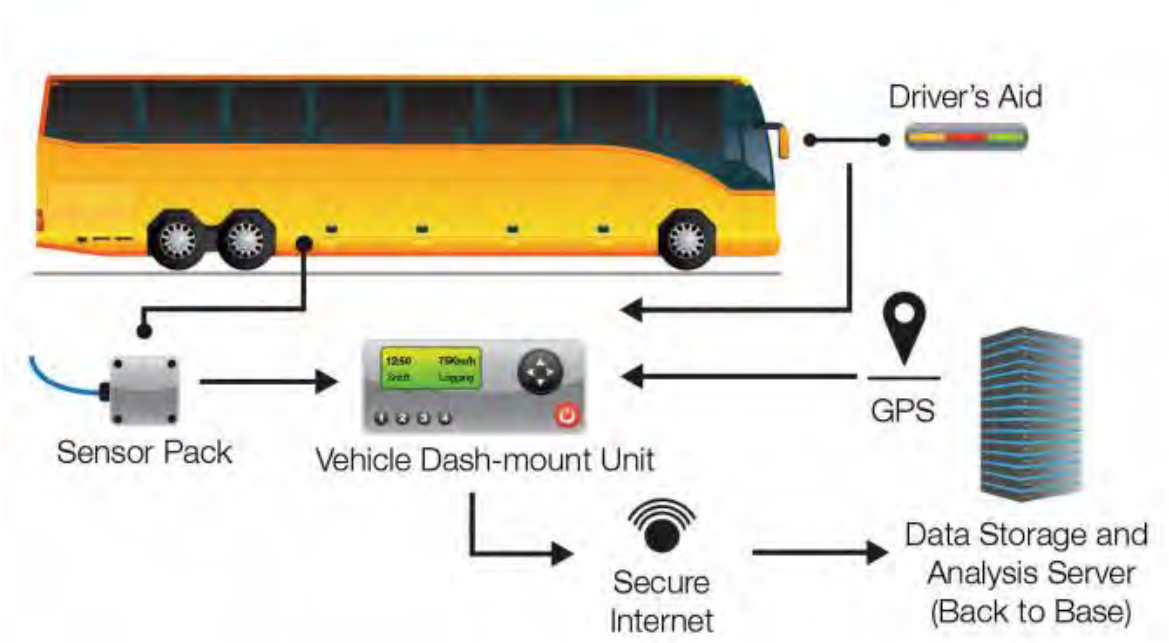
AUTO*monitor*

Complete Vehicle Condition Monitoring



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OVERVIEW

AutoMonitor is a complete vehicle condition monitoring system, which incorporates four technologies in one product. The AutoMonitor contains a digital tachograph that monitors the activities of drivers. One of the main purpose of a tachograph is to urge drivers to take adequate rest after prolong hours of driving. The wellbeing of drivers gets compromised if the driver does not take regular break hours. The AutoMonitor also has an integrated vehicle rollover detection system that predicts an impending rollover situation and provides a feedback indication to the driver via the provided driver aid equipment. AutoMonitor comes with a GPS Tracking system that lets the owner monitor and track vehicles online in real-time. The health monitoring aspect of AutoMonitor monitors vehicle performance such as the performance of a shock absorber and brakes. Additionally, the AutoMonitor can also monitor engine diagnostic codes via CAN Bus.

Figure 1 provides an overview of the AutoMonitor system.

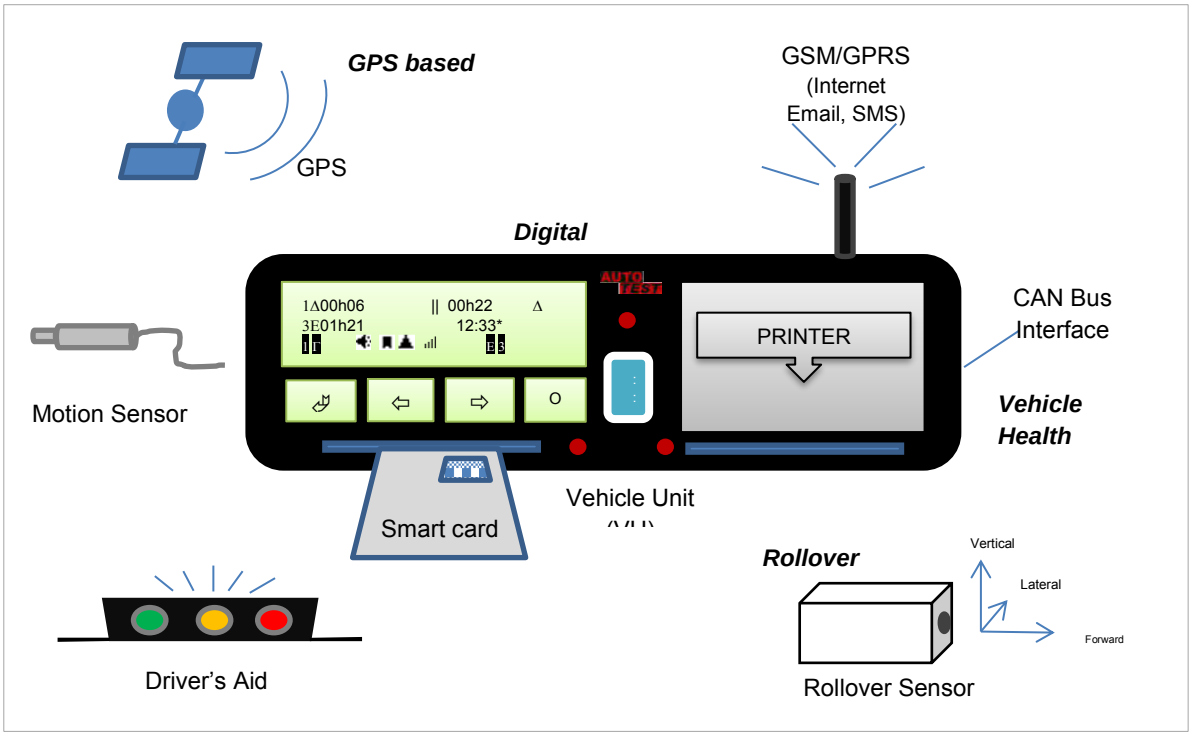


Figure 1: Overview of AutoMonitor

1. UNPACKING AND FIRST TIME USE

Congratulations on having AutoMonitor for your vehicle. Before you start to use this product, please take a note of all the accessories provided with it. A standard AutoMonitor kit will include the following items:

- Vehicle Unit
- Driver's Aid Module
- Rollover Sensor
- Motion Sensor
- GPS Antenna
- GSM/GPRS Antenna
- PC and auxiliary cables

2. INSTALLATION

AutoMonitor must be installed by a trained technician as the equipment will need to be calibrated once it is installed in a vehicle. The calibration of the equipment cannot be performed without a workshop card, which is only provided to a trained technician.

2.1 Vehicle Unit

Vehicle Unit (VU) or dashboard equipment has the standard dimensions as an automotive CD player, which makes it easy to fit in most vehicles that have dedicated space for a CD player.

Vehicle unit requires constant battery voltage, even when the ignition switch is off. Ignition signal wire is connected to VU, which is used to sense when vehicle is switching on. Additionally, an illumination/backlight signal is provided to VU, which controls the LCD backlight of VU.

Provided GPS antenna and the GSM/GPRS modem antenna connects to the back of the VU. The vehicle tracking feature of AutoMonitor requires an Internet enabled SIM card in order for it to be able to send vehicle position and other parameters to the control centre (control server). The SIM card should be inserted at the back of vehicle unit (VU).

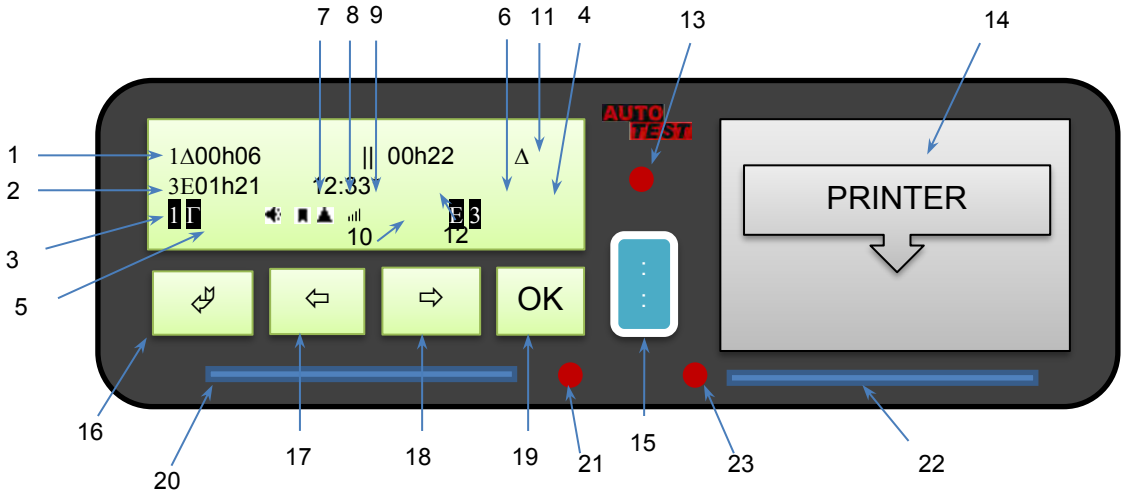


Figure 2: AutoMonitor - Front View

1	Slot 1 status	13	Attention LED
2	Slot 2 status	14	Thermal Printer
3	Slot 1 card inserted	15	PC connection port
4	Slot 2 card inserted	16	Menu/Return button
5	Slot 1 current activity	17	Previous key
6	Slot 2 current activity	18	Next key
7	Audio setting	19	Ok/Enter key
8	Rollover status	20	Smartcard slot 1
9	GPS status	21	Smartcard slot 1 status LED
10	GSM signal level	22	Smartcard slot 2
11	Current operational mode	23	Smartcard slot 2 status LED
12	Current time		

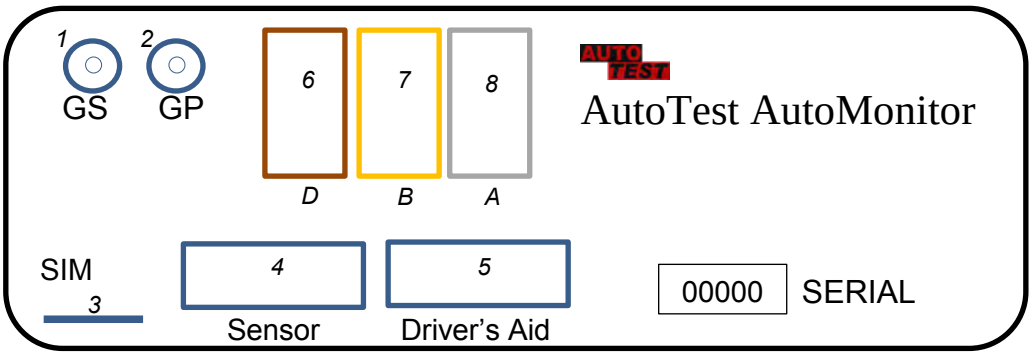


Figure 3: AutoMonitor - Rear view

1	GSM antenna connector	5	Driver's Aid connector
2	GPS antenna connector	6	Calibration port
3	SIM card slot	7	Motion sensor port
4	Rollover Sensor connector	8	Power port

2.2 Driver Aid

The driver aid unit indicates rollover state of the vehicle. When the vehicle is safe and stable, where the rolling-over probability is little, the driver aid displays green light. When the vehicle's rollover state is above the safe zone but below the critical zone, an amber light is lit as warning. When the vehicle has approached the critical zone of rolling over, a red light is lit to indicate the vehicle is about to rollover unless slowed down and handled safely.
The driver aid unit also contains a speaker which sounds audible alarms when the vehicle's rollover state is not in the safe zone. The audible alarm can be switched off through the settings menu under audio section.

The driver aid unit should be mounted on the dashboard, where drivers can see it clearly without any distraction to the driving style.

Note: Driver aid unit will flash all three LED lights if there is a communication problem between the dashboard unit and the rollover sensor.

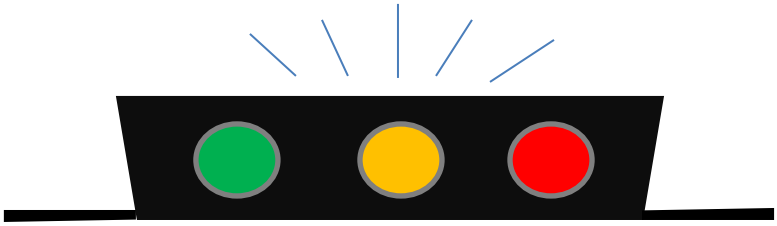


Figure 4: Driver's aid module

2.3 Rollover Sensor

Rollover sensor module constantly monitors the motion of the vehicle and determines whether the vehicle is in the safe state or it's approaching the rollover situation. The rollover sensor module also performs other tasks such as brake performance monitoring and shock absorber performance monitoring. The sensor should be mounted close to the rear axle, at the middle of the vehicle. The connector plug on the rollover sensor should face forward. The sensor should be mounted as horizontal to the ground, where the bottom of the sensor should face the ground.

Once the sensor is mounted on the vehicle and the connector plug is connected to the dashboard unit, the service personal should verify the connectivity and also check the orientation angle. If the vehicle is standing flat, the dashboard unit should display the orientation angle for pitch and roll axes as close to zero as possible.

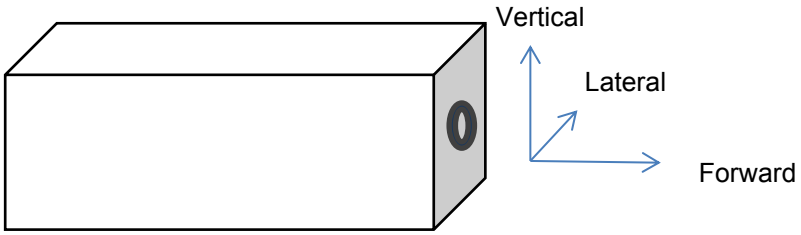


Figure 5: Rollover sensor module.

2.4 Motion Sensor

Motion sensor (tacho sensor) measures speed and distance travelled by a vehicle. The tacho sensor is mounted in the gearbox, where it picks up revolutions of gear output that are used to measure distance travelled by the vehicle and its current speed.

Figure 6: Motion Sensor module.

2.5 Calibration

AutoMonitor needs to be calibrated regularly according to the local regulation. The motion sensor and the rollover sensor both need to be calibrated by a trained workshop technician.

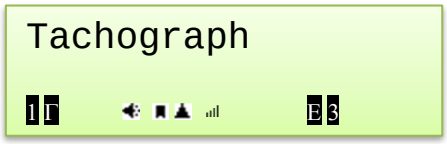
3. OPERATION

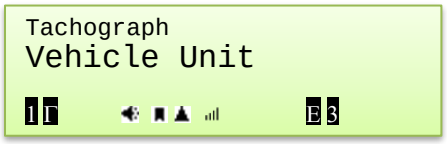
3.1 Tachograph

AutoMonitor's tachograph feature records driving hours of the drivers as well as grants access to the equipment via a smartcard. When a driver inserts his smartcard, the tachograph authenticates the driver and starts recording activities such as driving times, break & rest times, availability times and work times. Tachograph also records various other activities such as over-speeding, distance travelled by each driver, various events and faults.

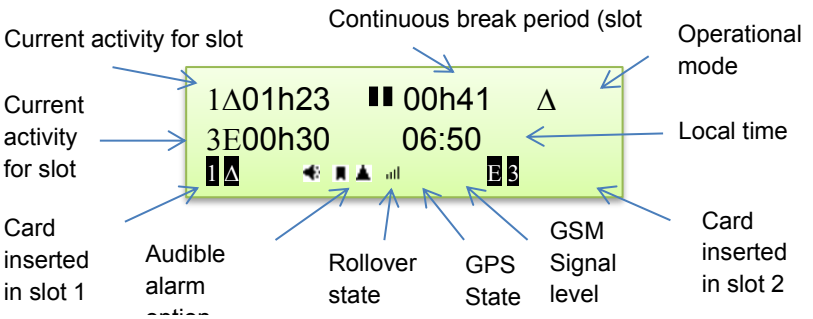
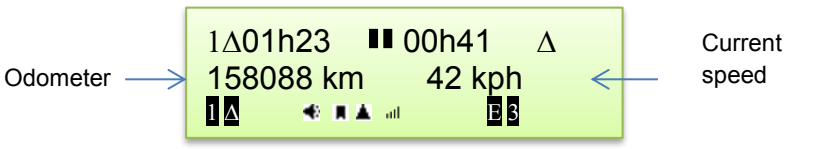
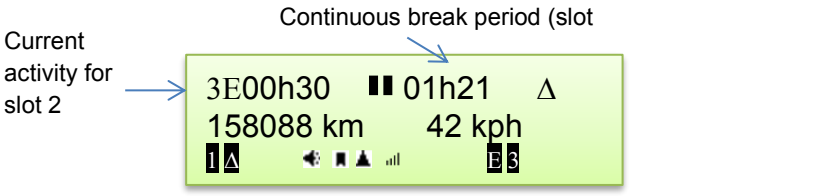
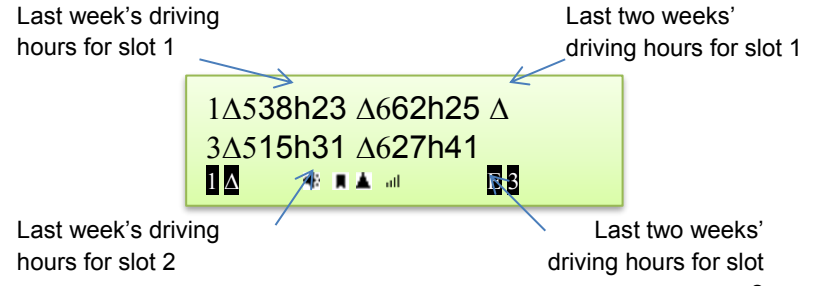
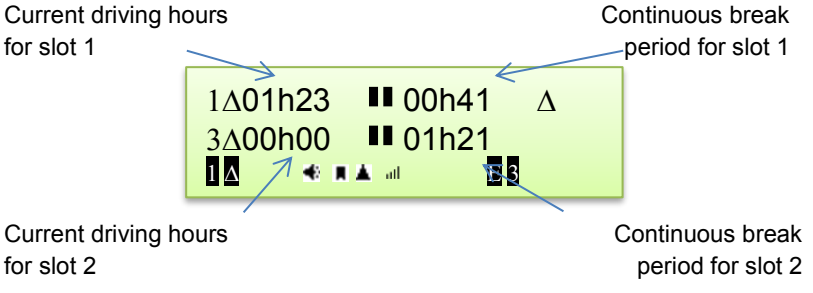
Symbol	Activity
Φ	Rest/Break
E	Available
Δ	Driving
Γ	Work
OUT	Out of condition
N	Ferry/train

Table 1: List of tachograph activities





3.1.1 Tachograph Home Screens

Screen No	Home Screen
1. Current activities for slot 1 and slot2	
2. Current Activity for slot 1	
3. Current Activity for slot 2	
4. Weekly driving data	
5. Current driving hours for slot 1 and slot 2	

3.1.2 Menu Layout

Primary Menu	Sub menu 1	Sub menu 2	Description
Tachograph	Eject card	Driver slot?	Ejects card in slot 1.
		Co-Driver slot?	Ejects card in slot 2.
	Driver (Slot 1)	Info	Displays cardholder information for card in slot 1
		Display	Displays activities and events stored on card in slot 1
		Print	Prints activities and events stored on card in slot 1
	Driver (Slot 2)	Info	Displays cardholder information for card in slot 2
		Display	Displays activities and event stored on card in slot 2
		Print	Prints activities and events stored on card in slot 2
	Vehicle Unit	VU Display	Displays activities, events, calibration record stored on VU
		VU Print	Prints activities, events, calibration record stored on VU
	Place Entry	Place Begin	Adds work begin place record
		Place End	Adds work end place record
	Spec. Condition	Out of scope	Adds out-of-scope specific condition
		Ferry/Train	Adds ferry/train specific condition
	Company	Lock-in	Sets company lock-in
		Lock-out	Sets company lock-out
Date/time	Date / time		Displays current date/time
Rollover	Info		Displays rollover sensor information
	Status		Displays rollover status
	Data		Displays rollovers sensor data
GPS Tracker	Status		Displays GPS status
	Data		Displays GPS data
	Tracker		Displays tracker info.
Print	Card Daily		Prints daily activities from a smartcard
	Card Events		Prints events stored on a smartcard
	VU Daily		Prints daily activities stored on VU
	VU Events		Prints events stored on VU
	Technical		Prints last calibration record stored on VU
	Overspeed		Prints overspeeding records stored on VU
Health	Summary		Displays health summary
	Brake Info		Displays brake performance info.
	Suspension		Displays suspension performance info.
	Mass		Displays vehicle mass
	DTC		Displays diagnostic trouble codes
	Engine Data		Displays engine parameters
	Service Log	Minor Service	Minor service menu
		Basic Service	Basic service menu
		Major Service	Major service menu
Settings	Display		Display related settings
	Sound		Audio related settings
	Date/Time		Date/Timezone related settings
	Daylight		Daylight on/off
	Units		Display unit settings
	Language		Interface language settings
System	Info		Device information

Inserting a smartcard

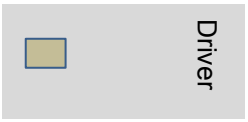
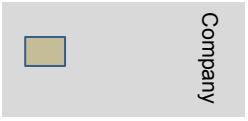
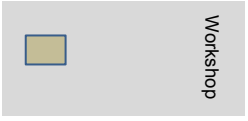
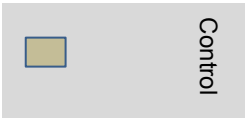
When a valid smartcard is inserted into any slot of the VU, the device will initialise card session. The card must be inserted when the vehicle is stationary, otherwise a 'card inserted while driving' event will be marked. Once the device has found the card to be valid and has loaded up the current session, the device will display a splash screen, which will include the type of card inserted and the name of the card holder.

