Stoneridge Electronics

Digital Tachograph SE5000

Control Manual

IMPORTANT INFORMATION

Due to driver and road safety requirements, it is strongly advised that driver interaction with a Digital Tachograph Vehicle Unit (VU) is not carried out whilst a vehicle is in motion.
Note: the term 'VU' will be used to describe a Digital Tachograph from this point forward.

If a driver does not have a valid VU driver smartcard they **must not** drive a vehicle fitted with the VU described in this manual as it is against EU law. If a card is lost, stolen or faulty, a temporary exemption to drive without a card **may** be granted by the national enforcement agency of the country in which driving is to be done. Drivers should contact national enforcement agencies **directly** (as indicated in *Appendix 7 - National Enforcement Agencies*) for clarification on this matter - **drivers** are responsible for ensuring that they obey driving laws.

Control smartcards contain a memory storage area that is used to hold control activity data. Typically 230 control activity data records can be stored on a control smartcard. It should be noted that once the data memory storage area on a control smartcard becomes full then any new control activity data will still be stored but the oldest data on the smartcard will be overwritten and permanently lost. A description of the types of control activity data stored is given in *Appendix 3 – Control Card and Control Card Activity Stored Data*.

Enforcement Officers **must** take care of their Control cards as these allow unlimited read-only access to a VU's data memory. Control cards are not transferable and **shall not** be made available to unauthorised personnel or any other person. All Smartcards **must** be handled with care – **do not** flex or bend the cards. Ensure that the card contacts are kept free from dirt – clean with a soft damp cloth if necessary.

Dirt ingress can lead to premature failure of a VU. Ensure that smartcard drawers are closed at all times, except when inserting or removing cards. Also ensure that the paper cassette is closed at all times except when changing the printer paper or when accessing the calibration / download front connector (which is located behind the paper cassette fascia). **Do not** use excessive force when removing the paper cassette from its compartment (see *section 3.6 Paper Cassette* for more details). It should also be noted that the printer paper fitted in a Stoneridge VU must be a Stoneridge approved type (see *Appendix 6 - Printer Spare Parts* for details) and must be stored in a cool, dark and dry environment.

The VU smartcard drawers are not capable of supporting weight in the open position.

Disconnect the electrical supply to the VU if:

- Electrical welding is carried out on the vehicle.
- Prolonged boost starting is anticipated.

High-level transient voltages can cause permanent damage to VU electronic circuits. Similarly, failure of other electrical components on the vehicle, for example the alternator regulator, may result in damage to the VU, which is permanently connected to the battery. Any permanent damage done to the VU in this way will result in the VU warranty being invalidated. The EMC performance of the Stoneridge VU complies with the requirements of EU Commission Directive 95/54/EC.

A VU case must **never** be opened, tampered with or manipulated, even in a Tachograph Workshop – if it is then it will become **invalid** for use. If a VU is faulty a Tachograph Workshop must decommission it. If a VU is to be decommissioned, then the owners of the VU **must** ensure that the internal data memory contents of the VU are downloaded and a copy of the downloaded data is returned to them to ensure that they have continuous records of VU stored data. If data cannot be downloaded from a Company's decommissioned VU then a Certificate of Undownloadability should be obtained from the decommissioning Tachograph Workshop and securely stored for a period of at least 1 year. In the case of any exterior damage to a VU, it is recommended that the VU be presented to a Tachograph Workshop for evaluation. If a VU does not pass an evaluation it **must be** decommissioned and will require replacing.

The Stoneridge VU has a normal operating temperature range of –25°C to +70°C.
Note: ADR version range is –25°C to +65°C.

If the VU UTC time is inaccurate by a magnitude of greater than ±20 minutes, then the system **must** be returned to a Tachograph Workshop for recalibration.

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1 Introduction

A Stoneridge VU can be operated in one of four modes of operation as described below:

- Operational Mode (Driver Card or No card Inserted).
- Control Mode (Control Card Inserted).
- Calibration Mode (Workshop Card Inserted).
- Company Mode (Company Card Inserted).

Note: if any combination of Workshop, Control and Company cards is inserted into a VU at the same time, then the mode of operation will be operational.

This manual is concerned mainly with the Control mode of operation. However, knowledge of the normal operation of the unit (i.e., as is usually done by Drivers with valid Driver cards inserted) is also required because an enforcement officer has to ensure that vehicles fitted with VU systems are used to within EU Tachograph laws and drivers of such vehicles adhere to drivers hours laws. Please note that a Control card can be inserted in either of the Smartcard drawers to initiate the Control mode of operation. However, it should also be noted that if Control cards are inserted in both drawers in a VU, the card in drawer '1' would be used for Control mode purposes with the card in drawer '2' ignored.

The VU detailed within this manual comprises two smartcard drawer mechanisms, a printer, an LCD display, a calibration/download interface (6-pin connector located behind paper cassette fascia) and user controls, located in an ISO standard radio enclosure. The VU has been designed to comply with EU Regulations and thus displays and records speed and distance in metric units (kilometres per hour and kilometres respectively). In addition the VU displays and records driver and crew (if applicable) work activity. The VU also incorporates an internal clock, which is used to indicate the current time on the VU display. The Stoneridge VU is available in versions for use in both 12 and 24 Volt vehicle systems.

The Smartcards used in a VU are credit card style flexible plastic cards. During normal operation, information on driving duties, speed and distance travelled are stored on inserted driver smartcards and also in the VU internal data memory. When in the Control mode of operation, a valid Control card is required to download or to view driving data stored on either inserted driver smartcards or in the VU data memory.
Note: a Control card provides read-only access to the entire contents of the VU data memory.

The VU drawers, when they contain smartcards, are **locked** in the closed position whilst the vehicle is being **driven** and can only be opened when **the vehicle is stationary**.
Note: if there is no smartcard inserted, the drawer can be opened at any time.

The 'Speed/Odo/distance' display for a VU when in the normal driving mode has, in the upper right hand area, the cumulative vehicle distance travelled to the nearest 1/10 km as an eight-digit figure (i.e., the 'odometer' reading between 0 and 9,999,999.9 Km). The current local time is displayed in the lower right hand area of the display as a four-digit figure (24-hour clock). The current speed of the vehicle is displayed on the left-hand side of the display (3-digit value with units km/h).

The VU is designed for use by up to two drivers, and thus two driver-specific buttons ('**1**' for driver and '**2**' for crew) are provided adjacent to the smartcard drawer slots. These buttons have the dual function of being able to set the current duty and to open the smartcard drawer. Four further control buttons are provided on the VU, immediately below the display. The left-hand control is the 'Cancel' button, the middle two are 'Up' and 'Down' buttons and the right hand control is the 'Enter' button.

The Stoneridge VU has full type approval for use in the European Union according with Commission Regulation (EC) No. 1360/2002 of 13 June 2002 and other legislatives related.
Note: The Approval Certificate number is e50002. This type approval number will be indicated on all Stoneridge VUs.

The Stoneridge VU is security certified in accordance with ITSEC E3 high as per the relevant EU Digital Tachograph legislation.

2 Description of the Digital Tachograph System

A Digital Tachograph vehicle system consists of a number of different parts as follows:

- The Vehicle Unit (VU) – this is an ISO standard radio sized device within which there is a printer, a display, user interface buttons and two smartcard slots. Information stored in a VU consists of: certain vehicle related parameters; all driver related activity; events and faults information; speed information (for the last 24 hours of driving only) and distance information. The VU internally calculates the speed of the vehicle and any distance travelled and updates the displayed values accordingly. The VU can also supply signals to other vehicle systems that require speed or distance information and can accept input signals for recording events information.

- Motion Sensor – this is used to provide a VU with speed signal pulses from a vehicle gearbox and must be a Stoneridge approved type. To ensure the integrity of the speed sensor signal, the speed signal is transferred between the sensor and the VU in an encrypted form – thus the motion sensor is also known as an "Encrypted Sender". Encrypting the speed signal ensures that any tampering with the signal will be detected and recorded. The Motion sensor is 'paired' specifically with a VU during the VU activation process. This means that the VU and the Motion sensor work together as a mutually inclusive pair. Thus neither the Motion sensor nor the VU with which it is paired can be replaced by another part unless the VU is in the Calibration mode at a Tachograph Workshop.

- Smartcard – a driver card is used to store driving data relating to the named driver on the card. A Control smartcard can be used to provide read-only access to the entire data memory of a VU.

- Remote Display – this usually takes the form of an Instrument Cluster that can be used to display speed (speedometer) and distance travelled (trip and odometer) using information passed from a VU. However it is possible that speed and distance will only be available for display on the VU.

3 Description of the Controls

Figure 1 shows the controls for the Stoneridge Digital Tachograph VU.

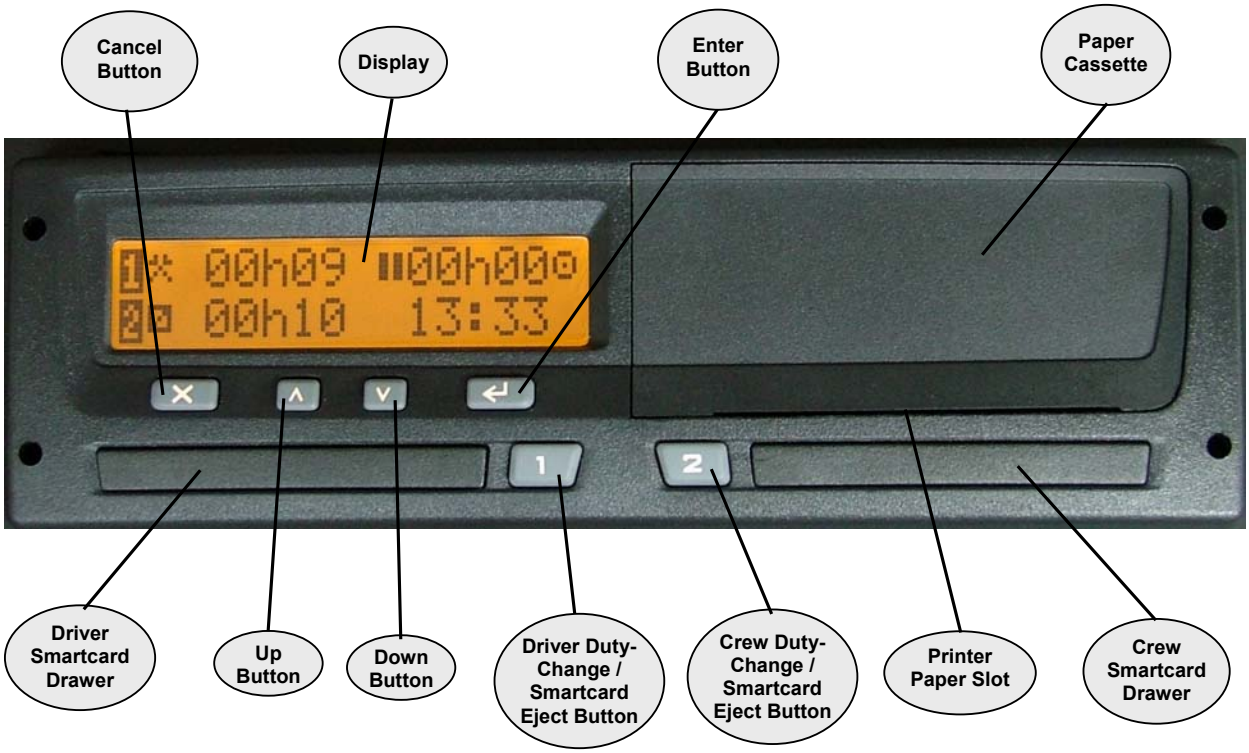


Figure 1 Illustration of the Controls

Figure 2 shows the VU with the paper cassette removed to reveal the position of the calibration/download front connector.

Figure 2 VU Calibration/Download Connector

3.1 Driver Duty-Change / Smartcard Eject buttons

These buttons (one for driver and one for crew) have the dual functionality of being used firstly to change the currently selected duty and secondly for ejecting the associated smartcard drawer.

3.1.1 Duty Change Function

Two individual buttons are provided, respectively for the driver and crew (if two drivers are present), for initiating a period of recorded duty in the normal driving mode. The **Driver** is allocated the left hand Duty-change button (**"1"**), while the **Crew** is allocated the right hand Duty-change button (**"2"**). The duty mode for the Driver or the Crew is selected by short pressing the appropriate Duty-change button. In order to change the mode of activity, the Driver or Crew will press their respective Duty-change button a number of times, until the correct mode of duty is displayed (top line for Driver and bottom line for Crew).

When a vehicle is stationary there are three Driver Duty types that can be selected, with the respective legends ⚒, ⧈ and ⊢. The legends are used to indicate that the Driver (or Crew) is in one of the following activity modes, which correspond with the activities defined in the relevant EU regulation:

⚒ indicates **work** – used to record non-driving active work (such as loading a vehicle etc.)

⧈ indicates **available** – used to record time when a driver is waiting to start driving (such as waiting for passengers to arrive or for paperwork to be completed etc.) and to record time spent travelling as Crew in a moving vehicle.

⊢ identifies **break** or **rest**.

It should be noted that when a vehicle begins to move, the VU automatically switches the Driver duty mode to 'drive' and the Crew duty mode to 'available', although it should also be noted that whilst a vehicle is moving Crew could select work as their duty but not rest. When a vehicle stops moving after being driven, the Driver duty **automatically** changes to 'work' and the Crew duty will remain at 'available'. **Please note that 'Rest' mode for both Driver and Crew, 'Available' mode for the Driver and 'Work' mode for the crew all must be explicitly selected. Note**: if a vehicle begins to move again after less than 1 minute then the duty modes selected will not be stored as a driver event.

3.1.2 Smartcard Eject Function

The Driver Duty-Change buttons also have an alternative function in that they can be used to eject the Smartcard drawers in order to insert or remove a smartcard (left hand '1' button for the Driver smartcard and right hand '2' button for the Crew smartcard). To eject a smartcard drawer '**long-press**' the appropriate button. After a short while the required drawer will latch open.

Notes:
1. If a smartcard is inserted in a VU, the associated 'eject' button is only active when the vehicle is stationary.
2. The 'eject' buttons are not active when the electrical supply to the VU is interrupted. If it is not possible to restore the power, the drawer will require to be released by an approved service engineer using procedures

and special tools, as described in *Appendix 8 - Troubleshooting (Section (b) Opening the Smartcard Drawers With No Power or Whilst Disconnected*).

3.2 Enter Button

The Enter button is pressed to enter the Main Menu of sub-functions whilst the standard Driving Mode screen (or one of the page selection alternatives) is displayed. The button also has the alternative function of being used to confirm selectable options as displayed in the various main menu sub-function screens and Manual duty entry screens etc. Finally, the Enter button can be used to acknowledge and clear warning messages.

