



VBOX3i

100Hz GPS Data Logger

User Guide



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EC declaration of conformity

We declare that this product has been tested to and meet the requirements of:

EC directive 2004/104/EC

“Adapting to technical progress council directive 72/245/EEC relating to the radio interference (electromagnetic compatibility) of vehicles and amending directive 70/156/EEC on the approximation of the laws of the member states relating to the type-approval of motor vehicles and their trailers.”

And has also been assessed, via technical construction File, by an independent DTI competent body and found to be in conformance with the essential requirements of:

EC directive 89/336/EEC (and amending directives)

“Council directive of 03 May 1989 on the approximation of the laws of the member states relating to electromagnetic compatibility.”

DTI competent body responsible for issuing certificate of compliance:

**3C Test Ltd,
Silverstone Technology Park,
Silverstone,
Northants
NN12 8GX**

Introduction

The VBOX3i represents the 3rd generation of GPS data logging system from Racelogic. Using a powerful GPS engine, the VBOX3i can log GPS and other data at 100Hz. The logged data is stored directly onto a compact flash card for easy transfer to a PC.

The VBOX3i also includes 4 high-resolution analogue input channels to record data from external sensors and 2 CAN bus interfaces to allow connection of Racelogic input modules while simultaneously transmitting GPS data on the second bus.

In line with previous VBOX models, the VBOX3i is compatible with all of the existing peripherals including the multifunction display, ADC03, TC8, FIM03 and YAW rate sensor. To use the IMU integration feature of the VBOX3i an IMU03 / IMU04 module is required.

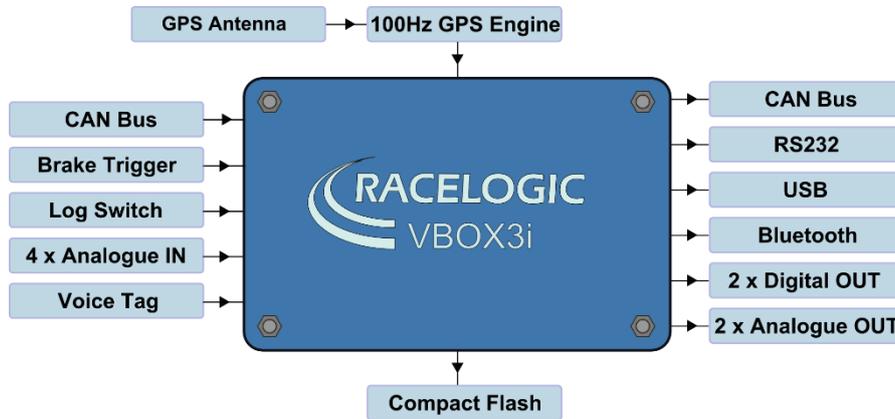
Features

- IMU integration with GPS data
- 6.75ms latency
- 4 x 24bit synchronous differential analogue inputs $\pm 50\text{v}$
- Brake/Event trigger input of 10ns resolution
- Voice tagging of data
- 2 x CAN bus interface
- RS-232 serial interface
- USB interface
- Bluetooth interface
- Compact flash interface
- 2 x 16bit User configurable analogue outputs
- 2 x Digital outputs
- Brake trigger Input with 100KHz scan rate
- Wide 7V to 30V operating range ***See Note**
- Low current consumption
- Logging rate selectable from 100, 50, 20, 10, 5 or 1Hz
- Can be used with a differential BaseStation for positional accuracies of up to 2cm**

*RACELOGIC external modules operate from a 12v vehicle supply. Therefore, when using external modules, VBOX supply must not exceed 15vDC

**2cm 95% CEP positional accuracy, (requiring RTK VBOX upgrade and RTK enabled Basestation)

Inputs/outputs



Standard inventory

Description	Qty	RL Part #	Description	Qty	Racelogic Part #
VBOX3i data logger	1	RLVB3I-V2	Serial PC cable	1	RLCAB001
Mains power supply	1	RLVBACS020	25 Way D connector	1	ADC25IPCON
Cigar lighter power supply	1	RLCAB010L	VBOX3i audio headset	1	RLACS120
GPS magnetic antenna	1	RLACS158	VB3i Bluetooth antenna	1	RLACS119
4GB compact flash card	1	RLACS098	USB A – mini Lead 2m	1	RLCAB066-2
USB multi card reader	1	RLACS163	VBOX padded carry case	1	RLVBACS013V4
VBOX Tools installation CD	1	RLVBACS030			

Optional accessories

Description	RL Part #	Description	RL Part #
Brake pedal trigger	RLVBACS004	8 Channel thermocouple interface	RLVBTC8
Hand-held brake trigger	RLVBACS009	Can to analogue output module	RLVBDAC01
Logging start/stop switch	RLVBACS010	Single YAW rate sensor + 2 axis G sensor	RLVB yaw03
Multifunction display	RLVBDSP03	Inertial measurement unit. 3 YAW rate sensors & 3 accelerometers*	RLVBIMU03
8 Channel (16bit) analogue interface	RLVBADC03	Inertial Measurement Unit. 3 Yaw Rate Sensors & 3 accelerometers*	RLVBIMU04
4 Channel frequency input module	RLVBFIM03	RTCM DGPS Basestation for 40cm positional accuracy	RLVBBS4
16 Channel vehicle CAN interface	RLVBCAN02	RTK DGPS Basestation for 2cm positional accuracy	RLVBBS4RG

*RLVBIMU03/04 required for IMU integration

Quickstart guide

Required equipment (All supplied as standard unless specified)

- VBOX3i
- Cigar lighter 12v adapter lead
- GPS antenna
- Blank compact flash card
- RS232 cable
- VBOX software CD
- Laptop PC (not supplied)

1. Mount the VBOX3i GPS antenna in a suitable position on the roof of the vehicle. The ideal position is in the centre of the roof away from any objects that may shadow the GPS signal such as roof bars. This creates a large metal object underneath the antenna to shield it from signals reflected by the ground that can cause multi-path errors.

NB: See troubleshooting section if having difficulty obtaining satellite lock.



2. Screw the gold SMA connector on the antenna cable firmly onto the VBOX3i 'GPS' socket, making sure that the socket on the VBOX3i is free from any contamination.

NB: It is important to connect the antenna to the VBOX3i before power is connected. The VBOX3i adjusts the signal gain to the antenna based on the current incoming GPS signal strength.

3. Connect the power connector to the socket marked 'PWR' on the VBOX3i. .

When power is connected, the red 'PWR' LED will illuminate and all of the other LEDs will flash once then go off.

4. Allow the VBOX3i time to acquire satellite lock (This should take no longer than a few minutes.) before moving off to log data. It is good practice to do this at the beginning of your day; after you have done this satellites will be instantly picked up and locked onto, even after periods of the power being switched off or overhead obstructions blocking the view of the sky.

If the VBOX3i has not been used for a long time or if it was last used many miles from its current location, it may take time to find satellite lock. If this situation arises perform a GPS coldstart to reset the GPS engine.

NB: See troubleshooting section for more info on carrying out a GPS coldstart.

5. The 'GPS' LED will be lit solid red when no satellite lock has been obtained, once the VBOX3i gets a lock on visible satellites, the 'GPS' LED will flash green to indicate the number satellites. At a normal test track facility you should expect to see between 7 and 12 satellites being received by the VBOX3i. When the VBOX3i has a lock on 4 or more satellites then the VBOX3i is ready to use.

NB: If fewer than 7 satellites are consistently seen the position of the GPS antenna on the vehicle may not be ideal, or the nature of the test surroundings may not be ideal; see troubleshooting section on antenna positioning.

6. Now simply drive the vehicle. In the VBOX3i's default mode it will log all data when the vehicle is moving at a speed above 0.5 Kmh and stop recording when the vehicle's speed goes below 0.5 kmh.

The blue CF LED on the front panel of the VBOX3i will flash to indicate when data is being logged to the CF card.

7. When you have finished your first test with the VBOX3i come to a halt, wait until the blue CF LED stops flashing before removing the CF card. Logging can be stopped at any time by pressing the 'LOG' button to close the current file.

NB: If the IMU integration feature of the VBOX3i is to be used refer to the 'IMU Integration' section later in this manual.

Operation

Power

Included with the VBOX3i is a cigar lighter power cable, which is the primary source of power input. This is terminated in a 2-way connector and mates with the 2-way 'PWR' socket on the VBOX3i.

The VBOX3i can be powered from a wide range of voltage sources, when considering batteries as a power source please note that the minimum operating voltage of the VBOX3i is 7V. The maximum operating voltage input must not exceed 30V DC. Failure to observe this could result in damage to the VBOX.

Warning

The VBOX can be connected to other Racelogic input modules including the ADC03, ADC02, TC8, FIM02/3 and multifunction display. Please note that the voltage supply to Racelogic modules connected to the VBOX will be at the same level as the VBOX power input. Therefore when using any of the Racelogic peripherals with VBOX3i, the input voltage must not exceed 15 volts. Failure to observe this could result in damage to the module and possibly the VBOX3i.

When running the VBOX from a battery pack, the VBOX will sound a warning tone to indicate when the battery voltage is reaching the minimum operating voltage level. When this tone is heard, the battery pack requires re-charging or replacing.

The VBOX3i has been designed to generate as little heat as possible and it has a wide operating temperature range, however it is good practice to mount the VBOX3i in a position where it has sufficient airflow around the case. You must connect the GPS antenna before connecting power to the VBOX3i. This is necessary because on power-up the VBOX3i will look for a connected GPS antenna and automatically adjust its gain for optimum performance.

Buttons

VBOX3i has two membrane buttons on the front panel, LOG and FUNC. LOG is used to start and stop logging to the compact flash card, and FUNC is used to switch between two sample rates, 100Hz and 20Hz.

