

# Video Vascar



**SPEEDAR** Ltd

Handbook

**Video Vascar** is our newest version of the tried and tested Vascar system of speed measurement, introduced to this country in 1975 with our first microprocessor based Vascar, in subsequent versions, Vascar 2000,3000 and 4000 the features were improved and the size reduced.

Now in line with the modern demand for video evidence, the new Video Vascar includes video recording and display with the Vascar information superimposed on the video, all in one self contained unit.

The system comprises a video camera with windscreen mounting, video recorder (MJPEG) 8" video screen, small hand-held control for the Vascar and the Vascar itself, all (except the camera and control) contained in a sturdy aluminium housing only slightly larger than the screen itself.



Remote controller for Video Vascar

High Quality Sony camera as standard

In addition there is a standard video input socket so that the screen may be used as a normal pc display if required for anpr use. Any camera may be used with the Video Vascar system but cameras other than those supplied by Speedar Ltd may not be able to use the zoom function on the Vascar remote controller.

There is one channel of audio available if required, any standard microphone may be used, the audio track is recorded along with the video on the CF card.

For single man operation, the system automatically blanks the video information on the screen when the host vehicle is being driven at faster than walking speeds so that only Vascar information is shown. This function can be overridden for 2 crew operation when the Vascar screen is angled away from the drivers field of view. In either mode the video is always recorded.

All the recorder operating buttons are arranged below the screen with a group of navigation buttons in the centre which are multi function depending on the feature being used. The Menu button is used for initial setup of the recorder and the remaining buttons control the recorder.

The camera is a high quality Sony unit with 10x optical zoom

## System description

The Video Vascar system is housed in an aluminium case which has threaded fixing holes on the rear. These holes are tapped M4 and are on 75 mm centres to conform with the VESA mounting standard so that various standard mountings may be used.

There is a hand-held controller which sends commands to the Vascar and has an inbuilt squeaker for audio feedback of button presses, in addition it has a rocker switch to control camera zoom.

The controller has 5 Buttons and a rocker switch labelled as shown

The rocker switch controls the zoom function in the camera allowing the operator to control the field of view of the camera. This function may not work with cameras other than those supplied by Speedar Ltd.

< and > These are multifunction buttons whose current function is shown on the Vascar screen, most commonly  
< means Increment (a number) or NO  
> means set or select a number or YES

The lower 3 buttons are for starting and stopping the D Distance and T Time functions of the Vascar The S Button starts and stops both time and distance in synchronism.



The main housing contains a digital video recorder, a video screen and the Vascar. The recorder records onto a 32 Gb CF card inserted into the right hand side of the casing which may be ejected by the push button alongside the card. Recordings are made in the MJPEG format and the card may be removed and the recording viewed on a pc using the supplied viewing program which may also be downloaded by authorised users from the speedar.co.uk website.

The recordings on the card can of course also be viewed in the recorder.

The screen is an 8" lcd display with variable backlighting, brightness and contrast and may be used either as the recorder screen or by pressing the mode button on the rear of the unit it may use the standard pc video socket to display video from an external source.



If required the screen can be made to show only the Vascar information by sliding the video switch on the right hand side of the unit to the auto position. This shows Vascar information only, on a grey background, when the vehicle is in motion to reduce driver distraction. Video information will always be recorded by the recorder however whatever the position of the video switch.



The system can be set to record in 3 different modes.

Assuming the recorder is stopped (press the stop button if there is any doubt, the record light should be off)

## Mode 1

Press the Record button. Recording will begin and continue until either the CF card is full (after approx 8 Hours) or the Stop button is pushed. In this mode whenever a Vascar measurement is made the recorder automatically marks this as an event on the recording. The event marker will show an E on the left of the screen for the duration of the event, ie the whole of the Vascar measurement)

Recording will be continuous.

## Mode 2

The Recorder is left in the Stop state and every time a Vascar measurement or calibration is begun the recorder automatically starts and then stops when the measurement is complete. During this period the record LED will light during the recording. Each of these recordings is marked as a clip in the recorder.

## Mode 3

If required the recorder can be used on its own by setting the Vascar to OFF in the menu, this removes all Vascar information from the screen except for the letters VV in the top left corner to indicate that the Video Vascar is available. To reactivate the Vascar press the D button on the hand controller.

Playback can show either the continuous record with the embedded events marked and selectable as events or as a series of clips which can also be selected.