3.3 Cancel Button

The Cancel button is used for returning to the main menu and driving mode screens.

3.4 Up / Down Buttons

The Up / Down buttons are used to scroll through the various Menu options or to increment or decrement displayed values e.g. hours.

3.5 Smartcard Drawers

The Driver (left hand side) and Crew (right hand side) Smartcard drawers and used to insert (or remove) smartcards into a VU, as explained in *section 3.1.2 Smartcard Eject Function*.

3.6 Paper Cassette

The Paper Cassette is used to house the paper roll. The paper cassette should remain closed at all times except when fitting a new paper roll. When taking a printout, the paper will emerge from the slot at the bottom of the cassette and consequently the slot must be kept free from obstructions.

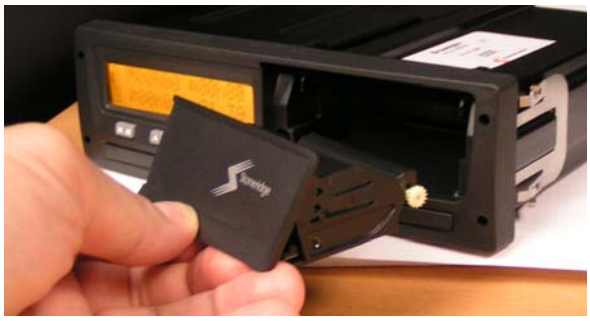
3.6.1 Printer Paper Insertion

To replace the printer paper the entire paper cassette has to first be removed from its compartment. The cassette can be removed as shown and described in Figure 3.

1. Gently press the fascia in the middle near the top of the VU.

2. This will result in the fascia tilting outwards at the bottom.

3. Hold the fascia at the bottom where it is tilting outwards.



4. Gently pull the fascia/mechanism forward out of the VU.

Figure 3 Paper Cassette Removal

The printer paper roll can then be placed in the removed paper cassette. The paper should be fitted such that the paper comes up from the cassette (nearest the front fascia) and then round the back of the cassette, over the paper roller at the rear of the paper cassette. Finally the paper should be fed underneath the paper cassette as shown in Figure 4. The paper cassette should then be carefully re-inserted into the VU compartment and gently pushed in the middle of the paper cassette fascia until it latches into the main unit.

Note: The printer paper used must only be a Stoneridge approved type (see *Appendix 6 - Printer Spare Parts* for details).

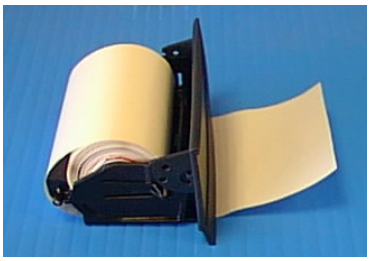


Figure 4 Printer Paper Orientation

3.7 Display

The display area of the fascia provides indication of all information that an operator will require to interface with the VU. The individual screens are described at relevant parts throughout the manual. A full listing of the display symbols and some display symbol combinations are listed in *Appendix 1 - VU Display Symbols.*

4 Control Mode Functions and Equipment Requirements

An enforcement officer will be involved in a number of different functions associated with VU systems. These functions will be carried out in the Control Mode of operation (i.e. with a valid Control card inserted in the VU). A Control card is obtained via an application to the relevant responsible body for each EU member country and will be valid for 2 years only. Control cards will only be issued to enforcement officers or enforcement authorities and they allow **read-only** access to driver or recording equipment data (i.e., on driver smartcards or in VU internal data memory respectively). The card is tied to the named enforcement officer and authority and is not transferable. A Control card enables read access to the entire memory contents of any VU and because of this extra care must be taken to ensure that only the authorised owner of a Control card has access to it at all times. It should be noted that when a Control card is inserted into a VU in order to perform a control activity a record of the control activity is stored on the Control card and in the VU. A description of the data stored during control activity is described in *Appendix 3 – Control Card and Control Card Activity Stored Data.*

The main operations carried out by an enforcement officer will be the downloading and checking of data stored either on driver smartcards or in the internal memory of a vehicles' VU. Checking of VU stored events and faults and the analysis of overspeeding data will also be required.

Enforcement officers will also be required to inspect VU systems (see *section 11 VU Inspections by Enforcement* Officers for full details). The inspections will consist of checking that the equipment functions properly and the VU complies with maximum tolerances for speed and distance display and recording. The type approval mark for the VU, the tyre size and L-factor of the vehicle (actual and recorded values), and the sealing of the VU system should also be checked as part of an inspection. Checking that the installation plaque is intact and is time valid (a new installation plaque is fitted at least every two years after each Tachograph Workshop inspection) will also be necessary. The VUs internally stored vehicle parameters (VIN, VRN etc) should be checked against the actual vehicle details and the VUs internally stored calibration factors should be checked against those included on the installation plaque. If there are any discrepancies or doubts about the recorded calibration factors the vehicle should be taken to a Tachograph Workshop to have a calibration check done. The check must be carried out using an approved method, such as a rolling-

road. A security inspection should also be carried out on the VU system. The VU UTC time should also be checked to see if it is within allowable tolerances (±20 minutes). Discrepancies in any of these items will result in the fitted VU breaking EU legislation and will hence result in the vehicle in which the VU is fitted being invalid for use.

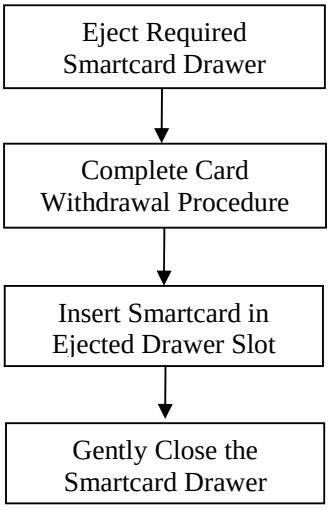
Dedicated download equipment will be essential for the downloading of any VU or driver smartcard stored data that is required to be checked. The download equipment will be interfaced to the VU via the 6-way front download connector (see *Appendix 10 - Technical Data section (b) Calibration and Download Front Connector* for details on individual connections) that is located behind the paper cassette (as shown in Figure 2). Data downloaded **must** be stored in a secure data store. Due to data protection laws any downloaded data must **never** be transferred to third parties without the permission of the vehicle (and hence data) owner.

5 Inserting and Removing Smartcards

This section describes the process of inserting and removing smartcards from a VU. It should be noted that when a control smartcard is inserted into a VU the card will be authenticated by the VU. Authentication of a control card by a VU is confirmed on card insertion by the VU displaying the pictograms "**1▯▮**" along with the control authority name, as read from the authenticated card. If a card is not authenticated and thus rejected by a VU on card insertion, the VU will display the message "**!▮ Insertion of non-valid card**" to confirm the non-authentication of the card.

5.1 Inserting a Card

Figure 5 shows a flow chart of the stages involved in inserting a smartcard in a VU.



Note: Long-press the '1' or '2' drawer eject buttons for either the Driver or the Crew drawer respectively.

Note: This will only be required if a driver or workshop card is currently inserted in the drawer (see *section 5.2 Ejecting a Card* for more details).

Note: The message "**Ejecting Card 1**" ('2' for crew) will be displayed for a short period before the drawer opens. Insert a card as shown in Figure 6.

Note: The message "**Busy Processing Card 1**" ('2' for crew) will be displayed until the card is accepted.

Figure 5 Flow Chart of Smartcard Insertion Procedure

Note: If the message "**×1⁄2×Unable to open slot**" is displayed then this means the drawer cannot be opened by the VU – acknowledge and clear the warning (as described in *section 9 VU Warnings (Events and Faults Conditions)* and retry opening the drawer. If a drawer repeatedly fails to open the vehicle must be taken to a Tachograph Workshop for VU investigation. For information on how to retrieve cards from drawers that will not open using the normal eject procedure please see *Appendix 8 - Troubleshooting (*Note*: Section (b) Opening the Smartcard Drawers With No Power or Whilst Disconnected*).

With the card drawer open, place the card in the drawer with the smartcard chip towards the rear of the drawer and facing upwards as shown in Figure 6.

Figure 6 Smartcard Insertion in Drawer

If a card is rejected by a VU the pictogram message "**Insertion of non-valid card**" will be displayed to indicate that the card is invalid and not authenticated. The warning should be acknowledged and cleared (as described in *section 9 VU Warnings (Events and Faults Conditions)*) and the smartcard should be ejected. The VU and card should be checked if necessary to determine which is faulty. If a card is faulty, a new card must be applied for and the relevant authority contacted for advice (see *Appendix 7 - National Enforcement Agencies* for details). If a VU is suspected faulty the vehicle must be taken to a Tachograph Workshop for VU investigation.

If the inserted card (control card in this case) is accepted and hence authenticated, the display will then be similar to that shown opposite. The pictogram message indicates that a valid control card is inserted in slot 1 and along with the display of the control persons' name or control agency, confirms the card has been validated.

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1 Officer
Enforcement
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5.2 Ejecting a Card

An inserted card may be ejected from a VU at any time providing the vehicle is stationary and the VU is either displaying one of the main driving displays or is in the main menu. If a control card is inserted in a VU it **must** be withdrawn before a vehicle is driven. To eject a card from a VU, long-press the relevant smartcard eject button (i.e. '1' for Driver and '2' for Crew). If the card being ejected is a driver card then questions on location etc will have to be answered – this is fully described in the Stoneridge VU User Manual (part number 6800-900).

The display will then be as shown opposite, to indicate the card ejection process is under way. After the card ejection sequence has been completed the slot will open automatically. If the VU displays the message "**Unable to open slot**" then this means the drawer cannot be opened by the VU - acknowledge and clear the warning (as described in *section 9 VU Warnings (Events and Faults Conditions)*) and retry opening the drawer. If a drawer repeatedly fails to open the vehicle must be taken to a Tachograph Workshop for VU investigation. For information on how to retrieve a card from a drawer that will not open through the usual method see *Appendix 8 - Troubleshooting (Note: Section (b) Opening the Smartcard Drawers With No Power or Whilst Disconnected*).

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Ejecting
Card 1
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If the drawer opens successfully, carefully remove the card from the drawer by popping the card out the slot from below using a finger (shown in Figure 7 below). Once the card has been removed, to close the drawer press gently on the front of the drawer slot until it latches.

Figure 7 Card Removal From Drawer Slot

6 Normal Operation (Driving with a Valid Smartcard)

This section describes the normal operation mode of the VU i.e. driving with a valid Driver card inserted in the Driver ('1') slot. Figure 8 shows a flow chart of the stages involved in normal driving operation of a VU.

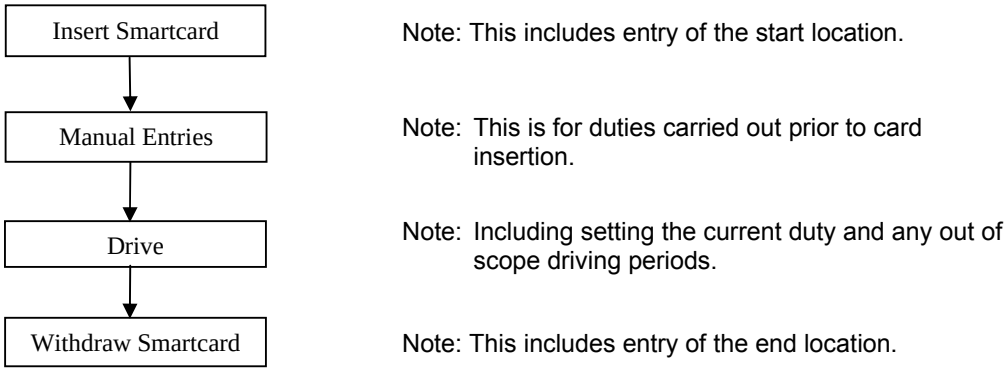
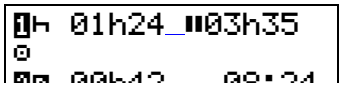


Figure 8 Flow Chart of Normal Driving Operation

Note: The purpose of the manual entry of driver duties is to provide a driver with the opportunity to store a record of any duties that have been carried since their smartcard was last withdrawn from a VU.

Please note that a full description of the normal operation process, i.e. the inputting of start and end locations, manual entry of duties, out of scope driving etc, can be found in the Stoneridge Digital Tachograph User Manual (part Number 6800-900).

6.1 Standard 'Driving' Display



In the normal operational mode, once the manual entry of driver duties has been validated and the 'Start of Day' location input, the display would change to show the standard 'Driving' display, which will be similar to that shown opposite. The top line relates to the Driver and shows the duration of the current activity (left hand side) and the cumulative break time (right hand side). The right hand corner of the top line shows the current mode of operation of the Tachograph (i.e. '' for Operational Mode – if a Control card is inserted in the VU, the Control mode of operation will be identified by the '' symbol). If the vehicle starts to move the current activity automatically changes to Drive. When the vehicle is stationary the driver must select the current

duty. The second line initially shows current activity and time for the Crew (42 minutes available in this case) and then has to the right hand side of the display the current local offset time in 24-hour format.

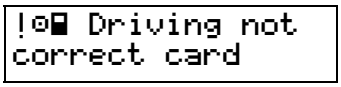
6.2 Driving

Once the vehicle starts to move the Driver duty automatically changes to 'Drive' and the Display will usually be the 'Standard Driving Display' as shown above. If the 'Standard Driving Display' is not shown, press the 'cancel' button to return to it. There are 4 other displays that may be selected whilst driving (by using the 'up' or 'down' buttons to scroll through the screens):

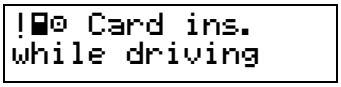
- Speed/Odo/Local Time display.
- UTC Date and Time display.
- 2-Week Driving totals (Driver and Crew).
- Drive and Cumulative Break (Driver and Crew) Display.

For a full description of the alternative screens see *Appendix 5 - Display Screens Selectable Whilst 'Driving'*. Whilst driving it is possible that driver warnings will be periodically displayed – see *section 9 VU Warnings (Events and Faults Conditions)* for a full list of possible warnings and details of how to acknowledge and clear warning messages.

6.3 Driving Without a Valid Smartcard



If a vehicle begins to move and there is no card inserted, then a warning message will be displayed as shown to indicate that the vehicle is being driven without a valid driver card inserted. If a card is lost, stolen or faulty, a temporary exemption to drive without a card **may** be granted by the national enforcement agency of the country in which driving is to be done. Drivers should contact national enforcement agencies **directly** (as indicated in *Appendix 7 - National Enforcement Agencies*) for clarification on this matter - **Drivers** are responsible for ensuring that they obey driving laws. Even though no driver card is inserted in the VU, the information relating to the Drivers' driving activity can still be obtained as the VU will still store a record of all driving activities. If a vehicle is moving, then inserting a valid driver card and closing the smartcard drawer will result in a warning message being displayed as shown to indicate that a card has been inserted whilst driving – acknowledge and clear the warning (as described in *section 9 VU Warnings (Events and Faults Conditions))* and continue. A record of the card being inserted whilst driving will be stored.