Ejecting a smartcard

A smartcard needs to be safely ejected before it is pulled out from its slot. To eject the card, first make sure the vehicle is not in motion then press the Menu key and select 'Tachograph' followed by 'Eject card' and then select the slot whose card is to be ejected. The device will write any pending activity/date to the card and will safely disconnect it. As the card is ejected, the slot number corresponding to the card slot will be removed from the screen, the user can then safely pull out the card.

3.1.3 Smartcard

Smartcards are security key cards that provide access to various features of the brake meter. Smartcards also hold identity data as well as activity data. There are four types of smartcards currently supported in AutoMonitor. The types of cards currently supported are synchronous memory cards.

Card	Description
 Driver Card	Driver card is carried by a driver or a co-driver.
 Company Card	Company card is used to lock records to a particular company and to download data to PC.
 Workshop Card	Workshop card is used trained technicians to install the tachograph equipment into a vehicle and to perform calibration.
 Control Card	Control card is used by control inspectors to download data for control inspection purpose and to check overspeeding.

3.1.4 Operating modes

There are four operating modes of the tachograph. Each mode is defined by the level of access granted to a particular user for various features of the tachograph application. An operating mode is triggered by the insertion or withdrawal of a smartcard. The four operating modes are listed below:

- Operational Mode (Δ)
- Calibration Mode (X)
- Control Mode (B)
- Company Mode (A)

The following table summarises the operational modes of the tachograph.

Operating Mode	Driver Slot				
Co-driver slot	*No Card*	*Driver Card*	*Control Card*	*Workshop card*	*Company Card*
No Card	Operational	Operational	Control	Calibration	Company
Driver Card	Operational	Operational	Control	Calibration	Company
Control Card	Control	Control	Control*	Operational	Operational
Workshop Card	Calibration	Calibration	Operational	Calibration*	Operational
Company Card	Company	Company	Operational	Operational	Company*

Table 2: Operational modes of tachograph

***Only the card in the driver slot is used.**

3.1.4.1 Operational Mode (Δ)

Operational mode is triggered by inserting a driver card into one of the card slots. When operational mode is active, the LCD screen will display (Δ) icon on the top right corner of the screen. The operational mode allows users to access driving activities, specific conditions, work places, and report printing features.

3.1.4.1.1 Driver's Activities

Users can manually select an activity when the vehicle is stationary, except for the driving activity. To manually select an activity, press OK button. When activity menu appears on the screen, press the Menu button (⏎) to change the activity of the driver slot and press OK button to change the activity of the co-driver slot. The tachograph module records the following driving activities:

3.1.4.1.1.1 Driving (Δ)

Driving activity is automatically set when the vehicle is moved. Driving state is only set for the card in the driver's slot (Slot 1), while the activity for the co-driver slot is set to Availability while the vehicle is moving. When the vehicle stops, the activity for the card in the driver slot is changed to Work, whereas the activity for the card in the co-driver slot is kept at Availability.

3.1.4.1.1.2 Work (Γ)

Work activity is automatically set when the vehicle has come to a stationary point after the activity of driving for driver slot. Work activity can be manually set by the user when the vehicle is stationary.

3.1.4.1.1.3 Availability (E)

Availability is selected automatically for co-driver slot when the vehicle is moving. Users can manually select this activity when the vehicle is stationary.

3.1.4.1.1.4 Break/Rest (Φ)

Break/Rest activity can be manually set by the user when the driver intends to take rest and the vehicle is stationary.

3.1.4.1.1.5 Continuous Break

Continuous Break period is the accumulated period of continuous 15 minutes or over for activities of Break/Rest, Availability, and Unknown period since the last Driving or Work activity. For continuous driving of over 4h30 minutes, a continuous break of 45 minutes or over is required.

3.1.4.1.1.6 Continuous Driving

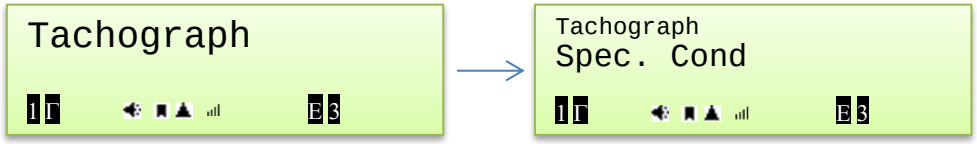
Continuous driving period is the accumulated period of driving since the continuous break period of 45 minutes or over. When the continuous break period is reached to 45 minutes or above, the continuous driving period will be reset to zero at the next driving activity.
If continuous driving period is reached to 4h15 minutes, the device will turn on Attention LED and will display a notification message to inform the driver to take 45 minutes break/rest.
When the continuous driving period is reached to 4h30 minutes, the device will display another notification message and the attention LED will stay on blinking once per second.

3.1.4.1.2 Specific conditions

Specific conditions are set by the drivers to indicate activity other than the four activities mentioned above. The specific conditions include the following activities:

- Out of scope (begin/end)
- Ferry / Train Crossing

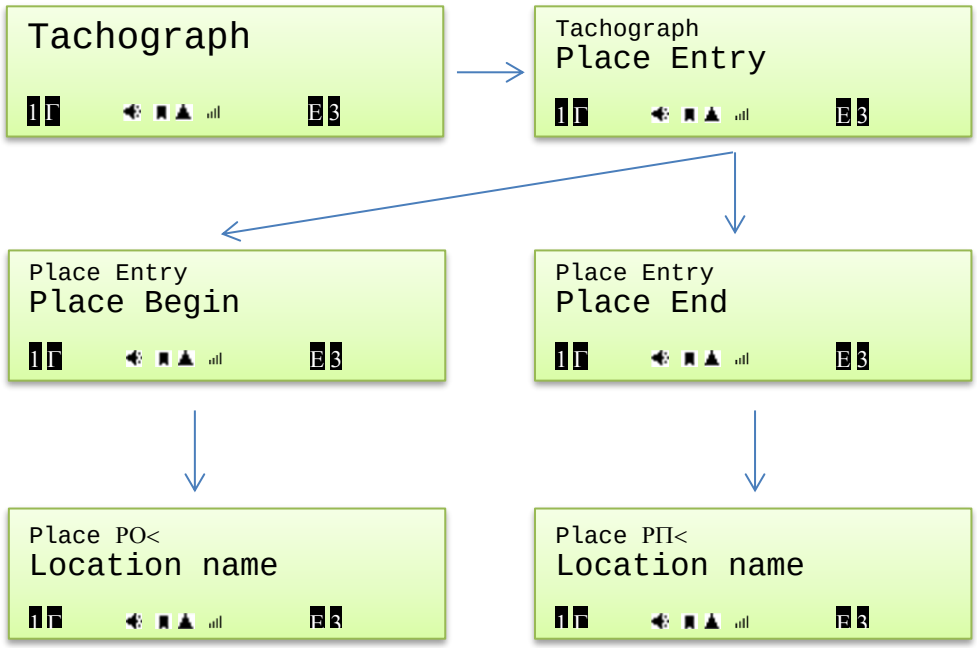
Specific condition can be selected by accessing the Tachograph menu.



When ferry/train crossing condition is selected, the condition will be automatically cleared when the vehicle is driven. The specific condition will automatically be cleared when a card in the driver-slot is inserted or removed.

3.1.4.1.3 Places

Drivers and co-drivers can manually select the place where the work starts and ends. Whenever a driver card is inserted into the device, the device will prompt the user to select the location of the place where the work begins. When the card is ejected from a slot, the device will prompt the user to select work end place. Users can manually select place using the Tachograph menu and then selecting Places Entry menu.



3.1.4.2 Calibration Mode (X)

Calibration mode is used by the tachograph when a workshop card is inserted or as indicated in Table 2. The calibration mode allows technicians to configure the device and perform calibration as well as to diagnose the system.

To activate calibration mode, insert a workshop card into any card slot while making sure there is no card in the other slot.

3.1.4.3 Control Mode (B)

Control mode is used by the tachograph when a control card is inserted or as indicated in Table 2. The control mode allows control inspectors to print technical report or perform download operation as well as to see over-speed report.

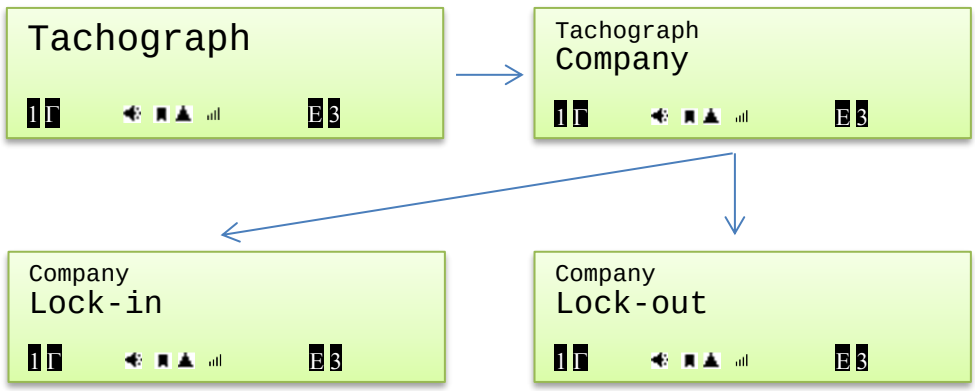
To activate control mode, insert a control card into any card slot. There should not be any card in the other slot except for a driver card. While the tachograph is operating in control mode, if any activities such as printing, displaying of stored activities, downloading is performed, the tachograph will record it as control activity into the control card, driver card (if inserted) and in the vehicle unit (VU).

3.1.4.4 Company Mode (A)

Company mode is activated when a company card is inserted or as indicated in Table 2. The company mode allows for displaying, downloading and printing of the data records stored in the vehicle unit which has been locked by this company.

A company should lock-in the tachograph immediately so that any new data recorded into the system could be protected by that company.

To activate company mode, insert a company card into any card slot.



3.1.5 Activities

3.1.5.1 Driver Activities

Driver activities include the following types of activities:

- Driving
- Work
- Availability
- Rest/Break
- Specific condition
- Work start/end place names.

When the vehicle starts moving, the activity for the driver slot will be automatically changed to 'Driving' and the activity for the co-driver slot will be changed to 'Availability'. When the vehicle becomes stationary after a period of driving, the activity for the card in driver slot will be changed to 'Work' and the activity for the co-driver slot will stay at 'Work'.

Drivers should take break after driving a continuous of 4 hour and 20 minutes. The tachograph will display a warning message if the driver has driving vehicle for a continuous of 4 hour and 30 minute. When such a warning message appears on the screen, the user should take rest for at least 15 minutes.

Whenever a driver or workshop card is inserted into the card slot, the tachograph application will prompt user to enter work start place name. Use the arrow keys to scroll through available places. And when a driver or workshop card is removed, the device will prompt the user to enter the work ending place name.

Drivers can record their activities more discretely by setting specific conditions in case if the vehicle is carried on a ferry or the vehicle is waiting at a train crossing. Specific condition activities can be selected through AutoMonitor's Tachograph menu. Users can select 3 activities type:

- Out of scope (Begin)
- Out of scope (End)
- Ferry / Train Crossing

The *out of scope* activity could be selected when the vehicle is being driven for applications that are out of the scope of the tachograph regulation such as on non-public roads, or regions where tachograph regulations are not active.

3.1.5.2 Control Activities

Control activities include the activities performed by a control operator when tachograph is operating in Control Mode. The following activities are recorded as control activities by the tachograph:

- Card Downloading
- VU Downloading
- Printing
- Display

3.1.5.3 Company Activities

Company activities include the activities performed by a company card holder when tachograph is operating in company mode. The following activities are recorded as company activities by the tachograph:

- Card Downloading
- VU Downloading
- VU Lock-in
- VU Lock-out

3.1.5.4 Calibration Records

Calibration records are created when tachograph is operating in calibration mode using a workshop card.

3.1.6 Events and Faults

Tachograph constantly monitors various faults and events. Description of those events and faults is provided in the following pages.

3.1.6.1 Event Records

When an event is triggered, the AutoMonitor will display an event notification message. The message will contain the type of event being triggered and its brief description. The user will need to acknowledge the notification message by pressing any button from the front panel. Once an event message is acknowledged, the message will disappear from the screen. A record of the event will also be recorded into the vehicle unit. If there is a driver card or a workshop card inserted into the AutoMonitor, any relevant events to the smartcard will also be written onto the smartcard.

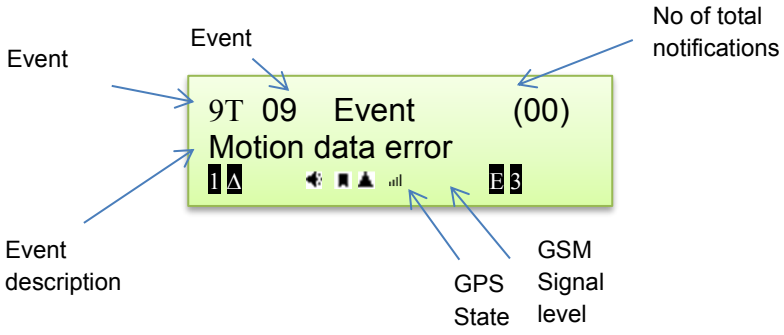


Figure 7: Typical event alert screen

Table 3 lists the type of event notifications displayed by the AutoMonitor.

Event	Description	Screen Message
Invalid Card	Indicates that an invalid, unformatted or unreadable, or an expired card is inserted	"Non-valid card"
Card Conflict	This event is raised when cards in the two slots of the tachograph conflict with the operating modes of the tachograph. Table 5 lists the scenarios when card conflict event is raised.	"Card conflict"
Time-overlap	This event is raised when the date/time of last withdrawal of a driver card is later than the current date/time of the tachograph equipment.	"Time overlap"
Driving without appropriate card	This event is raised when vehicle is moved while one of the conditions listed in Table 6 is met.	"Driv'g w/o approp. card"
Card inserted while driving	This event is raised when a tachograph card is inserted while the vehicle is in motion.	"Card insert. while driving"
Unsaved last session	This event is raised when a driver card or a workshop card is inserted, whose last session was not properly closed/saved.	“C/session not closed”
Over-speeding	This event is raised when the vehicle speed reached above the maximum speed set for the tachograph.	"Over speeding"
Motion sensor data error	This event is raised when the tachograph finds errors in the data obtained from the motion sensor.	"Sensor fault"
Rollover Event	This event is raised when vehicle’s rolling force is approaching closer to the rollover. The event is recorded when the rollover detector issues a warning or a danger alert.	"Rollover Event"
Company lock	This event is raised when the tachograph is locked or unlocked by a company.	"Company lock event" "Company unlock event"
Rollover sensor fault	This event is raised when communication with the rollover sensor is dropped.	"Roll-Sensor Err"

Table 3: Events notification and description

A purpose code is recorded with the properties of an event. The description of each purpose code is listed in Table 4.

Purpose Code	Description
0x00	One of the 10 most recent (or last) events/faults
0x01	The longest event for one of the last 10 days of occurrence
0x02	One of the 5 longest events over the last 365 days
0x03	The last event for one of the last 10 days of occurrence
0x04	The most serious event of one of the last 10 days of occurrence
0x05	One of the 5 most serious events over the last 365 days
0x06	The first event or fault having occurred after the last calibration
0x07	An active/on-going event or fault
0x80	Manufacturer specific

Table 4: Purpose codes for an event

When AutoMonitor detects that multiple cards are inserted into its two slots, the AutoMonitor will compare the card type of each card with the possibilities of card conflict listed in Table 5. If a card conflict is detected, an event notification will be triggered.

Co-driver slot	Card Conflict	Driver Slot				
		No Card	*Driver Card*	*Control Card*	*Workshop card*	*Company Card*
	No Card					
	Driver Card				X	
	Control Card			X	X	X
	Workshop Card		X	X	X	X
	Company Card			X	X	X

Table 5: Scenarios when Card Conflict event is raised

When a vehicle starts driving, the AutoMonitor will check the appropriateness of each card inserted into the card slots according to the possibilities listed in Table 6. If AutoMonitor detects that vehicle is driven without an appropriate mode, a 'driving without an appropriate card' event will be triggered.

Co-driver slot	Driving without an appropriate card	Driver Slot				
		No Card	*Driver Card*	*Control Card*	*Workshop card*	*Company Card*
	No Card	X		X		X
	Driver Card	X		X	X	X
	Control Card	X	X	X	X	X
	Workshop Card	X	X	X		X
	Company Card	X	X	X	X	X

Table 6: Scenarios when 'Driving without and appropriate card' event is raised

For example, the AutoMonitor will register 'driving without an appropriate card' event when the vehicle moves while there is a driver's card in the driver's slot along with any other card in the co-driver's slot.

3.1.6.2 Fault Records

When a fault is detected by AutoMonitor, a fault notification message will be displayed. Once a fault notification message is triggered, the user will need to acknowledge it by pressing any button from the front panel. The detected faults will be recorded by the AutoMonitor, which can be later downloaded to the PC. If a driver card or a workshop card is inserted, a copy of the faults related to the smartcard will be recorded onto the smartcard.