A list of both clips and events can be displayed and selected from the on-screen recorder menu. When necessary the CF card can be erased from the recorder menu options.

## Operation of Vascar

The principles of the Vascar speed measuring system are extremely simple making the system easy to use and requiring minimal effort to understand.

They are simply that, Speed equals distance travelled, divided by the time taken to travel that distance

eg. 60 MPH equals 1 Mile travelled in 1/60 Hour ( 1 minute)

The fundamental basis of all Vascar measurement relies on the following two statements.

- 1 Distance measurement is always carried out by car in which the Vascar is installed
- 2 Time measurement is always carried out on the target vehicle

Full training in its use should always be undertaken before operators use the system for enforcement purposes. Normally this will be as specified by individual police forces with reference to ACPO guidelines.

There is one other important consideration and that is that for distance measurement to be carried out by the Vascar it is necessary for the Vascar to be connected to the distance pulse output of the car to which it is fitted. Normally this would now be done by taking distance pulses directly from the canbus wiring in the car but any other method of extracting distance pulses from the vehicle would suffice.

Since no two vehicles will give the same number of distance pulses per unit distance travelled and in fact any one vehicle will over time give different numbers of distance pulses dependant on tyre fitment and wear, there must be a way of standardising these variations and this is done by calibrating the Vascar. This is achieved by driving over an accurately measured distance and counting the number of distance pulses generated over that distance, this number is used as a calibration factor and applied automatically by the Vascar when calculating distances.

Calibration will normally be carried out at the beginning of each shift or as specified by individual police forces but is additionally required at least every 7 days under HOSDB design requirements. The Vascar will not operate until this recalibration is carried out if the time of 7 days between calibrations is exceeded.

The calibration number is stored internally in two separate locations these numbers are checked against each other when Vascar is switched on, if there is exact agreement between these numbers the Vascar considers them to be a valid calibration factor, if they disagree, or if there has been any memory failure within the Vascar the Vascar will refuse to operate until a new calibration has been performed.

Certain other limits are automatically imposed on measurements by the Vascar so that unduly short distances are not used in speed measurements nor in calibration distances and unacceptably low calibration numbers are not allowed. These limits are set by HOSDB in the Manual Distance/Time Speedmeter Handbook and fully complied with in the Video Vascar.

The time of day and the calibration number are stored internally in the Vascar and are retained for several weeks with the equipment switched off. If the equipment is switched off for very long periods then this information will be lost and the Vascar will require it to be re-entered before any measurements can take place. Any calibration number older than 7 days will in any case be rejected.

**It is an absolute requirement that if a Video Vascar is moved from one vehicle to another, a recalibration must be performed before the Video Vascar is used for enforcement.**

Normally Video Vascar should only be moved to another vehicle by a qualified vehicle installer

## Initial switch on and calibration

It is assumed that the camera has been positioned on the windscreen and connected to the Vascar, also that the distance sensor has been connected and the hand controller has been connected. All these items will normally be completed by the installers of the Video Vascar.

Switch on the unit with the front panel power switch. Check that the video switch on the right side of the unit is on Auto for one man operation, or if the Video Vascar is angled away from the drivers line of sight for two man operation the switch may be moved to ON This will allow video to be shown on screen with the Vascar information as an overlay

The screen will light and the Vascar will carry out internal checks for stuck switches and internal computation functions. The camera will zoom out to a preset zoom factor.

The following messages will appear on screen

NO Switches stuck ... or if any are stuck the appropriate one will be indicated



Then 60.01 .1251  
1 (to 7) Days since calibration  
Internal test OK



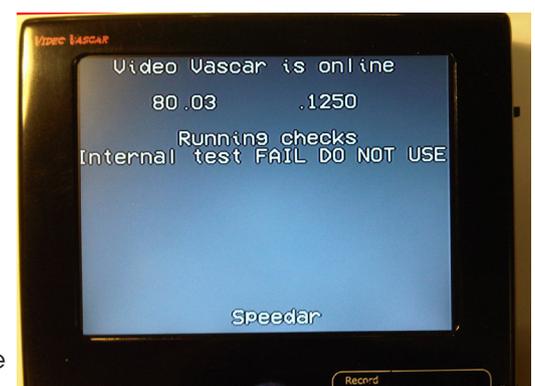
This confirms that the Vascar is calculating correctly and that the internal timers are operating correctly It is carried out by using one of the 2 independent time sources within the Vascar as a distance input .