When driving without a valid driver smartcard, in order to obtain a record of details of driving activity for any 'driving without a card' period, a Driver can obtain printouts from the VU. The printout required from the VU for this is the "Daily Driver Activities from VU" printout and for information on how to obtain this printout please see *section 7.2 How to Initiate a Printout and How to Stop a Printout*.
Note: printouts should be taken both before and after driving in order to obtain a complete record of driving without a card activity.

7 Printouts

A VU has the ability to supply various types of printout relating to the unit itself and to inserted smartcards (Driver or Workshop only). The following sections will describe the types of printout available and how to obtain a printout and also show the layout of a sample printout.
Notes:
1. The ignition switch must be switched on to obtain a printout.
2. Only Downloaded data are ensured to be authentic.

7.1 Types of Printout

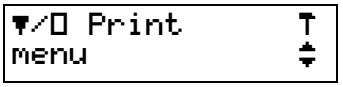
There are six types of printout available from a VU via the 'print/display' sub-menu as follows:

Displayed Message	Printout Type	Description
24h▪▼ Print 24h card	Daily Driver Activities from Card	This is a list of all driver activities stored on a smartcard for a selected day.
24h▲▼ Print 24h VU	Daily Driver Activities from VU	This is a list of all driver activities stored in a VU for a selected day. In the normal operational mode (valid Driver card inserted) only the 8 previous days activities can be accessed.
!x▪▼ Print event card	Warnings from Card (Events and Faults)	This is a list of all Events and Faults stored on a driver smartcard.
!x▲▼ Print event VU	Warnings from VU (Events and Faults)	This is a list of all Events and Faults stored in a VU.
T▪▼ Print technical data	Technical Data	This is a list of technical data applicable to a VU, e.g. Calibration factors VIN etc.
>>▼ Print overspeeding	Overspeed Data	This is a list of over-speeding events. **Note**: an over-speeding event is recorded if a VU's set over-speed limit is exceeded for a period of greater than one minute.

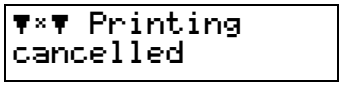
It should be noted that if the printer is not working or if no printer paper is available, then when required the data that would be printed on the above listed printouts could instead be shown on the VU display.

7.2 How to Initiate a Printout and How to Stop a Printout

Printouts are obtained via the "Print/Display" sub-menu and this can be accessed as follows. From any of the 'Driving' display screens (see *Appendix 5 - Display Screens Selectable Whilst 'Driving'* for details), press the 'Enter' button to access the 'Main Menu'. Press the 'up' or 'down' buttons to scroll through the main menu functions until the "Print/Display" sub-menu screen is displayed as shown opposite. Press the 'Enter' button again to enter the "Print/Display" sub-menu and use the 'up' or 'down' buttons to scroll through the list of six printout types (as listed in *section 7.1 Types of Printout*) until the required option is displayed on the bottom line. Press the 'Enter' button once more to select the required displayed 'print/display' option. If the wrong sub-menu is entered, press the 'Cancel' button to go to the previous menu.

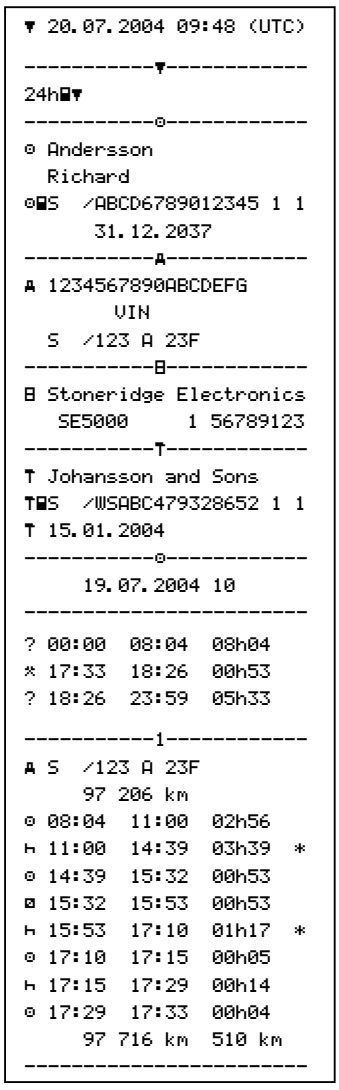


Once a printout has been initiated it can only be stopped by long-pressing the 'cancel' button. A warning message will be displayed as shown to indicate that printing has been cancelled. It should be noted that if there is a problem with the printer then a warning message will be displayed, with the exact message displayed dependant on the problem. A full list of printing instructions for each printout type and a description of printer warning messages is included in *Appendix 4 - Details of Printing Routines*.



7.3 Sample Printout

A sample 'Daily Driver Activities From Card' printout is shown below in Figure 9. The printout initially consists of information on the cardholder and then information on VU and vehicle in which it was inserted. Then shown are details of the driver duties for the day and start and end odometer information.



Date & time of printout

Type of print out - Daily Driver Activities from card

Cardholder's last name
Cardholder's first name
Card issuing state & number
Card expiry date.

Vehicle registration state & number

VU Manufacturer
VU Part Number

Workshop carrying out last calibration
Workshop card number
Date of last calibration

Date of Driver Activities, daily counter

Period of unknown activity
Period of activity entered manually
Period of unknown activity

Card inserted into slot 1
Vehicle Card was inserted into
Vehicle odometer value at card insertion
Activities whilst card was inserted

⊢ = Rest (Note: rest periods more that 1 hour are identified with '*')

◘ = Available

⚒ = Work

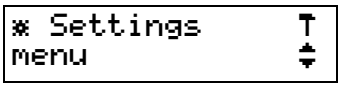
⊙ = Drive

Vehicle odometer value at card removal, distance travelled

Figure 9 Sample Printout

8 Settings Menu

The settings menu is used for setting the VU clock (adjustment of UTC and setting local time), to invert the display or to carry out VU internal tests. It should be noted that Settings menu interaction is identical regardless of which mode of operation the VU is in. The Settings menu can be accessed from any of the 'Driving' display screens (see *Appendix 5 - Display Screens Selectable Whilst 'Driving* for details). Initially press the 'enter' button to access the 'Main Menu'. The 'up' or 'down' buttons should be pressed to scroll through the main menu functions until the 'Settings' sub-menu screen is displayed as shown. Press the 'enter' button again to access the 'Settings' sub-menu and press the 'up' or 'down' buttons to scroll through the list of settings options as follows:



- "**✱ Settings Local Time"** - this is used to adjust the VU local offset time.
- "**✱ Settings UTC**" - this is used to adjust the VU UTC time.
- "**✱ Settings Invert display**" - this is used to invert the VU display.

- "**✱ Settings Built-in test**" - this is used to check the functionality of different parts of a VU.

Once the required settings option is shown on the bottom line, press the 'enter' button once more to select the required option. If the wrong sub-menu is entered, press the 'cancel' button to go to the previous menu.

8.1 UTC Time and Local Time

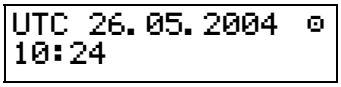
All VUs use Universal Time Coordinated (UTC) as their master reference time. UTC is an incremental count of the number of elapsed seconds since 1st January 1970, and is approximately equivalent to Greenwich Mean Time. UTC time does **not** change due to seasonal adjustment. A local time may also be shown on the VU and this can be adjusted in ±30 minute offsets up to a maximum of ±12 hours from the UTC time. It should be noted that **all** driving event times stored are UTC times - setting a local time on the VU is for display purposes only.

8.1.1 Adjusting VU UTC Time

Any VU user can alter the VU UTC time by a magnitude of ±1 minute per 7-day period. However a valid Workshop card holder can alter the VUs' UTC time by any amount.

Notes:
1. For alterations greater than ±1 minute per week the VU **must** be in calibration mode (i.e. valid Workshop card under PIN control inserted) and external programming equipment is also required.
2. UTC time adjustments are restricted to within the time validity limits of the VU inserted Workshop card.
3. If the VU UTC time becomes inaccurate by a magnitude of greater than 20 minutes, then the vehicle **must** be taken to a Tachograph Workshop for VU recalibration.

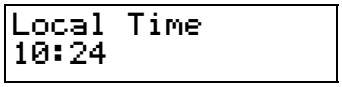
To modify UTC time using the VU manual entry method, enter the UTC sub-menu via the main menu/settings sub-menu as described in *section 8 Settings Menu*. With the UTC date/time displayed as shown opposite, press the 'up' or 'down' buttons to increment or decrement the UTC time.



Note: using this method by ±1 minute per 7-day period only - if the UTC time has already been changed within the previous 7 days then no adjustment will be possible and the display will stay at the 'settings menu / UTC option' display screen.
Press the 'enter' button to accept the new UTC time or the 'cancel' button to leave the UTC time at its original setting.

8.1.2 Setting VU Local Time

To set the local time, enter the 'Local Time' sub-menu via the main menu/settings sub-menu as described in *section 8 Settings Menu*. The 'Local Time' sub-menu display will then be similar to that shown opposite. To adjust the local 'offset' time, press the 'up' or 'down' buttons respectively to increment or decrement the local 'offset' time.



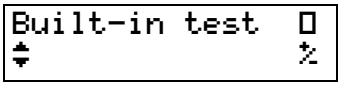
Note: increments/decrements are in ±30 minute steps only up to a maximum of ±12 Hours variance from the UTC time.
Press the 'enter' button to accept the new local 'offset' time or the 'cancel' button to exit without changing the local time.

8.2 Inverting the Display

The settings menu can also be used to set a positive display (dark characters on a light coloured background) or a negative display (light coloured characters on a dark background). The display can be adjusted in this manner using the 'Invert Display' option from the Settings sub-menu. Enter the 'Invert Display' sub-menu via the main menu/settings sub-menu as described in *section 8 Settings Menu*. The 'Invert Display' sub-menu display will be as shown opposite. Press the 'up' or 'down' buttons to highlight either the '+' option for a positive display or the '-' option for a negative display. When the required display option is highlighted, press the 'enter' button again to select the display setting or press the 'cancel' button to exit without changing from the previous display setting.

8.3 Built-In Test

The settings menu can also be used to access the 'Built-in Test' sub-menu and this can be used to check the functionality of different parts of a VU. The 'Built-in Test' sub-menu can be accessed via the main menu/settings sub-menu as described in *section 8 Settings Menu*. The 'Built-In Test' sub-menu display will be as shown opposite. Press the 'up' or 'down' buttons to select the sub-functions available with the required sub-function pictogram highlighted at the right hand side of the display. The functions available are as follows:



Display Pictogram	Test Type	Description
	Display Test	This is used to test the VU display
	Invert Display Test	This is used test the inversion of the VU display.
	Printer Test	This is used to print a test printout.
	Keypad Test	This is used to check the operation of the VU buttons.
	Smartcard Test	This is used to check VU inserted smartcards.

A fuller description of the built-in test sub-functions is included in *Appendix 8 - Troubleshooting*.

9 VU Warnings (Events and Faults Conditions)

A VU can detect a number of different Events and Fault conditions and these are described in the sub-sections that follow. Details of any Events and Faults that are detected are stored in the VU. A printout of the Events and Faults stored can be obtained as described in section *7.2 How to Initiate a Printout and How to Stop a Printout*.

The VU will warn a user when it detects an event or fault condition. The warning will consist of a visual display message (see sections that follow for details of messages). Initially the user should press the 'enter' button to acknowledge the warning. Once a message is acknowledged, to clear the message the user must again press the 'enter' button. Please note that manufacturer specific warnings, i.e. with a reference number greater than 0x80, require only one 'enter' button press to acknowledge and clear the warning. It should also be noted that warnings of power-supply interruptions would be delayed until the power is restored. Finally, if the ignition switch is turned off then on again then any 'still active' warning messages will be re-displayed even although they had previously been acknowledged and cleared.

It should be noted that when certain of the warning messages listed below are displayed, the reason for the warning should be noted and appropriate action taken as described in the sections that follow.

9.1 General Events Warning Messages

Message Description	Warning Message	Warning Reference Number	Reason For Occurring And Required Action To Be Taken
Insertion of a Non-valid Card	! Insertion of a non-valid card	0x01	The card may be faulty, out of date or the wrong type. Eject card and check. See note 1 below also.
Card Conflict	! Card Conflict	0x02	This will occur either if workshop and driver cards or any combination of workshop, control and company cards are inserted in slots 1 and 2 at the same time. Eject one of the cards to stop the card conflict.

Time Overlap (Note: 2 displayed for slot 2)	!◎◎1 Card 1 Time overlap	0x03	The smartcard just inserted has a last card withdrawal time that is later than the current VU UTC time. Check current VU UTC time is correct. Adjust VU UTC time if necessary. If VU UTC time more than 20 minutes inaccurate, the VU system must be taken to a Tachograph Workshop for recalibration.
Driving Without an Appropriate Card	!◎■ Driving w/o validnot correct card	0x04	A vehicle is in motion and there is no valid driver or workshop card inserted in the driver smartcard drawer. Stop driving and insert a valid Driver card into the VU.
Card Insertion While Driving	!■◎ Card ins. while driving	0x05	A card has been inserted whilst a vehicle is in motion. If card is valid continue driving.
Last Card Session Not Correctly Closed (Note: 2 displayed for slot 2)	!■A1 Last sess. not closed OK	0x06	The card was removed erroneously from the last VU in which it was inserted or the previous withdrawal of the card was not terminated correctly by the VU. Eject card and check. See note 1 below also.
Over Speeding	>> Over speeding	0x07	The vehicle has travelled faster than the set over-speed limit for 1 minute and the event will be stored. The vehicle speed must not increase above the speed limiter setting.
Power Supply Interruption	!÷ Power supply interruption	0x08	The VU supply voltage has dropped below the minimum limit or above the maximum limit for the correct operation of the VU. Check battery voltage and wiring. See note 3 below also.
Motion Data Error	!⅄ SensorMotion data error	0x09	The data from the vehicle motion sensor is erroneous. The vehicle **must** be taken to a Tachograph Workshop for investigation where the motion sensor operation and wiring can be checked.