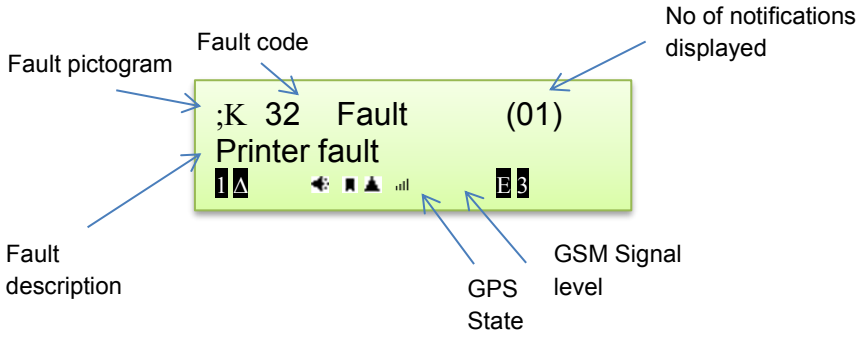


Figure 8: Typical fault notification screen

The description of the faults detected by AutoMonitor is given in Table 7.

Fault	Description	Screen Message
Internal VU Fault	This fault is raised when the vehicle experiences an internal fault.	"VU internal fault"
Printer Fault	This fault is raised when the built-in thermal printer is missing or does not communicate with the vehicle unit.	"Printer fault"
Display Fault	This fault is raised when the LCD display is missing or cannot be communicated with.	"Display fault"
Downloading Fault	This fault is raised when the vehicle unit detects a communication problem while downloading data to PC or a remote unit.	"Downloading fault"
Sensor Fault	This fault is raised when motion sensor is missing or cannot be communicated with.	"Sensor fault"
Card Fault	This fault is raised when there is a problem when reading/writing to/from a smartcard.	“Card fault”

Table 7: Fault notifications and description

3.1.6.3 Event Notification Service

The device can be configured to send notification messages via email and SMS services in case of an event or a fault. Additionally, the AutoMonitor can also send timely reports containing the recent state of the device. The schedule for the timely reports can be customised using the software.

3.1.6.3.1 Events Notification Configuration

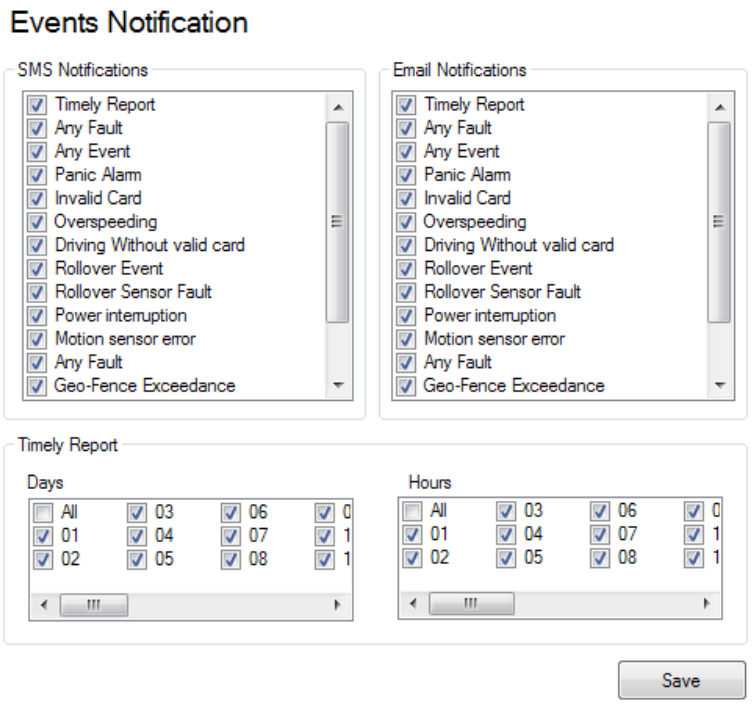


Figure 9: Notification selection for email and SMS services

To configure the scheduling of timely reports, select the days and the hours on each day when AutoMonitor should send timely reports using SMS and email services. Press save to update settings.

3.1.6.3.2 SMS Configuration

SMS service sends out SMS notification messages. To enable the SMS service, set 'Enable SMS notifications' and enter the SMS phone numbers. Multiple mobile numbers can be entered if an SMS message is to be sent to multiple mobile phones. Press 'Save' to update settings.

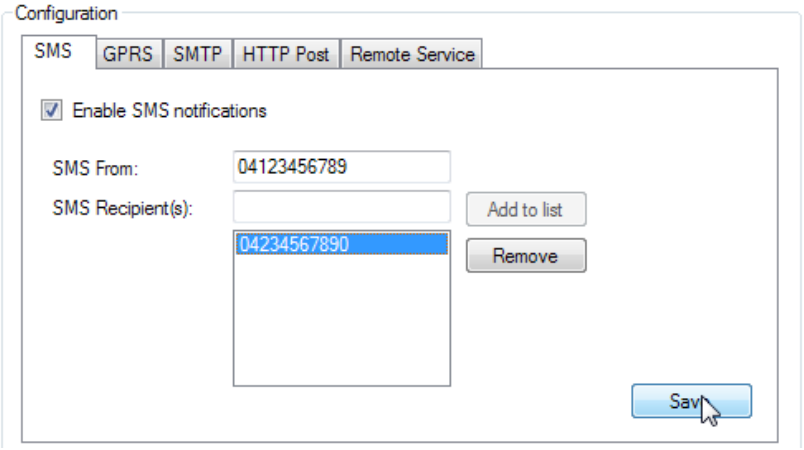


Figure 10: SMS notification service settings

3.1.6.3.3 GPRS Configuration

The GPRS service allows communication with the AutoMonitor via the internet connection. This service is required for HTTP, SMTP and remote connection services. To enable GPRS service, select 'Enable GPRS' and enter Access Point Number (APN) of the sender's internet service providers.

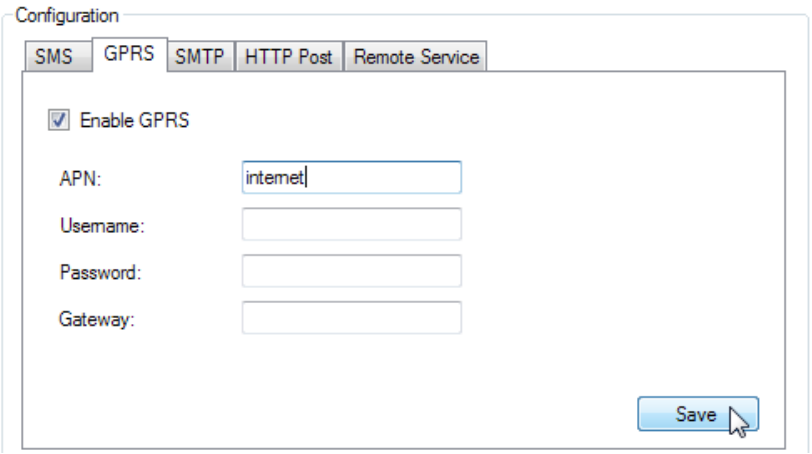


Figure 11: GPRS service configuration window

If GPRS service is not enabled or the GPRS configurations are not valid, the services that rely on GPRS will not be able to function.

3.1.6.3.4 SMTP Configuration

The Simple Mail Transfer Protocol (SMTP) service is used to send notifications that are configured to be sent by email. The user can specify the recipients of the notification emails.

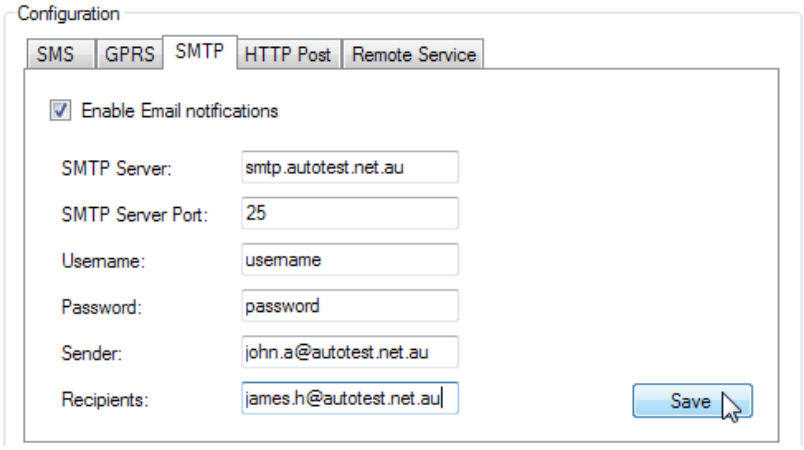


Figure 12: SMTP service configuration window

3.1.6.3.5 HTTP Post Configuration

The HTTP post service can be used to send out live feeds of essential information to a webserver. This is useful if clients wish to build their own web based vehicle monitoring system.

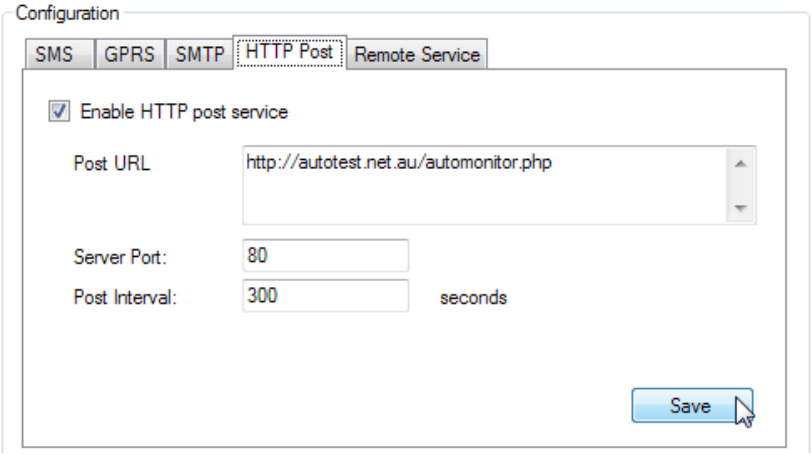


Figure 13: HTTP post service configuration window

If the HTTP post service is enabled, the AutoMonitor will send periodic post feeds after 'post interval' seconds to the given post URL address. The following post fields will be sent with each http post query. The driver name fields will only be sent with the post query if there is a valid card in the AutoMonitor.

Post field	Description	Example	Unit
"timestamp="	Current time (Unix timestamp)	"timestamp=455678545"	
"rego="	Vehicle registration no.	"rego=rego1234"	
"vin="	Vehicle identification no.	"vin=VIN24323222"	
"odometer="	Odometer reading	"odometer=45688"	km
"lon="	Current longitude position	"lon=145.445785"	deg
"lat="	Current latitude position	"lat=-37.588640"	deg
"alt="	Current Altitude (above sea)	"alt=127.0"	m
"speed="	Current speed	"speed=24"	km/h
"heading="	Current heading direction	"heading=232.0"	true deg
"mass="	Current mass	"mass=3242"	kg
"driverFirst="	First name of cardholder in slot 1	"driverFirst=James"	
"driverLast="	Last name of cardholder in slot 1	"driverLast=Cook"	
"codriverFirst="	First name of cardholder in slot 2	"codriverFirst=Oliver"	
"codriverLast="	Last name of cardholder in slot 2	"codriverLast=Ken"	
"vuserial="	Vehicle unit serial no.	"vuserial=222421"	

Table 8: AutoMonitor feeds sent to webserver using HTTP post service

3.1.6.3.6 Remote service

The remote service connects to the vehicle tracking application running on a PC or a server. The AutoMonitor will try to establish a remote connection using the fixed servicer/PC IP address after every 'poll interval' many seconds. Once the AutoMonitor is remotely connected to the PC, the AutoMonitor will stay connected until the user disconnects it.

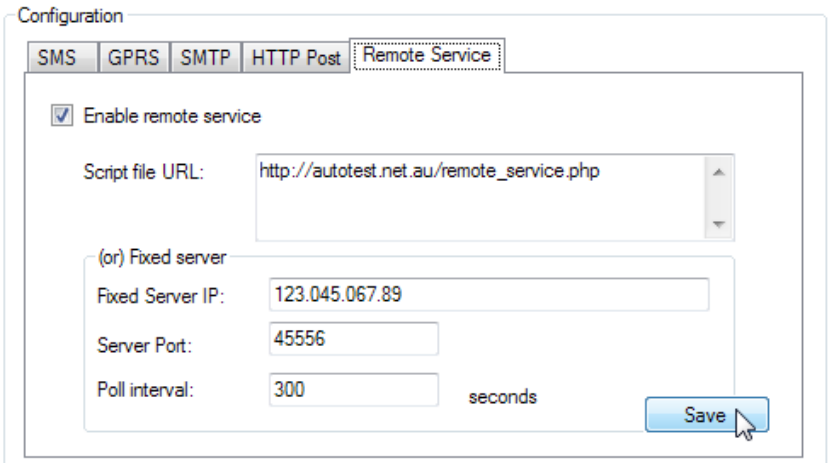


Figure 14. Remote connection service configuration window.

If the IP address of the remote service likely to change, the user can specify a website link, where the current IP address of the remote device could be specified. If the script file URL is provided, the AutoMonitor will send a 'GET' request to the website and provide the registration number of the vehicle as an input parameter. The website could use the registration number and provide the current IP address of the computer where the tracking software is running. For example, if AutoMonitor is configured with the above script file URL displayed in Figure 14, the device will send the following HTTP query:

```
"GET /remote_service.php?rego=rego1234 HTTP/1.0\r\n"
```

to host: `"autotest.net.au"` at port 80.

The expected response from the website should have the following fields to indicate the IP address (or hostname) of the remote PC:

```
{REGO}{REMOTE_SERVER}{PORTNUMBER}
```

Or,

{rego1234}{123.245.167.089}{5475}

The description of the expected response fields is given in Table 9:

Field code	Description
{REGO}	Registration number of the vehicle
{REMOTE_SERVER}	IP address of the remote server/pc
{PORTNUMBER}	Port number of the remote server/pc

Table 9: Response fields of the IP request query for remote service

3.1.6.3.7 Timely reports

The timely reports are sent to provide periodic updates on the status and condition of the vehicle via email. The following sample report indicates the information contained in a timely report.

Timely email report

Vehicle Information

Vehicle Registration:	REG30012345
Vehicle Identification:	VIN30012345
VU Serial No:	30012345-8040-255-21
Odometer (km):	121
Date/Time:	2014/09/17 11:00
GPS Longitude:	144.946069
GPS Latitude:	-37.830840
Altitude (m):	16
Vehicle Mass (kg):	1700

Vehicle Health

Brake Performance

Title	Current	Average	Maximum
Deceleration	0.00g	0.34g	0.50g
MFDD	4.39m/s2	4.39m/s2	4.39m/s2

Suspension Performance

Title	Current	Average	Maximum
Damping Ratio	20 %	35 %	37 %
Rating	13 %	91 %	100 %

Card Insertion/Withdrawal records

No	Card holder	Card No	Card Expiry	Insertion Time	Withdrawal Time	Odometer At Insertion	Distance
1	Leonhard Euler		2015/06/28	2014/09/17 00:00:00	00:01:06	121	0
2	Leonhard Euler		2015/06/28	2014/09/17 00:53:16	00:57:22	121	0

Figure 15: Sample timely report sent by email

3.2 Report Printing

Tachograph can print out a number of types of print reports. The reports can be printed onto paper using the built-in printer. The users can also view a printout report onto the AutoMonitor's LCD screen.

3.2.1 Card Activities

Card Activities printout allows cardholders to print stored activities data from their smartcard.

```
AUTOTEST
AUTOMONITOR v1.0

K 05/08/2014 09:22 (UTC)
-----------K-----------
24hHK
-----------Δ-----------
Δ JOHN
   ALLEN
ΔHR    /191112932111 0 0
   29/04/2017
-----------Λ-----------
ΛVIN3543988939000
  R  /REG12345
-----------⊟-----------
⊟ AUTOTEST
  AUTOMONITOR
-----------X-----------
X WORKSHOP NAME
XHR   /224929885822 0 0
X 04/05/2016
-----------B-----------
BHR   /329233939442 0 0
B 08/07/2014 03:13 HY
-----------Δ-----------
    04/08/2014    13
  --------------------
<00:00  00:01  00h02
  ----------1----------
Λ R   /REG1234
      44888 km
Φ 00:22 05:40 05h18 ΔΔ *

  --------------------
< 12:55 12:65 00h22
  ----------3----------
Λ R   /REG1234
Φ 16:43 17:33 01h33 ΔΔ

  ----------∑----------
   Δ 00h00     322 km
   Γ 00h00   E 00h00
   Φ 00h00   < 00h00
  ΔΔ 00h22
-----------9;H----------
-----------9;Λ----------
```

(1) Product information

(2) Print date/time

(3) Report type (24h card printout)

(4) Card holder details of the card in driver slot

(5) Vehicle Identification Information

(6) Manufacturer information

(7) Workshop information where last calibration was performed.

(8) Last control information

(9) Date of the activities

(10) Unknown activities

(11) Vehicle information of the vehicle where the card was inserted (Slot 1, driver slot)

(12) Activities

(13) Vehicle information of the vehicle where the card was inserted (Slot2, codriver slot)

(14) Daily summary of the activities

(15) Events and faults stored in the card and VU

(16) Control place

(17) Control officer's signature

(18) Driver's signature

3.2.2 Card Events

Events stored on a smartcard can be printed using ‘Print’ menu. The following sample report illustrates the printout report of the stored events on a smartcard.

```
AUTOTEST
AUTOMONITOR v1.0

K 22/08/2014 10:14 (UTC)
------------K------------
9;HK
------------X------------
X WORKSHOP NAME
XHR   /224929885822 0 0
X 04/05/2016
------------Λ------------
ΛVIN3543988939000
  R  /REG12345
--------------------------
!II  16/07/2014  06:56
!003  00h00
--------------------------
!HΛ  19/08/2014  06:45
!006  65h07
--------------------------
!Σ    21/08/2014  23:53
!008   00h00
--------------------------
!T    21/08/2014  23:53
!009   00h06
-----------;H----------
;T   21/08/2014  23:53
!053  00h06


B • . . . . . .

B  . . . . . .

Δ  . . . . . .
------------K------------
```

(1) Printout date/time

(2) Printout type (events stored on card)

(3) Last calibration record

(4) Current vehicle information

(5) Stored Events

(6) Stored Faults

(7) Controller place

(8) Controller’s signature

(9) Driver’s signature

3.2.3 Vehicle Unit Daily Activities

Daily activities stored in the vehicle unit are printed in this report.

```
AUTOTEST
AUTOMONITOR v1.0

K 22/08/2014 10:14 (UTC)
-----------K-----------
24hΛK
-----------Δ-----------
Δ Micheal
   Paul
ΔHR   /CD154586645 0 0
Δ 17/03/2016
-----------Λ-----------
ΛVIN3543988939000
  R  /REG12345
-----------⊟-----------
⊟ AUTOTEST
  AUTOMONITOR
-----------X-----------
X WORKSHOP NAME
XHR   /224929885822 0 0
X 04/05/2016
-----------B-----------
BHR   /329233939442 0 0
B 08/07/2014 03:13 HY
-----------Δ-----------
        22/08/2014
       1331 – 1332 km
  ----------1----------
Λ R   /REG1234
      44888 km
Φ 00:22 05:40 05h18 ΔΔ *

  ----------3----------
Λ R   /REG1234
      44888 km
Φ 00:22 05:40 05h18 ΔΔ *
  ---------------------
```

(1) Printout date/time

(2) Type of print report

(3) Currently inserted card

(4) Vehicle information

(5) Manufacturer Information

(6) Recent calibration workshop info. Workshop name, card id & card expiry

(7) Last control information

(8) Date and odometer of the day

(9) Activities of Slot 1

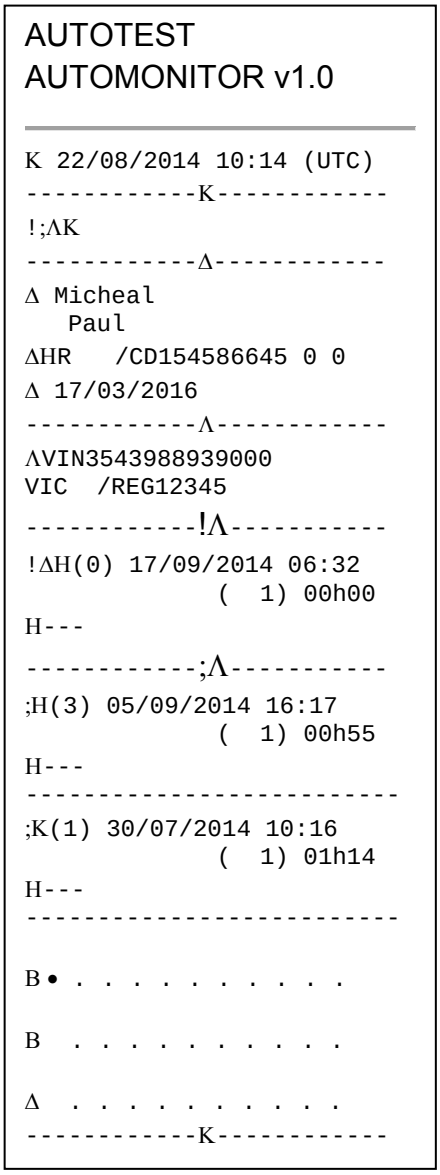
(10) Rest activity start time, end time and duration.

```
ΔΔ Crew mode
* rest period >= 1 hour
```

(11) Activities of Slot 2

3.2.4 Vehicle Unit Events

Events and faults stored in the vehicle unit are printed in this report.