If the results of this calculation are incorrect the Vascar will refuse to operate further and will display the message

Internal test fail do not use

This will prevent further use of the Vascar except for rebooting

In this case the Video Vascar must be tested before further use



If the equipment is being switched on for the first time the Vascar will now show the message

Clock Fail Calibration invalid.

or if it has not been calibrated for over 7 days.

Calibration out of date recalibration mandatory.

It will then proceed to the calibration procedure. No other operation is possible until this has been carried out

The Vascar will now show the message

Calibration distance

<INC 0.000 Miles SET>

Use the increment button on the hand controller to either increment the first digit or move on the next digit by pressing set.

Only distances greater than 0.500 Miles will be accepted by the Vascar,

To complete the distance input, step the cursor off to the right by repeated presses of the set button. Distances less than 0.5 Miles will return the Vascar to the calibration screen.



The Vascar will now show the message

Press D Drive off when ready.

Line the vehicle up with the first measured distance mark by for instance opening the passenger door and lining up the door pillar with the mark.

When this is done press the D Button on the hand controller.



The Vascar will display

Press D when Cal distance travelled.

Begin to drive at moderate speed and in as straight a line as possible until the second measured distance mark approaches, then line up this mark with the vehicle in exactly the same way as the first mark was aligned. Note this must be done without passing the mark and then reversing as the Vascar will count additional pulses during the reversing.



When the second mark is aligned press the D button again, the Vascar will calculate the calibration factor and if acceptable will store it internally and show the message

CALIBRATION ACCEPTED



If the calibration factor is below 1760 pulses per mile the calibration will be rejected and the Vascar will show

CALIBRATION No TOO SMALL

and then revert to the calibration screen..

In this case the Vascar can not be used in this vehicle.



The self test function may be carried out at any time if required by simultaneously pressing the D,S and T buttons on the hand controller

## To Make a Vascar measurement.

There are 5 ways of carrying out a Vascar speed measurement some require more practice than others.

### 1 **The Following check**

The simplest check is the Following check in which the target vehicle is followed by the Vascar vehicle. There are actually two ways of carrying out this check one in which the time and distance of the target vehicle are measured directly and the other in which by use of the Synch button both time and distance are measured on the Vascar vehicle which is assumed to be following the target vehicle at a constant distance. Because this version of the following check has been incorrectly used in the past it is now a Home Office requirement that when the Synch button is used to measure a speed the final speed measurement will indicate that it is actually the speed of the Vascar vehicle which has been measured. This is done by showing the legend MY SPEED instead of SPEED at the completion of the check.

### 2 **The Being followed check**

This is similar to the following check but in this case the target vehicle is behind the Vascar vehicle. Obviously this requires a clear view behind the Vascar vehicle

### 3 **The Preset Distance check**

This uses a previously measured distance, either a known distance or a distance previously measured by the Vascar and this is entered or recalled into the Vascar. The Vascar vehicle is parked with a clear view of both the start and end of the measured distance and targets are timed over the measured distance by using the T switch on the Vascar.

### 4 **The Oncoming check**

This requires a clear view ahead and a clear reference point at least 1/8 of a mile ahead. The target vehicle is timed from the distant reference point until it passes the Vascar vehicle, at the instant it passes the Vascar vehicle the time measurement is stopped, distance measurement is started and terminated when the Vascar vehicle reaches the distant reference point. This is the most difficult check to carry out and requires a clear view in front of the Vascar vehicle,

### 5 **The Crossing check**

This is used with the Vascar vehicle at right angles to the traffic flow ie at a road junction or a lay by. The target vehicle is timed between two reference points and then the Vascar vehicle drives between the same reference points and measures the distance between them.

## Reference points.

The importance of suitable reference points cannot be stressed too highly, the accuracy of the Vascar measurement depends entirely upon these points. To reduce to a minimum the effects of parallax on measurements, points should only be chosen that are directly on the road surface.

Many possibilities are available which fulfil this requirement.

Road markings, changes in road surface, drain covers, shadows across the road, are all suitable reference points, but note that shadows must not be used to define pre-fed distance measurements as they will move with the time of day due to the sun's apparent movement.

Posts beside the road and objects above road level are not suitable reference points unless they cast a shadow directly on the road.