Notes:

1. If it can be clearly identified that a smartcard is faulty (either by checking that the suspected card is faulty in a number of different VUs or by checking if a suspected VU is faulty by trying other 'known good' cards in it), then a new card must be applied for and the relevant authority contacted for advice (see *Appendix 6 – National Enforcement Agencies*).
2. If a VU is found to be faulty or if it is unsure whether a card or VU is faulty, the vehicle must be taken to a Tachograph Workshop for investigation. A Tachograph Workshop will decommission a VU that is faulty beyond repair.
3. The reason for display might be known e.g. the message will be displayed if the battery is disconnected to enable welding to be carried out for example. Repeated unknown display of this message will mean the vehicle must be taken to a Tachograph Workshop for VU investigation. A Tachograph Workshop will decommission a VU that is faulty beyond repair.

9.2 VU Related Security Breach Attempt Events Warning Messages

Message Description	Warning Message	Warning Reference Number	Reason For Occurring And Required Action To Be Taken
VU Motion Sensor Authentication Failure	!⅄⅃× Sensor auth. failure	0x11	The VU does not recognise the motion sensor connected to it as the one it should be paired with. The vehicle **must** be taken to a Tachograph Workshop for investigation where re-Pairing of the VU & motion sensor should be carried out and

Message Description	Warning Message	Warning Reference Number	Reason For Occurring And Required Action To Be Taken
			the system retested. The sensor should be repaired or replaced if necessary.
VU Tachograph Card Authentication Failure (Note: 2 displayed for slot 2)	!AB×1 Card auth. failure	0x12	The VU has identified that the card inserted has failed the security check. Eject card and check. See note 1 also.
VU Unauthorised Change of Motion Sensor	!JJ× Unauth. change of sensor	0x13	The VU does not recognise the motion sensor connected to it as the correct type. The vehicle **must** be taken to a Tachograph Workshop for investigation where re-Pairing of the VU & motion sensor should be carried out and the system retested. The sensor should be repaired or replaced if necessary.
VU Card Data Input Integrity Error (Note: 2 displayed for slot 2)	!A←B×1 Card data integrity error	0x14	The data transferred from the smartcard to the VU memory has errors. Eject card and check. See note 1 below also.
VU Stored User Data Integrity Error	!A/A× Data integrity error	0x15	The user data stored in VU memory has errors. Check VU operation for errors. If VU operation not satisfactory, the vehicle **must** be taken to a Tachograph Workshop for VU investigation.
VU Internal Data Transfer Error	!A→A× Int. data transfer error	0x16	Data transferred internal to the VU has errors. Check VU operation for errors. If VU operation not satisfactory, the vehicle **must** be taken to a Tachograph Workshop for VU investigation.
VU Hardware Sabotage	!A××× Hardware sabotage	0x18	The VU has been tampered with. Inspect VU casing for damage etc. Check VU operation. If inspection fails the VU must be decommissioned. If VU operation not satisfactory, the vehicle **must** be taken to a Tachograph Workshop for investigation.

Notes:

1. Where it can be clearly identified that a smartcard is faulty (either by checking that the suspected card is faulty in a number of different VUs or by checking if a suspected VU is faulty by trying other 'known good' cards in it), then a new card should be applied for and the relevant authority contacted for advice (see *Appendix 6 – National Enforcement Agencies*).
2. If a VU is found to be faulty or if it is unsure whether a card or VU is faulty, the vehicle must be taken to a Tachograph Workshop for VU investigation. A Tachograph Workshop will decommission a VU that is faulty beyond repair.

9.3 Sensor Related Security Breach Attempt Events Warning Messages

Message Description	Warning Message	Warning Reference Number	Reason For Occurring And Required Action To Be Taken
Sensor No further details	!J? No further details	0x20	A sensor error of an unknown type has occurred. The vehicle **must** be taken to a Tachograph Workshop for investigation where motion sensor operation and wiring can be checked, repaired or replaced if necessary.

Sensor Authentication Failure	!Л▲× Sensor aΘuth. failure	0x21	The motion sensor does not recognise the VU it is connected to as the one it should be paired with. The vehicle **must** be taken to a Tachograph Workshop for investigation where re-Pairing of the VU & motion sensor should be carried out and the system retested. The sensor should be repaired or replaced if necessary.
Sensor Stored Data Integrity Error	!Л/Л×Sensor data integrity error	0x22	The internal data in the motion sensor has errors. The vehicle **must** be taken to a Tachograph Workshop for investigation where the motion sensor operation can be checked and repaired or replaced if necessary.
Sensor Internal Data Transfer Error	!Л→Л×Sensor data transfer error	0x23	Data transferred internal to the motion sensor has errors. The vehicle **must** be taken to a Tachograph Workshop for investigation where the motion sensor operation can be checked and repaired or replaced if necessary.
Sensor Unauthorised Case Opening	!Л∠× Sensor unauth.case open	0x24	The motion sensor has identified that its case has been opened. The vehicle **must** be taken to a Tachograph Workshop for investigation where the motion sensor operation can be checked and the sensor resealed, repaired or replaced if necessary.
Sensor Hardware Sabotage	!Л×××Sensor hardware sab.	0x25	The motion sensor has been tampered with. The vehicle **must** be taken to a Tachograph Workshop for investigation where the motion sensor operation can be checked and the sensor resealed, repaired or replaced if necessary.

Note: Repeated Sensor/VU authentication problems may mean that the VU is faulty. If the VU is suspected faulty, the vehicle must be taken to a Tachograph Workshop for VU investigation. A Tachograph Workshop will decommission a VU that is faulty beyond repair.

9.4 Recording Equipment Faults Warning Messages

Message Description	Warning Message	Warning Reference Number	Reason For Occurring And Required Action To Be Taken
VU Internal Fault	x▲ VU internal error	0x31	The VU has detected an internal hardware fault during self-test. Check VU operation for errors. If VU operation not satisfactory, the vehicle **must** be taken to a Tachograph Workshop for VU investigation.
Printer Fault	x▼ Printer fault	0x32	The VU has detected an internal fault during the printer test. Check printer operation. Check paper cassette and paper and replace if necessary. If the printer still fails the vehicle **must** be taken to a Tachograph Workshop for VU investigation.
Display Fault	x□ Display fault	0x33	The VU has detected an internal fault with the display. If the display is unreadable the vehicle **must** be taken to a Tachograph Workshop for VU investigation.

Downloading Fault	×↧ Downloading fault	0x34	The VU has detected an internal fault during the data download process. Check external download equipment and connections. If VU is the cause of repeated downloading failures the vehicle **must** be taken to a Tachograph Workshop for VU investigation.
Sensor Fault	×⎍ Sensor fault	0x35	The VU has detected a fault with the motion sensor. The vehicle **must** be taken to a Tachograph Workshop for investigation where motion sensor operation and wiring can be checked, repaired or replaced if necessary.

Note: A Tachograph Workshop will decommission a VU that is faulty beyond repair.

9.5 Card Faults Warning Messages

Message Description	Warning Message	Warning Reference Number	Reason For Occurring And Required Action To Be Taken
Card Fault (driver slot)	!▪10 Card 1 fault	0x40	The card inserted in the driver smartcard drawer is faulty. Eject card and check. See note 1 below also.
Card Fault (crew slot)	!▪20 Card 2 fault	0x40	The card inserted in the crew smartcard drawer is faulty. Eject card and check. See note 1 below also.

Notes:

1. If a smartcard is faulty then a new card should be applied for and the relevant authority contacted for advice (see *Appendix 7 - National Enforcement Agencies)*. If a VU is found to be faulty or if it is unsure whether a card or VU is faulty, the vehicle must be taken to a Tachograph Workshop for VU investigation. A Tachograph Workshop will decommission a VU that is faulty beyond repair.
2. Only "card fault" (reference number 0x40) is stored irrespective of which card is faulty.

9.6 Manufacturer Specific Events & Faults Warning Messages

Message Description	Warning Message	Warning Reference Number	Reason For Occurring And Required Action To Be Taken
Quarter Left Reminder	>4½h? Quarter left reminder	0x81	The driver has 15 minutes of driving time left until they reach 4½ Hours of continuous driving time.
Time For Break Reminder	>4½h Time for break reminder	0x82	The driver must complete their 45-minute cumulative break following 4½ Hours of continuous driving.
Unable to Open Slot 1 (Note: 2 displayed for slot 2)	×▯/▪2/× Unable to open slot	0x83	The appropriate smartcard slot will not open. Check drawer eject operation. If drawer will not eject the VU must be taken to a Tachograph Workshop for decommissioning.
~~Printing Complete~~	~~▼√▼~~ Printing ~~complete~~	~~0x84~~	~~The current printout has been completed successfully. Detach printout from VU as required.~~
Printing Cancelled	▼×▼ Printing cancelled	0x85	The current printout has been cancelled.

Printing Stopped – No Paper	▼P× Printer out of paper	0x86	The current printout has stopped because there is no paper left. Replace paper. If printer does not work the vehicle **must** be taken to a Tachograph Workshop for VU investigation and decommissioning if necessary.
Printing Stopped – Low Power	▼↓ϟ Printer low power	0x87	The current printout has stopped because the input VU voltage has dropped below the minimum allowed. Check battery voltage, wiring etc. If OK vehicle must be taken to a Tachograph Workshop for VU investigation. If VU faulty beyond repair it will be decommissioned.
Printing Stopped – Low Temperature	▼↓° Printer low temperature	0x88	The current printout has stopped because the ambient temperature has dropped below the minimum allowed for the printer. The vehicle cab ambient temperature must increase to allow the printer to work.
Printing Stopped – High Temperature	▼↑° Printer high temperature	0x89	The current printout has stopped because the ambient temperature has risen above the maximum allowed value for the printer. The vehicle cab ambient temperature must decrease to allow the printer to work.
Printing Stopped – High or Low Temperature	▼↕° Printer high/low temp.	0x8A	The current printout has stopped because the printer temperature is out with the range of allowed temperatures. Wait until printer temperature is within allowable range and try to print again.
Card Withdrawn Without Proper Saving (Note: 2 displayed for slot 2)	!▮→×1 Card ejectout without saving	0x8B	The card was removed after a failure to write data to the card. Check VU / card operation. If VU suspected faulty vehicle must be taken to a Tachograph Workshop for VU investigation. If card faulty replace with new card.
Wanted Function Not Possible to Perform	fn× Function not possible	0x8C	The last function request was not possible.
Over Speeding – Pre Warning	>>? Overspeeding pre-warning	0x8D	The vehicle is travelling faster than the set over-speed limit (Note: 1 minute continuous overspeeding will result in an overspeed event being stored). The vehicle speed must not increase above the speed limiter setting.
Timeout – Card Insertion or Withdrawal Passivity	▮→⊘ Timeout no key press	0x8E	A user has tried to insert (or withdraw) a smartcard and has not answered the required questions within the allowable time limits.
Driving Cannot Open Slot	⊘▯/▮× Driving can't open slot	0x8F	A user has attempted to open a smartcard drawer whilst the vehicle is in motion. A smartcard may not be accessed whilst a vehicle is moving.
Pairing	▯→▲... Sensor Pairing	0x90	The Motion Sensor and VU are in the process of pairing – message only relevant to Tachograph Workshops.
Pairing Complete	▯→▲...✓ Pairing complete	0x91	The Motion Sensor – VU pairing process has been completed successfully – message only relevant to Tachograph Workshops.

Pairing Failed	Pairing failed	0x92	The Motion Sensor – VU pairing process has failed – message only relevant to Tachograph Workshops who must either replace or repair sensor if required or decommission VU if it is faulty beyond repair.
Inserted Valid Card Expired (Note: 2 displayed for slot 2)	Card expired	0x96	The inserted card was valid but has now expired. Eject card and replace with valid card.
Activation	Activation	0x97	The VU is being activated for use – message only relevant to Tachograph Workshops.
Activation Complete	Activation complete	0x98	The VU activation process has been completed successfully – message only relevant to Tachograph Workshops.
Activation Failed	Activation failed	0x99	The VU activation process has failed – message only relevant to Tachograph Workshops. If VU will not activate it must be decommissioned and replaced.
~~Processing Card1 Busy (Note: 2 displayed for slot 2)~~	~~Busy processing Card 1~~	~~0x E0~~	~~A card has just been inserted in the slot – the message will be displayed until the VU has accepted the card as valid.~~
~~Please Wait Ejecting Slot 1 (Note: 2 displayed for slot 2)~~	~~Ejecting Card 1~~	~~0x EC~~	~~A request has been made to eject a card – the message will be displayed until the VU is ready to eject the card.~~
No Driver or Workshop Card Inserted	No driver/ workshop card	0xED	The user has tried to interface with a card and there is no driver or workshop card present in either drawer. Insert a valid card as required.
Enter PIN	J1 PIN? Enter PIN code	0xEE	Used to inform a user to enter a PIN code to enter the VU calibration mode. Message only relevant to Workshop card holders.
Memory Full	Memory full!	0xEF	The maximum number of manual duty entries has been reached.
More Than 24 hours Since Last Card Withdrawal.	>24h last card withdrawal >24h	0xF0	The card just inserted was last withdrawn from a VU more than 24 Hours ago.
Downloading Busy	Downloading busy	0xF1	The VU is downloading data. Wait for the download procedure to complete.
Downloading Incomplete	Downloading failed	0xF2	The VU download process has failed. Remove card from VU. Check connections and download equipment. Re-insert card and retry download. Replace or repair download equipment if required. If VU is faulty the vehicle **must** be taken to a Tachograph Workshop for VU investigation and decommissioning if necessary.
Downloading Complete	Downloading completed	0xF3	The VU download process has been completed successfully.

10 Downloading Data

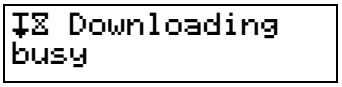
An enforcement officer must download data from Digital Tachograph VU systems - firstly to aid investigations into Drivers Hours legislation checks and secondly to aid determination of the validity of Digital Tachograph systems. Downloading means the copying, together with a security digital signature, of a partial or a

complete set of data that is stored in the memory of a VU or on a driver smartcard. It should be noted that an enforcement officer using a valid control card has read-access to the **entire** VU data memory contents whether or not data has been company locked using a valid company card. Due to data protection laws care must be taken to ensure that VU data is not downloaded and passed on to third parties without the permission of the VU (and hence data) owners. When carrying out Drivers Hours Investigations care must be taken to identify the true owners of blocks of stored VU data. Company Lock-in/Lock-out details can be used to identify owners of VU stored data – enforcement officers should encourage companies to Lock-in VU data as it not only identifies their company as the owner of the data, but also prevents third party company card owners from viewing or downloading their data. Also, when transferring ownership of a VU to another company, the current VU owner should Lock-out the data before transfer of the VU and thus any future data stored after the Lock-out would be clearly identified as not applying to them.