AUTOTEST
AUTOMONITOR v1.0

```
K 22/08/2014 10:14 (UTC)
------------K------------
!;ΛK
------------Δ------------
Δ Micheal
   Paul
ΔHR   /CD154586645 0 0
Δ 17/03/2016
------------Λ------------
ΛVIN3543988939000
VIC  /REG12345
------------!Λ-----------
!ΔH(0) 17/09/2014 06:32
             (  1) 00h00
H---
------------;Λ-----------
;H(3) 05/09/2014 16:17
             (  1) 00h55
H---
-------------------------
;K(1) 30/07/2014 10:16
             (  1) 01h14
H---
-------------------------

B• . . . . . .

B  . . . . . .

Δ  . . . . . .
------------K------------
```

(1) Printout date/time

(2) Type of report

(3) Current card holder's information

(4) Vehicle information

(5) events from VU

(6) event type, purpose, date and time

(7) event code, no. of similar events, duration of the event

(8) faults from VU

(9) fault type, purpose, date and time

(10) similar events, duration of the fault

(11) on-going faults and events

(12) Controller place

(13) Controller's signature

(14) Driver's signature

3.2.5 Technical Report

The tachograph calibration report includes details of the previous calibration. Records of date/time changes are also displayed in the technical report.

```
AUTOTEST
AUTOMONITOR v1.0

K 22/08/2014 10:14 (UTC)
------------K------------
XIK
------------Δ------------
Δ Micheal
   Paul
ΔHR   /CD154586645 0 0
Δ 17/03/2016
------------Λ------------
ΛVIN3543988939000
  R  /REG12345
------------⊟------------
⊟ AUTOTEST
  61-63 Parsons St,
  Kensington, VIC
  AUSTRALIA   3031
  42350
  au12-345
  1234567890 8040 ff 15
  2014
  V 2014/08/11
------------T------------
T 1234567855
------------X------------
X AutoTest Workshop
XHR   /224929885822 0 0
X 04/05/2016

X27/08/2014 (2)
ΛVIN200123456
ΛNSW   /REG200123456
w 9100  Imp/km
k 9100  Imp/km
l 3145  mm
Δ315/80 R22.5
:100
000 – 100 km
------------I------------
!I 27/08/2014 01:10
 I 27/08/2014 01:30
XAutoTest Workshop
 61-63 Parsons St,
 Kensington, Vic 3031
XHWLD /28376419

-----------!;Λ-----------
! 16/09/2014 03:10
;16/09/2014 03:10

   --------------------
```

(1) Printout date/time

(2) Type of printout indicating technical report

(3) Current cards inserted in the tachograph

(4) Vehicle information where report is generated

(5) Company information

(6) Motion sensor information

(7) Calibration record details

(8) Workshop card used to perform calibration

(9) Date of calibration
vehicle information
w = coefficient of vehicle
k = constant of recording equipment
l = effective circumference of tyres
Δ = tyre type, radius of the tyres
>100 = maximum speed limit = 100 kph
old and new odometer readings

(10) Time adjustment records

(11) Most recent event and fault recorded

3.2.6 Over-speeding Report

Over-speeding report contains the recorded events of over-speeding by drivers. The report contains all the major and recent over-speeding events. Each over-speeding event contains the time of the event, max. speed, average speed, duration of speeding, and the ID of the driver involved in over-speeding.

```
AUTOTEST
AUTOMONITOR v1.0

K 22/08/2014 10:14 (UTC)
------------K------------
::K     100 km/h
------------Δ------------
Δ Euler
  Leonhard
ΔHR   /CD253586645 0 0
Δ 26/06/2015
------------Λ------------
Λ VIN200123456
  NSW  /REG200123456
----------::------------
B20/04/2014 14:20
>> 17/05/2014 07:50 (001)

---------::X-----------
>> 27/08/2014 03:25 00h00
   120 km/h  112 km/h (0)
XHWLD /WS7641900000 0 0


--------::(365)---------
>>27/08/2014 03:25 00h00
  120 km/h 112 km/h (000)
XHWLD /WS7641900000 0 0

---------::(10)---------
>>27/08/2014 05:35 00h00
  121 km/h  121 km/h (000)
XHWLD /WS7641900000 0 0

BP. . . . . .

B  . . . . . .

Δ  . . . . . .
```

(1) Printout date/time
(2) Report type and max. speed limit set
(3) Currently inserted card
(4) Current vehicle identification
(5) Speeding control information
(6) First over-speeding after last calibration
(7) date, time, duration of over-speeding
(8) max. speed, average speed, no. of similar events
(9) over-speeding driver's card id
(10) five most serious over speeding events over the last
(11) five most serious over speeding events over the last 10
(12) Control place
(13) Controller's signature
(14) Driver's signature

3.3 Rollover Detection

The Auto*Monitor*'s rollover sensor constantly monitors vehicle's orientation and motion and can sense the likelihood of vehicle rollover. The factors that aid in rolling over of a vehicle are its tilt angle across its roll axis of rotation and the lateral force exerted by the acceleration of the vehicle around curves and corners. The rollover parameters are calculated based on the dimensions of a vehicle. A vehicle, whose centre of gravity (c.g.) height is low, will require more lateral acceleration to make it roll over, whereas a vehicle with higher centre of gravity (c.g.) height can easily roll over in the event of lower lateral force.

The lateral force can be exerted on a vehicle when the vehicle travels around a bend. The higher the speed of the vehicle around a bend, the greater the lateral force will be. AutoMonitor constantly monitors the changes in lateral force and compares it to the maximum force the vehicle can sustain before becoming unstable. When the AutoMonitor predicts the rollover tendency of the vehicle is approaching the critical value, a warning sound will be produced and the warning lights on the driver's aid module will illuminate. When the driver experiences the rollover alarm, the driver should immediately slow down the vehicle until the rollover warning is gone and the vehicle becomes safe.

3.3.1 Vehicle Profile

The vehicle parameters required by AutoMonitor to predict an impending rollover situation are illustrated in the following diagram.

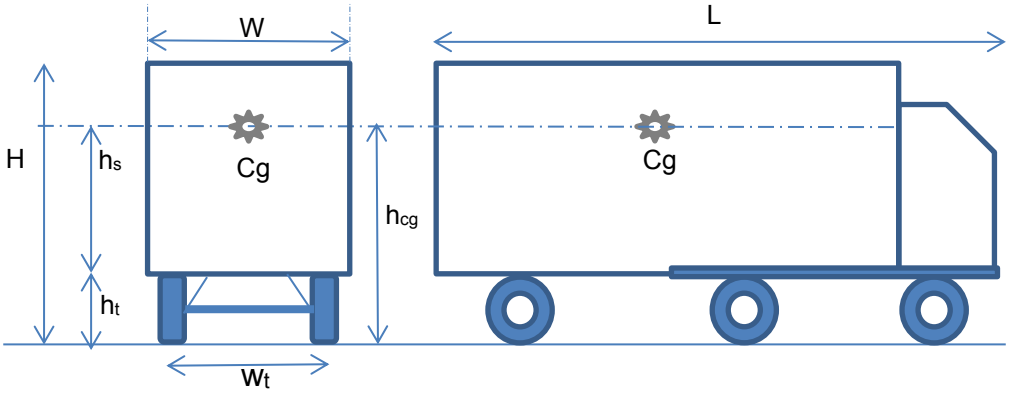


Figure 16: Vehicle rollover sensing parameters

W	Total width of the vehicle
H	Total height of the vehicle
L	Total length of the vehicle
h_{cg}	Centre of gravity height
w_t	Track width
h_t	Tyre height
h_s	Suspended height
Cg ⚙	Centre of gravity

Table 10: Vehicle related rollover sensing parameters

As the weight of the vehicle is increased, the centre of gravity height (h_{cg}) rises. The higher the height of the Cg point, the more the vehicle's stability will be sensitive to the lateral force. The centre of gravity point is calculated from the current mass of the vehicle, the gross mass limit and the tare mass.

Weight Type	Description
Gross Weight	Total weight of the vehicle when fully loaded
Tare Weight	Total weight of the vehicle when not loaded (empty)
Current Mass	Current mass of the vehicle

Table 11: Vehicle mass related parameters

There are three configurable methods used by the AutoMonitor to calculate the centre of gravity height of the vehicle.

C.g. Calc. Method	Description
Mixed Freight	It is assumed that 70% of the payload is located at the bottom half of the vehicle, and 30% of the payload is located in the top half. The maximum height of c.g. point is therefore around 40% of the maximum height of the payload.
Uniform Density	The height of the c.g. point rises linearly with payload. The maximum height of the c.g. point is reached to the maximum height of the vehicle when the payload is at maximum.
Fixed c.g. height	The c.g. point defined by the user and always remains constant. Changes in vehicle mass will not change the value of c.g. height.

Table 12: Centre of gravity point calculation methods

3.3.2 Threshold levels

There are two trigger levels used by the rollover detection system. Whenever a trigger level is reached, the rollover detection system will raise an alarm to warn the driver about the likeliness of the vehicle getting rolled over.

3.3.2.1 Warning Level

A warning message is raised when the vehicle's likelihood of getting rolled over is between 40 % to 60 %. When the warning alarm is raised, the driver aid will illuminate amber light. If audio alerts are enabled in the settings, the AutoMonitor will sound a warning tone. Once the warning level is observed by the driver, the driver should immediately slow down the vehicle's speed until the green light is illuminated indicating the vehicle is now safe.

3.3.2.2 Critical Level

A critical alert is raised when the likelihood of a vehicle getting rolled over is above 60%. The red light on the driver's aid unit will be illuminated when the rollover state of the vehicle has reached critical level. A critical audio tone will sound if audio alerts are enabled in the settings. The driver should immediately slow down the vehicle if the critical alert is raised.

3.3.3 Driver Aid

The driver aid module helps drivers by warning them about the likelihood of vehicle getting rolled over. The driver aid module contains three lights, where the description of each is listed in Table 13.

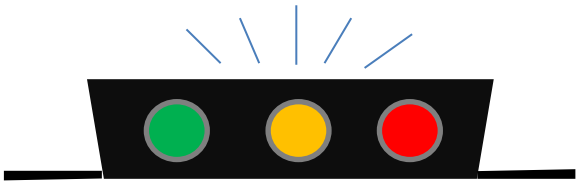


Figure 17: Driver's aid module to warn about impending rollover

Light	Description	Audio Tone (if enabled)
Green	Rollover state is safe	-
Amber	Warning level is reached	Warning tone
Red	Critical level is reached	Critical alert tone

Table 13: Description of lights in driver aid module

When the rollover sensor is not connected or does not function properly, the three lights of the rollover will start scrolling at a fast rate to indicate a problem with the rollover sensing system.

3.4 GPS Tracker

The GPS based vehicle tracking system incorporates a GPS module and GSM/GPRS modem. A vehicle's location is determined by using GPS satellites and the location is then provided to the control centre in real-time. The status of the GPS module is displayed on the bottom of the screen. Table 14 lists the operational states of the GPS module.

Symbol	Description
	GPS Module Error
	Acquiring GPS satellites (locating position)
	GPS running OK.

Table 14: GPS status icon description

If the status of the GPS module remains in 'Acquiring' () for over 5 minutes, check the GPS antenna connectivity. Depending on the strength of the GPS signal, under normal conditions, the AutoMonitor should be able to acquire position in less than 3 minutes. Once the GPS module has acquired position, the state of the GPS module will be changed to  .

GPS based tracking system requires a SIM card to connect to the Internet in order to provide vehicle status updates to the control centre.

The GPS tracker can store a maximum of 10,000 track points in the internal memory. When the maximum number of track points is reached, the device will overwrite the oldest track points. All recorded track points can be downloaded to PC using the AutoMonitor Tachograph software.

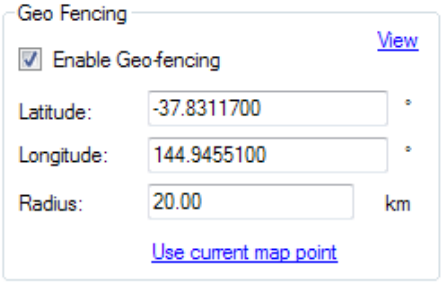
3.4.1 Geo-Fencing

The Geo-Fencing feature allows a company using the AutoMonitor to restrict the vehicle to be within a defined perimeter or zone. If the vehicle is driven outside its designated zone, AutoMonitor will automatically raise notification alarms to notify the owner or vehicle management via email and/or SMS. When SMS/Email message for geo-fence exceedance is sent, the current GPS location coordinate is also sent with the message. If the geo-fencing notification is disabled, AutoMonitor will not send email or SMS messages.

The geographic fence can be defined using the AutoMonitor Tracker application. To define the zone, the user should first select the centre coordinates of the zone using the mapping interface and then select an appropriate radius of the zone circle. The following screenshot displays the geo-fence as a large circle in red colour.

Figure 18: AutoMonitor tracker - geo fencing

Geo-fencing feature can be enabled or disabled by selecting the device and clicking on the device configuration icon. To view the centre point of a geo-fence, click on ‘View’ link. A new geo-fence range can be defined on a map screen by selecting ‘Use current map point’ and entering the desired radius value geo-fence circle.



3.5 Vehicle Health Monitoring

AutoMonitor monitors various aspects of the vehicles performances via the On Board Diagnostic (OBD II) protocol. Additionally, the device monitors the brake performance and the performance of shock absorbers via the sensors already contained in the rollover sensor module. Depending on the user requirements, the application software can be upgraded to monitor, log and display additional parameters related engine and emission control.

3.5.1 Vehicle Service Log

AutoMonitor can be used to keep a history of vehicle servicing performed by mechanics. The advantage of service history allows vehicle mechanics to observe which maintenance on the vehicle has already been performed in the past. The service history can be downloaded to a PC when downloading health records.

Inspection type	Accessories to test
1. Minor inspection	Lights, windows, wipers, mirrors, seat belts, hoses, horn, fuel level
2. Basic oil change	engine oil level, radiator level, fluid leaks
3. Major service	air conditioner, transmission level, radiator, alternator

For each of the inspection records, the AutoMonitor will record information such as the time of service, the odometer of the vehicle, type of service and any DTCs currently registered by the vehicle engine.

3.5.2 Brake Performance

A decelerometer sensor is used to sense deceleration or braking events. Brake performance values will only be calculated for an event that lasts longer than 0.33 seconds, otherwise the braking event is considered momentary braking, which is not sufficient for the determination of a valid brake test. The device also considers the maximum deceleration value, which should be above 0.35 g for a valid brake test. Once a valid brake test is detected, the device will perform calculation to determine maximum deceleration, average deceleration, MFDD, and rating.

3.5.3 Shock Absorber Performance

Vehicle movement of the vehicle introduces oscillation in the vehicle suspension system. The rate at which the suspension oscillations converge to idle is called damping ratio. For a well-functioning suspension system, the damping ratio should be above 30%. The calculated shock absorber readings are logged by the system and the data can be transferred to the PC.

3.5.4 On-Board Diagnostic (OBD II)

The on-Board diagnostic codes stored in the Engine Control Unit (ECU) are retrieved by AutoMonitor system via CAN bus that gets shared with the ECU of the vehicle. The diagnostic trouble codes (DTCs) are recorded codes of the problems experienced the vehicle.

3.5.5 Engine parameters (optional)

Depending on the user requirements, the device can be revised to read additional parameter information via the CAN bus interface.

3.5.6 Emission related parameters (optional)

Depending on the user requirements, the device can be revised to read emissions related parameters via the CAN Bus.

4. CONFIGURATION

The device configurations cannot be adjusted while the vehicle is moving. To access settings menu, make sure the vehicle is stationary.

4.1 Display

LCD display brightness and contrast values can be adjusted via the configuration menu. To adjust display related settings, perform the following operations:
Press Menu button (⏎) and scroll to the Setting menu and then press OK, use ⇦ and ⇨ keys to scroll through the menu. When Display menu appears, press OK. Device will prompt the user to set contrast value. Brightness menu can be accessed by pressing OK key from the contrast menu. To return back to main screen press return key (⏎).

4.2 Audio

Audio settings allow user to turn On or Off rollover alarm sound during a rollover event. The audio settings can be accessed via Settings menu then Audio menu. If the rollover warning of the AutoMonitor is set to MUTE, the LED lights in the driver's aid could be used to detect rollover warnings.

4.3 Date Time

The date and time menu allows users to configure time-zone. If OK key is pressed during the time-zone screen, device will display current date and time that is adjusted by the currently set time-zone.

4.4 Daylight saving

Daylight saving time can be set using Settings->Daylight menu. If the daylight saving is active during summer, set DST to ON and press OK.

4.5 Unit

Measurement units can be switched been Metric (default) and Imperial. At the moment, only metric units are supported by the device.

4.6 Language

Language menu allows user to change language interface of the device. Presently, only English language is supported by the AutoMonitor's user interface.

5. PC SOFTWARE

5.1 System Requirements

AutoMonitor PC software is based on Microsoft Windows operating system. Additionally, the software requires .NET framework v 3.5 SP2. An Internet connection is also required to remotely track vehicles and observe real-time status of the vehicle on a PC. The minimum hardware specifications are listed below:

- Intel Processor 1.8 GHz
- 2 GB RAM
- 10 GB Hard Disk
- Windows XP or above

5.2 Installation

An AutoMonitor PC software CD is required for installation. The installation program should start up automatically once the software CD is inserted into the PC. If the installation program does not start automatically, the setup program can be run by browsing to the CD/DVD directory and the executing 'Setup.exe' file.