LOG

The LOG button will override any of the automatic logging thresholds set in the VBOX. For example, if you have set the VBOX to log all the time, the LOG button will toggle logging on and off. If you have set the VBOX to 'log only when moving' and you are moving, pressing the LOG button will stop the VBOX logging and close the file on the compact flash. Logging will now not continue even if you are moving until the LOG button is pressed again or the compact flash card is removed and reinserted. The VBOX will then continue to log only when moving.

- Every time the logging is toggled with the LOG button, a new file is created.
- When the VBOX is logging, the blue CF light flashes.
- **Do not remove the CF card or power down whilst this LED is flashing, if you need to remove the card or power down whilst the CF light is flashing, then press the LOG button first to stop the VBOX logging. Failure to do so will result in data loss or corruption.**

FUNC

Pressing the FUNC button briefly flashes the LED's to indicate the current sample rate. A slow flash (once per second) on all the LED's indicates 20Hz, and rapid flashing (5 times a second) indicates a 100Hz sample rate. A running sequence of lights indicates a sample rate other than 100Hz or 20Hz. Pressing and holding the FUNC button for 5 seconds toggles the current sample rate. The sample rate can also be set in the VBOX software.

Default setup

The default factory settings are restored to the VBOX by pressing and holding the FUNC and LOG buttons for 5 seconds. This will put the VBOX3i into the default factory settings, 100Hz logging when moving, and the standard logging parameters: sats, time, latitude, longitude, velocity, heading, height, vertical velocity, and brake trigger event time. (DGPS will be off by default.).

Logging

The VBOX3i has three logging modes that are selected and configured via VBOX setup with the supplied VBOXTools software.

Log continuously:

With 'log continuously' ticked the VBOX will log data, regardless of movement.

Log only when moving:

Without 'log continuously' ticked then the VBOX will only log data to the CF card when it detects speed >0.5Km/h.

Advanced:

The advanced logging option on the VBOX3i allows any of the logged data channels to be used to trigger the logging on the VBOX.

This is selected and configured through VBOX setup of the supplied VBOXTools software.

This facility allows a threshold value to be set as either > or < so that the logging will start or stop when a data value is exceeded or not.

Multiple data channels can be combined in a Boolean 'OR' manner to control the logging.

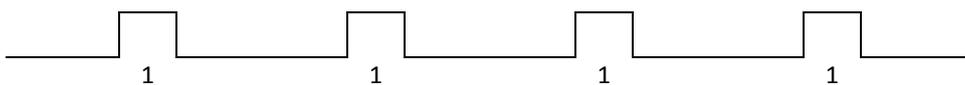
LED indicators

There are a series of LED indicators on the front panel of the VBOX3i, their functionality is as follows:

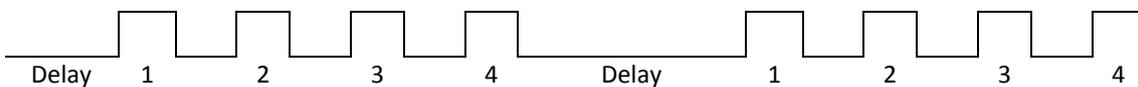
SATS:

- Flashing red indicates no satellites in view
- Flashing green sequence indicates the number of GPS satellites currently being tracked. Each flash indicates a satellite with a short pause between each sequence.
- Flashing orange sequence indicates the number of GLONASS Satellites currently being tracked. Each flash indicates a satellite with a short pause between each sequence.

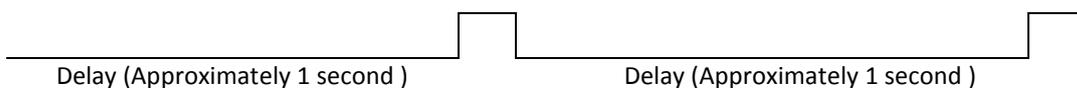
Sequence showing 1 Satellite



Sequence showing 4 Satellites



Sequence showing 0 Satellites



DIFF/DGPS:

- Solid **orange** indicates a DGPS lock (either WAAS/EGNOS or 40cm local DGPS)
- Solid **green** indicates a 2cm 'Fixed' RTK lock

PWR:

- Solid **green** indicates that a suitable power source is connected.
- Solid **red** indicates that the VBOX is not ready to operate either because it is still booting up or because there is an error condition.

D IN:

- Solid **green** indicates that the brake trigger input has been activated/triggered.

CAN:

- Flashing **yellow** indicates that expected incoming CAN data has been decoded properly and is being logged.
- Flashing **green** indicates that there is incoming serial traffic through this socket.

SER:

- Flashing **yellow** indicates that expected incoming CAN data has been decoded properly and is being logged.
- Flashing **green** indicates that there is incoming Serial traffic through this socket.

BLUETOOTH:

- V1 Bluetooth module - Flashing **blue** indicates Bluetooth is waiting for a connection.
- V2 Bluetooth module – Flashing **blue** indicates Bluetooth is initialising coms with a Bluetooth device.
- Solid **blue** indicates the VBOX3i has a Bluetooth connection with another Bluetooth device.

CF:

- Flashes **blue** when data is being written to the card

LOG:

- Solid **green** when data is being logged to the CF card.
- Flashes **red** indicating current logging rate after 'FUNC' button press, fast for 100Hz, slow for 20Hz

IMU: (VB3i V2/V3 only)

- Solid **orange** indicates that IMU integration is enabled but no IMU is connected.
- Flashing **orange** shows IMU is connected and integration initialisation is running. This will not complete until the VB3i has had a satellite lock whilst stationary for 30 seconds.
- Flashing **green** indicates Initialisation complete – movement not yet detected.
- Solid **green** indicates movement detected – IMU integration working OK.

Memory cards

The VBOX3i stores logged data onto CF cards. The CF cards available from Racelogic are already optimised for use on the VBOX3i and as such do not need formatting before use. Should the CF Card need formatting due to card errors it can be done through Windows, as the VBOX3i supports the following format type:

- FAT
- FAT16
- FAT32

Racelogic strongly recommends the following media card brands: **SanDisk** **Kingston** **Lexar** **Ultra** **PQi**

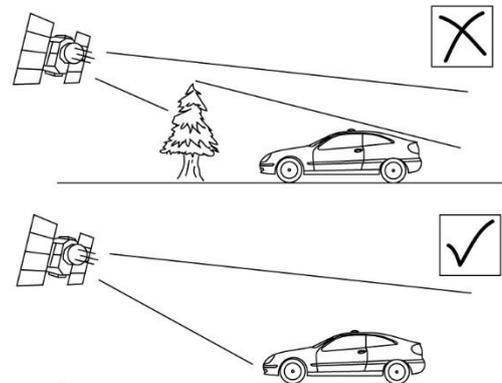
GPS antenna

The GPS antenna supplied with the VBOX3i is a 5V active antenna. For the best possible signal quality, it is important to maintain a clean connection between the antenna and the VBOX3i. Before fixing the antenna to the VBOX3i, ensure that there are no dust particles in either connector. Replacement antennae are available by contacting your VBOX3i distributor.

The antenna is a magnetic mounting type for quick and simple mounting to the vehicle roof. For optimum GPS signal reception, make sure that the antenna is fitted to the highest point of the vehicle away from any obstructions that may block satellite reception. The GPS antenna works best with a metal ground plane underneath (a metallic vehicle roof is perfect for this).

Please also note that when using any GPS equipment, a clear sky view is important. Objects in the surrounding area such as tall buildings or trees can block the GPS signal causing a reduction in the number of satellites being tracked, or introducing reflected signals that can decrease the accuracy of the system. Note that clouds and other atmospheric conditions do not affect the VBOX3i's performance.

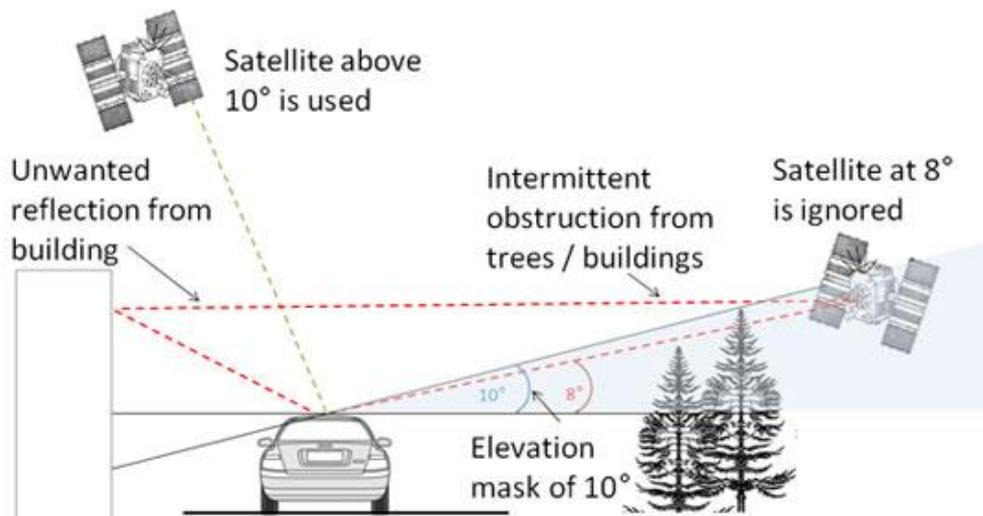
GPS antennas require a ground plane to operate correctly. This helps to reduce unwanted reflections of the GPS signal caused by nearby objects, and usually the metal roof of a vehicle performs this function. However, if a test requires an antenna to be placed either off the vehicle, or on a vehicle that does not have a metallic roof, a special ground plane antenna must be used. This has an internal ground plane and can operate perfectly without the need for mounting on a metal surface. Ground plane antennas are available from your VBOX3i distributor.