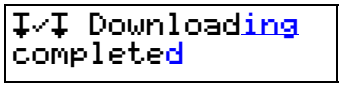
Note: Only Downloaded data are ensured to be authentic.

VU stored data contains personal information and any download of data must take into account data protection laws. It should be noted that different member states are likely to have different data protection laws and an enforcement officer should refer to the Data Protection Act of their own country for information - please contact national enforcement agencies **directly** (as indicated in *Appendix 7 - National Enforcement Agencies*) for clarification on this matter. Any VU data downloaded by enforcement officers must be securely stored to prevent unauthorised access and stored downloaded data must never be made accessible to third parties unless permission to do this has been granted by the owner of the downloaded data.

All downloading of stored data from a VU or from a driver smartcard must be done when the vehicle is stationary and when the VU is in the Control mode of operation, i.e. with a valid control card inserted – see *section 5.1 Inserting a Card* for information on how to insert a control card into a VU. The actual download of stored data from the VU memory (or an inserted driver card) will be done using approved models of dedicated download equipment. These tools must be compliant with the protocol as laid out in the legislative document 1360/2002 Annex 7. Communication between the VU and the download equipment will take place via the VU Calibration/Download front 6-way connector. Information on the actual method of data download should be found in the literature supplied with the dedicated download device.



When the actual download of the stored data begins (i.e. under control of the dedicated download equipment) a message will be displayed as shown opposite to indicate that the VU downloading process is active. When downloading is complete, a message will be displayed as shown below to indicate this. If the download process is not completed then the pictogram-warning message "**Downloading failed**" will be shown on the VU display to indicate the download failure. If download fails, the control card should be removed from the VU. The connections and download equipment should be checked for faults before the control card is re-inserted and a further attempt to download the required data is made.



If data download cannot be completed and a faulty VU is found to be the cause or if it is unsure whether a card or VU is faulty, the vehicle must be taken to a Tachograph Workshop for VU investigation. A Tachograph Workshop will decommission a VU that is faulty beyond repair. If the control card is faulty then a replacement card must be applied for and the relevant authority contacted for advice (see *Appendix 6 – National Enforcement Agencies*).

10.1 Workshop Return of a Decommissioned VUs Downloaded Data

If a Tachograph Workshop has to decommission a faulty VU then it must download the data stored in the VU and return the data to its owner. This would ensure that a company is able to provide continuous records of driver and vehicle activity for enforcement agency audits. Company Locks can help to identify the ownership of the blocks of data stored in a VUs memory. A company uses its own company cards to 'lock' data in a VU that it owns and thus no other company will be able to view locked-in VU data. However it should also be noted that if a Tachograph Workshop informs a company that it has downloaded data from one of its VUs, a company must still apply **in writing** and supply proof of ownership to the Tachograph Workshop for the return of the downloaded data it owns. Data would normally be returned in an encrypted format for security purposes – a company would need a software decryption key to access the encrypted data. It should also be noted that if Tachograph Workshop held downloaded data is to be passed on to a third party, then due to

data protection laws, a company must give written permission to the Tachograph Workshop for it to be able to do this.

If it is not possible to download data from a faulty VU, then a Tachograph Workshop will issue a Certificate of Undownloadabilty. Any such certificates received by a company should be securely stored for a period of at least one year so that they could be made available for enforcement agency officers during investigations or audits.
Note: a copy of any Tachograph Workshop stored downloaded data can be given to an authorised enforcement officer for investigative purposes without the permission of the data owner if a written request to the Tachograph Workshop is received from the relevant enforcement authority.

11 VU Inspections by Enforcement Officers

An enforcement officer may inspect a vehicles' Digital Tachograph VU system to ensure that it still meets the EU legislation requirements. When inspecting a VU system an officer should check the following:

- That the operation of the recording equipment including data storage on cards is satisfactory.
- The VU operates to within maximum tolerances for speed and distance.
- That the correct type approval mark is shown on the VU.
- All the VU system seals are intact (see *section 13 Sealing of a VU System* for more information).
- The VU installation plaque for validity and content (see *section 12 VU Installation* Plaque for details).
- The vehicle drive wheel tyre size and compare against that recorded on the installation plaque.
- The VU's internally stored vehicle parameters (Vehicle Identification Number (VIN) and Vehicle Registration Number (VRN)) and compare against the actual vehicle data.
- The VU's internally stored calibration data against the values recorded on the installation plaque.
- The accuracy of the UTC clock (Note: if this is inaccurate by more than 20 minutes the vehicle must be taken to a Tachograph Workshop for re-calibration).

Note: if the validity of the vehicle calibration data (either stored or as on the installation plaque) is in doubt, then the vehicle calibration parameters should be independently determined using an approved method such as a rolling road. The recorded values can then be checked against the independently determined values for validity.
During a VU inspection if an enforcement officer uses dedicated equipment to inject simulated speed pulses into a VU via the front connector (e.g. when checking the operation of the VU) then if the vehicle begins to move, the simulated pulses from the front will be ignored at the expense of the real speed pulses coming from the vehicles' motion sensor. It should also be noted that the VU front connector simulated speed pulses **will not** result in data being stored in the VU internal data memory store.

Additionally, due to the security requirements of Digital Tachograph systems, an enforcement officer should carry out a security visual inspection on a VU as shown in Figure 10.

The following list must be checked as indicated on the diagrams:

1. It must be ensured that there is no damage to or drill holes in the entire exterior casing of the VU including rubber acorn, so that a security breach attempt could be made.
2. Any evidence of tampering with the VU seals and labels shall be checked for.
3. Any evidence of additional seals or labels shall be checked for as they might cover drill holes.
4. It must be checked that the heat seal is present.
5. The label positioned as shown in the right hand diagram shall be present and must be in one piece.
6. The hologram with the Stoneridge name and logotype shall be present.

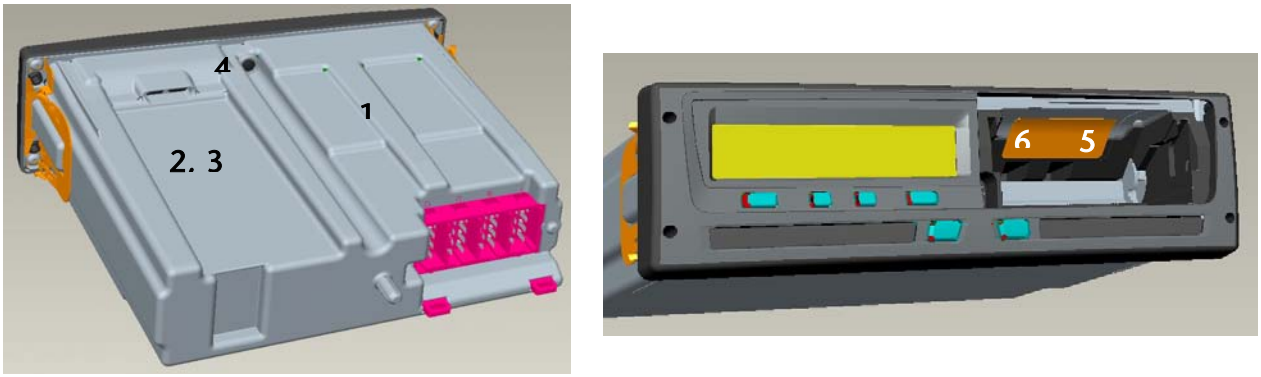


Figure 10 External Inspection of a VU

Please note also that a VU must never be opened even in a Tachograph Workshop, as this would be a breach of Digital Tachograph security and would result in the VU becoming invalid for use. If there is any doubt about a VU inspection the relevant national enforcement agency (see *Appendix 7 - National Enforcement Agencies*) should be contacted for advice. If a VU fails an inspection the vehicle must be taken to a Tachograph Workshop so that the failed VU can be decommissioned and replaced by another unit.

Note: Depending on the Member State of the enforcement officer, local requirements for inspections may vary from that described above please contact national enforcement agencies **directly** (as indicated in *Appendix 7 - National Enforcement Agencies*) for clarification on this matter.

12 VU Installation Plaque

The final part of a VU system installation or inspection procedure, as carried out by Tachograph Workshops, is the completion and fitment of an installation plaque. This is a legal requirement as a correctly completed plaque provides proof that a VU meets the requirements of the EC Council Regulations in terms of system calibration and security. If the plaque is a replacement, the old plaque should have been removed first and the newly completed plaque should be placed in approximately the same position as the old one. Please note that it is a requirement that the plaque is placed on or near the VU and must be clearly visible and easily accessible. An example installation plaque showing the type of information required is shown in Figure 11.

Workshop Details	Calibration Details	Date Determined:	Stoneridge
Name:	W=……. Imp/km	……..	
Address:	K=……...Imp/km		
	L=……mm	……..	
	Tyre Size=…….		
	VIN=…….		

Figure 11 Example Installation Plaque

13 Sealing of a VU System

A vehicles' VU system must be sealed at all times when in use to ensure the integrity of the system. Sealing will initially take place after the installation of the VU system and then subsequently after each Tachograph Workshop inspection, calibration or repair. Sealing of the motion sensor at its connection to the gearbox is a necessity. This is to ensure the integrity of the signal from the vehicle (through the gearbox) to the VU. It should be noted that the sensor cable connections do not require to be sealed as the encrypted signal ensures that undetected tampering is not possible. The VU front programming connector does not require to be sealed as security is provided via the use of workshop cards – after a VU has been activated it cannot be reprogrammed without the insertion of a valid PIN protected workshop card. All connections from the VU system to the vehicle speed limiter system must also be sealed and finally the installation plaque must be sealed unless it is of a type that cannot be removed without damaging it.

Sealing of the motion sensor may be achieved using the same methods as that used for analogue Tachograph systems i.e., by the use of sealing pliers and traditional seals. Authorised holders of valid Workshop cards must carry out resealing of Digital Tachograph systems. Please note that when a VU system is presented to a Tachograph Workshop with a broken seal, as well as inspecting, calibrating and resealing the VU system, a report must be prepared and made available to the relevant authorities as to why the seal was broken.

Figure 12 shows an example of how a motion sensor is sealed at the gearbox. However it should be noted that the actual sealing method used must be authorised by the relevant authorities (see *Appendix 7 - National Enforcement Agencies* for details). As shown in the diagram, the retaining nut for the motion sensor is cross-drilled so that it may be wired and sealed to a suitable drilled bolt securing the gearbox.

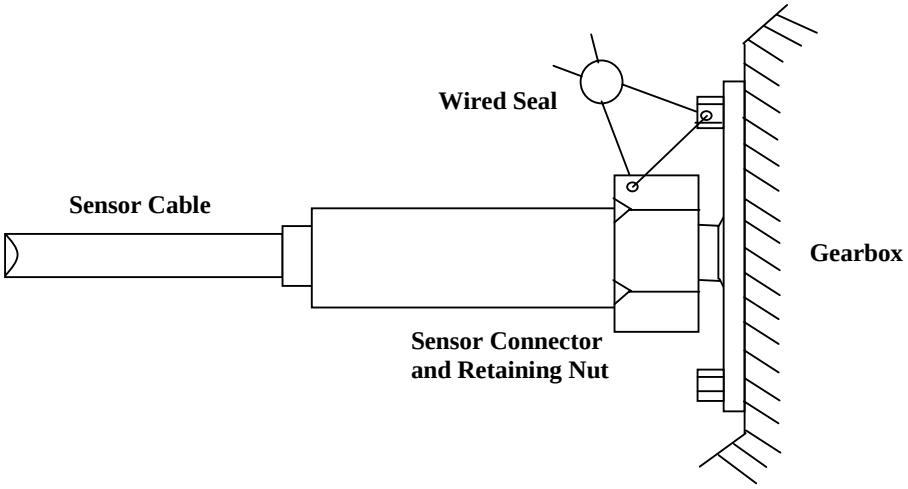


Figure 12 Sealing the Motion Sensor at the Gearbox

14 Stoneridge ADR Digital Tachograph

The ADR version of the Stoneridge VU is approved for use in Dangerous Goods Vehicles. An ADR type VU is identified by the use of the ADR identification symbols as shown in Figure 13.

II3(2)G EEx nA [ib]IIC T6

Figure 13 ADR Identification Symbols

The Stoneridge ADR VU must only be fitted to vehicles that are equipped with a battery master (or isolator) switch. It should be noted that the **explosion protection of the Stoneridge ADR VU is only ensured when the vehicle is stationary and the battery master switch is opened**. When fitting a Stoneridge ADR VU the unit must be mounted within the Truck cabin. To ensure that the VU conforms to IP54, the unit must be mounted with the VU at least level with the horizontal. If a VU is to be mounted at an angle the front fascia must be lower than the rear of the VU. It should also be noted that ADR vehicles might have a safety network integrated into the VU wiring system as well as a battery master switch. If fitted, the safety network will be connected between the main supply from the battery and the VU itself.

The Stoneridge ADR VU is certified according to the EU Commission Directive 94/9/EC. The relevant examination certificate number for this is: TÜV 04 ATEX 2507 X. This number will be displayed on the data label as shown in Figure 14.

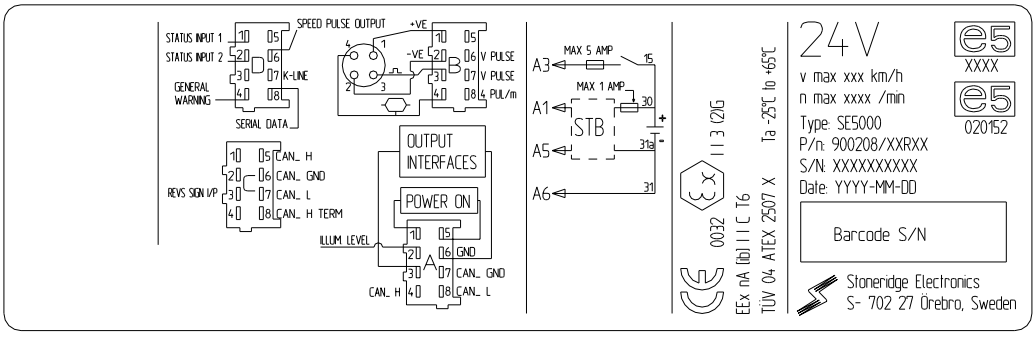


Figure 14 ADR VU Data Label

The permissible ambient operation temperature range for a Stoneridge ADR VU is –25°C to +65°C.

The main differences between the standard Stoneridge Digital Tachograph and the ADR version are all concerned with the situation where the vehicle ignition switch is **off**. The differences are listed as follows:

- Any Smartcards inserted in a VU **CANNOT** be ejected – if smartcard ejection is attempted, a warning message will be displayed to indicate that this function is not possible.
- The VU printer will **not** function at all under this condition.
- The backlights for the display will be switched off and will remain off until the ignition switch is turned on again.
- The backlights for the buttons on the VU fascia will be turned off and will remain off as long as the ignition is off also.