5.3 Software Usage

5.3.1 Tachograph downloader

Activities stored in the tachograph can be downloaded to computer via a serial cable. To establish a connection between the device and the PC, connect one end of the provided serial communication cable to the AutoMonitor's downloading port, and connect the other end of the serial cable to a PC. If the PC does not have a serial port (RS232), a serial-to-USB converter cable will be required. Once the cable is connected, run the tachograph downloader application on the PC and select the serial port and desired baudrate.

Figure 19: Tachograph connection window

Tachograph module requires sufficient credentials before a downloading operation can be processed. A company card, a workshop card, or a control card must be inserted into the AutoMonitor's co-driver slot when performing any downloading operation. Once a valid card with sufficient privileges is inserted, click on 'Connect' and the PC will try to establish a connection. When a connection is successfully established, the tachograph software will allow the user to select the types of data that the software should download. The following types of data can be downloaded using tachograph downloader software:

1. Overview
2. Activities (time)
3. Events and faults
4. Detailed speed
5. Technical data
6. Card data
7. Rollover events
8. GPS track log
9. Vehicle health

5.3.1.1 Overview Records

An overview record item includes the vehicle identification record, vehicle registration, current time, downloadable period, company locks, control activity data. The overview record is mandatory and it is downloaded every time a downloading session is started.

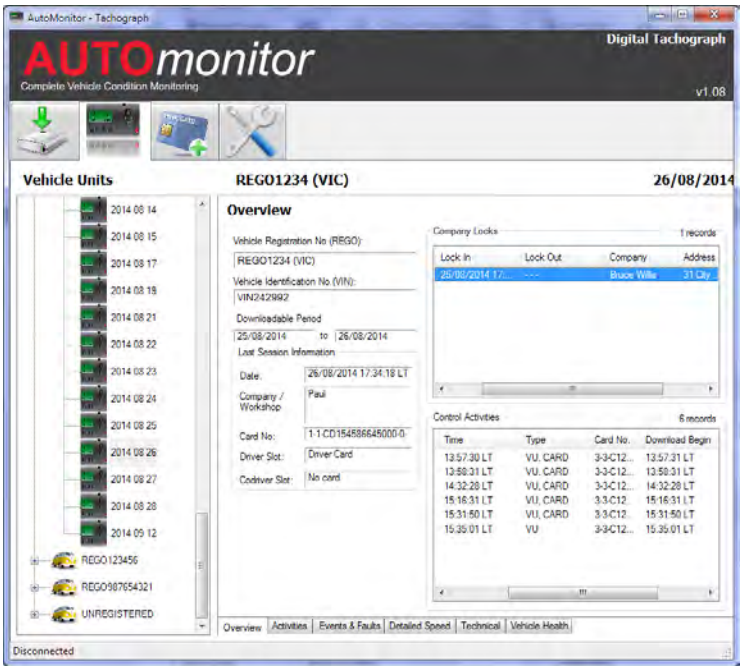


Figure 20: Vehicle unit overview record window

5.3.1.2 Daily Activities Records

A daily activities record includes the daily driving related activities stored in the vehicle unit (VU) by vehicle users. The download period for daily activities can be specified to the dates for which the daily activities should be retrieved. The daily activity records include driving activities for both slots, card insertion/withdrawal records, daily work begin/end places, and specific condition records.

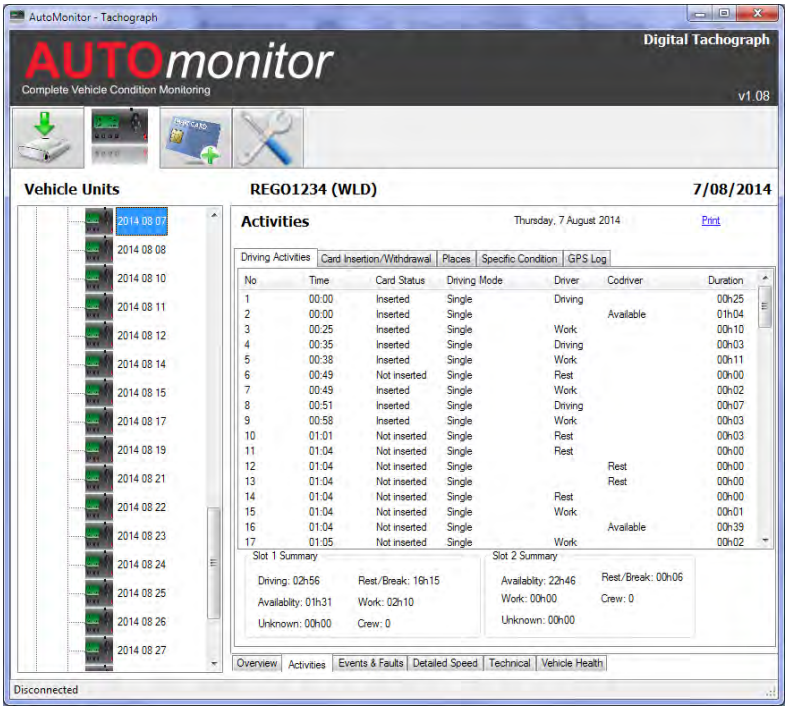


Figure 21: Vehicle unit daily activities window

The print link located on the top right corner of the window can be used to generate a printable report of daily activities.

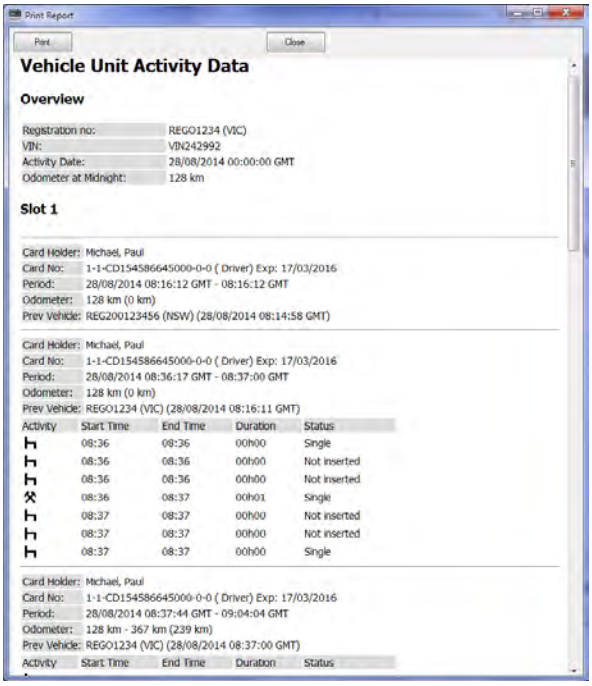


Figure 22: Vehicle unit daily activities report

5.3.1.3 Events and Faults

Event and fault records are the recorded events stored in VU every time a fault or an event is detected by AutoMonitor. The currently marked or on-going events and faults are also downloaded when transferring events/faults to PC. The types of records include any event, faults, speed control record, over-speeding records, and time adjustment records.

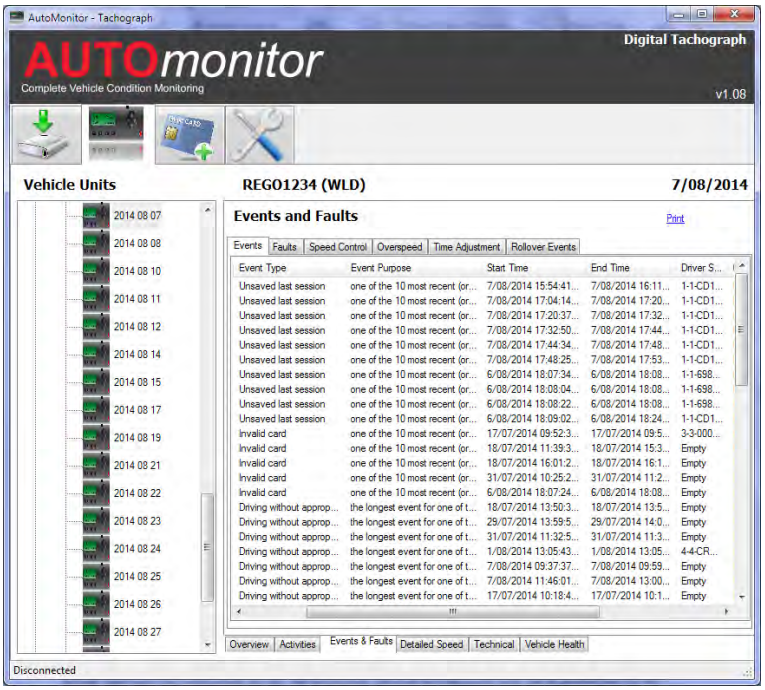


Figure 23: Vehicle unit event records

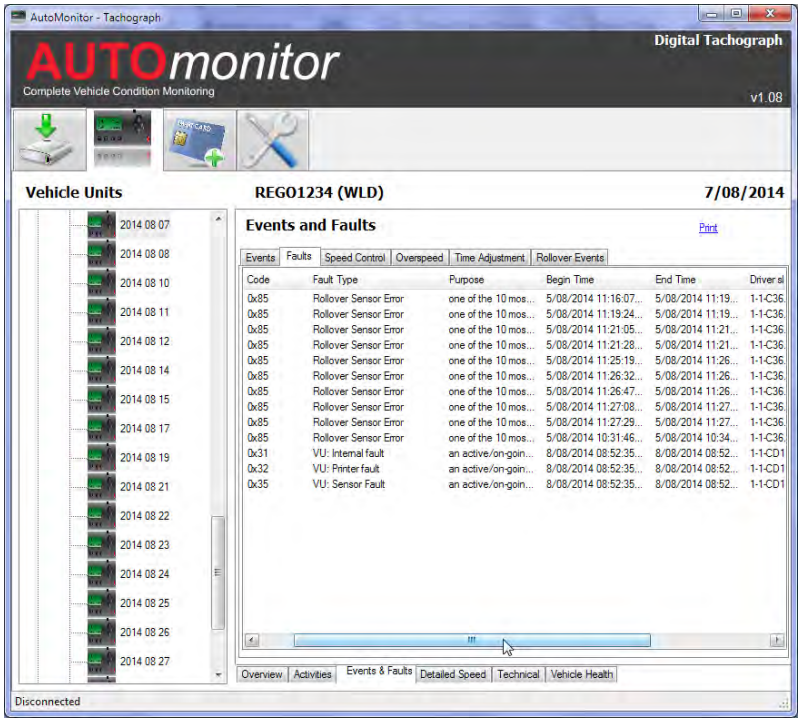


Figure 24: Vehicle unit fault records

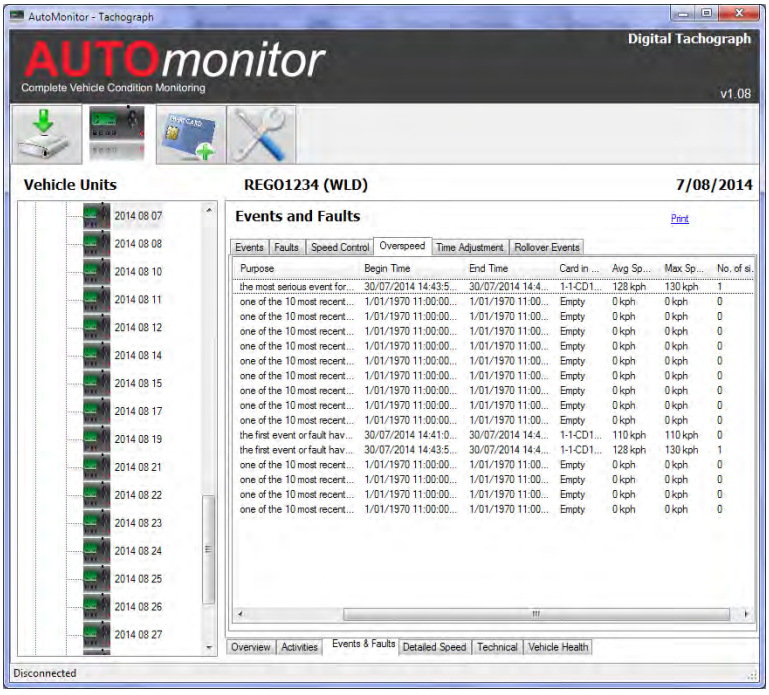


Figure 25: Vehicle unit over-speeding events

5.3.1.4 Detailed speed log

The tachograph constantly records vehicle speed data onto its internal storage memory. The speed of the vehicle is sampled once per second over the past 24 hours. The following screenshot displays how a detailed speed log downloaded from the vehicle unit.

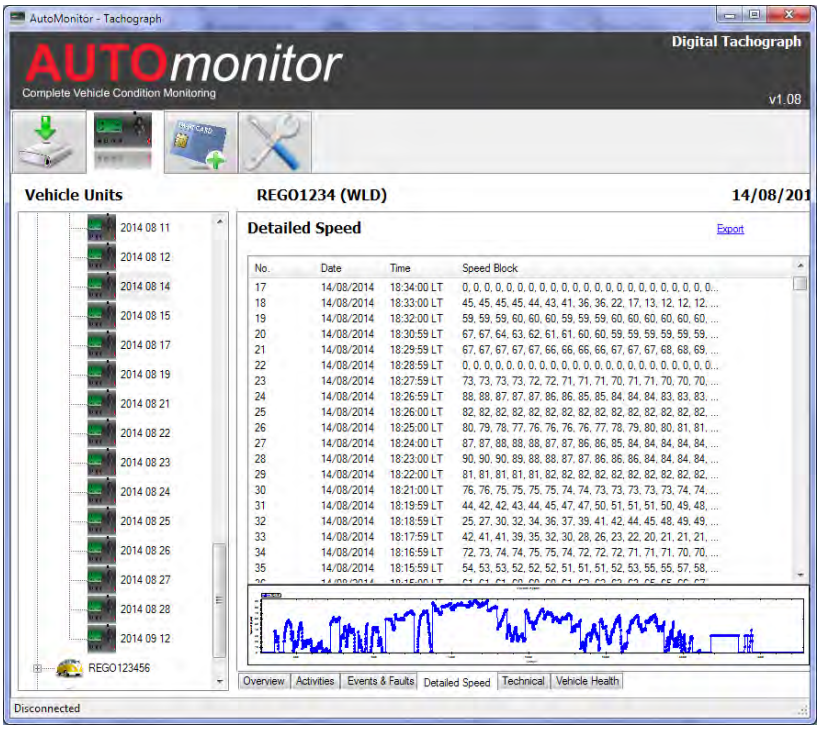


Figure 26: Vehicle unit detailed speed records

5.3.1.5 Technical Data

Technical data includes the past calibration history. The previously configured calibration data related to tachograph application, and the details of the technician are contained in the technical record.

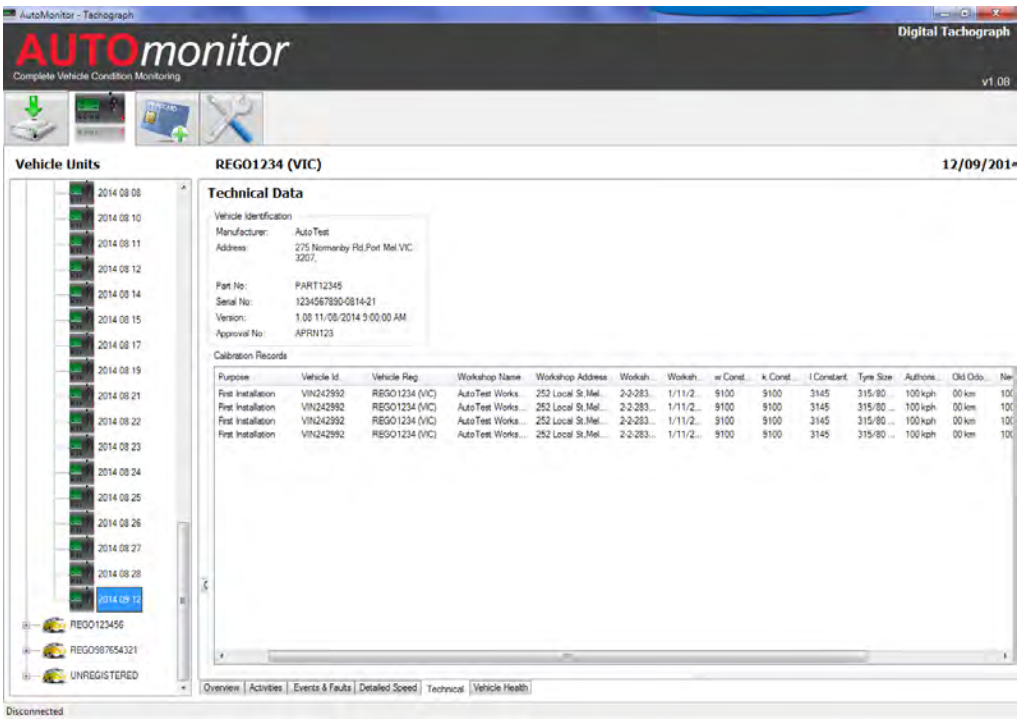


Figure 27: Vehicle unit calibration of tachograph related technical data

5.3.1.6 Card Data

Card data includes the data stored in the smartcard placed in one of the slots of the tachograph. If there are two cards currently inserted in the tachograph then the card that is currently placed in the driver slot will be uploaded to PC. All activities stored in the card will be transferred to PC.