Satellite elevation mask

This feature can be used to improve GPS signal quality when nearby obstacles like trees and building are reflecting or temporarily obscuring the signal from satellites at low elevation. Raising the mask will cause the GPS engine to ignore satellites below the mask angle, so must be used carefully as it also reduces the total number of received satellites.

The elevation mask angle can be changed in the GPS section within VBOX Tools Setup.



VBOX Tools

Version 2.2.2b42 and above now has an option to change the SEM value for the VBOX3i series.

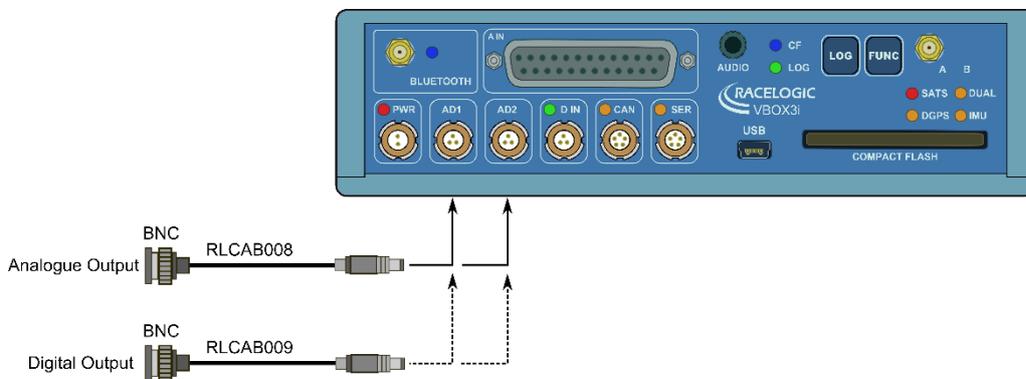
Analogue and digital outputs (AD1 & AD2)

The AD1 and AD2 connectors each have 1 analogue voltage and 1 digital output. The digital output on connector AD2 is a frequency/pulse output corresponding to velocity. The pulse per meter range is adjustable in software. The digital output on connector AD1 is a simple on/off state output. This digital output can be associated with any of the data channels being logged by the VBOX. A threshold level can be set for the selected data channel where a true condition gives a 5v output and a false condition gives a 0v.

I.e. Data channel –Speed, threshold 40Km/h. When speed is >40 output = 5V, speed, 40 output = 0V
 A hysteresis and tolerance value can also be associated to this condition.

The default function of this digital output is to indicate the current logging status of the VBOX.

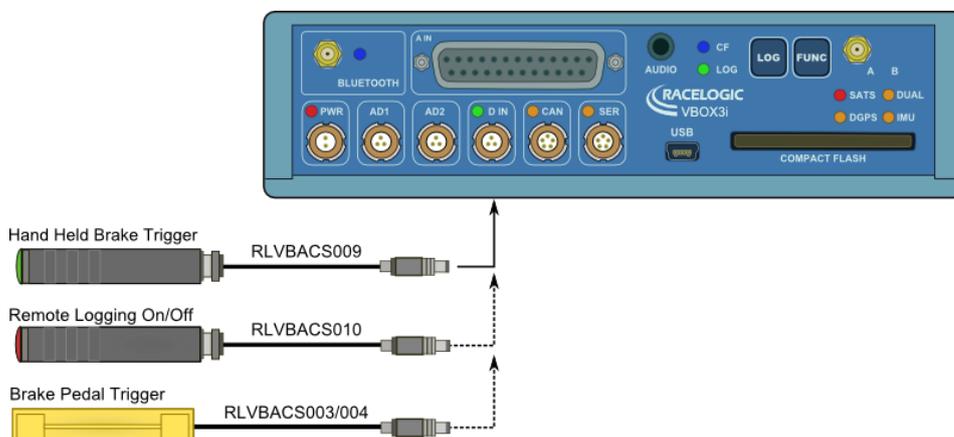
The analogue outputs on connectors AD1 and AD2 are both user configurable. For example, analogue output 1 could be configured to output velocity while analogue output 2 might be configured to output lateral acceleration. The voltage range of both analogue outputs is 0 to 5v DC.



Digital inputs (D IN)

The ‘D IN’ connector contains the two digital inputs for the VBOX3i. Digital input 1 is also referred to as the brake trigger input. This input is connected to an event capture input on the GPS engine. This captures precisely the trigger event time (10nS resolution) for use in brake distance calculation. This period of time is called the trigger event time, and is logged and used to correct the measured brake stop distance to the exact point at which the trigger was pressed.

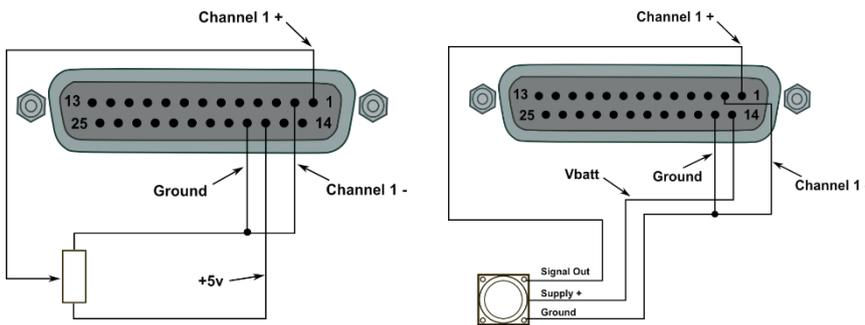
A hand-held brake trigger is also available to allow the user to record marker events in the VBOX3i data file. A remote logging on/off switch is also available for ease of use and when the front panel switch is not accessible.



Analogue inputs (A IN)

The VBOX3i contains four differential 24bit analogue input channels with a maximum sample rate of 100Hz. Each channel has its own dedicated analogue to digital (A/D) converter with all four channels being sampled synchronously to each other. The voltage range of the input channels is ± 50 volts. Note that unlike the ADC03 module, the analogue channels in the VBOX3i are not electrically isolated from each other.

The analogue input connector also contains voltage outputs that can be used to power external sensors. These are a Vbatt connection which is equal to the VBOX input voltage level and a 5V DC out connection which is equal to $5V \pm 2\%$. The 5V out connection is internally protected by 350mA thermal fuse. The Vbatt connection is internally protected by a 200mA thermal fuse on V2/V3 units, and 100mA fuse on V1 units. For connector pin configuration see page 16. A screw-terminal connector block is available as an option for easy connection of signal pins.



Note: A 25W D-sub to 4W BNC adaptor block is available through your VBOX distributor, part number RLVBACS054

Using the VBOXTools software, logging of the analogue channel data can be switched on or off. It is also possible to change the name of each input channel and configure scale and offset values for calibration of sensors. A scale value of 1 and offset of 0 correspond to a channel reading in volts DC. This means that the value stored on the compact flash card for the channel will also be in volts. When using a sensor such as a load cell, it may be desirable to store a reading in Kg. In this case, changing the scale and offset to suit the sensor data sheet allows the data stored onto the compact flash to be in Kg. When changing settings for an analogue channel using VBOXTools software, a live data view of the current channel is shown. The value shown is the value after scale and offset is applied and can therefore be used to aid sensor calibration.

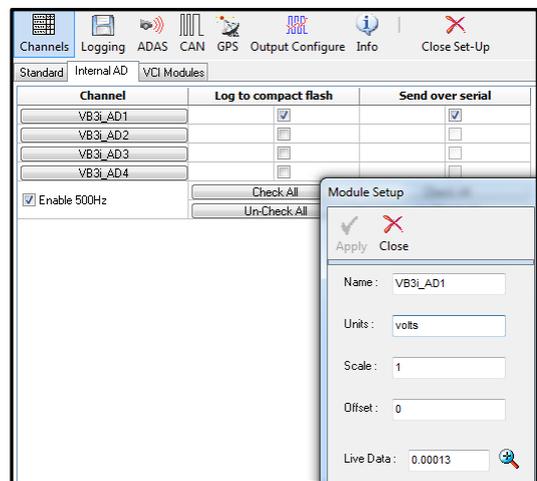
NOTE: The 5V regulated output on pin16 is only good for VBOX power supply voltages >8.5V

Using VBOXTools software, logging of the analogue channel data can be switched on or off. It is also possible to change the name of each input channel and configure scale and offset values for calibration of sensors.

A scale value of 1 and offset of 0 correspond to a channel reading in volts DC. This means that the value stored on the compact flash card for the channel will also be in volts. When using a sensor such as a load cell, it may be desirable to store a reading in Kg. In this case, changing the scale and offset to suit the sensor data sheet allows the data stored onto the compact flash to be in Kg. When changing channel setup for an analogue channel using VBOX Tools software, a live data view of the current channel is shown. The value shown is the value after scale and offset is applied and can therefore be used to aid sensor calibration.

500Hz logging

VB3i has the ability to log 4x analogue channels at 500Hz. With this feature enable the file sizes will increase as a result. When loading the VBO file into VBOX Tools ensure you are running the very latest version as older versions are not compatible with 500Hz data.