## Using the Vascar to make speed measurements.

Important, remember that distance is ALWAYS measured by the Vascar vehicle and Time is ALWAYS measured on the target vehicle.

### To carry out a speed check.

With the Vascar switched on, and calibrated, the next choice displayed on the screen is following check. If this is chosen the automatic following check will be carried out. When following a target vehicle the synch button is used to start a measurement. The measurement will be automatically terminated after a distance of 0.125 Miles and MY SPEED will be displayed, this indicates that it was the speed of the Vascar vehicle which was measured directly not the target vehicle. The speed of the target vehicle can be assumed to be the same only if the distance between the target and Vascar vehicles was the same at the beginning and the end of the check. This can be evaluated from the video recording of the check.

To carry out any other form of speed check except the pre-fed distance check proceed as follows.

Adjust the zoom of the camera using the rocker switch until the screen shows a suitable view of the target vehicle., choose a zoom which also shows the road surface by the target vehicle, then the exact point at which the time measurement is started will be visible on the recording.

This can be carried out at any time without affecting the Vascar measurement.

Select No when the following check message is shown. This will take you to the normal speed measuring screen.

### 1 Following a target

Follow the target vehicle, not necessarily as the next car. The Vascar vehicle may be separated by several vehicles as long as it has a clear view of the target vehicle, Select in advance a suitable reference point on the road surface. Assume for instance that there is a painted mark on the road. When a point on the

target vehicle eg the rear wheel passes the mark start the Time measurement by pressing the T button on the Vascar hand control.

When the Vascar vehicle passes the same mark on the road press the D button on the Vascar control. Ensure that you press the D button as a specific part of the Vascar vehicle passes the reference point so that this can be repeated at the end of the measurement. Continue to follow the target vehicle for at least 0.125 Miles. At all times during the measurement both elapsed time and distance are shown on screen.

While following the target vehicle it may be appropriate to zoom in on the target to record the index mark of the target, having done this zoom out again so that the recorder will see the point on the road at which the time measurement is stopped.

Looking ahead of the target vehicle choose a second reference point on the road. As the same part of the target vehicle as used to start the Time measurement passes the mark, stop the Time measurement by pressing the T button on the Vascar. When the Vascar vehicle passes the second mark and ensuring the same part of the Vascar vehicle as used to start the measurement is seen crossing the mark, stop the distance measurement by pressing the D button on the Vascar.

SPEED Time and Distance will now all be shown on the screen and in addition the time and date on which the measurement was made will be shown at the bottom of the screen.

In all cases if the distance travelled during the check is less than the Home Office requirement of 0.125 Miles the check will give no speed result and the display will show insufficient distance travelled.

All this information is recorded as an overlay on the video feed from the camera and may be viewed either immediately to show a driver or at a later date.

## **2 Being followed by a target**

Observe the target vehicle following the Vascar vehicle separated by one or more other vehicles, ensure that you have a clear view of the target vehicle. Select a reference point on the road surface and as the Vascar vehicle passes this point start the Distance measurement by pressing the D button on the Vascar. As always ensure that you use a specific part of the Vascar vehicle passing the reference point to start the distance measurement. When the target vehicle approaches the reference point choose a suitable part of the vehicle eg the front wheel and when this chosen part passes the reference point start the time measurement by pressing the T button on the Vascar. Drive on for at least 0.125 Miles and select a suitable second reference point ahead on the road surface. When the chosen part of the Vascar vehicle passes this point stop the distance measurement by pressing the D button on the Vascar, when the chosen part of the target vehicle passes the same reference point stop the time measurement by pressing the T button on the Vascar. The display will show SPEED TIME and DISTANCE on the display and the time and date at which the measurement was made.

If the target vehicle passes the Vascar vehicle during this check then continue the check stopping the time when the target vehicle passes a second reference point and stopping the distance when the Vascar vehicle passes the same point.

### 3 Oncoming traffic check

This requires a clear view of a distant reference point eg the shadow of a bridge on the road. The target vehicle is observed and when it crosses the distant reference point the time measurement is started by pressing the T button on the Vascar. When the target vehicle is abreast of the Vascar vehicle both T and D buttons are pressed simultaneously stopping the time measurement and starting the distance measurement. ( do not use the synch button to do this as this will then indicate MY SPEED as a result.) When the Vascar vehicle passes the distant reference point stop the distance measurement by pressing the D button on the Vascar. SPEED TIME and DISTANCE will be shown on the display along with the time and date of the measurement.