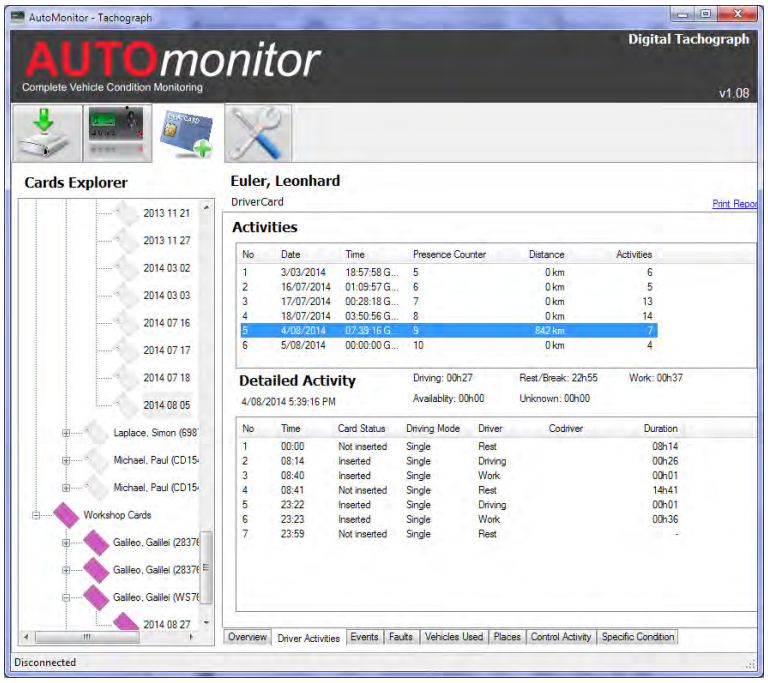


Figure 28: Driver activities stored on driver card

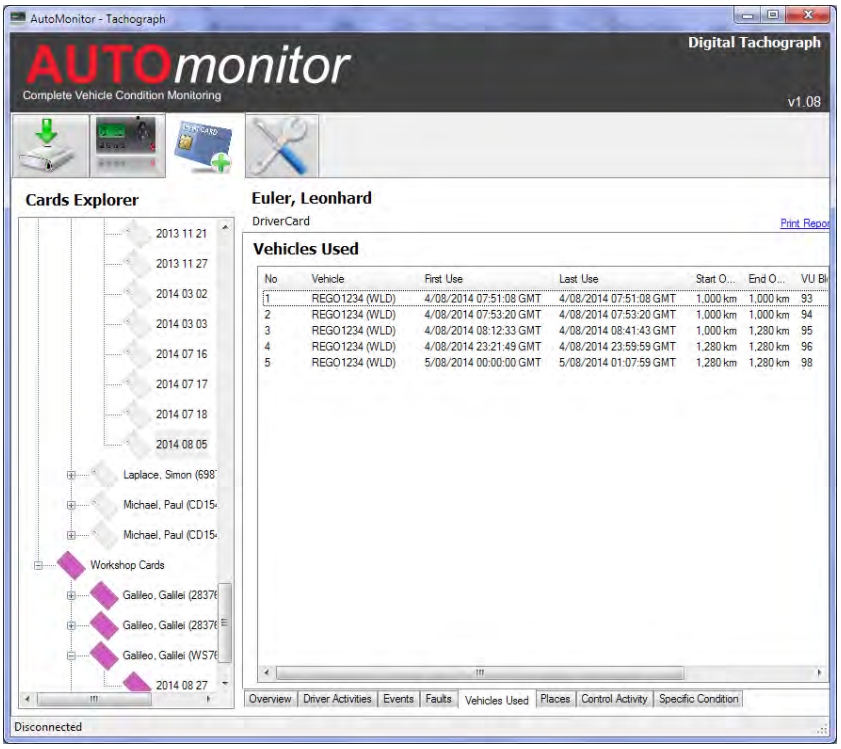


Figure 29: Vehicles used records stored on a driver card

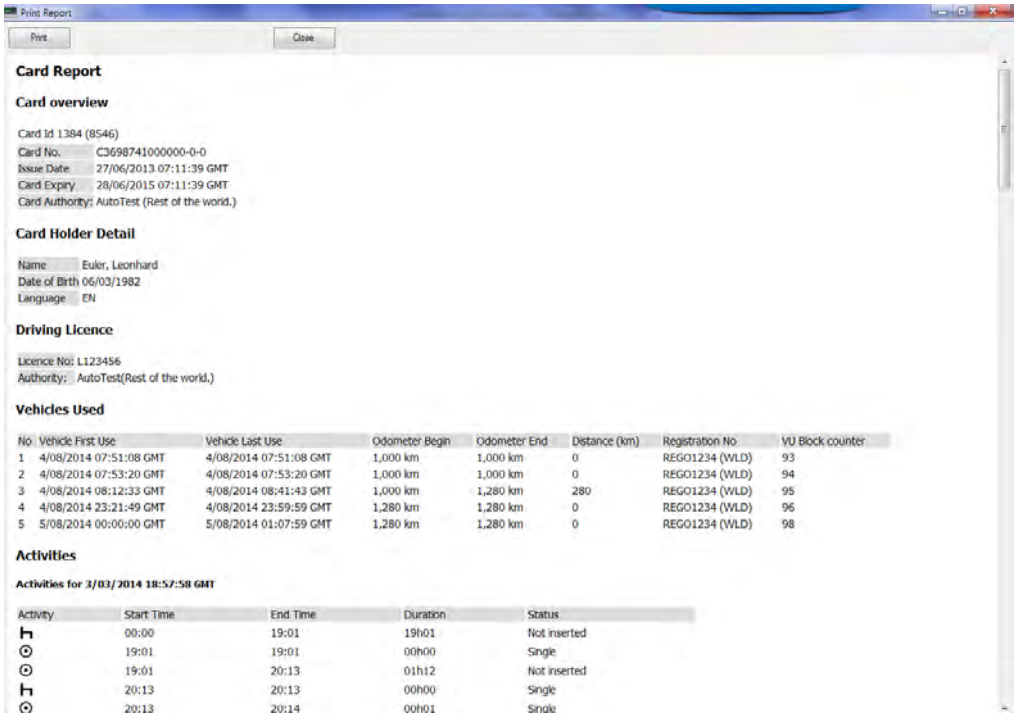


Figure 30: Driver activities report using data stored on a driver card

5.3.1.7 Rollover events

Rollover events include the recorded history of rollover alerts. Whenever a rollover alert is raised, the vehicle unit will store a record of that along with the GPS location and current speed. Rollover records could be useful in observing hazardous spots of rollover on roads.

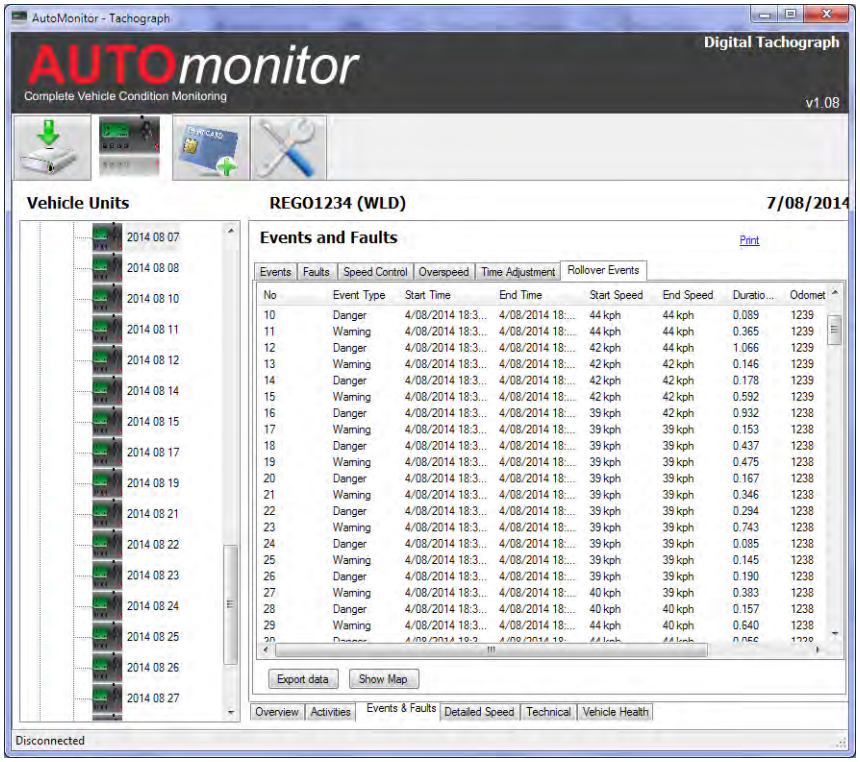


Figure 31: Rollover events downloaded from VU

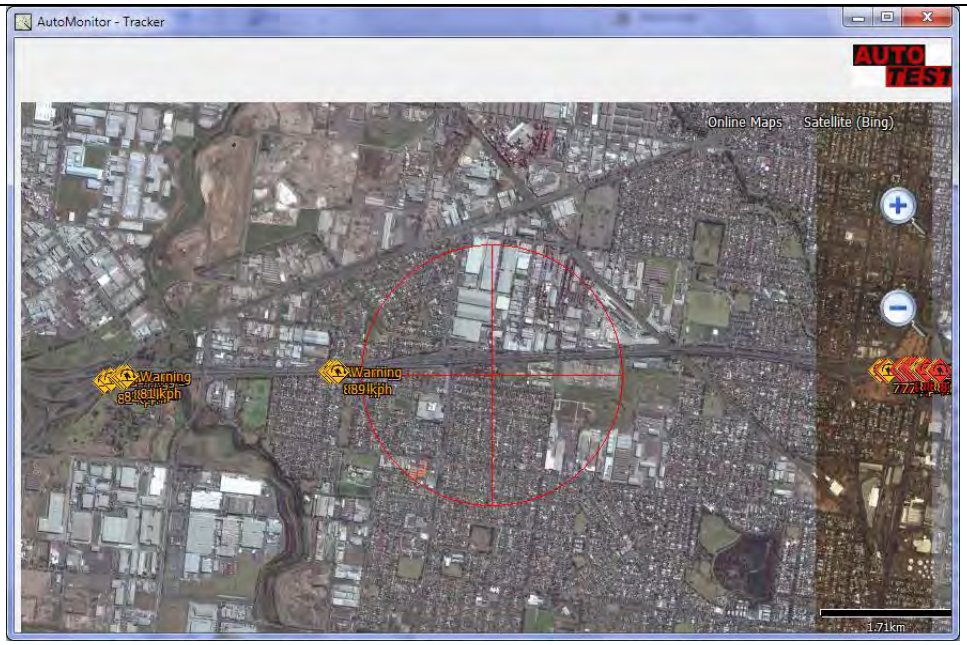


Figure 32: Display of rollover events on map

5.3.1.8 GPS Track Log

AutoMonitor can hold up to 10,000 track points. When 10,000th track point is reached, the program will replace the oldest records. To download track points, insert a company card into one of the slots of the tachograph and select “GPS Log” from the downloading options in the PC software.

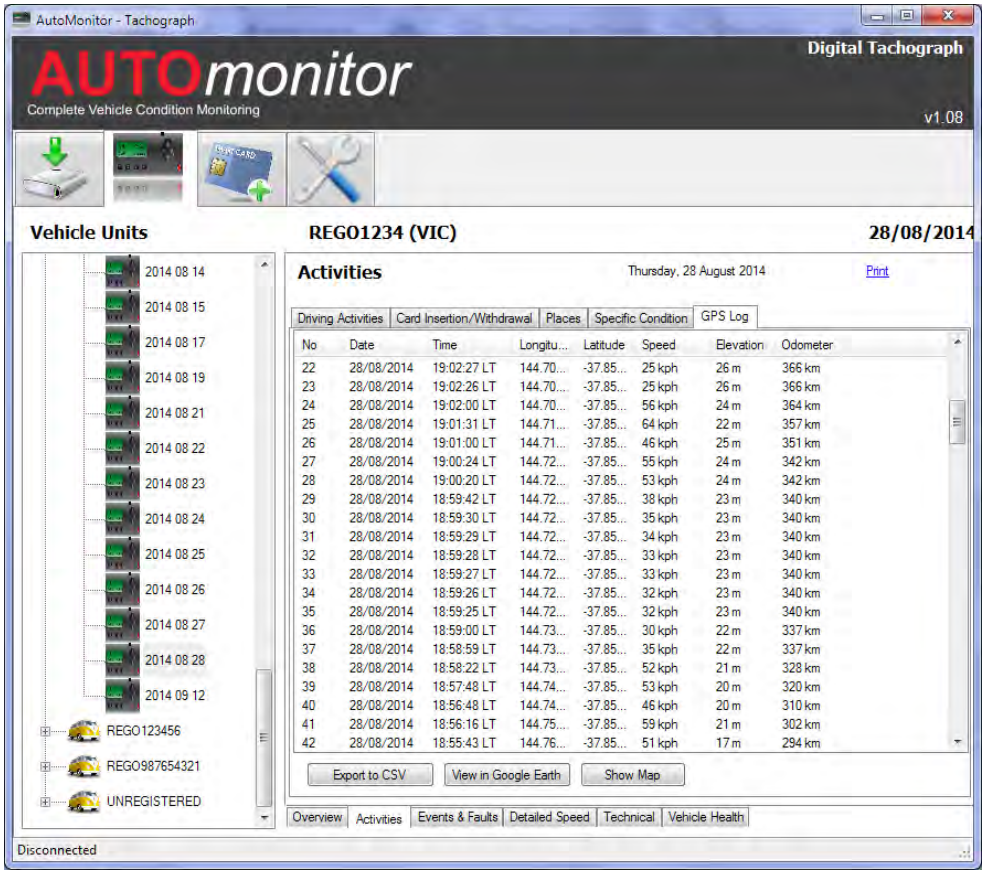


Figure 33: GPS track log download from VU

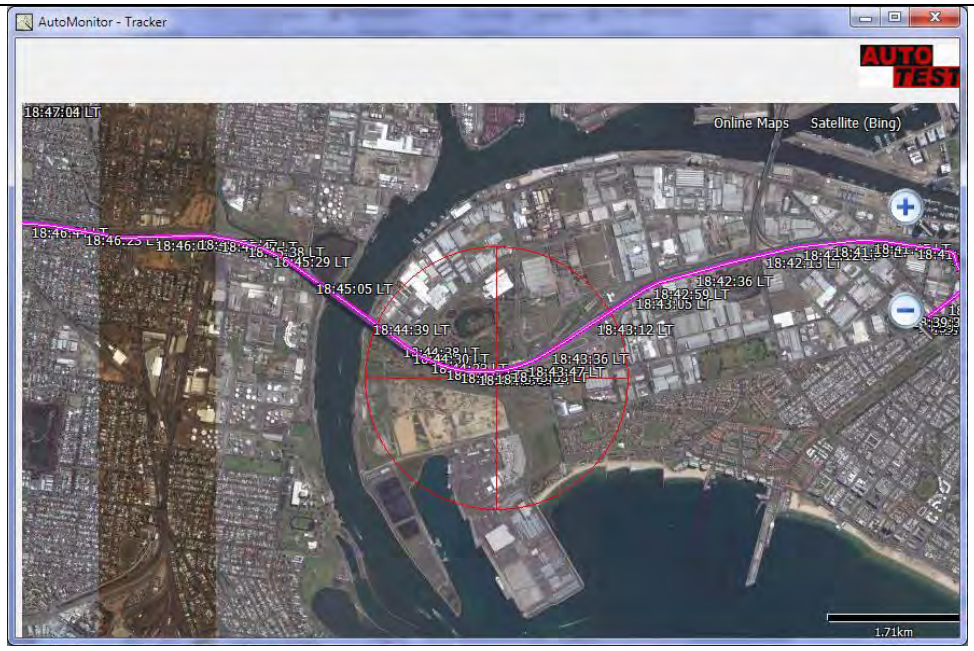


Figure 34: Downloaded GPS track log displayed on map

5.3.1.9 Health data

Vehicle's health related data can be downloaded by selecting 'Health data' during downloading. Health data includes vehicle brake performance, suspension performance, vehicle mass profile, diagnostic information, engine parameters.

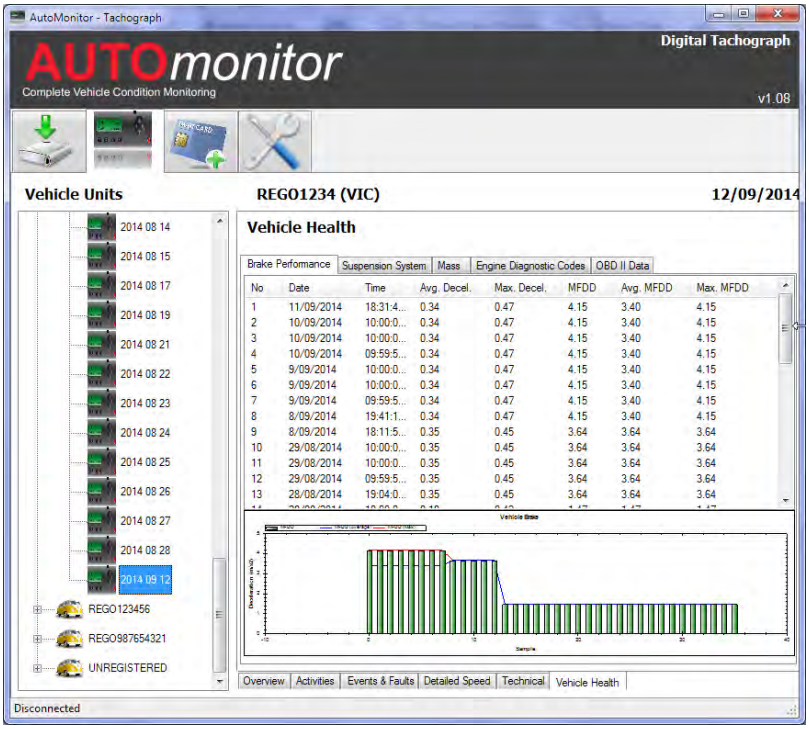


Figure 35: Vehicle health log download from VU

5.3.2 Real-time GPS Tracking Application

AutoMonitor Tracker software allows vehicle owners to track their vehicle in real-time. The tracking software acts as a server and monitors incoming TCP/IP connections from vehicle units. If a vehicle unit or remote device is configured to remotely connect to the PC where tracking software is running, the remote device will automatically try to establish connection with the PC at configurable periodic times. Once the remote device is connected to the tracking software, the software will plot the device onto a map and will show status information of the vehicle. More detail on the connection settings is described in Section 0.

5.3.3 AutoMonitor Configuration

AutoMonitor configuration software allows various settings to be altered. The software requires a sufficient degree of access level before it allows users to configure changes.

5.3.3.1 Authentication

AutoMonitor Calibrator software can be used with a valid workshop and company cards. When the calibrator software is running in company mode (i.e. using a company card), the software will only provide access to the configuration-related settings, while the calibration-related tools will not be available. The calibrator software provides full access when operating in calibration mode (i.e. using a workshop card).

When the calibrator software is first run, the software will prompt the user to select the communication port to which the device is connected.

Figure 36: Authentication dialogue for calibrator software

Once the login authentication is successful, the software will retrieve current settings and operational mode.

5.3.3.2 Vehicle model and registration

The vehicle model and registration page allows the description of the vehicle to be set. The serial number and part number of the vehicle unit (VU), the identity of the vehicle, and the model information of the vehicle are configured on this page.

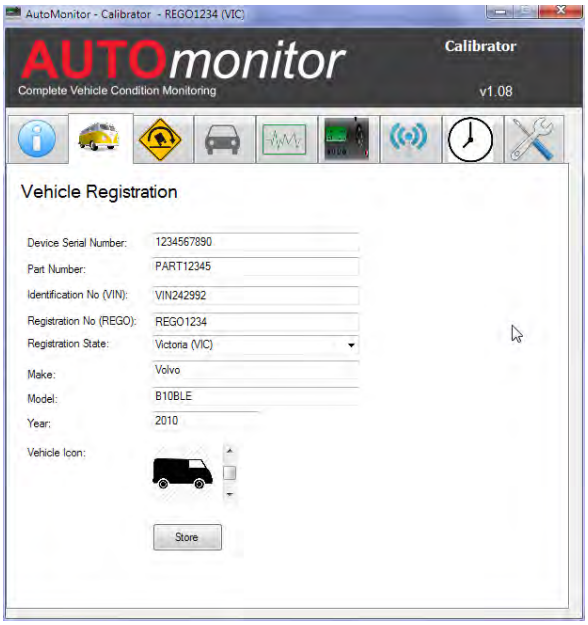


Figure 37: Vehicle registration and model type configuration window

The vehicle icon selected will be the icon of the vehicle when it appears on the map of the tracking software.

5.3.3.3 Rollover threshold settings

The rollover threshold setting page allows users to alter settings of the threshold values of the rollover detection and notification system.

Figure 38: Rollover threshold configuration window

5.3.3.4 Connection Setup

The connection setup page allows the user to alter the modem settings Users can configure SMS, Dial-out, GPRS, SMTP, HTTP and Remote services.