RS232 serial / CAN

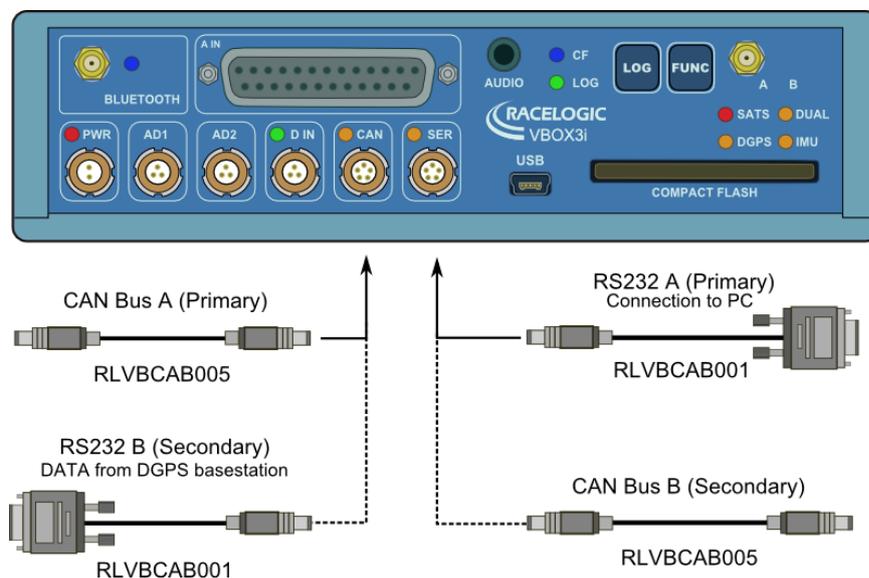
VBOX3i is equipped with 2 CAN Bus interfaces and 2 RS232 serial ports. The primary RS232 port is used for all communication between the VBOX and laptop PC. The primary port is marked RS232 on the VBOX3i front panel. The primary RS232 port is able to transmit live data from the VBOX to the PC for viewing and performing real-time tests. It is important to note however that due to limitations of the PC serial port, live data transfer of all channels is limited to 20Hz, at 50Hz only standard GPS channels should be transmitted, and at 100Hz only Sats, Time, Speed, and Trigger Event Time should be transmitted. Logging too many channels at too high a rate is likely to cause drop-outs and loss of data.

Therefore for maximum accuracy, tests performed at a GPS sample rate above 20Hz should be logged to compact flash and post processed.

The secondary RS232 port is used for connection to a Telemetry Radio module allowing the reception of Differential GPS (DGPS) data for local correction from a Racelogic Local DGPS basestation. The secondary RS232 port is located in the connector marked CAN on the VBOX3i front panel.

The CAN Bus ports A and B are located in the VBOX3i connectors "CAN" and "RS232" respectively. The function of these ports is configurable by the user for use by either Racelogic external modules or the users own CAN Bus equipment. For dual use of RS232 and CAN from one of the sockets you will require a 5Way Lemo splitter RLVBACS024.

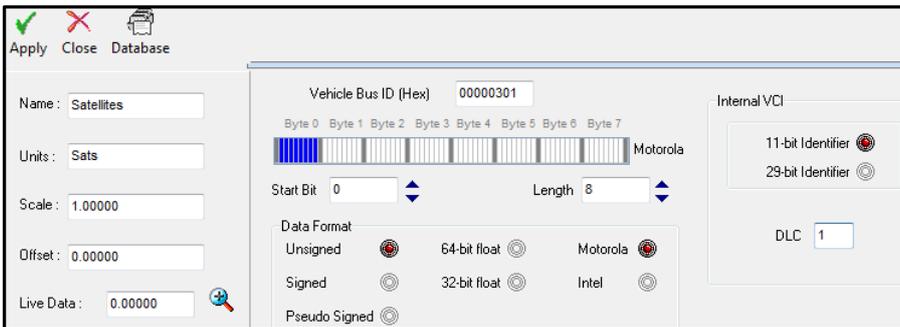
Power supplied to external Racelogic CAN modules through the "CAN" or "RS232" cables is at the same voltage as the input power supply. Therefore when using Racelogic external CAN modules (eg; MFD or ADC03), the VBOX3i supply voltage must not exceed 15vDC.



VCI CAN input (vehicle CAN interface)

The VBOX3i can log up to 16 user defined CAN bus signals on CAN port B. Configuration is performed using the VCI modules tab under log channels in VBOXTools software setup window. CAN signal parameters can be entered manually by the user or imported directly from a CAN database (.DBC) file if available.

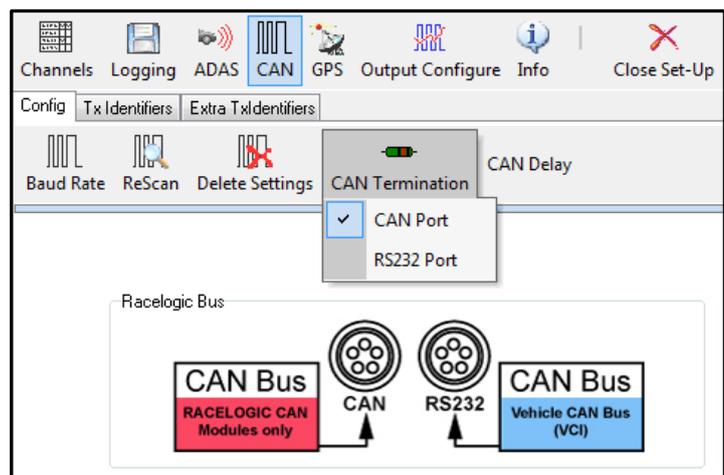
Racelogic supplies a free encrypted vehicle CAN database, giving the user the ability to log basic CAN data from a large number of current vehicles from a broad selection of manufacturers. All of the CAN database files for vehicles we have reverse engineered can be downloaded from [our website](#).



CAN termination

The VBOX3i contains an active termination between 0 Ohms and 120 Ohms, the active terminations are selectable via VBOXTools as shown above right.

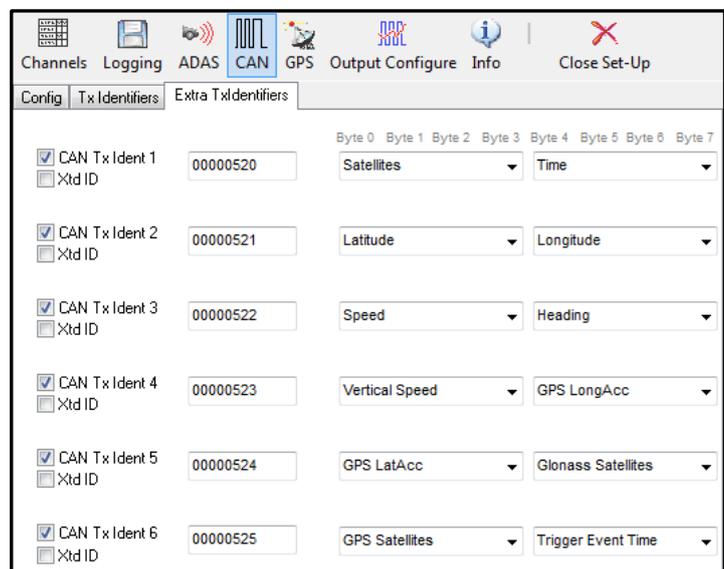
NOTE: When the Usage of the CAN ports is swapped from one output socket to the other the termination resistor setting does not follow. So you should check that the Termination is correctly set for the output socket that you are then using.



CAN pass through

Ability to output channel data from modules on the secondary bus with user defined identifiers. Eg; VBOX3i can log IMU data on one CAN bus and output the IMU data to third-party equipment on second CAN bus with a user defined identifier. The VBOX3i can output up to 6 CAN messages and 12 CAN channels over the secondary bus.

Note: These output CAN channels will be in a 32 bit IEEE float format. 29 bit extended identifiers optional.



CANVEL

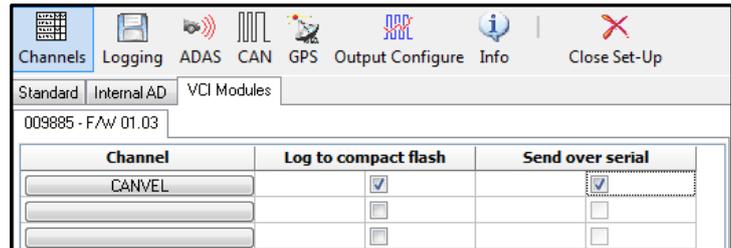
If an input channel is given the name “CANVEL” then the VBOX3i will translate the data of this channel directly through to the GPS speed channel under the following criteria.

- IMU integration is not enabled
- The VBOX3i cannot calculate speed, i.e. no satellite signal (complete satellite drop out)

The VBOX3i will scale the input channel to the default speed output format of Km/h according to what the units have been assigned to the substitution speed channel. VBOX3i will recognise the following unit names: MPH, KM/H, KPH, Knots, m/s, and ms-1.

Note: If no UNITS have been assigned to the input channel then VBOX3i will assume that it is KPH

This function is useful while testing around built up areas or driving under large bridges.



Dynamic modes

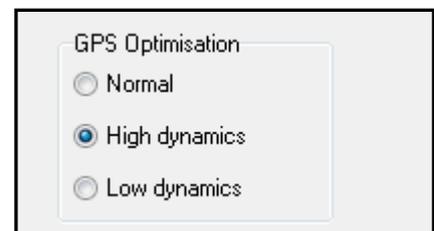
The VBOX3iSL has three dynamic modes. These dynamic modes directly change the SMI smoothing index applied by the GPS engine to all Doppler-derived data, notably speed and heading. The lower smoothing levels have a higher dynamic response but are adversely noisier.

The three options are:

High dynamics: The ‘High dynamics’ setting should be used for high accuracy trigger brake stops or any test where time and distance are critical and the vehicle test incorporates highly dynamic manoeuvres.

Normal: The ‘Normal’ mode should only be used for any testing that does not involve any high dynamic manoeuvres.

Low dynamics: The ‘Low dynamics’ mode can be used for smoother velocity and heading data and less acceleration noise only in lower dynamic tests.



USB

The VBOX3i includes a USB 2.0 connection that can be used for VBOX configuration and the output of real-time VBOX3i serial data at the full 100Hz data rate.

Ensure that before you connect your VBOX3i to your PC that you have installed the supplied VBOXTools software, as this will also put the required USB drivers onto your PC.

