Training Support Document

LVD Installation, Commission & Primary Site Maintenance

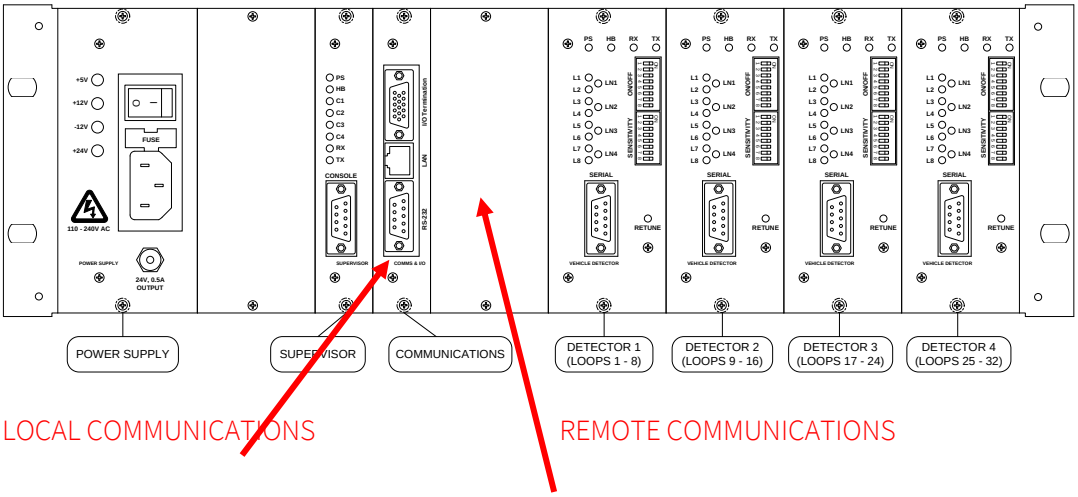
XL-1000-I

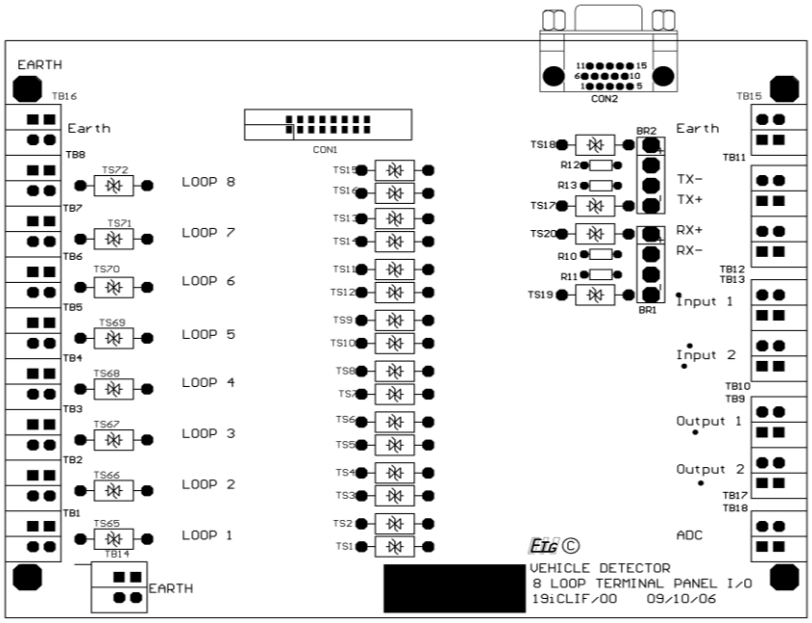
Version Control

Version Number	Date	Author	Change Notes
1.0	20/10/2015	Paul Higgins	Initial Release
1.1	31/03/2021	Damien Cox	General format update and typographical corrections