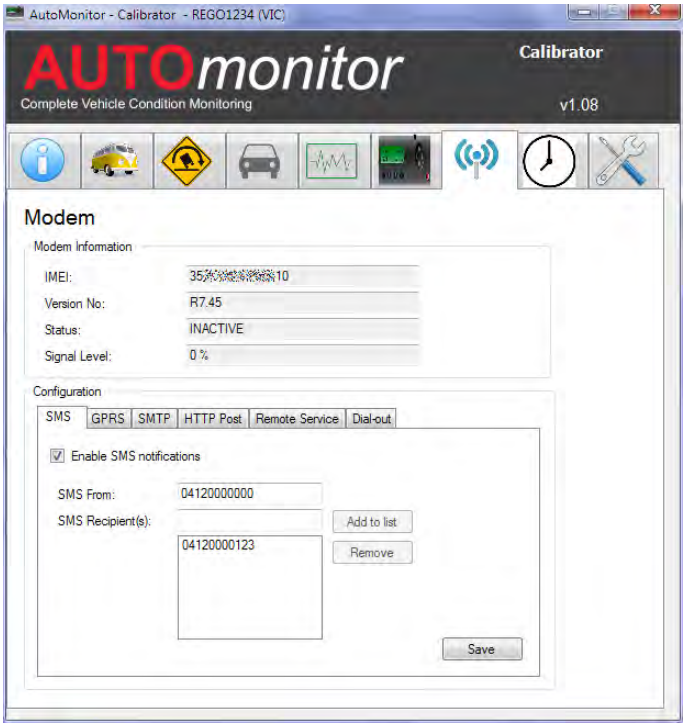


Figure 39: Modem configuration window

More detail on the connection configuration is provided in section 0.

5.3.3.5 Notification Setup

The notification service allows users to configure AutoMonitor to send out events and faults notifications via emails and SMS. It also allows users to configure schedule for timely reports. More detail on the notification service is provided in section 0.

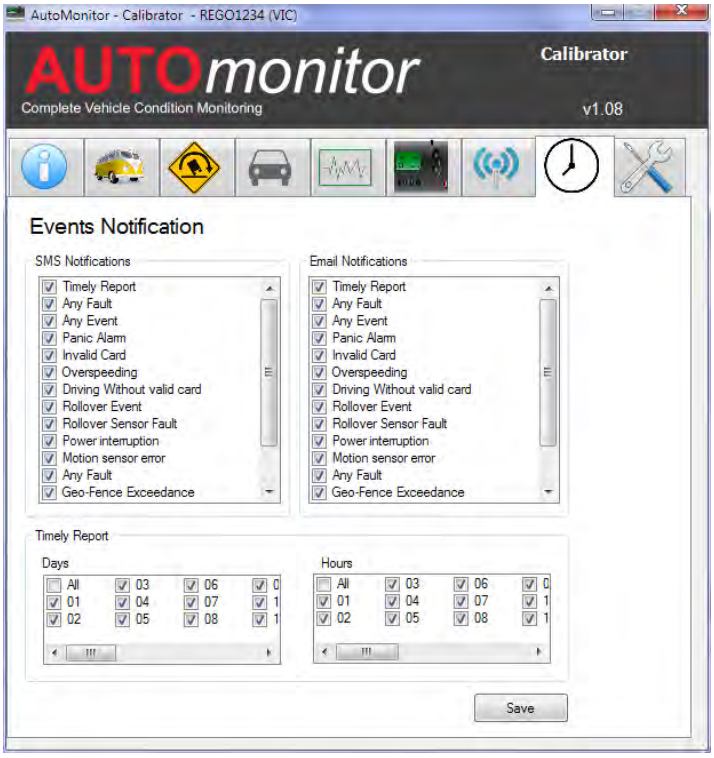


Figure 40: Events notification selection window

5.3.3.6 General Settings

The general settings page allows users to erase previously stored data and configure general settings of the device.

Figure 41: Miscellaneous configuration window

5.3.3.7 Vehicle Dimension

The vehicle dimension settings page is used to configure the vehicle profile and it requires calibration level access, which is possible using a workshop card. The dimensions of the vehicle, the type of suspension system of the vehicle, the weight of the vehicle, and the method for estimating the weight of the vehicle are all configurable on this page.

Figure 42. Vehicle dimension configuration window.

5.3.3.8 Tachograph Calibration

The tachograph calibration page calibrates the tachograph and it requires the calibration level access, which is only possible with a workshop card.

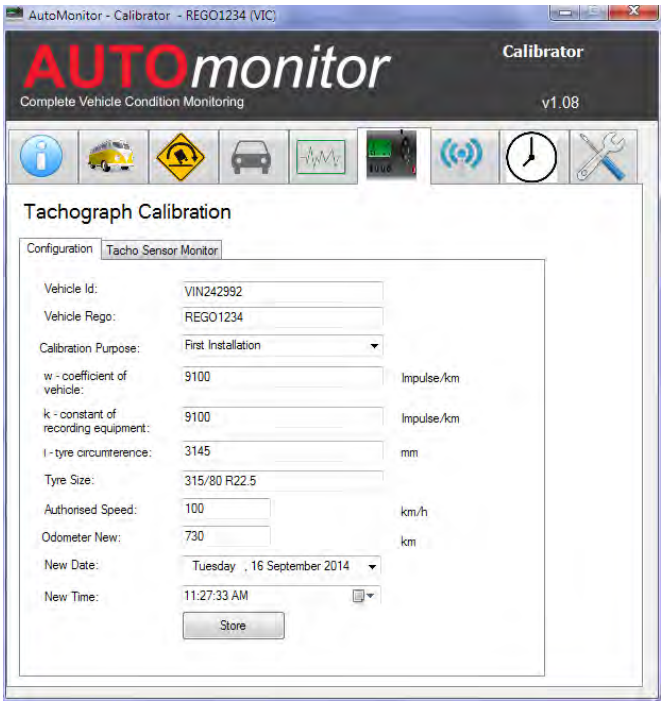


Figure 43: Tachograph related calibration window

5.3.3.9 Rollover Sensor

Rollover sensor calibration page is used to calibrate the accelerometer and gyroscope sensors of the rollover sensor module at two temperature points.

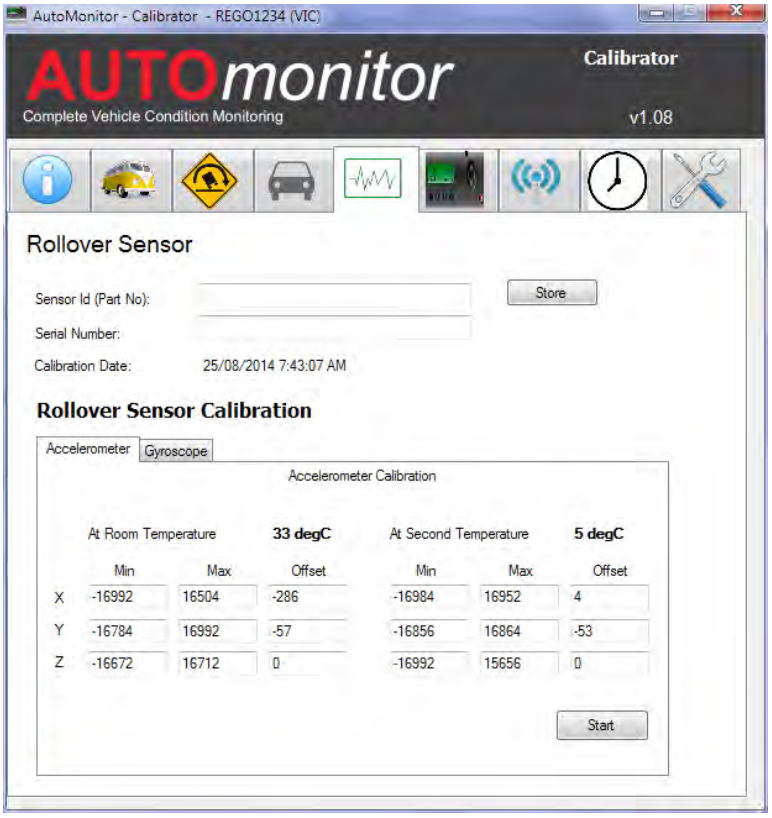


Figure 44: Rollover sensor calibration window

6. CALIBRATION

6.1 Rollover sensor calibration

There are two sensors contained in the rollover sensor module that require calibration:

1. Accelerometer
2. Gyroscope

6.1.1 Accelerometer

The accelerometer used in the rollover sensor module is a tri-axial accelerometer and it is calibrated at two temperature points, where the temperature difference between the two points should be over 15 °C. The temperature for the first point can be the room temperature. To calibrate the accelerometer of the rollover sensor module at room temperature, place the rollover module on a level surface and press start. The window will display current temperature value for the first calibration point. After 10 seconds, gently hold the accelerometer and rotate it around all three axes at a very slow speed. The calibrator software will display the calibration values on the screen. Once all three axes have been rotated 360 degrees press stop button.

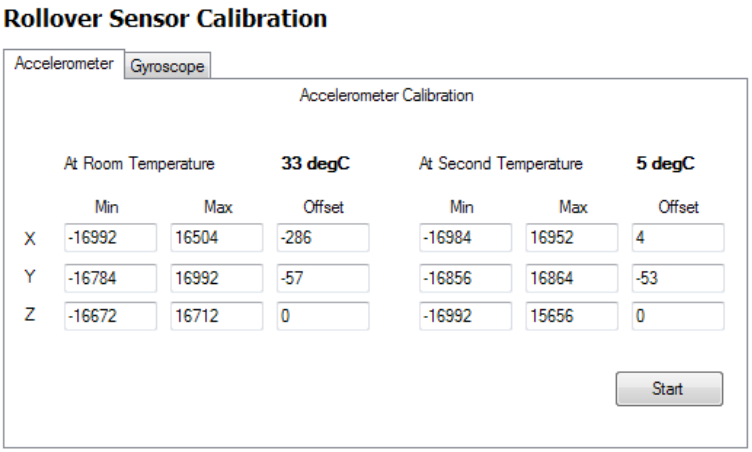


Figure 45: Rollover sensor calibration - accelerometer

To calibrate the second point of the accelerometer, either raise the temperature of the device to about 40 °C or cool it down to about 0 °C. Once the expected temperature of the device is reached, connect the sensor AutoMonitor and place the sensor on a flat surface. Press start button on the accelerometer calibration page when ready and wait for 10 seconds. The temperature value for the second point will be displayed on the PC screen. As with the first point, rotate the rollover sensor module around all three axes. Once all axes have been rotated 360 degrees press stop. The accelerometer is now calibrated.

6.1.2 Gyroscope

The gyroscope used in the rollover sensor is a tri-axial digital gyroscope and requires calibration for all three axes at two temperature points. The first temperature can be the room temperature, while the second temperature can be at about 0 °C.

To calibrate the first point at room temperature, leave the rollover sensor connected in a room for 10 minutes. Place the gyroscope on a plane surface and click on start to start the first point calibration. The rollover sensor should not move during the first 15 seconds. After 15 seconds click on stop.

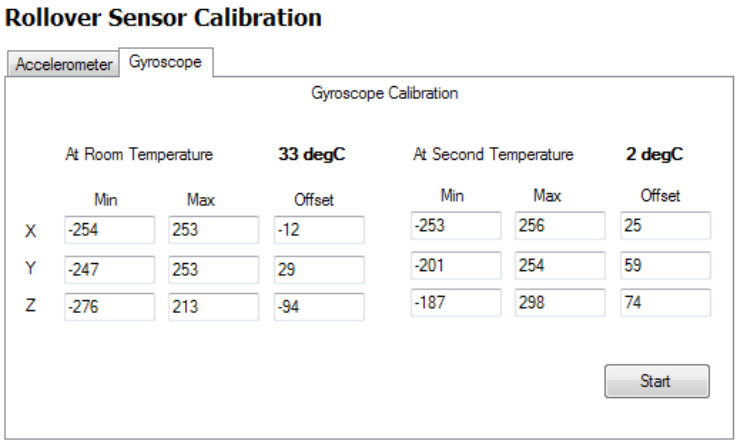


Figure 46: Rollover sensor calibration - gyroscope

To calibrate the second point of the gyroscope, raise the temperature of the rollover sensor to 40 °C or lower the temperature to about 0 °C. Once the expected temperature is reached, connect the rollover sensor to the vehicle unit and the follow the same steps described earlier for the first temperature point.

6.2 Tachograph Calibration

The tachograph calibration includes the calibration of the wheels and motion sensor, setting up the vehicle identification information, date and time of the device, odometer of the vehicle, and maximum authorised speed for the vehicle.

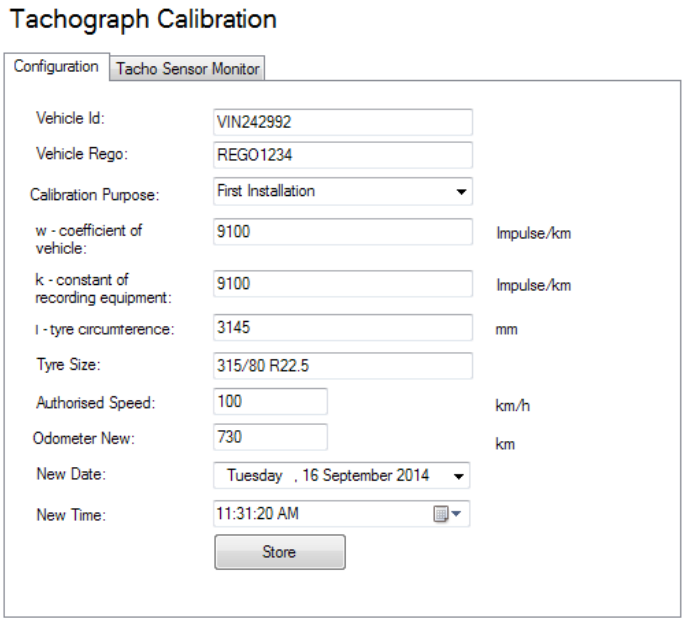


Figure 47: Tachograph calibration window

The coefficient of vehicle (w) indicates the number of pulses required from the motion sensor for the vehicle to travel a distance of one kilometre. The constant of recording equipment (k) indicates the number of pulses obtained from the motion sensor for the vehicle to travel a distance of one kilometre. The tyre circumference (l), given in millimetres mm, is the average circumference of all wheels of the vehicle under normal conditions. The tyre circumference is the distance travelled by the wheel in one wheel rotation. The tyre-size is the size of the tyre marked on the side of the tyre. The authorised speed is the maximum speed permitted for the vehicle. If the vehicle exceeds this maximum authorised speed, the tachograph will register an over-speeding event. The odometer field should have the current odometer readings of the vehicle indicated in the vehicle's dashboard. The 'New Date' field contains the current date that needs to be set in the tachograph. The date and time indicated in the settings window is according to the local time of the PC.

6.3 Motion sensor calibration

The motion sensor calibration is used to validate the speed of the vehicle.

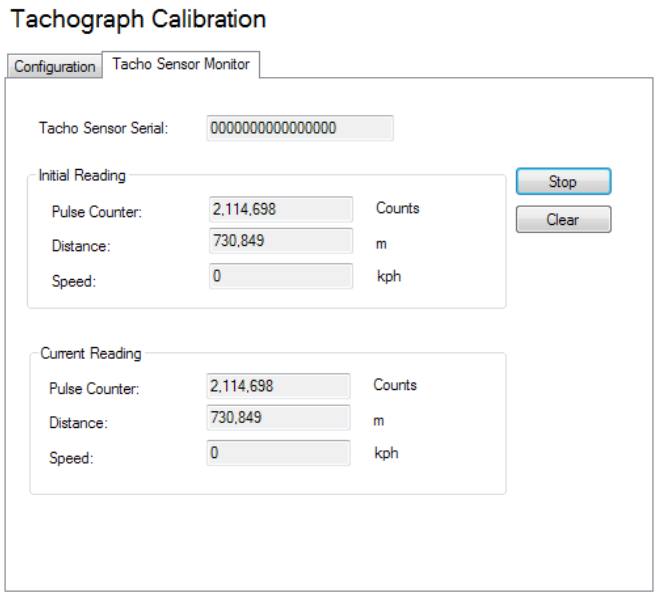
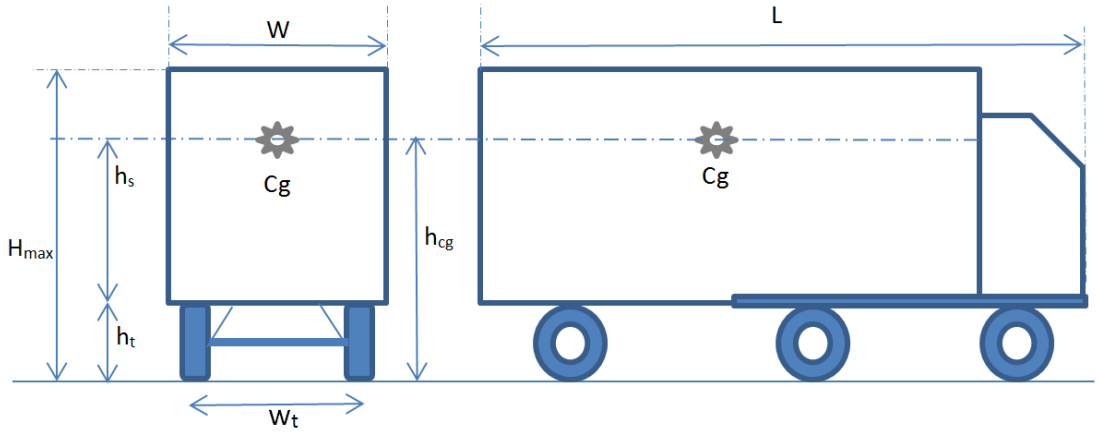


Figure 48: Motion sensor validation

6.4 Vehicle profile setup

The profile of the vehicle includes the dimensions of the vehicle body, the combined weight of the vehicle, and the properties of the suspension system.



Dimension	Description
W	Width of the vehicle body
L	Length of the vehicle
H_{max}	Maximum height of the body
h_t	Height of the tyres
w_t	Track width
h_{cg}	Height, current centre of gravity height

The profile of the vehicle can be entered in the vehicle dimensions form.

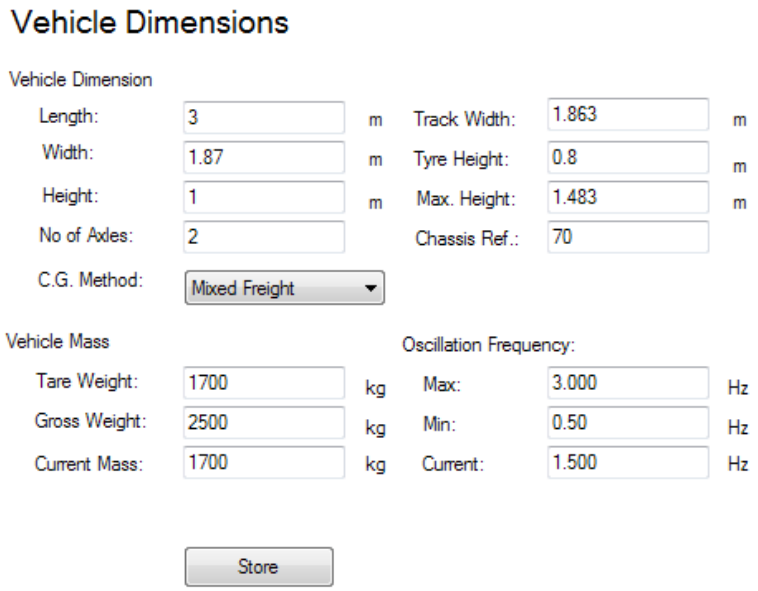


Figure 49: Vehicle profile configuration window

The dimensions of the vehicle are used to sense impending rollover of the vehicle. The suspension properties or oscillation frequency detail is used to estimate the current load of the vehicle. As the load of the vehicle is increased, the centre of gravity point will also increase correspondingly. There are three methods used to estimate the height of the centre of gravity point:

C.g. Calc. Method	Description
Mixed Freight	It is assumed that 70% of the payload is located at the bottom half of the vehicle, and 30% of the payload is located in the top half. The maximum height of c.g. point is therefore around 40% of the maximum height of the payload.
Uniform Density	The height of the c.g. point rises linearly with payload. The maximum height of the c.g. point is reached to the maximum height of the vehicle when the payload is at maximum.
Fixed c.g. height	The c.g. point defined by the user and always remains constant. Changes in vehicle mass will not change the value of c.g. height.