The VBOXTools software installation will place the VBOX3i USB drivers in the following location on your computer.

C:\program files\Racelogic\Drivers

These drivers can also be found on the actual VBOXTools installation CD.

When you connect you powered up VBOX3i to your PC with the supplied RLVBCAB066 USB A to USB mini lead your PC will recognise the presence of new hardware and open the typical Windows install window for new hardware. Follow the on screen prompts and point the Windows installation to the location of your drivers.

Note: USB drivers are available on the Racelogic website, also installed into C:\program files\Racelogic\Drivers after VBOX Tools installation.

Bluetooth

The VBOX3i comes equipped with a Bluetooth radio allowing configuration of the VBOX remotely along with remote output of real-time VBOX3i serial data, at the full 100Hz data rate, to any Bluetooth capable PC or Data logger.

Pairing your computer with the VBOX3i

The VBOX3i will need the Bluetooth antenna connected and the computer will require a Bluetooth module or dongle to establish a virtual connection. VBOX3i will connect to the computer via SPP (serial port profile) this can be done as a secure or unsecure connection. **Note: Pairing code for secure connection is 1234**

Audio

Voice tagging

The VBOX3i has the ability to record audio tags with a GPS 'synched' timestamp accuracy of 0.5 seconds along with the .VBO data file. Voice notes regarding test conditions or erroneous runs can be recorded, which can be replayed instantly when viewing logged files in the graph facility of the VBOXTools software.

A WAV file will be recorded onto the CF card along with the normal VBOX data file.

The supplied headset/microphone includes a switch, which is used to start and stop the recording of an audio tag.

Recording a sound wav

Pressing the headset switch once will sound an audible beep, through the headset, to confirm that recording of the WAV file has begun.

Pressing the switch for a second time will then stop recording, this will be confirmed by a second beep through the headset.

If the switch has only been pressed once the VBOX3i will record for 30 seconds then automatically stop recording.

Replaying voice tags in VBOXTools

When a logged VBOX data file .vbo is loaded into VBOXTools and displayed in the Graph screen any associated WAV files will appear in the speed data trace as green circles provided that the logged file is in the same folder as the loaded VBOX data file.

Play the associated WAV file by clicking the Green circle.

NOTE: if a Red circle is seen on the graph screen in VBOXTools then the associated WAV file is not present in the same folder as the loaded VBOX data file.

VBO file format

The VBOX3i data files are saved in standard space de-limited text format. This allows the data to easily be imported into third party applications such as word processors or spreadsheets. The files each contain a header section before the main data that describes the channel content and information about the VBOX such as serial number and firmware version.

The [column names] parameter specifies the data in each column of the data section.

An example of a VBOX3i VBO file is shown on the right.

```

File created on 03/12/2013 @ 10:57

[header]
satellites
time
latitude
longitude
velocity kmh
heading
height
vertical velocity kmh
Event 1 time

[channel units]

[comments]
Racelogic
GPS Time offset by -16 seconds
GPS Firmware : 4.0 Dec,05,2011 b2
VB3i version 0002.0000 build 0057
Serial Number : 00031752
Log Rate (Hz) : 100.00
Kalman Filter - OFF
Gps Optimisation : High Dynamics

[module information]

[column names]
sats time lat long velocity heading height vert-vel event-1

[data]
019 105633.680 +3119.37247163 +0059.48225769 000.153 218.05 +0155.06 +0000.03 0.000000
019 105633.690 +3119.37247162 +0059.48225730 000.149 209.09 +0155.06 +0000.03 0.000000
019 105633.700 +3119.37247189 +0059.48225665 000.112 197.16 +0155.06 +0000.07 0.000000
    
```

VBOXTools software

The VBOXTools software is used for configuration of the VBOX3i and also for analysis of the VBO data files.

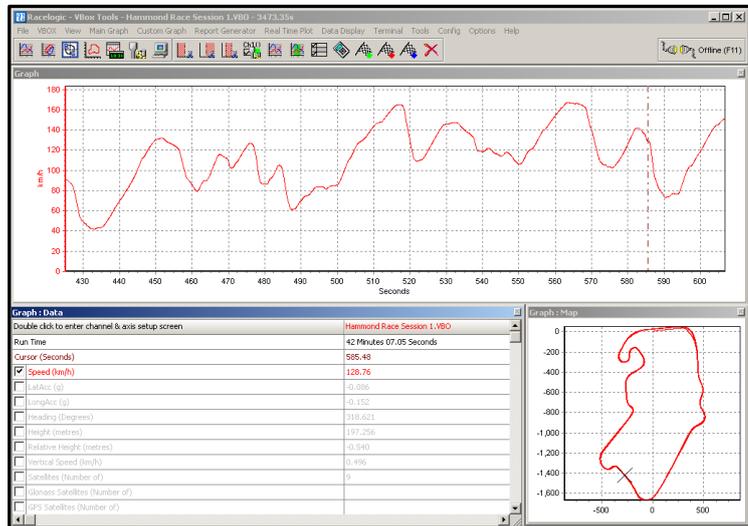
For further information on the VBOXTools software refer to the VBOXTools user manual supplied with VBOX3i.

Software installation

The VBOX3i setup software must be installed onto the hard drive of a computer; it cannot be run from the installation CD.

To install the software insert the CD into the CD drive of your computer. The default installation language is English. Press 'OK' to continue, then follow the on-screen instructions to complete the installation.

The VBOX3i setup software is not limited to one user or computer and can be installed on multiple workstations if so desired.



Local DGPS Basestation

When the VBOX3i is used in conjunction with a local DGPS Basestation the positional accuracy can be improved from the standard 3m 95% CEP.

There are two available Basestation options:

40cm positional accuracy:

If the VBOX3i is used with a RTCM-V2 enabled Basestation then the positional accuracy is increased to 40cm 95% CEP. The height accuracy is improved to 1M 95%CEP

2cm positional accuracy:

If the VBOX3i has an RTK upgrade option installed and is used with a RLVBBS4RG then the positional accuracy is increased to 2cm.

- **Racelogic** proprietary 2cm correction (Not compatible with VB3i-SL RTK)
- **CMR** 2cm correction (Trimble standard message type)
- **RTCMv3** 2cm correction (RTCM standard message type) **RECOMMENDED**

RTCMv3 is recommended as the default RTK 2cm correction type. This message format is a globally recognised type and more resilient to data loss caused by radio errors.

Note:

RLVBOX3iR2G2 has a max log rate of 20Hz when in RTK mode.

RLVBOX3iR10G10 & RLVB3i-SL RTK has a max log rate of 100Hz when in RTK mode.

Enabling the DGPS modes

The VBOX must have the correct DGPS mode enabled in VBOX Tools or VBOX Manager before it is capable of receiving and using the DGPS correction information transmitted by a Local Basestation.

- Run the latest VBOXTools software
- Enter the VBOX setup screen and go to the GPS page
- Click on the DGPS button and select the correct DGPS mode from the available option
- Close the VBOX setup screen.

IMU integration

Required equipment

IMU04

- VB3i-V3
- IMU04
- VBOX Tools
- RLCAB119 VBOX – IMU connecting cable
- RLCAB001 / RLCAB066-2 – VB3i PC connection cable
- File manager (optional)

IMU03

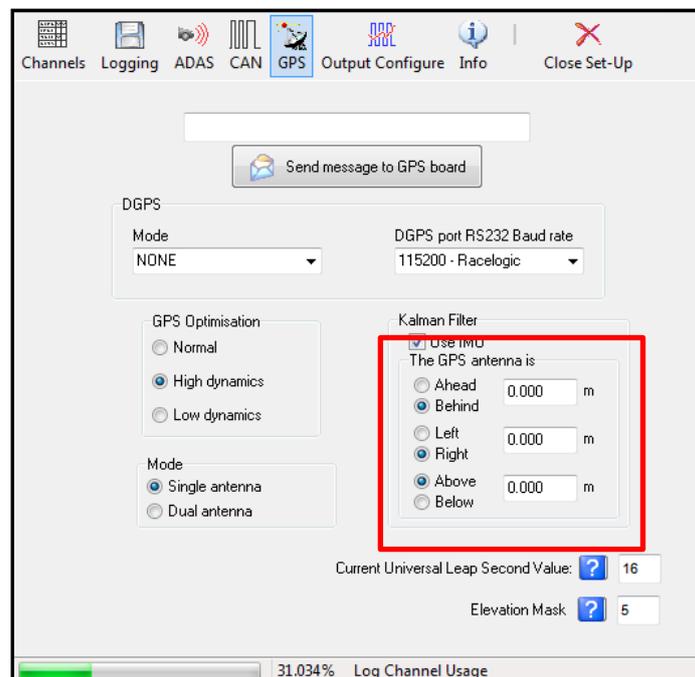
- VB3i (works with all VB3i units)
- IMU03
- VBOX Tools
- RLCAB005-CS VBOX – IMU connecting cable
- RLCAB001 / RLCAB066-2 – VB3i PC connection cable
- File manager (optional)

Setup

Important note: IMU04 must be connected to VB3i before power is applied to ensure data is correctly synchronised.