- The supply voltage to pin 5 of the front connector is not active.

ADR VU Electrical Data Specification (all Rear Connector)
Supply Circuit (permanent supply from the vehicle battery, i.e. A1 (+) and A5 (-)): U_n = 24Volts

Ignition System (supply via the battery master switch and the ignition switch from the battery, i.e. A2 (illumination), A3 (ignition supply) and A6 (chassis ground)): U_n = 24Volts

Motion Sensor Connections (compliant with Intrinsic safety Eex ib IIC protection): B1 (Sensor +ve), B2 (Sensor –ve), B3 (Sensor Signal) and B4 (Sensor Encryption).

(**Note**: the motion sensor data is only valid for connection to motion sensor type KITAS 2171.xx according to EU type examination certificate number TÜV 02 ATEX 1842 X).

Appendix 1 - VU Display Symbols

The following is a list of display symbols and combinations that the Stoneridge VU uses:

(a) Basic Display Symbols

	People	Actions	Modes of operation
	Company		Company mode
	Controller	Control	Control mode
	Driver	Driving	Operational mode
	Workshop/test station	Inspection/calibration	Calibration mode
	Manufacturer		

	Activities	Duration
	Available	Current availability period
	Driving	Continuous driving time
	Rest	Current rest period
	Work	Current work period
	Break	Cumulative break time
	Unknown	

	Equipment	Functions		Equipment	Functions
1	Driver slot		2	Co-driver slot	
	Card			Clock	
	Display	Displaying		External storage	Downloading
	Power supply			Printer/printout	Printing
	Sensor			Tyre size	
	Vehicle/vehicle unit				

Specific conditions

OUT	Out of scope		Ferry/train crossing

Miscellaneous

!	Events		Faults		Menu
	Start of daily work period		End of daily work period		Settings
	Location	M	Manual entry of driver activities		Busy
	Security		Speed		Contrast
	Time	∑	Total/summary		Invert
	Eject		Lock		Enter
	Case Opened		Paper		Activation
°C	High Temperature	°C	Low Temperature	°C	High or Low Temperature

Qualifiers

24h	Daily	W	Weekly
2W	Two weeks	+	From or to

(b) Display Symbol Combinations

Miscellaneous

	Control place		From vehicle
	Location start of daily work period		Location end of daily work period
+T	From time	+T	To time
OUT+	Out of scope begin	+OUT	Out of scope end

Cards

Driver card		Company card	
Control card		Workshop card	
No card			

Driving

Driving time for one week		Driving time for two weeks	

Printouts

24h	Driver activities from card daily printout	24h	Driver activities from VU daily printout
!	Events and faults from card printout	!	Events and faults from VU printout
	Technical data printout	>>	Over speeding printout

Manual Entries

?|	Still same daily work period?		End of previous work period?
?	Enter location of start of work period.	?	Enter location of end of work period.

Appendix 2 - VU Location Countries/Regions

The countries (and regions for Spain) that can be used as digital tachograph Locations at the start and end of the daily work period are listed as follows:

(a) Countries

A	Austria,	AL	Albania,	AND	Andorra,
ARM	Armenia,	AZ	Azerbaijan,	B	Belgium,
BG	Bulgaria,	BIH	Bosnia and Herzegovina,	BY	Belarus,
CH	Switzerland,	CY	Cyprus,	CZ	Czech Republic,
D	Germany,	DK	Denmark,	E	Spain,
EST	Estonia,	F	France,	FIN	Finland,
FL	Liechtenstein,	FR	Faeroe Islands,	GE	Georgia,
GR	Greece,	H	Hungary,	HR	Croatia,
I	Italy,	IRL	Ireland,	IS	Iceland,
KZ	Kazakhstan,	L	Luxembourg,	LT	Lithuania,
LV	Latvia,	M	Malta,	MC	Monaco,
MD	Republic of Moldova,	MK	Macedonia,	N	Norway,
NL	The Netherlands,	P	Portugal,	PL	Poland,
RO	Romania,	RSM	San Marino,	RUS	Russian Federation,
S	Sweden,	SK	Slovakia,	SLO	Slovenia,
TM	Turkmenistan,	TR	Turkey,	UA	Ukraine,
UK	United Kingdom, Alderney, Guernsey, Jersey, Isle of Man, Gibraltar,	V	Vatican City,	YU	Yugoslavia,
UNK	Unknown,	EC	European Community,	EUR	Rest of Europe,
WLD	Rest of the world.				

(b) Regions in Spain

AN	Andalucía,	AR	Aragón,	AST	Asturias,
C	Cantabria,	CAT	Cataluña,	CL	Castilla-León,
CM	Castilla-La-Mancha,	CV	Valencia,	EXT	Extremadura,
G	Galicia,	IB	Baleares,	IC	Canarias,
LR	La Rioja,	M	Madrid,	MU	Murcia,
NA	Navarra,	PV	País Vasco.		

Appendix 3 – Control Card and Control Card Activity Stored Data

When a control card is inserted into a VU in order to perform a control activity a record of the control activity is stored on the control card and in the VU as described in the sub-sections that follow.

(a) Control Card Stored Data

A control card has stored on it a single record containing the following card and card holder information:

- The card number
- The issuing Member state, issuing authority name and the issue date
- The card validity start date and expiry date
- The control body name and address
- The surname and forename of the card holder
- The preferred language

Each time a control card is used to carry out a control specific activity, such as printing or downloading for investigative purposes, the following data is stored on the control card:

- The date and time of the control activity
- The type of control activity performed (displaying and/or printing and/or downloading VU and/or card)
- The period downloaded, if applicable
- The VRN and Member State registering authority of the controlled vehicle
- The card number and card issuing Member State, in the case of a controlled card

(b) VU Stored Control Activity Data

Each time a control card is used to carry out a control activity a record of the activity is stored in the VU. The data in each record stored is:

- Date and time of the control
- The control card number and card issuing Member State
- The type of control (displaying and/or printing and/or downloading VU and/or card)

Note: in the case of downloading, the date of the oldest and most recent days downloaded shall also be recorded.

Appendix 4 - Details of Printing Routines

Printouts are obtained via the “Print/Display” sub-menu. Instructions on how to access this sub-menu are listed in *section 7.2 How to Initiate a Printout and How to Stop a Printout*. The full details of the six types of printout available from the “Print/Display” sub-menu of a VU are described in the subsections that follow. Please note that once printing has started it can only be stopped by long-pressing the ‘cancel’ button until the message “▼×▼ Printing cancelled” is displayed to indicate printing has been cancelled. It should be noted that if there is a problem with the printer then a pictogram-warning message will be displayed, with the exact message displayed dependant on the problem as follows:

- “▼P× Printer out of paper” – indicates that the printer is out of paper.
- ““▼↓ Printer low power” – indicates that printing has stopped due to low power.
- “▼↓° Printer low temperature” – indicates that printing has stopped due to low temperature.
- “▼↑° Printer high temperature” – indicates that printing has stopped due to high temperature.
- “▼↕° Printer high/low temperature” – indicates that printing has stopped due to high or low temperature.

(a) Daily Driver Activities from Card

This option is used to provide a copy of the driving activities stored on a driver or workshop smartcard for a selected day. To initiate the printout, press the 'enter' button when the display in the "Print/Display" sub-menu is as shown opposite. If a valid driver or workshop card is **not** inserted in either slot '1' or slot '2', then the warning message "**No driver/ workshop card**" will be shown before the display returns to the previous display.

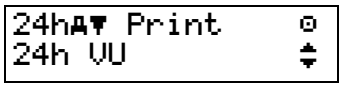
If there are valid Driver or Workshop cards inserted in both smartcard slots, then the VU will need to know which slot contains the card from which the printout information is to be taken. The display will be as shown opposite. Press the 'up' or 'down' buttons to toggle between slots '1' and '2' and when the required slot is highlighted, press the 'enter' button to continue.

The VU then needs to know for which date the printout of the driver activities from the card is required. The display will be as shown, with the current date displayed on the bottom line and the two digits of the day highlighted. Press the 'up' or 'down' buttons to increment or decrement until the correct number is displayed for the day and then press the 'enter' button to accept the day displayed. Repeat this process for the month and year until the correct date for printing is displayed. Please note that when modifying the date, adjustments are restricted to within normal calendar possibilities and also to that for the first and last drivers records stored on the smartcard inserted. To accept the displayed date, press the 'enter' button or press the 'cancel' button to go back and modify the date.

Once the correct date for printing has been accepted, the option will be given to display or to print the driver activities from the card for the selected date. The display will be as shown - press the 'up' or 'down' buttons to toggle between "Paper Print" (i.e. '▼') and "Display" (i.e. '□'). With the required option highlighted, press the 'enter' button to print (or display) the stored data, or to abort the operation, press the 'cancel' button. When the printout is complete, the message "**▼/▼ Printing complete**" will be displayed. Acknowledge the message (as described in *section 9 VU Warnings (Events and Faults Conditions))* and the display will return to the Print/Display sub-menu.

(b) Daily Driver Activities from VU

This option is used to provide a copy of the driver activities stored in a VU for a selected day. To initiate the printout, press the 'enter' button when the display in the "Print/Display" sub-menu is as shown opposite.



The VU then needs to know for which date the printout of the driver activities from VU is required. The display will be as shown, with the current date displayed on the bottom line and the two digits of the day highlighted. Press the 'up' or 'down' buttons to increment or decrement until the correct number is displayed for the day and then press the 'enter' button to accept the day. Repeat this process for the month and year until the correct date for printing is displayed. Please note that when modifying the date, adjustments are restricted to within normal calendar possibilities but also in the normal operation mode (driver card inserted) only the eight previous days can be selected. To accept the displayed date, press the 'enter' button or press the 'cancel' button to go back and modify the date.

Once the correct date for printing has been accepted, the option will be given to display or to print the VU driver activities for the selected date. The display will be as shown - press the 'up' or 'down' buttons to toggle between "Paper Print" (i.e. '▼') and "Display" (i.e. '□'). With the required option highlighted, press the 'enter' button to print (or display) the stored data, or to abort the operation, press the 'cancel' button. When the printout is complete, the message "**▼/▼ Printing complete**" will be displayed. Acknowledge the message (as described in *section 9 VU Warnings (Events and Faults Conditions))* and the display will return to the Print/Display sub-menu.

(c) Warnings from Card (Events and Faults)

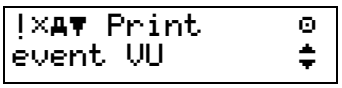
This printing option is used to provide a copy of all Events and Faults stored on a driver smartcard. To initiate the printout, press the 'enter' button when the display in the "Print/Display" sub-menu is as shown opposite. If a valid driver card is not inserted in either slot '1' or slot '2', then "**No driver workshop card**" will be shown as a warning message before the display returns to the previous display.

If there are valid driver cards inserted in both smartcard slots, then the VU will need to know which slot contains the card from which the printout information is to be taken. The display will be as shown opposite. Press the 'up' or 'down' buttons to toggle between slots '1' and '2' and when the required slot is highlighted, press the 'enter' button to continue.

The option will then be given to display or to print the Events and Faults from the card. The display will be as shown - press the 'up' or 'down' buttons to toggle between "Paper Print" (i.e. '▼') and "Display" (i.e. '□'). With the required option highlighted, press the 'enter' button to print (or display) the stored data, or to abort the operation, press the 'cancel' button. When the printout is complete, the message "**▼✓▼ Printing complete**" will be displayed. Acknowledge the message (as described in *section 9 VU Warnings (Events and Faults Conditions))* and the display will return to the Print/Display sub-menu.

(d) Warnings from Vehicle Unit (Events and Faults)

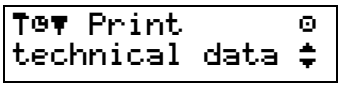
This printing option is used to provide a copy of all Events and Faults stored in a VU. To initiate the printout, press the 'enter' button when the display in the "Print/Display" sub-menu is as shown opposite.



The option will then be given to display or to print the stored VU Events and Faults. The display will be as shown - press the 'up' or 'down' buttons to toggle between "Paper Print" (i.e. '▼') and "Display" (i.e. '□'). With the required option highlighted, press the 'enter' button to print (or display) the stored data, or to abort the operation, press the 'cancel' button. When the printout is complete, the display will show the pictogram-message "**▼✓▼ Printing complete**" to indicate this. Acknowledge the message (as described in *section 9 VU Warnings (Events and Faults Conditions))* and the display will return to the Print/Display sub-menu.

(e) Technical Data

This printing option is used to provide a copy of technical data with regard to a VU, e.g. calibration factors, VIN etc. To initiate the printout, press the 'enter' button when the display in the "Print/Display" sub-menu is as shown opposite.



The option will then be given to display or to print the stored technical data. The display will be as shown - press the 'up' or 'down' buttons to toggle between "Paper Print" (i.e. '▼') and "Display" (i.e. '□'). With the required option highlighted, press the 'enter' button to print (or display) the stored Technical data, or to abort the operation, press the 'cancel' button. When the printout is complete, the display will show the pictogram-message "**▼✓▼ Printing complete**" to indicate this. Acknowledge the message (as described in *section 9 VU Warnings (Events and Faults Conditions))* and the display will return to the Print/Display sub-menu.

(f) Over-speeding Data

This printing option is used to provide a copy of over-speeding events stored in a VU. To initiate the printout, press the 'enter' button when the display in the "Print/Display" sub-menu is as shown opposite.

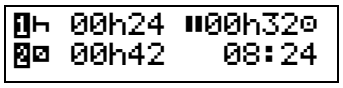
The option will then be given to display or to print the stored Overspeed data. The display will be as shown - press the 'up' or 'down' buttons to toggle between "Paper Print" (i.e. '▼') and "Display" (i.e. '□'). With the required option highlighted, press the 'enter' button to print (or display) the stored

Overspeed data, or to abort the operation, press the 'cancel' button. When the printout is complete, the message "▼▽▼ Printing complete" will be displayed. Acknowledge the message (as described in *section 9 VU Warnings (Events and Faults Conditions))* and the display will return to the Print/Display sub-menu.

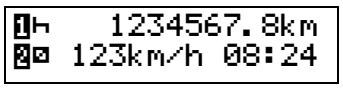
Appendix 5 - Display Screens Selectable Whilst 'Driving'

The full details of the five display screens that are available whilst in the normal 'driving' mode are shown below. When in the standard 'Driving' mode, press the 'up' or 'down' buttons to scroll through the different driving displays shown as follows.
Note: in most of the displays that follow the top line relates to the driver ("1") and the bottom line to the crew ("2").