### 4 Prefed Distance check

This method uses a parked Vascar vehicle and requires two reference points both of which can be seen from the parked position. The distance between these reference points must either be known ie specifically marked at for instance 0.125 Miles apart or previously measured with the Vascar distance function.

The HOSDB requirements are that for speed limits greater than 40 MPH 0.125 Miles is the minimum allowed, below 40 MPH 0.07Miles is the minimum allowed The Vascar automatically enforces these minimums.

From the initial Vascar screen answer No to measure speed

Then yes to use prefed distance. If the Vascar has been used to carry out a distance measurement previously it will ask OK to use last distance measured, if yes is chosen this distance will appear as the distance measured on the screen.

If no is chosen enter the speed limit and then the known distance between the reference points in the same way that the calibration distance is entered, When the cursor is stepped off the last digit to the right the distance will appear as the distance measurement. Distances less than the HOSDB minimums will be rejected.

To measure a speed observe the target vehicle and as a specific part of the vehicle eg the front wheel passes the first reference point start the time measurement with the T button on the Vascar. When the same point on the target vehicle passes the second reference point stop the time measurement by pressing the T button on the Vascar again.

Speed distance and time will appear on the display along with the time and date of the measurement.

Further measurements can be carried out at the same position by choosing reset and then when the OK to use last distance message appears choose yes.

Choose Exit to change to another mode.

## 5 The crossing check

Assuming the Vascar vehicle has come to rest at for instance a T junction

A target vehicle is observed approaching the T junction, as the target vehicle passes a reference point on the left side of the junction the time measurement is started by pressing the T button on the Vascar. When safe to do so the Vascar vehicle pulls out of the junction and as it passes the same reference point the distance measurement is started by pressing the D button on the Vascar.

The Vascar vehicle continues to follow the target along the road until as in a normal speed check a suitable reference point is seen ahead and as in a normal check the T button is used to stop the time measurement when the target passes the reference point and the D button is pressed when the Vascar vehicle passes the reference point.

As normal SPEED TIME and DISTANCE are shown on the display

In all cases when a speed measurement is completed the following information is also output to an RS232 port on the main connector

Date	xx xx xxxx
Time	xx:xx
Speed	xxx.x
Distance	xxxx
Time	xx:xx

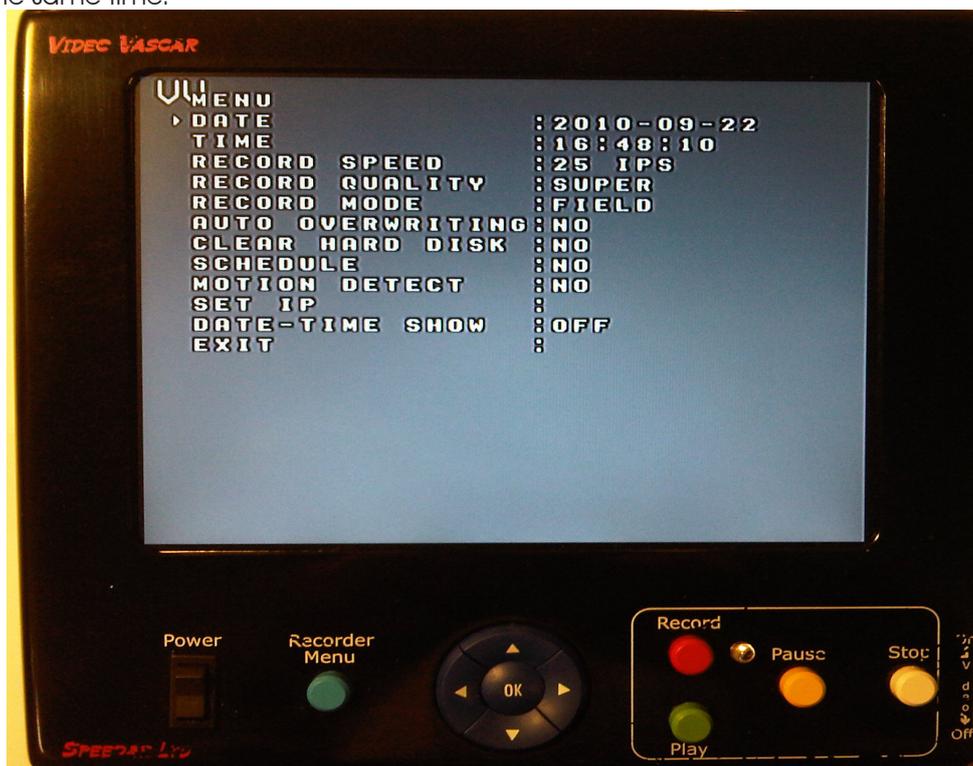
RS232 parameters are 9600b NO parity 1 Stop bit no handshake.