1. Mount the VB3i and IMU in test vehicle. The IMU should be mounted rigidly to the vehicle mid-way along the wheelbase in the direction of vehicle travel.
2. Fit VB3i GPS, GPS/GLONASS antenna to centre of vehicles roof. Connect antenna to VB3i.
3. Measure the relative position from the top centre of the GPS antenna to the top centre of the IMU (see mounting section for more detail) and enter these distances in the highlighted box below.
4. IMU04 – Connect CAN/KF port to VB3i-V3 25W D analogue input port using RLCAB119 cable.
IMU03 – Connect either port on IMU to VBOX RL CAN port using RLCAB005-CS cable.
5. After IMU is connected, apply power to VB3i.
6. Connect VB3i to PC using RLCAB001 or RLCAB066-2 cable (RS232 or USB).
7. Open VBOX Tools and VBOX Setup.
8. Tick 'Use IMU' box measured from GPS

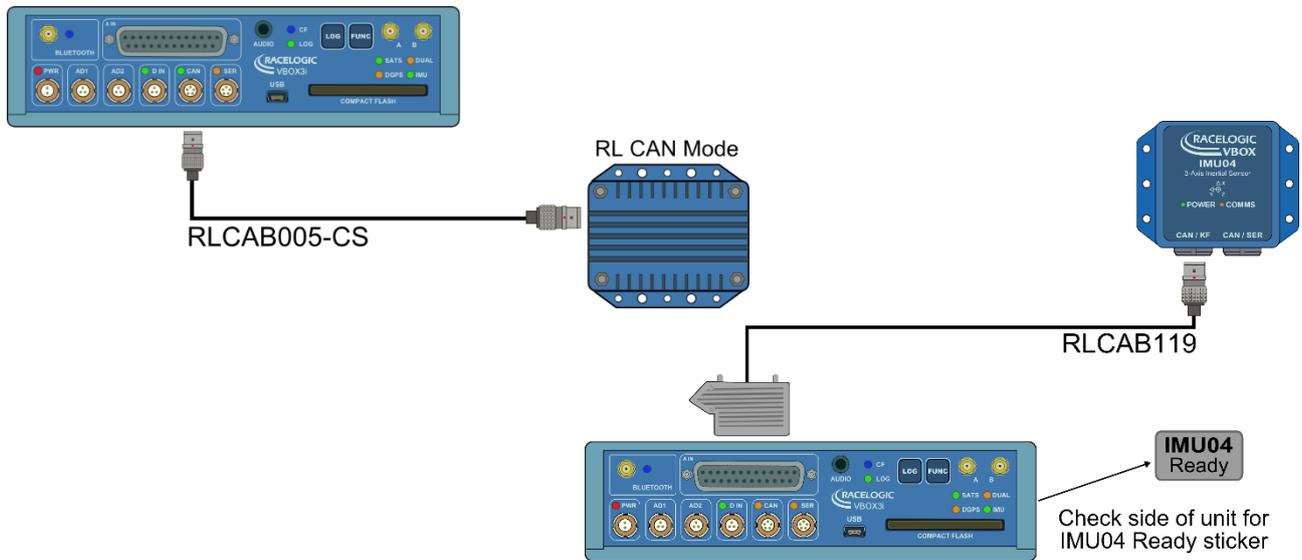
and enter the distances antenna to the IMU.



Important notes:

1. To use IMU04 integration, a **VB3i-V3** must be used. This is an IMU04 enabled unit.
2. IMU04 cannot be used with IMU integration if it is connected to a VBOX via CAN (RLCAB120 / RLCAB005-CS). This method of connection will only allow standard IMU channels to be logged. See 'using IMU as CAN module' section for details.
3. The IMU04 standard channels can also be logged when the IMU04 is connected via KF port with cable RLCAB119, without enabling IMU integration.

Hardware Setup



Initialisation

When using IMU integration, an initialisation phase is required when the IMU is first connected to the VBOX after being set up. This will be run through automatically after the VBOX has successfully gained satellite lock. When the IMU LED on VB3i front panel has turned a flashing green, the initialisation is complete. Note, if you are using a VB3i-V1, which has no IMU LED, read the LED indicators section below for LED behaviour.

LED indicators (VB3i V2/V3)

IMU04 LED	Colour			
	Red	Orange	Green	
Power	Initial boot up phase.	Temperature checks. If temperature outside optimum operation range, LED will remain orange.	Fully operational.	
Comms	No coms.	Using IMU integration, inertial data being sent to host VBOX via RS232.	Inertial data being sent to host system via CAN.	
VB3i LED	Colour			
	Solid Orange	Flashing Orange	Flashing Green	Solid Green
IMU	IMU enabled, no IMU connected.	SAT lock OK. 30 second stationary initialisation in progress. If vehicle moves, LED will continue to flash until 30 seconds stationary completed.	Initialisation complete – movement not yet detected.	Movement detected – IMU integration working OK.

LED indicators (VB3i V1)

When the filter is enabled and the IMU is connected, the satellite LED will remain off to act as an indicator for the IMU integration status. Only when the filter is initialised and movement is detected will the SAT LED return to its normal operation.

The user will need to leave 1 minute after powering the VBOX on with the IMU connected before starting to move. This occurs on every power up of the VBOX unit.

Kalman Filter calibration – High dynamic tests

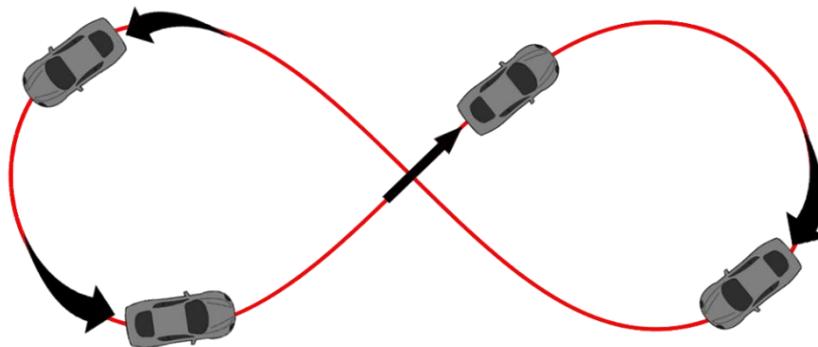
To produce the optimum level of accuracy as quickly as possible, a series of specific manoeuvres can be performed that help the Kalman filter characterise the outputs from the IMU. Note that while this is recommended, it is not completely necessary as the Kalman filter will have enough data to achieve accurate results within a few minutes of normal dynamic driving (including left and right hand turns, braking and accelerating).

Recommended procedure

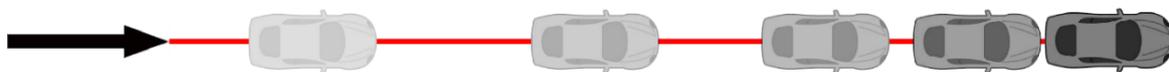
1. Wait for IMU to complete 30 second stationary initialisation, VB3i front panel IMU LED will change from flashing orange to flashing green upon completion. If the vehicle moves before initialisation finishes, the 30 second process will restart once stationary again.

2. Drive in a ‘figure of eight’ at least twice.

These can be as little as 5m in radius (almost full-lock in some vehicles), but 10m is better. The vehicle should be travelling above 15km/h during this procedure in order to generate sufficient forces for the calibration process.



3. Accelerating hard from standstill to 50km/h or above, perform two brake stops with a decel force of at least 0.5g.



When is the calibration required?

When carrying out high dynamic tests such as braking and ESC testing, this recommended process calibrates the Kalman filter as quickly as possible. When carrying out low dynamic tests such as driving on urban routes, or doing long term data collection, then this calibration is not as critical.

Re-running the calibration

The Kalman filter is constantly adapting its calibration depending on the information received from GPS and the IMU. Therefore, if the vehicle is left stationary for a long time, or the IMU is moved from its mounting position, then the calibration procedure should be repeated if further high dynamic testing is to be carried out.

The calibration should also be repeated after anything which causes the communication to break between IMU and VBOX, such as:

- Power cycle to either IMU or VBOX.
- ‘RL Config’ software is used to read IMU settings.
- ‘VBOX Tools’ software is used to read VBOX settings.
- A GPS Coldstart is performed

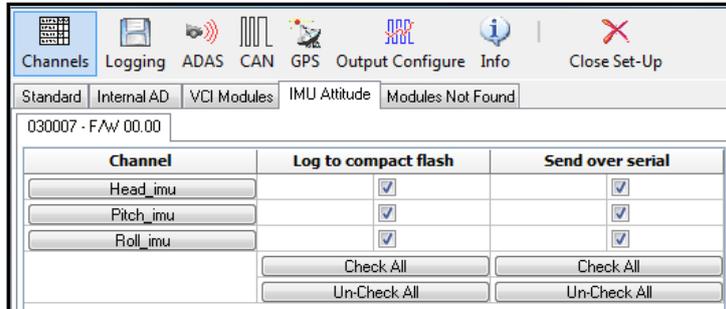
What happens if this isn’t done?

If this procedure cannot be carried out as above then the speed accuracy will be reduced, especially for the first few minutes until the Kalman Filter is able to calibrate itself. We strongly recommend that the Kalman Filter is calibrated when carrying out high dynamic tests.

Additional IMU channels (IMU04 only)

IMU Attitude

When using IMU04 integration with a VB3i-V3, there are three IMU attitude channels which can be logged. These body angle channels are heading, pitch and roll calculated from IMU derived data.



RMS Channels

These four channels are for diagnostic purposes only and cannot be turned on or off. They show the noise which is present on the vertical and horizontal speed channels, as calculated by the VB3i GPS engine. The RMS (root mean square) channels which will be logged are listed below.

RMS_HPOS RMS_VPOS RMS_HVEL RMS_VVEL

Using IMU as CAN module

Important note: IMU04 CAN based coms are not supported by Kalman filter, so RLCAB005-CS connection method cannot be used for IMU04 integration. This CAN module connection can be used purely to log IMU04 data channels.