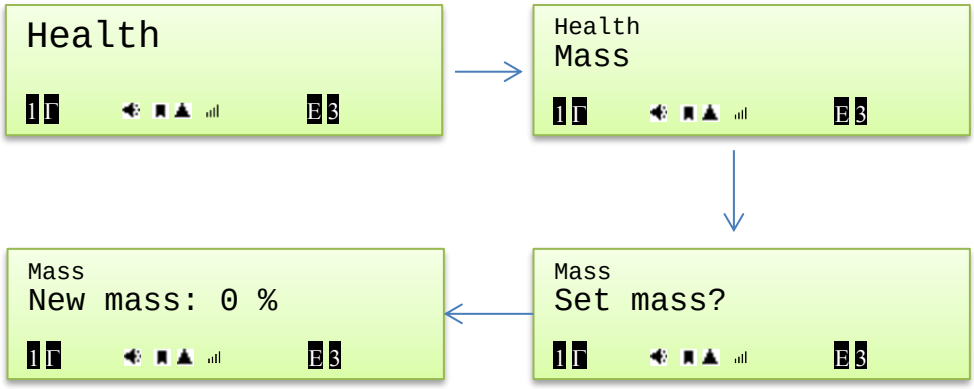
Table 15: Centre of gravity point calculation methods

The reference chassis value is used to calculate the rating of shock absorbers.

6.5 Vehicle mass calibration

The mass calibration of the vehicle requires the vehicle profile data to be already configured.

The calibration of mass is performed by driving the vehicle at two load levels, where the difference between the two loads should be 40% of the maximum payload. The first point can be calibrated when the vehicle is empty, or at 0% of maximum payload. Follow the steps indicated below and set the new mass value to 0%.



Once the new mass is set to zero percent, drive the vehicle over speed breakers a few times to let the AutoMonitor learn the behaviour of suspension system. Set the second calibration point of vehicle mass by adding load into the vehicle. The load added should be over 40% of maximum payload. Once the mass is added and the vehicle is ready to be driven, set the new mass value to the amount of payload just added into the vehicle. Perform another test drive over speed breakers a few times. Once the mass has been calibrated, the real-time mass of the vehicle will be displayed on the screen.

Note: *While the mass calibration is being performed and AutoMonitor learns the vehicle's profile, the LCD will display 'c' to indicate mass-calibration mode. While the AutoMonitor is in mass-calibration mode, the vehicle mass value might not update and the rollover alarms might not be accurate until the mass profile has been learnt by the system.*

7. SMARTCARD PROGRAMMING

AutoMonitor works with synchronous card such as SLE5528/ISSI4428 memory cards. Each card is formatted according to its card type. There are four primary types of smartcards:

1. Driver card
2. Company card
3. Control card
4. Workshop card

The description of these card types has been given in Section 3.1.3.

To create a new smartcard or to edit an existing card, AutoMonitor Card Maker tool is required. Once the card maker software is run, the software will need to connect to AutoMonitor via serial port. Once the software is connected, the details of the currently inserted card will be retrieved. Click on Refresh link to view the card details on the card maker application.

7.1 Driver Card

The driver card contains card identification data, card holder's identification, and driving license number.

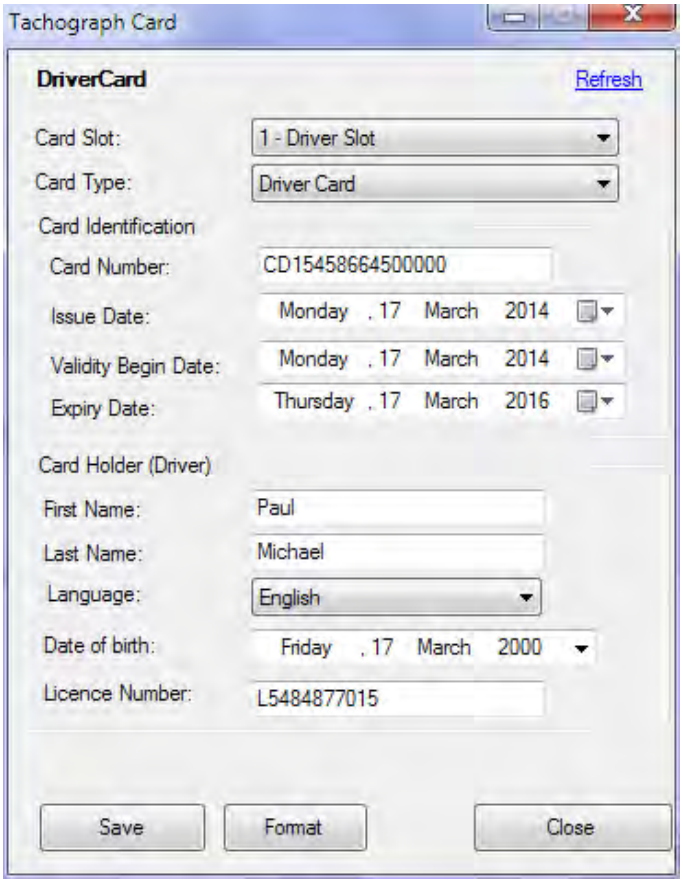


Figure 50: Tachograph card maker - driver card

7.2 Company Card

The company card contains the identification of the card and the details of the company.

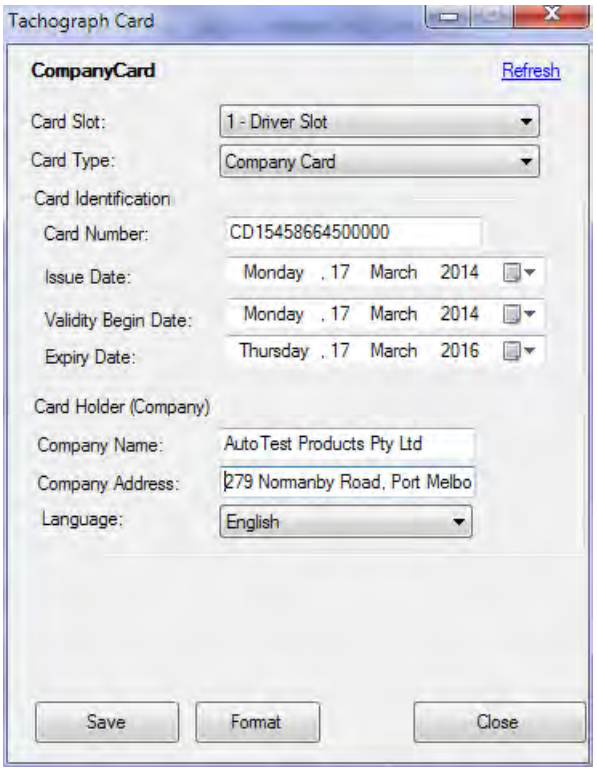


Figure 51: Tachograph card maker - company card

7.3 Control Card

The control card contains the identification of the card, the identification of the card holder and the name & address of the control body.

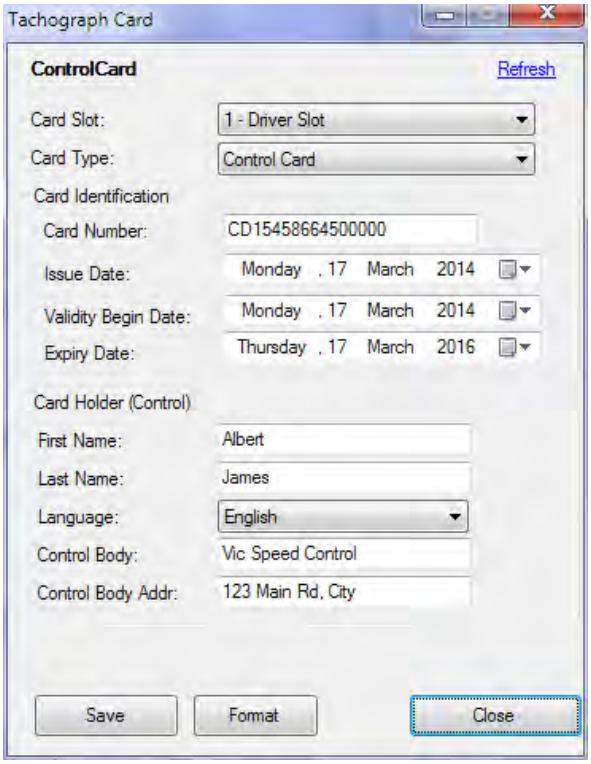


Figure 52: Tachograph card maker - control card

7.4 Workshop Card

The workshop card contains card identification detail, the names of the card holder, and the detail of the workshop.

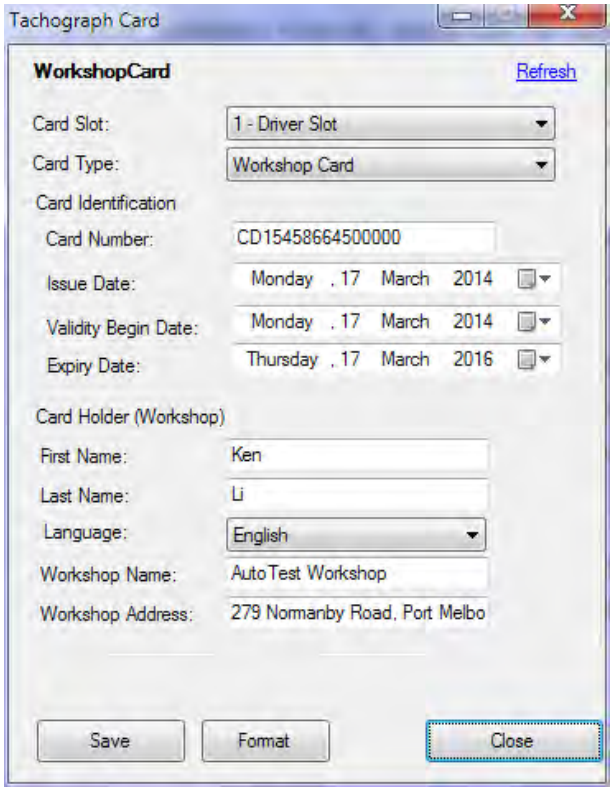


Figure 53: Tachograph card maker - workshop card

8. TACHOGRAPH PICTOGRAMS

People

A	Company
B	Controller
Δ	Driver
X	Workshop/test station
⊟	Manufacturer

Activities

E	Available
Δ	Driving
Φ	Rest
Γ	Work
6	Break
<	Unknown

Equipment

1	Driver slot
3	Co-Driver Slot
H	Card
I	Clock
ϑ	Display
K	Printer/Printout
Λ	Vehicle/Vehicle unit

Miscellaneous

O	Start of daily work period
Π	End of daily work period
P	Location
Θ	Security
I	Time
4	Daily
5	Weekly
6	Two weeks
7	From/To
PO	Location start of daily work period
ΠP	Location end of daily work period
M7	Out of scope begin
7M	Out of scope end

Driving

ΔΔ	Crew driving
Δ5	Driving time for one week
Δ6	Driving time for two weeks

Cards

ΔH	Driver card
AH	Company card
H888	No card
1ΔH888	period without card in slot
3ΔH888	period without card in slot

Events

9H	Insertion of a non-valid card
9HH	Card conflict
9II	Time overlap
9ΔH	Driving without an appropriate card
9HΔ	Card insertion while driving
9HΛ	Last card session not correctly closed
::	Over-speeding
9Σ	Power supply interruption
9T	Motion data error
9Θ	Security breach
9I	Time adjustment (by workshop)
:B	Over-speeding control

Faults

;H	Card faults
;H1	Card fault (driver slot)
;H3	Card fault (co-driver slot)
;ϑ	Display fault
;Y	Downloading fault
;K	Printer fault
;T	Sensor fault
;Λ	AutoMonitor Internal Fault

Additional Pics

OΔ	Driving time over daily work period
O7	Daily work period amplitude
ΠΦ	Time left to the driver before starting his daily rest period
7H1	Update of data on card 1 before withdrawal
7H3	Update of data on card 2 before withdrawal
ΘA7	Company lock start
7ΘA	Company lock end
ΠP<	Confirm/Enter location of end of work period
PO<	Enter location of start of work period

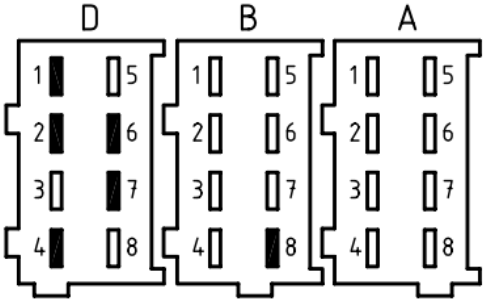
Specific conditions

M	Out of scope
N	Ferry/Train crossing

9. LAYOUT OF ELECTRICAL CONNECTORS AND PLUGS

9.1 Standard connectors

Connectors A, B and D located at the rear of the vehicle unit (VU) are the standard tachograph connectors. The description of each connector and the associated pins is provided below:



Connector A – Power supply and CAN bus connection

Pin	Description
A1	Permanent power (Positive +)
A2	Illumination
A3	Ignition
A4	CAN_H
A5	Battery (Negative -)
A6	Ground, GND
A7	CAN_GND
A8	CAN_L

Connector B – Tachograph speed transmitter connection

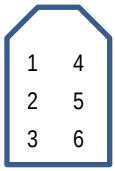
Pin	Description
B1	Positive supply
B2	Battery (negative -)
B3	Speed signal, real time
B4	Data signal
B5	-
B6	Speed pulse output
B7	Speed pulse output
B8	Distance signal, 4 pulses/m

Connector D – Optional functions

Pin	Description
D1	Status input 1
D2	Status input 2
D3	-
D4	General tachograph warning output
D5	-
D6	Speed pulse output for instrument
D7	Data communication I/O
D8	-

9.2 Download Port

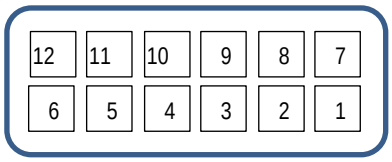
The downloading connector is located on the front panel near the key buttons. The description of the six pins of the downloading port is given below:



Pin	Description
1	Battery (-)
2	Data communication K-line (ISO 14 230-1)
3	RxD – Downloading
4	Input/Output signal - Calibration
5	Permanent power output
6	TxD - Downloading

9.3 Driver's Aid Connector

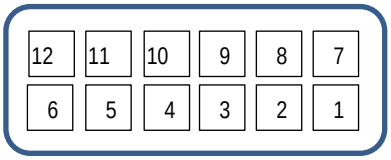
The driver's aid connector is located at the rear of the vehicle unit (VU). Some of the pins of this connector are connected to the driver's aid box, while other pins are general digital I/O and analog input pins.



Pin	Description
1	Digital I/O 1
2	Speaker
3	Red Lamp
4	Green Lamp
5	Amber Lamp
6	Positive (+)
7	GND
8	Analog Input 1
9	Analog Input 2
10	Digital I/O 4
11	Digital I/O 3
12	Digital I/O 2

9.4 Rollover Sensor Connector

The rollover sensor connector is located at the back of the vehicle unit (VU). The rollover sensor module is connected to this port. The description of individual pins of this port is provided below:



Pin	Description
1	Sensor Ready
2	Sensor Interrupt
3	-
4	Sensor Off
5	Battery (+)
6	-
7	-
8	-
9	GND
10	GND
11	Data Out
12	Data In

10. PRODUCT SPECIFICATIONS

Tri-axial acceleration resolved to	Forward, Lateral and Vertical vectors	
Maximum angular velocity	± 250 °/s	
Angular velocity accuracy	1 %	
Maximum acceleration	± 2g	
Acceleration accuracy	< 2 %	
GPS receiver type	50 channels GPS L1 frequency, C/A Code	
Horizontal position accuracy	GPS	2.5 m
GPS Time to first fix	Cold start	26 s
	Warm start	26 s
	Hot start	1 s
Frequency response	0 – 5 Hz	
Temperature stability	Internally compensated	
Temp. compensation accuracy	5 %	
Outputs	Speaker: 85 dBA @ 1 m	
Warning lamp	40 mcd	
Danger lamp	70 mcd	
Digital interface	RS232C-standard 9 pin	
GPRS interface	Broadband modem	
Live GPS tracking resolution	2 m	
Historical GPS	Audit trail analysis 10,000 track points	
Built-in thermal printer		
Paper width	58 mm	
Paper roll size	Max. ∅ 32 mm	
Memory retention	5 years	
Radiated RF emissions	SAEJ1113 Class 3	
Compliant with	SAE J1455, ISO 7736	
Operating temperature	-10º to +70ºC	
Humidity	Up to 90% non-condensing	
Dimensions (h × d × w)		
Vehicle Unit (VU)	60 mm × 188 mm x 188 mm (Complies with ISO 7736)	
Rollover sensor	60 mm × 135 mm x 80 mm	
Driver's Aid	40 mm × 115 mm x 90 mm	
Supply Voltage	12 – 28 V	
Power consumption	300 mA	(Standby)
	500 mA	(Typical)
Suspension performance	Damping ratio, overall rating	
Brake Performance	Max. deceleration, avg. deceleration, MFDD	
Detailed speed log	24 hour recording at 1 Hz	

The replacement of any components must be carried out by AutoTest™ Products or an Authorised AutoTest Products Service Centre.

11. WARRANTY

To ensure prompt warranty service should it be required, please complete warranty registration form, and return to AutoTest Products Pty Ltd within 10 days of purchase of the product. AutoTest Products or an Authorised Service Centre warrants this product against defects in material and workmanship for a period of 12 months from the original date of purchase. This warranty applies only to products and components supplied by AutoTest Products which can be identified by the trade name or logo affixed to them or by other documents. AutoTest™ Products does not warrant any products not supplied by AutoTest Products.

During the warranty period, AutoTest Products or an Authorised Service Centre will repair (or at its option replace), any defective component(s) without charge for labour, provided the product is returned in its original or suitable equivalent container, freight prepaid, to an authorised AutoTest Service Centre. Transit insurance and return freight will be at the owner's expense.

In order to obtain calibration, warranty or non-warranty service, ship the product, freight and insurance prepaid to your nearest AutoTest Service Centre. Attach to the product your name, address, contact numbers, description of the problem and if a warranty claim, proof of purchase (dated sales receipt or invoice). AutoTest Products or an Authorised AutoTest Service Centre reserves the right to refuse warranty repair if accident, abuse, misuse or misapplication has damaged the product in transit or as a result of service or modifications by other than an Authorised Service Centre, nor are any other warranties expressed or implied, including any regarding merchantability or fitness for any other particular purpose.
AutoTest Products or an Authorised Service Centre is not responsible for incidental or consequential damages resulting from the breach of any express or implied warranty, including damage to property and, to the extent permitted by law, damages for personal injury.

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