## Using the recorder

The recorder automatically starts and stops every time a Vascar measurement is made, it also automatically records the calibration sequence. There are two possible modes of recording, Event recording where the recorder treats each measurement as a separate event and stores them as a series of separate recordings, or clips, where the recorder is recording continuously and automatically marks the beginning and end of each Vascar measurement as a clip. Whenever the recorder is recording the record LED will be on and an E will appear on the left of the screen

The recorder is controlled by the switches below the screen on the main Video Vascar unit. They are each marked with a self explanatory function. eg Record starts the recorder and lights the record LED, Stop stops the recorder etc.

The main recorder menu is used only to set up the recorder initially. Set the Video Vascar to standby so that only the letters VV are shown at the top Left of the screen, and press the Recorder menu button. This will bring up the menu as shown below. Note the menu can be called up at any time but will appear as an overlay on any other information on the screen, so it is better not to have any other information on screen at the same time.



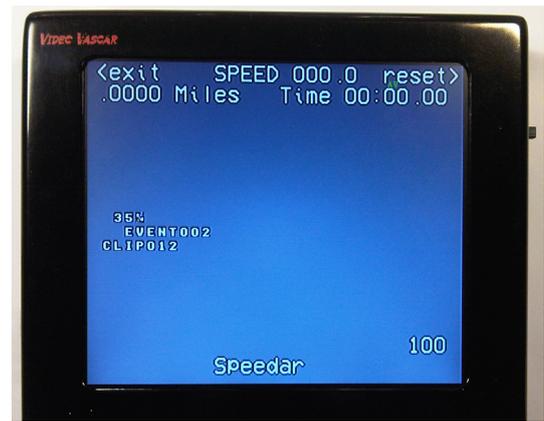
The recorder date and time can be set on this menu by moving the cursor to the appropriate line and pressing the OK button the value can then be changed with the up/down navigation buttons.

To move to the next value to be set use the left/right navigation buttons. When all values have been set press the OK button.

All the other recorder parameters should be left as in the picture above. Move the cursor to the Exit line, press OK and the menu will disappear.

## To View a recording in the car

Make sure the Video switch on the side of the Video Vascar is set to ON, Press OK, the event and clip totals and amount of memory used will appear on the display.



Press Play then press Pause twice.

The Event/Clip Menu appears

While the recorder is showing Pause on the screen you can change between Event and Clip by pressing the Pause button.

Each press changes from event to clip or vice versa.

When in this menu the clip or event no can be changed by pressing the Left Right buttons on the central navigation switches.



Select the clip or event you want to watch and press play.

The recording will play from the beginning of the clip or event chosen. While playing the playback can be speeded up or reversed by pressing the Left/Right buttons on the central navigation switches. To return to normal speed press Play again. The play speed will be shown on the screen beside the word play

While in the Play mode the playback can be stopped at any point by pressing the Pause button.

When paused the recording can be stepped on or back 1 frame at a time by pressing the Up/Down buttons on the central navigation switches.



Recordings can also be viewed on a computer by removing the CF card from the right hand side of the Video Vascar and inserting it in a suitable card reader attached to an office computer or laptop running the viewing software supplied by Speedar Ltd with the Video Vascar.

## To view a recording on a computer

Switch off the Video Vascar and eject the CF Card from the right hand side of the casing by pressing the eject button.

Plug the CF card into the computer card reader socket or into a suitable card reader plugged into a USB socket on the computer. Card readers can be purchased from Speedar Ltd if required.

Start the Viewer program by double clicking on its icon in the normal way,

The Viewer controls are shown below.

Click with the mouse on the Hammer icon below the viewing panel.



The icons below the viewer have the following meanings.