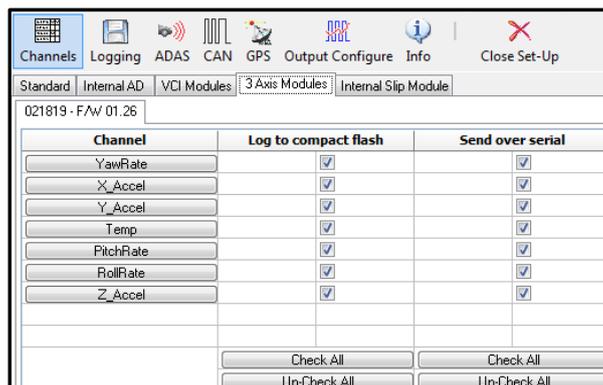
Required equipment

VB3i (works with all VB3i units)
 IMU03 / IMU04
 VBOX Tools

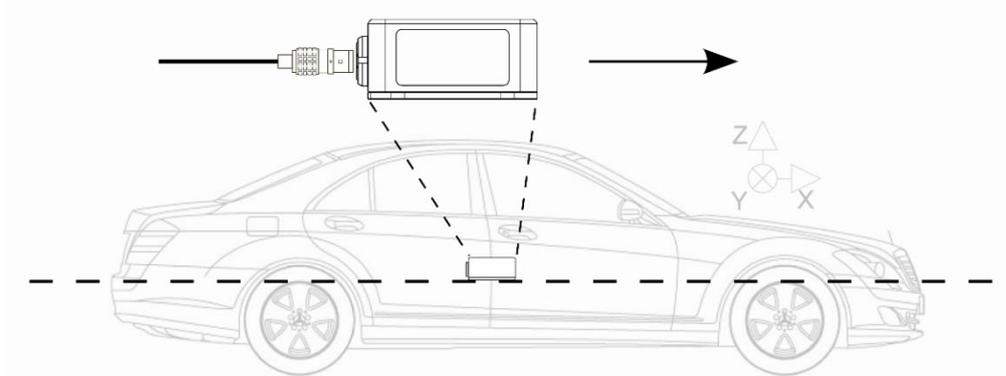
RLCAB005-CS or RLCAB120 (IMU04 only)
 RLCAB001 / RLCAB066-2 – VB3i PC connection cable (RS232 or USB)
 File manager (optional)

Setup

1. Connect IMU to VBOX (RL CAN port) using RLCAB005-CS or RLCAB120 (IMU04 only) cable.
2. Connect VBOX to PC using RLCAB001 or RLCAB066-2 cable (RS232 or USB).
3. Open VBOX Tools and VBOX Setup.
4. Click on the 3 Axis Module tab, and tick all IMU channels to be logged and sent over serial.
5. Mount the VB3i and IMU in test vehicle. The IMU should be mounted rigidly to the vehicle mid-way along the wheelbase in the direction of vehicle travel.
6. Fit VB3i GPS, GPS/GLONASS antenna to centre of vehicles roof. Connect antenna to VB3i and power up.



Mounting the IMU



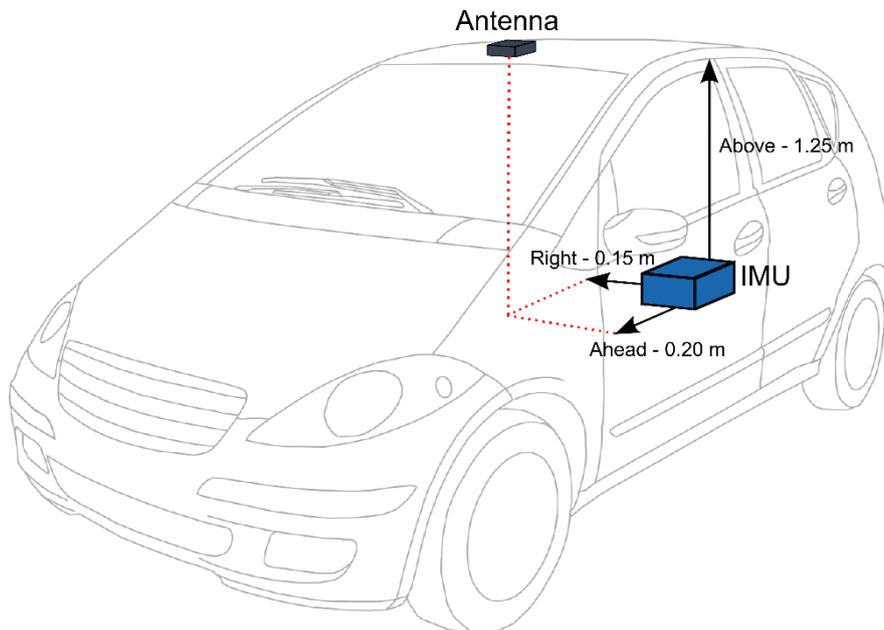
The IMU should be mounted rigidly to the vehicle mid-way along the wheelbase. Try to position the unit as close as possible to the centre of the vehicle, making sure it is mounted in the direction of travel - as shown in the image above. It is also important to mount the sensor so that it is level with the ground.

For best results, mount antenna as close to each other as possible. For example: Bolt the IMU to the GPS antenna on the



the IMU and GPS other as possible. For the seat rails and place roof directly above.

If you are using IMU03, you the relative antenna in IMU to at least These distances entered into via VBOX Tools using a VBOX



an IMU04 or must measure position of the relation to the within +/- 5cm. must then be the VBOX either > VBOX Setup or Manager.

Troubleshooting

Trouble locking onto satellites

If the VBOX3i is having trouble locking onto satellites then please follow the checklist below for typical solutions:

- Ensure that the antenna is placed in a position where it has an unobstructed view of the sky. (See 'GPS antenna placement' below)
- Check the antenna connection with the VBOX3i; only small amounts of dirt in the socket can cause a significant reduction in signal strength. Also check the cable at the plug and along its length for any damage.
- Check that the power supply is connected and free from damage.
- If possible try another known working antenna, to confirm antenna functionality.
- Perform a GPS coldstart and then leave the unit powered up in an open static position for at least 15 minutes. See 'VBOX3i not responding' below.

Once the VBOX3i has locked on to 4 or more satellites it will be ready for use.

No communication with PC

- If the red LED on the front of the VBOX3i is not illuminated then there is no power to the unit; check that battery contains adequate charge or, if using a cigar lighter, check internal cigar lighter fuse.
- Check that the correct COM port has been selected in VBOXTools
- Check that no other programs are using the same COM port.
- Disconnect the power to the VBOX3i then reconnect it.

COM port unavailable

- The computer may have been started with a different VBOX3i connected to it; disconnect the VBOX3i, restart the computer then reconnect the VBOX3i.
- Another software package installed on your computer may have reserved the COM port.

No data is logged in the VBO file

- Check satellite reception. Loss of reception may prevent data from being logged to the card (dependent on logging mode).

VBOX3i not responding - GPS coldstart

- The GPS engine has locked up.
- Perform a GPS engine coldstart

A GPS coldstart forces the GPS engine to reset its downloaded almanac of current satellite positions. This can be useful if the VBOX3i is having trouble locking onto satellites, which typically occurs if the VBOX3i has not been used for several weeks or if it was last used a long distance (over one thousand miles) away from the current location.

After performing a GPS coldstart leave the VBOX3i powered up in a static location where the antenna has an unobstructed view of the skies until the 'GPS' LED becomes solid green.

Once the VBOX3i has downloaded the new almanac it will reacquire satellites in noisy situations (such as near trees, buildings and under bridges) much more quickly. It will also acquire satellite much more quickly on power-up.

To perform a GPS coldstart on the VBOX3i perform the following actions:

- Press and hold the 'LOG' button on the front of the VBOX3i for five seconds until a long beep is sounded.
- When the button is released the 'GPS' LED will start to flash red showing that the coldstart has been performed and the GPS engine is now not locked onto any satellites.
- After approximately 30-45 seconds the 'GPS' LED will start to flash green indicating that satellite lock has been achieved and indicating the number of satellites that it is locked onto.

VBOX3i V3 specification

GPS			
Velocity		Distance	
Accuracy	0.1 Km/h (averaged over 4 samples)	Accuracy	0.05% (<50cm per Km)
Units	Km/h or Mph	Units	Metres / Feet
Update rate	100 Hz	Update rate	100Hz
Maximum velocity	1000 Mph	Resolution	1cm
Minimum velocity	0.1 Km/h	Height accuracy	6 Metres 95% CEP**
Resolution	0.01 Km/h	Height accuracy with DGPS	2 Metres 95% CEP**
Latency	6.75ms		
Absolute Positioning		Brake Stop Accuracy	
Accuracy	3m 95% CEP**	Accuracy	+/- 2cm
Accuracy with SBAS DGPS	>1m 95% CEP**		
Accuracy with RTCMV2 DGPS	40cm 95% CEP**		
Accuracy with RTK DGPS***	2cm 95% CEP**		
Update rate	100 Hz	Time	
Resolution	1.8mm	Resolution	0.01 s
		Accuracy	0.01 s
Heading		Power	
Resolution	0.01°	Input Voltage range	7v-30v DC
Accuracy	0.1°	Power	Max 5.5 watts
Acceleration		Environmental and physical	
Accuracy	0.5%	Weight	Approx 900 grammes
Maximum	20 G	Size	170mm x 121mm x 41mm
Resolution	0.01 G	Operating temperature	-20°C to +70°C
Update rate	100Hz	Storage temperature	-30°C to +80°C
Memory		Definitions	
Compact Flash	Type I	** CEP = Circle of Error Probable	
Recording time	Dependent on flash card capacity*	95% CEP (Circle Error Probable) means 95% of the time the position readings will fall within a circle of the stated diameter	
*Approximately 29Mb per hour used when logging GPS data at 100Hz			
Approx 182Mb per hour total logging capacity			