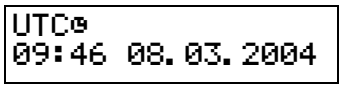
1. Default Display. The example display shown opposite is the default driving display for the VU. The top line shows the Driver's current activity and time (24 minutes rest in this case) and the Driver's cumulative break time. The right hand corner shows the current mode of operation of the VU (i.e. '⊙' for Operational Mode in this case). The second line initially shows current activity and time for the Crew (42 minutes available in this case) and then has to the right hand side of the display the current local offset time in 24-hour format.



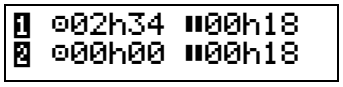
2. Speed/odometer/local time display. As shown opposite, the speed is a 3-digit value in km/h, the odometer is an 8-digit value in km (i.e. from 0 to 9,999,999.9 km) and the local 'offset' time is shown in 24-hour format.



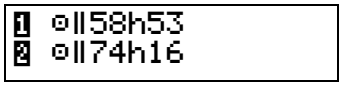
3. UTC Date and Time Display (see *section 8.1 UTC Time and Local Time* for a full description of UTC). As shown on the bottom line, the UTC time is in 24-hour format and the date in dd.mm.yyyy format.



4. Drive and Break display. The continuous driving time and the cumulative break time for the Driver and Crew and shown on the top and bottom lines of the display respectively.



5. Two-Week Driving Time display. The cumulative driving for the previous week and the current week in hours and minutes is displayed with the Driver on top line and Crew on the bottom line.



Appendix 6 - Printer Spare Parts

A list of Stoneridge Approved Printer parts is shown below. This list is correct at the time of publication only - please contact Stoneridge directly for availability and prices (Note: see also *Appendix 9 - Stoneridge Electronics Aftermarket Contact Details*).

Printer Approved Parts	Part Number
Printer Paper Cassette	6800-001
Printer Paper Roll	6800-002

Appendix 7 - National Enforcement Agencies

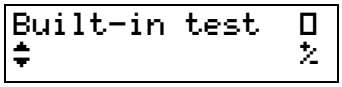
A list of National Enforcement Agencies is shown below. These agencies **must** be contacted **directly** on any matter relating to the legal implications of Digital Tachograph systems.

Enforcement Agency Name	Country	Telephone Number	Address
Vehicle & Operator Services Agency	UK	+44 (0)870 6060440	Berkeley House, Croydon Street, Bristol, BS5 0DA.
	Austria		
	Belgium		
	Cyprus		
	Czech Republic		
	Denmark		
	Estonia		
	France		
	Finland		
	Germany		
	Greece		
	Hungary		
	Italy		
	Latvia		
	Lithuania		
	Luxemburg		
	Malta		
	Netherlands		
	Poland		
	Portugal		
	Ireland		
	Slovakia		
	Slovenia		
	Spain		
	Sweden		

Appendix 8 - Troubleshooting

(a) Built-In Tests

If there is a suspected problem with a VU then the functionality of different parts of the VU can be checked via the 'Built-in Test' sub-menu. This menu is accessed via the main menu/settings sub-menu as described in *section 8 Settings Menu*, i.e. press the 'enter' button when the settings sub-menu display shows the 'Built-in Test' option (i.e., "**Settings Built-in test**"). The 'Built-In Test' sub-menu display will be similar to that shown opposite. Press the 'up' or 'down' buttons to highlight the required sub-function and then the press the 'enter' button to initiate the test. The functions available in the sub-menu are listed below. It should be noted that the 'Built-in Test' mode is not active when a vehicle is moving and tests will automatically stop if a card is inserted. A 'Built-in Test' can be stopped at any time by pressing the 'cancel' button.



Display Pictogram	Test Type	Description	Action to be Taken
	Display Test	This is used to test the VU display. Selecting this test will result in the display going all light for 1 second, all dark for 1 second and finally a pattern of rows of dark and light squares will be displayed for 1 second.	If the display is unreadable the vehicle **must** be taken to a Tachograph Workshop for VU investigation.
	Invert Display Test	This is used test the inversion of the VU display. This test causes the display to invert (i.e. dark becomes light / light becomes dark) for 2 seconds before returning to the original display.	As for the display test.
	Printer Test	This is used to print a test printout. Selecting this test will result in a default printout being emitted from the VU.	The paper cassette and paper should be checked and replaced if necessary. If the printer still fails the vehicle **must** be taken to a Tachograph Workshop for VU investigation.
	Keypad Test	This is used to check the operation of the VU buttons. If this test is selected the user will be prompted to press all of the buttons in turn from left to right - each button press must be done within 2 seconds or the test will automatically fail.	If a button fails the fascia should be wiped gently with a damp cloth and mild detergent solution. Repeated failure of a button will mean that the vehicle must be taken to a Tachograph Workshop for VU investigation.
	Smartcard Test	This is used to check VU inserted smartcards. For the smartcard test to be carried out a card must already be inserted in the required slot. When the Smartcard test is initiated the VU will read the inserted card and then display the owners name for 2 seconds.	See below.

In the case of the smartcard test if it can be clearly identified that a smartcard is faulty (either by checking that the suspected card is faulty in a number of different VUs or by checking if a suspected VU is faulty by trying other 'known good' cards in it), then a VU **must not** be taken to a Tachograph Workshop for investigation but a new smartcard should be applied for and the relevant authority contacted for advice (see *Appendix 7 - National Enforcement Agencies*).

If a VU is found to be faulty or if it is unsure whether a card or VU is faulty, the vehicle must be taken to a Tachograph Workshop for VU investigation. A Tachograph Workshop will decommission a VU that is faulty beyond repair.

(b) Opening the Smartcard Drawers With No Power or Whilst Disconnected

In the event of a VU drawer or power failure, in order to gain access to any smartcards held in the VU the unit must be presented to a Tachograph Workshop to gain access to the cards. If a control card becomes locked in a VU and a Tachograph Workshop is not available to retrieve it then the following **emergency procedure should be carefully carried out to retrieve the control card**.

Initially the VU should be removed from its dashboard mounting cage via the four small holes that can be seen at the sides of the front fascia, as indicated in Figure 15. To remove the unit, a pair of VU extraction tools (6350-023) should be inserted into the two pairs of holes, with the tools perpendicular to the VU. Once pushed in, both extraction tools should be pushed out sideways and then pulled at the same time. The tools will grip the unit and enable it to be pulled forward out of the cage.

Figure 15 Position of VU Removal Holes

With the VU out of its mounting cage the drawers should only be released **without power** connected. As shown in Figure 16, on the bottom of the VU there are 2 small breakout slots. Use a thin sharp tool (e.g. a small screwdriver) to carefully penetrate the thin breakout slot behind the card drawer that is to be opened. If a drawer eject tool is inserted in the penetrated slot as shown and light pressure is applied followed by angled movement of the eject tool towards the display side of the VU, the appropriate drawer will unlock and spring out as shown.

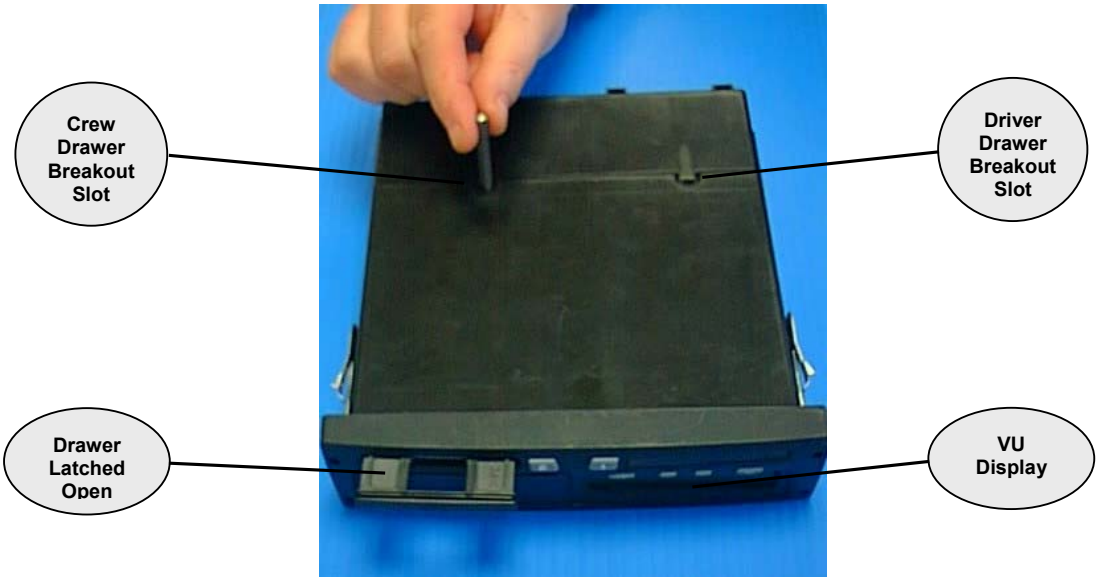


Figure 16 Opening the Smartcard Drawers Without Power

Warning: When the card has been ejected as described above, the unit will be decommissioned since there is a hole in the cover.

Appendix 9 - Stoneridge Electronics Aftermarket Contact Details

Any queries on the Stoneridge Electronics VU discussed in this manual should be made to one of the Stoneridge Electronics Aftermarket contacts listed below:

UNITED KINGDOM:

Stoneridge Electronics Ltd
Charles Bowman Avenue
Claverhouse Industrial Park
Dundee
Scotland DD4 9UB
Tel.: +44 (0)871 700 7070
Fax: +44 (0)870 704 0002
E-mail: sales@elc.stoneridge.com

GERMANY / DEUTSCHLAND:

Stoneridge GmbH
Paradiesweg 11
D-73733 Esslingen
Tel.: +49 (0)711-99 33 82-0
Fax: +49 (0)711-99 33 82-12
E-mail: info@elc.stoneridge.com

FRANCE:

Stoneridge Electronics France
Zone Industrielle De St Etienne
Chemin De Cazenave
64100 Bayonne
Tel.: +33 (5) 59 50 80 46
Fax: +33 (5) 59 50 80 41
E-mail: info@elc.stoneridge.com

SPAIN / ESPAÑA:

Stoneridge Electronics España
Avda. Severo Ochoa 38,
Pol. Ind. Casa Blanca
28108 ALCOBENDAS
MADRID
Tel.: +34 (91) 662 32 22
Fax: +34 (91) 662 32 26
E-mail: info@elc.stoneridge.com

See also at http://www.stoneridge-electronics.com/“Aftermarket Division”.

Appendix 10 - Technical Data

(a) VU Technical Parameters

The technical parameters for the Stoneridge Electronics VU are listed below.

Operating Voltage Range	24Volt System: 18-32Volts 12Volt System: 9.4-16Volts
Normal Operating Temperature	-25°C to +70°C
Storage Temperature	-40°C to +85°C
Weight	Less than 700g (including paper roll).
Dimensions	188 x 218 x 59 mm (approx)
Current Consumption (Normal Operation)	65mA @24V (approx); 100mA @12V (approx)
Current Consumption (Ignition off)	45mA @24V (approx); 60mA @ 12V (approx)
LCD	Dot-Matrix LCD (19 x 98 pixels); Visible Area 72x16.6mm; 2 Rows x 16 Characters
Printer	Paper Width 57-58mm; Paper Roll Diameter 30mm (max); 24 Characters per Line.

(b) Calibration and Download Front Connector

The calibration and download front connector is a 6-pin connector and the pin pitch is 2.54mm. The connector is located behind the paper cassette (see *3 Description of the Controls* for details). The pin-out connections, as viewed from the front of the connector, are shown in Figure 17. The functional descriptions of the pins are also listed below.

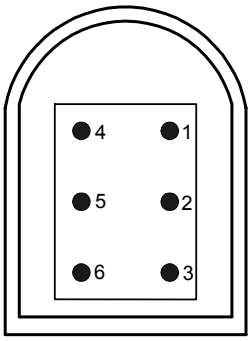


Figure 17 Calibration and Download Front Connector Pin-out

Pin	Name	Functional Description
1	Battery minus	Connected to battery minus, A5.
2	Data comms.	The software and hardware configuration of this serial comms interface is in accordance with ISO 14230. This is used for bi-directional K-line I/O.

3	RxD comm.	Serial Data to recording equipment, VU. Complies with RS232 specifications at baud rates from 9600 -> 115200 bps.
4	Calibration I/O.	Calibration Signal Input/Output.
5	Battery plus.	Permanent Power Output. Voltage range is battery supply – 3V @ 40mA.
6	TxD comm.	Serial Data from recording equipment, VU. Complies with RS232 specifications at baud rates from 9600 -> 115200 bps.

(c) Rear Socket Connections

The rear connector is a 32-pin device and the connector pin-outs according to the ISO16844 connector format, and as viewed from the rear of the unit, is shown in Figure 18.

Pin numbers marked as striped pins in Figure 18 below (B5, D3 and D8), describe optional pins/functions added by Stoneridge to the connector format ISO16844-1. The functional descriptions that follow for these pins are in **bold** and *italic* format.

Pin numbers marked as black pins in Figure 18 below (B8, C1 to C8 and D1, D2, D4, D6 and D7) describe optional pins/functions defined by ISO16844-1. The functional descriptions that follow for these pins are in **bold** format.

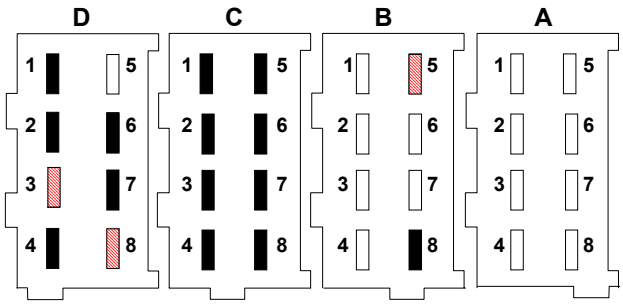


Figure 18 Rear Socket Connections – Optional Functions

It should be noted that the corresponding plugs for connection to sockets A, B, C and D are keyed and colour coded (White, Yellow, Red and Brown respectively) to prevent incorrect insertion.

Pin	Name	Functional Description
A1	Battery plus +	Permanent power supply line powering the VU.
A2	Illumination	Connection to illumination power supply. For this VU it is an analogue input.
A3	Ignition supply	Power supply line connected to the vehicle ignition supply and used to power appropriate input / output interfaces.
A4	CAN_H	CANbus HIGH signal line.
A5	Battery minus -	Return line for the permanent power supply (A1).
A6	Ground, GND	Return line for ignition supply, normally connected to local chassis ground.
A7	CAN_GND	CANbus GND line, which is connected to VU GND (A5) via a series combination of a 1Ω Resistor and 680nF capacitor.
A8	CAN_L	CANbus LOW signal line.
B1	Positive supply to motion sensor	Motion sensor supply signal that is derived from the permanent power supply.