Select a video source, always press this to start viewing

Show Clip list (128 clips maximum)

Show Event list (128 events maximum)

When paused Save video to file avi or bmp

When paused Print Frame

Play

Rewind

In playback fast forward x2,x4,x8,x16

In playback fast rewind x2,x4,x8,x16

When paused step forward 1 frame

When paused step back 1 frame

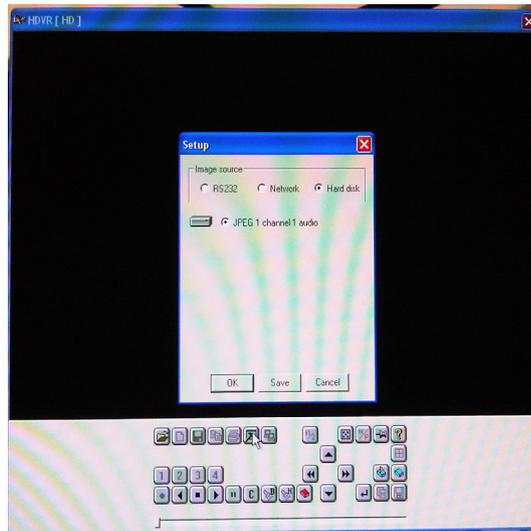
Switch large/small view

Viewer always on top

When paused bookmark frame

When paused go to bookmark list

The program should have identified the CF card and selected Hard disk and JPEG 1 channel 1 audio.  
Click on OK



Choose an event  
by double clicking on the chosen item in the list.



or a clip

Press play to view the clip or event.

The playback will stop on the last frame of the clip or event,

Press  to print the frame as evidence



## Technical description

Video Vascar consist of four subsystems, they are

- 1 The Vascar measuring unit
- 2 The Display screen
- 3 The Digital recorder
- 4 The Camera

With the exception of the camera and the hand control for the Vascar all these subsystems are contained within the same machined aluminium housing. This housing is provided with Vesa standard mounting holes to enable its fitment in a vehicle.

The subsystems are described in more detail below.

The Vascar measuring unit.

To comply with current HOSDB requirements the Vascar subsystem is divided into two completely isolated parts, the various input switches, video processing circuitry and the Can-bus interface are on a part of the circuit board which is grounded to the vehicle power system, the Vascar microprocessor, battery chargers and real time clock are completely isolated from all vehicle power by opto-isolators .

Five opto-isolator ics separate the grounded circuits from the floating circuits  
Signals flow in both directions through this isolation interface to allow the microprocessor to output information to the video circuitry and to receive commands from the various switches.

Commencing with the five switch buttons on the hand control, inputs from these buttons are fed through a filtered D connector into the Main casing and from there pass through the opto isolators to the microprocessor.

To allow the controller to perform a hardware reset, signals from three of these buttons, D,T and S are or-ed together. When all three are pressed simultaneously a hard reset of all ics will take place on both sides of the isolation barrier.

An additional rocker switch on the hand control is fed to a dedicated microcontroller which converts signals from the rocker switch to serial commands which are sent to the camera. This allows control of the camera zoom to be completely independent of any other function. It does not affect the Vascar operation in any way.

A small buzzer is also incorporated in the hand control to give audio feedback when buttons are pressed and when measurements are completed, this is driven from the Vascar microprocessor via the isolated interface and a transistor buffer.

The Camera supplied with the video Vascar is a high quality Sony unit with 10 times optical zoom completely controllable by the Sony VISCA protocol

It is connected via a cable with Lemo connectors and feeds its video signal to the video processing circuits only. The camera has no connections to the isolated circuitry and plays no part in the actual Vascar measurements. It is solely a means of obtaining a video record of each Vascar operation.

The remaining connector supplies power to the complete system and takes an input from the vehicle directly related to the movement of the vehicle, this is commonly known as the speed pulse although in fact it is really a measure of the frequency of rotation of a particular part of the vehicle eg a gearbox output shaft and can be directly correlated with the distance the vehicle moves between pulses.

Two possible sources of this pulse are catered for, either directly from the vehicle's Can-Bus or from a proprietary Can-Bus interface which produces a 12Volt pulse train.

These speed pulses are fed across the isolation barrier to the Vascar microprocessor and form the Distance pulse input.