Outputs			
CAN Bus			
Bit rate	125Kbits, 250Kbits, 500Kbits & 1Mbit selectable baud rate		
Identifier type	Standard 11bit 2.0A		
Data available	Satellites in View, Latitude, Longitude, Velocity, Heading, Altitude, Vertical velocity, Distance, Longitudinal acceleration & lateral acceleration, Distance from trigger, Trigger time, trigger Velocity		
Analogue		Digital	
Voltage range	0 to 5Volts DC	Frequency range	DC to 44.4Khz
Default setting *	Velocity	Default setting *	25Hz per Km/h (0 to 400Km/h)
	0.0125Volts per Km/h (0 to 400Km/h)		90 pulses per metre
Accuracy	0.1 Km/h	Accuracy	0.1Km/h
Update rate	100Hz	Update rate	100Hz
* The range settings can be adjusted by the user in software			

Inputs			
CAN Bus			
Racelogic modules	Up to 32 channels from any combination of ADC02, ADC03, FIM02, TC8, YAW sensor or CAN01. Limited to 16 with the Kalman Filter enabled		
External CAN Bus	16 Channels of user definable CAN signal from external bus. Eg; vehicle CAN bus Can load signal data from industry standard DBC database file.		
Analogue		Digital	
Number Channels	4	Resolution	24 bit
Input range	±50v	DC Accuracy	400 µV
Channel Sample order	Synchronous		
Digital			
Brake/Event Trigger	10ns resolution		
On/Off Logging control	Remote log control from hand-held switch		

Connection data



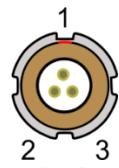
Front View of VBOX3i V1



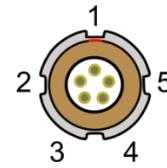
Front View of VBOX3i V2/V3



2 PIN LEMO socket



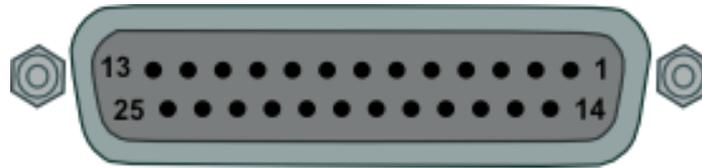
3 PIN LEMO socket



5 PIN LEMO socket

Connector	1 POWER	Type	Lemo 2 pin
PIN	In/Out	Description	Range
1	I	Power +	7V to 30V
2	I	Ground	0V
Connector	2 AD 1	Type	Lemo 3 pin
PIN	In/Out	Description	Range
1	O	Analogue 1 Output	0V to 5V
2	O	Digital 2 Output	0V to 5V
3	I	Ground	
Connector	3 AD 2	Type	Lemo 3 pin
PIN	In/Out	Description	Range
1	O	Analogue 2 Output	0V to 5V
2	O	Digital 1 Output	0V to 5V
3	I	Ground	
Connector	4 D IN	Type	Lemo 3 pin
PIN	In/Out	Description	Range
1	I	Ground	
2	I	Digital Input 2. Start/Stop Logging	0V to 5V (14v tolerant)
3	I	Digital Input 1. Brake Trigger	0V to 5V (14v tolerant)
Connector	5 CAN	Type	Lemo 5 pin
PIN	In/Out	Description	Range
1	O	RS232 Tx (PORT B)	±12v
2	I	RS232 Rx (PORT B)	±12v
3	I/O	CAN Bus High (PORT A)	
4	I/O	CAN Bus Low (PORT A)	
5	O	+V Power	Same as Power +
Connector	6 SER	Type	Lemo 5 pin
PIN	In/Out	Description	Range
1	O	RS232 Tx (PORT A)	±12v
2	I	RS232 Rx (PORT A)	±12v
3	I/O	CAN Bus High PORT B)	
4	I/O	CAN Bus Low (PORT B)	
5	O	+V Power	Same as Power +
Connector	ANT	Type	SMA
PIN	In/Out	Description	Range
Center	-	RF Signal / Power for active antenna	
Chassis	-	Ground	

Analogue input connector V1/V2



View of Socket on VBOX 3i

Connector: Analogue Type: Sub-D 25-way Socket

PIN	In/Out	Description	Range
1	I	Channel 1 +	
2	I	Channel 1 -	
3	I	Channel 2 +	
4	I	Channel 2 -	
5	I	Channel 3 +	
6	I	Channel 3 -	
7	I	Channel 4 +	
8	I	Channel 4 -	
9			
10			
11			
12			
13			

Connector: Analogue Type: Sub-D 25-way Socket

PIN	In/Out	Description	Range
14	O	Vbatt	Equal to Input Voltage. 100mA
15	O	GND	
16	O	5 V Out	5V ±2%. 350mA
17	O	GND	
18			
19			
20			
21			
22			
23			
24			
25			

Note: A screw terminal connector block is available to purchase on request from your VBOX supplier.

Analogue input connector V3

Connector: Analogue Type: Sub-D 25-way Socket

PIN	In/Out	Description	Range
1	I	Channel 1 +	
2	I	Channel 1 -	
3	I	Channel 2 +	
4	I	Channel 2 -	
5	I	Channel 3 +	
6	I	Channel 3 -	
7	I	Channel 4 +	
8	I	Channel 4 -	
9			
10			
11	I	1PPS Output	-IMU04
12	I	RS232 TxD	-IMU04
13	I	RS232 RxD	-IMU04

Connector: Analogue Type: Sub-D 25-way Socket

PIN	In/Out	Description	Range
14	O	Vbatt	Equal to Input Voltage. 200mA
15	O	GND	
16	O	5 V Out	5V ±2%. 350mA
17	O	GND	Ground
18			
19			
20			
21			
22			
23			
24			
25			

CAN output

The VBOX3i has a CAN output which is present on the 5-way connector output; Data format: Motorola; Baud rate: 500Kb/s.

Format	Motorola							
ID**	Data Bytes							
	1	2	3	4	5	6	7	8
0x301	(1) Sats in view	(2) Time since midnight UTC			(3) Position – Latitude MMMM.MMMMM			
0x302	(4) Position – Longitude MMMMM.MMMMM				(5) Velocity. (Knots)		(6) Heading. (Degrees)	
0x303	(7) Altitude. WGS 84. (Metres)			(8) Vertical velocity. (M/S)		Unused	(9) Status	(10) Status
0x304	(11) Distance. (Meters)				(12) Longitudinal Accel. (G)		(13) Lateral Accel. (G)	
0x305	(14) Distance travelled since VBOX reset				(15) Trigger time		(16) Trigger Velocity	
0x306	(17) Velocity Quality			Unused	Unused		Unused	
0x307	Unused			Unused	Unused		Unused	
0x308	(18) Position latitude						(19) Status	
0x309	(20) Position longitude						Unused	
0x322	(21) Trigger event UTC time – milliseconds (part1)				(22) Trigger event UTC time – nanoseconds (part2)			

*Update rate depends on GPS update rate. 10ms Update rate shown corresponds to 100Hz GPS setting.

**Default Identifiers. The identifier values can be changed using the configuration software.

- (1) If Satellites in view < 3 then only Identifier 0x301 transmitted and bytes 2 to 8 are set to 0x00.
- (2) Time since midnight. This is a count of 10mS intervals since midnight UTC. (5383690 = 53836.90 seconds since midnight or 14 hours, 57 minutes and 16.90 seconds)
- (3) Position, Latitude * 100,000 (311924579 = 51 Degrees, 59.24579 Minutes North). This is a true 32bit signed integer, North being positive.
- (4) Position, Longitude * 100,000 (11882246 = 1 Degrees, 58.82246 Minutes West). This is a true 32bit signed integer, West being positive.
- (5) Velocity, 0.01 knots per bit.
- (6) Heading, 0.01° per bit.
- (7) Altitude, 0.01 meters per bit, signed.
- (8) Vertical Velocity, 0.01 m/s per bit, signed.
- (9) Status. 8 bit unsigned char. Bit 0=VBOX Lite, Bit 1=Open or Closed CAN Bus (1=open), 2=VBOX3
- (10) Status is an 8 bit unsigned char. Bit 0 is always set, Bit 3=brake test started, Bit 4 = Brake trigger active, Bit 5 = DGPS active
- (11) Distance, 0.000078125 meters per bit, unsigned. Corrected to trigger point.
- (12) Longitudinal Acceleration, 0.01G per bit, signed.
- (13) Lateral Acceleration, 0.01G per bit, signed.
- (14) Distance travelled in meters since VBOX reset.
- (15) Time from last brake trigger event. 0.01 Seconds per bit.
- (16) Velocity at brake trigger point in Knots.
- (17) Velocity Quality, 0.01 km/h per bit.
- (18) Position, Latitude 48bit signed integer, Latitude * 10,000,000 (minutes). North being positive.
- (19) Kalman filter status
- (20) Position, Longitude 48bit signed integer, Longitude * 10,000,000 (minutes). East being positive.
- (21) Trigger event UTC time - milliseconds since midnight UTC (part 1 of 2 part message).
- (22) Trigger event UTC time - nanoseconds since midnight UTC (part 2 of 2 part message).

Upgrading VBOX3i firmware

Occasionally Racelogic releases new versions of firmware (internal code) for VBOX3i products, often to introduce new features. New firmware is loaded into the VBOX3i using a computer and a CF card.

The latest firmware upgrade file for the VBOX3i is available from the [Racelogic website](#).

If you need the latest update file, download it from the website and copy it to your CF card

How to upgrade the firmware

- To upgrade the firmware power the VBOX3i and wait until the box has finished initialisation.
- Insert the CF card containing the upgrade file.
- Once the upgrade is complete the VBOX3i will beep twice and resume normal operation.
- Once the upgrade is complete the upgrade file will be erased and a report file will be generated.
- If the upgrade fails for any reason the upgrade file remains on the card and the VBOX3i retains the previous version of firmware.

Once the firmware upgrade has completed successfully, the VBOX3i should be power cycled before use.

Contact details

Racelogic
Unit 10 Swan Business Centre
Osier Way
Buckingham
Bucks
MK18 1TB
United Kingdom

Email: support@racelogic.co.uk

Web: www.racelogic.co.uk