B2	Battery minus to motion sensor	Return Line for motion sensor supply (B1).
B3	Motion sensor speed signal	Real time speed signal from the motion sensor.
B4	Speed data signal	Encrypted Channel (bi-directional) from the motion sensor. Is used to verify the signal integrity.
B5	***General purpose input***	***Input signal to indicate an event to the processor.***
B6	Speed pulse output	Positive going pulse output signal triggered by each pulse from the motion sensor. Can be used as an alternative customer variant V-Pulse signal.
B7	Speed pulse output	Positive going pulse output signal triggered by each pulse from the motion sensor. The standard ISO V-Pulse signal.
B8	Distance signal, 4 pulses / m	An output string of positive going pulses generated at a rate corresponding to 4 pulses per metre.
C1	**NC**	**This pin is not connected.**
C2	**Battery minus -**	**Return line for the battery supply.**
C3	**Revs signal input**	**This input signal is monitored by the processor and is used to determine engine speed. The input line is connected to the W terminal of the alternator, KL_W.**
C4	**NC**	**This pin is not connected.**
C5	**CAN_H**	**Alternative CANbus HIGH signal line.**
C6	**CAN_GND**	**Alternative CANbus GND line, which is connected to VU GND (A5) via a series combination of a 1Ω Resistor and 680nF capacitor.**
C7	**CAN_L**	**Alternative CANbus LOW signal line.**
C8	**Internal resistor to CAN_H**	**Connected to CAN_H on A4 via a 120Ω resistor.**
D1	**Status input 1**	**Input, which signals that an event may be recorded.**
D2	**Status input 2**	**Alternative event input, which signals that an event may be recoded.**
D3	***Positive supply***	***An output supply suitable for status inputs.***
D4	**General tachograph warning output**	**This is a general open collector output controlled by the processor.**
D5	Over speed output	An output which is active when an over speed condition is detected.
D6	**Speedometer output**	**An open collector output or an ISO16844 output controlled by the processor. It is a rectangular waveform that is used to drive a vehicles' speedometer.**
D7	**Data comm. I/O K-line**	**The software and hardware configuration of this interface is in accordance with ISO 14230.**
D8	***Serial data output line***	***Serial data output channel continuously transmitting speed, distance, time, date, engine revs, driver and crew duty information in a Stoneridge Electronics proprietary format.***

Note: the CANbus (Controller Area Network) is a versatile vehicle communications system. It is a serial bus system that is used as an open communication system for intelligent devices. It functions as an interface between the Tachograph, the vehicle instrument cluster and other systems within a vehicle. Different vehicle manufacturers have different CANbus specifications and thus VUs are not interchangeable between different

manufacturers vehicles. The CANbus transmission lines CAN_H and CAN_L are protected against short circuits and electrical transients, which may occur in an automotive environment. In case of short circuit (CAN_H to CAN_L or Ground and vice-versa) the protection circuit recognises this fault and the CAN transmitter output stages are disabled.

(d) Diagnostic Trouble Codes (DTCs)

A list of the Stoneridge Digital Tachograph DTCs is shown below. For all DTCs that are stored in a VU, a check should be made to determine whether the DTC is still active or is inactive. The reason for the DTC should be determined and appropriate action taken as described in the table that follows.

DTC	DTC Description	Suggested Action To Be Taken
0x2007	Sensor power supply above maximum value.	Check vehicle and motion sensor power supply levels. If DTC remains active for no apparent reason the vehicle must be taken to a Tachograph Workshop for investigation where they can check the motion sensor operation and all wiring and replace the sensor if faulty.
0x2003	Sensor power supply below minimum value.	As DTC 0x2007.
0x2004	Sensor power supply no signal	As DTC 0x2007.
0x0007	VU power supply above maximum value.	Check vehicle power supply levels and the power supply input to the VU. If DTC remains active for no apparent reason the vehicle must be taken to a Tachograph Workshop for VU investigation where they can fully check all connections and the VU operation.
0x0003	VU power supply below minimum value.	As DTC 0x0007.
0x0004	VU power supply no signal.	As DTC 0x0007.
0x0200	Error on Driver Card in slot 1.	Eject card and check. Replace card if necessary (see note 1 below). Check VU with known good Driver card. If DTC remains active for no apparent reason the vehicle must be taken to a Tachograph Workshop for VU investigation.
0x0300	Error on Driver Card in slot 2.	As DTC 0x0200.
0x0660	Printer Paper is out.	Replace paper if necessary. If DTC still active replace paper cassette. If DTC remains active for no apparent reason the vehicle must be taken to a Tachograph Workshop for VU investigation and decommissioning if necessary.
0x2180	No Speed signal from Sensor	Check the motion sensor/VU wiring and check for evidence of tampering. If DTC remains active for no apparent reason the vehicle must be taken to a Tachograph Workshop for investigation where they can fully check the motion sensor operation and all wiring and replace the sensor if faulty.
0x2280	Invalid speed signal or data link error.	As DTC 0x2180.
0x2380	Data link error between speed sensor and vehicle unit.	Check the motion sensor/VU wiring and check for evidence of tampering. If DTC remains active for no apparent reason the vehicle must be taken to a Tachograph Workshop for investigation where they can fully check the motion sensor operation and all wiring, replace the sensor if faulty and re-Pair the motion sensor and VU if required.
0x2452	Speed Sensor – VU signature mismatch.	The sensor ID is not the same as during calibration. Check the motion sensor/VU wiring and check for evidence of tampering. If DTC remains active for no apparent reason the vehicle must be taken to a Tachograph Workshop for investigation where they can check sensor operation, re-Pair the motion sensor and VU and re-calibrate the VU system.

0x0800	Time / date error.	Check VU UTC time accuracy and adjust if necessary. If UTC time inaccurate by more than 20 minutes or if the DTC remains active for no apparent reason, the vehicle must be taken to a Tachograph Workshop for VU investigation and/or recalibration.
0x0900	Ignition off, but speed pulses are present.	Check the motion sensor/VU wiring and check for evidence of tampering. Check speed pulses are not being injected through front connector. If DTC remains active for no apparent reason the vehicle must be taken to a Tachograph Workshop for investigation where they can fully check motion sensor operation and replace sensor if faulty.
0x0A70	CANbus internal error.	Check the CANbus settings and wiring. Check CANbus present in vehicle. If DTC remains active for no apparent reason the vehicle must be taken to a Tachograph Workshop for VU investigation.
0x0B78	CANbus off.	As DTC 0x0A70.
0x1177	No signal between VU and CAN communication instrument.	Check the VU CANbus wiring. Check CANbus settings and check CANbus present in vehicle. Check instrument cluster operation. If DTC remains active for no apparent reason the vehicle must be taken to a Tachograph Workshop for VU investigation.
0x0C31	Checksum error in VU Program memory.	The vehicle must be taken to a Tachograph Workshop for VU investigation and probable decommissioning.
0x0D33	Read/Write Error in VU Calibration Memory.	As DTC 0x0C31.
0x0D40	Calibration Error.	The vehicle must be taken to a Tachograph Workshop for re-calibration of the VU system. If DTC remains active for no apparent reason the VU would be decommissioned.
0x0700	Printer Error.	Check printer function. Replace paper cassette and paper if necessary. If DTC remains active for no apparent reason the vehicle must be taken to a Tachograph Workshop for VU investigation and decommissioning if necessary.
0x0400	Error in Card 1 Reader.	The vehicle must be taken to a Tachograph Workshop for VU investigation and probable decommissioning.
0x0500	Error in Card 2 Reader.	As DTC 0x0400.
0x0F00	Keyboard Error.	Check VU button function (see *section Appendix 8 - Troubleshooting* for more details). If button repeatedly fails or DTC remains active for no apparent reason the vehicle must be taken to a Tachograph Workshop for VU investigation and decommissioning if necessary.
0x2508	Internal Sensor Error.	Check the motion sensor/VU wiring and check for evidence of tampering. If DTC remains active for no apparent reason the vehicle must be taken to a Tachograph Workshop for investigation where they can fully check motion sensor operation and wiring and replace the sensor if faulty.
0x3000	B7 Speed Pulse Output.	Check the VU wiring and the external equipment connected to B7 output for faults. If DTC remains active for no apparent reason the vehicle must be taken to a Tachograph Workshop for investigation.
0x0139	Internal Error in VU.	The vehicle must be taken to a Tachograph Workshop for VU investigation and probable decommissioning.
0x1260	Driving Without a Card (Driver or Workshop)	Highlight that driving must be done with a valid Driver or Workshop card inserted. Report as necessary.

Notes:

1. Where it can be clearly identified that a smartcard is faulty (either by checking that the suspected card is faulty in a number of different VUs or by checking if a suspected VU is faulty by trying other 'known good' cards in it), then a new card should be applied for and the relevant authority contacted for advice (see *Appendix 6 – National Enforcement Agencies*).

2. If a VU is found to be faulty or if it is unsure whether a card or VU is faulty, the vehicle must be taken to a Tachograph Workshop for VU investigation. A Tachograph Workshop will decommission a VU that is faulty beyond repair.

Appendix 11 - VU Driving Display and Main Menu Navigation

Figure 19 below gives an overview of the driving displays (left hand side) and main menu structure (right hand side) for the VU and shows how to navigate between them using the 'up', 'down', 'enter' and 'cancel' buttons. It should be noted that the main menu structure shown is for operational (driver card inserted) and calibration (workshop card inserted) modes of operation **only**. In the control mode of operation (i.e. with a valid control card inserted) only the 'Print' and 'Settings' main menu items are available.

It should also be noted that driving with a control card inserted will result in the VU display showing the warning message "**Driving not correct card**" – a vehicle **should not** be driven with a control card inserted.

Note: Any 'Begin' or 'End' place location changes done via the main menu will **only** effect the Driver smartcard locations. If the Crew smartcard 'Begin' or 'End' place locations require changing, these must be done whilst inserting or removing the Crew smartcard from the VU respectively.

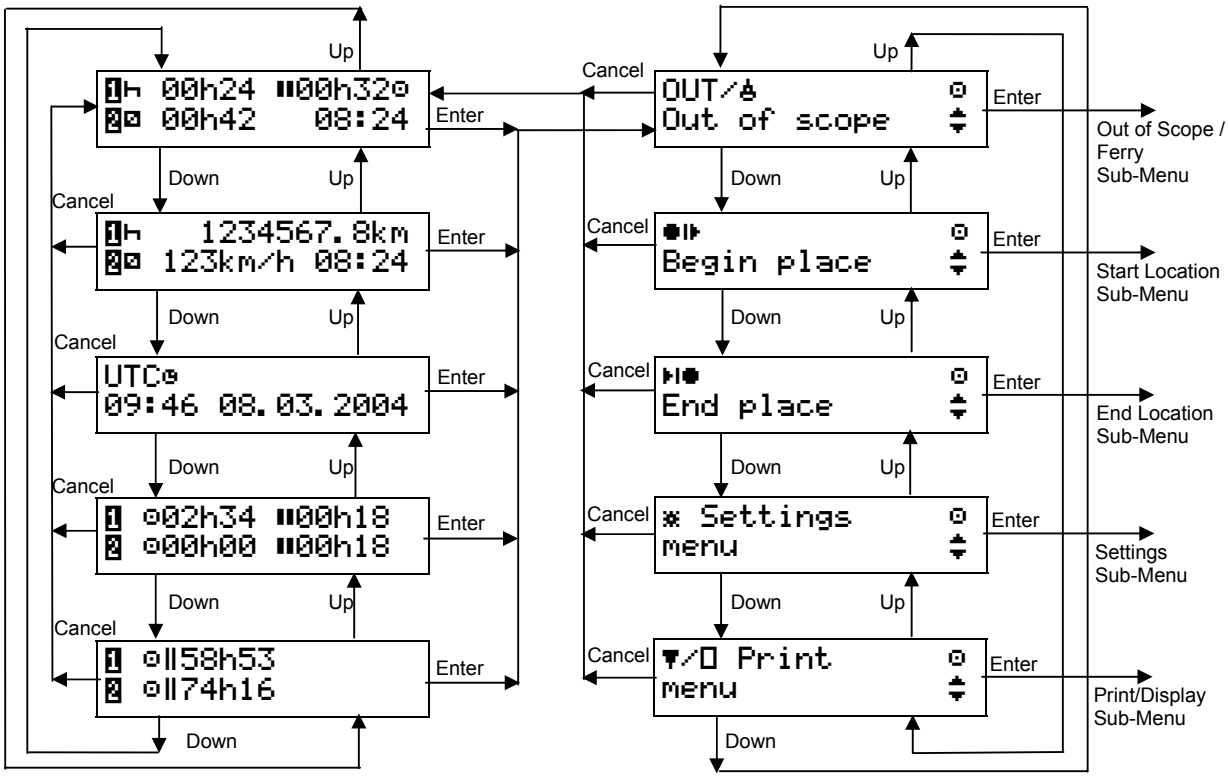


Figure 19 Driving Displays and Main Menu Navigation

Appendix 12 - Glossary of Terms

Listed below are explanations of common terms that are used throughout the manual.

VU – this is the Digital Tachograph radio sized vehicle unit.

Crew – this is the currently off-duty driver or co-driver in a dual-driver vehicle.

Available – this is in-active time spent as Crew in a moving vehicle or time spent whilst a Driver is waiting to start driving (e.g. waiting for passengers to arrive or for paperwork to be completed etc).

Work – this is non-driving active work (e.g. loading a vehicle).

Long Press – this is pressing and holding a VU button for two seconds or more.

Short Press – this is pressing and releasing a VU button in less than 1 second.

Daily Work Period – this is the time from the start to the end of a drivers' working day.

Out of Scope – this is any driving carried out on a road that is not covered by EU Drivers' hours laws.

UTC – this is Universal time coordinated and is an incremental count of the number of elapsed seconds since 1st January 1970.

Local Time – this is the time shown on the VU standard driving display and is the current time of the country in which driving is being done.

Card Insertion Time – this is the time at which a smartcard was inserted into a VU i.e. when the drawer was closed.

Card Withdrawal Time – this is the time at which a smartcard was withdrawn from a VU i.e. when the drawer was opened.

IDE – Intelligent dedicated equipment. This is equipment that enables interaction with a VU via the front calibration/download connector.

Tachograph Workshop – for the purposes of this manual, this is defined as any premises that have been approved to fit, replace, calibrate and inspect Stoneridge VUs.

Motion Sensor – this is used to provide a VU with encrypted speed signal pulses from the vehicle gearbox. Thus a motion sensor is also referred to as an encrypted sender.