The video circuitry is solely on the grounded side of the isolation barrier and takes an input from the camera and superimposes on this video stream the information sent to it by the Vascar microprocessor. There are two video processors working in parallel one of which has no video input so that the operator has a choice of either a grey screen with Vascar information only or a screen with Vascar information overlaid on the video. Switching between these two modes is done in a video switch controlled by the slide switch on the right side of the unit.

Control of the entire Vascar system is via an SPI interface which connects to all the major components on both sides of the isolation barrier, the SPI bus itself is fed through the isolation barrier so that components on both sides of the barrier can be controlled. The Vascar microprocessor acts as the only master on this bus all other connections are slaves.

Through this SPI bus the video overlay information is sent to the video ic's can-bus filter values are sent to the can bus interface and time and date information and calibration values are sent and received from the Real time clock.

The Real Time Clock contains additional memory space which is used to store system variables such as calibration number, time since last calibration, date and time and measurement units in use. This information is retained in the memory through voltage supplied from a separate battery allowing retention of data for a period of several weeks.

It is also used to compare its own accurate crystal controlled clock with the Vascar microprocessor crystal controlled clock, both during normal operation and when the Vascar is initially switched on ( This is how the Vascar makes a test measurement by using the RTC as a distance input)

Power to the isolated circuitry is supplied by Li ion battery. Power for the charging is supplied by an isolated 5V converter. Using this arrangement the power supply for the isolated circuitry is always from a floating battery having no connections with the vehicle supply. In addition changing of the battery state is inhibited while a Vascar measurement is in progress.

Transistor switches isolate the batteries when vehicle power is removed.

The switch panel incorporates push button switches to control the recorder, navigation switches to move through recorder menus and the video switch used to change between video overlay and Vascar only display modes

The main power switch is also attached to this board and it also handles power distribution to all the separate pcb modules.

The recorder always takes the output from the video processing circuit having the Vascar information overlaid on it and records this in MJPEG format onto a solid state memory, a 32GB CF card giving a continuous recording time of about 8 hours. This card may be removed and plugged into a pc if required for viewing in the office with the supplied software or may be viewed in situ. Recordings on the CF card may be saved as .avi files or as a .bmp image.

The card may be erased from the recorder menu.

Event marker information is passed to the recorder from the Vascar microprocessor over the isolation barrier to allow the recorder to mark parts of the recording as events. Any Vascar measurement including calibration is considered to be an event.

Events are marked as events when the recorder is already in record mode when an event is signalled by the Vascar microprocessor, if the recorder is not in record mode, the event is recorded as a clip. Both events and clips are listed in playback mode and can be selected for playback as required, there is of course the normal facility for fast forward, reverse and pause. When in pause mode, recordings may be advanced frame by frame for examination of exact points at which Vascar time or distance measurements were started or stopped.

The Screen is an LED backlit tft screen of 8 inch diagonal giving a standard 4x3 image format. The input to the screen may be either the output from the recorder, the output from the video switch or from the external standard 15 way D video connector. Selected via a push button on the casing. Note when the recorder is stopped the video in from the camera passes through the recorder as live video.

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## Engineering menu

The engineering menu for use by installers is available by following this sequence of button pushes

Step along the main menu to Turn Vascar off, press the yes button.

Note the Vascar will say press D to restart.

Hold down the < > and S buttons and then press and release the D button on the hand controller.

When the Vascar beeps release all the buttons. Then immediately press the T button, when the engineering menu appears release the T button.

The engineering menu gives options to change the units, distance input mode and language. It is also possible to see the current calibration factor, the manufacturing date and the serial number of the unit. The operation is self explanatory.

Units may be either MPH or km/h.

Currently the distance input mode for internal Canbus is not enabled and Video Vascar will always require an external Canbus interface or other means of providing a distance input.

The only language installed at present is English, other languages will become available to customers requirements.

A hard reset may be performed at any time by holding down the D,T and Sync buttons on the hand controller.

The date may be set by holding down the < and > buttons while the Video Vascar is switched on.

### Pin connections

#### 9 pin D connector Plug

1	+ 12 Volt vehicle supply
2	Distance pulse input
3	CANH
4	Vehicle Gnd Distance pulse ground
5	RS232 out
6	Vehicle ground 0V
7	Vehicle ground 0V
8	CANL
9	RS232 in

#### 9 pin D connector socket

1	< Button
2	D Button
3	S Button
4	T Button
5	> Button
6	Buzzer
7	Lens Wide
8	Lens Tele
9	0V