Table of Contents

1. LVD Chassis Component Infrastructure



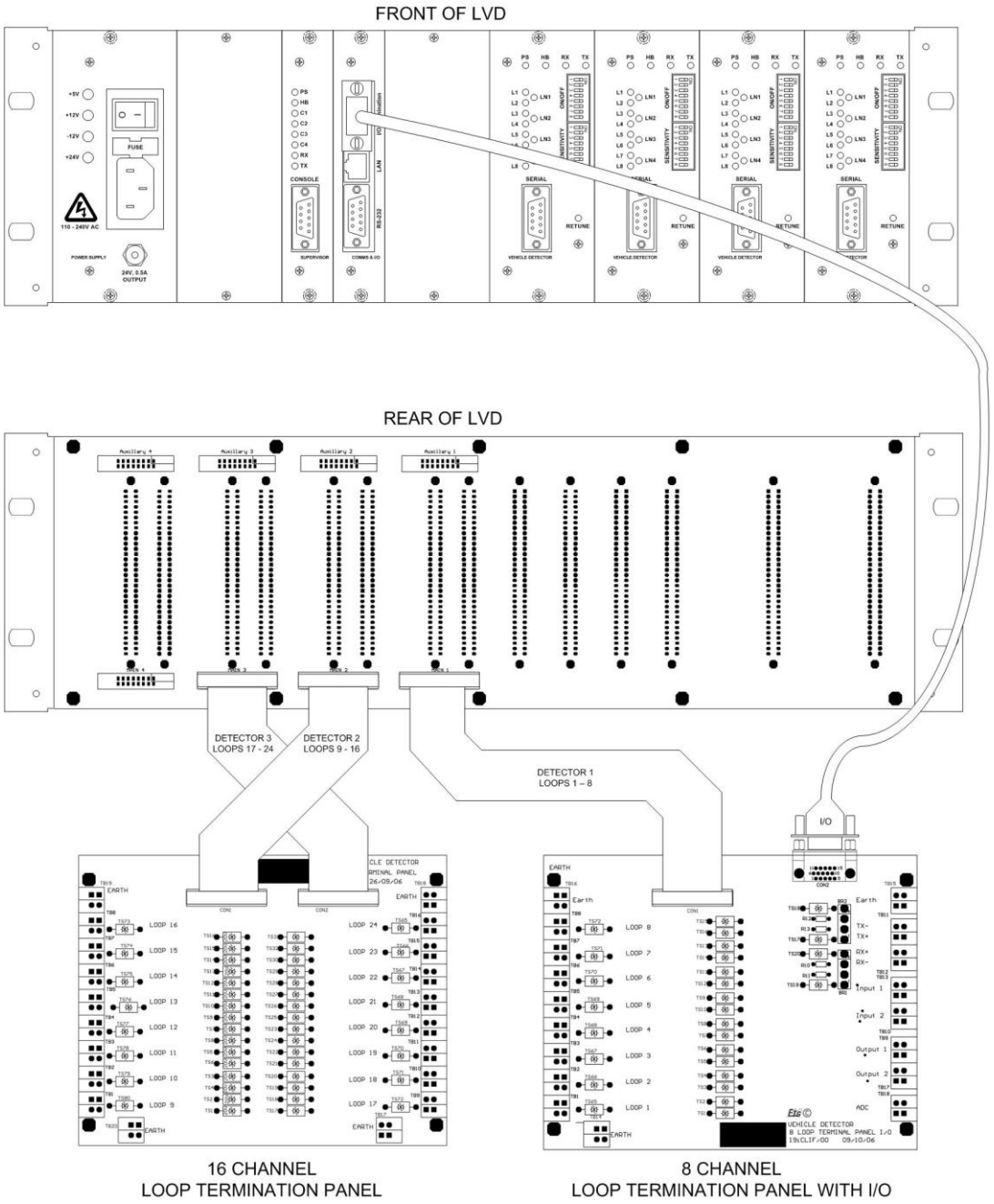


Field termination panel

Several versions of Field Termination Panels are available. The example above displays 8 loop channels, Digital Input/Output and Galvanic isolation Rs-485. There is a version with 8 loop channels and either 4 or 8 piezo inputs. There is another version with 8 loop channels & temperature, battery level monitoring and Digital I/O. There is a version with 16 loop channel inputs.

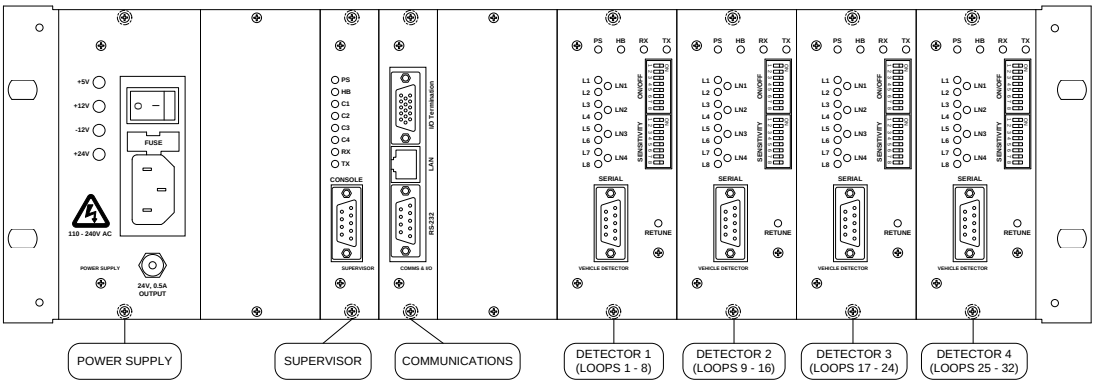
All Field Termination Panels have a provision for an 'Earth' connection (see above). A connection should be made between the Earth Terminal and the Cabinet Earth – Verify this connection as either a fastening screw or an earth wire connection. This is not a safety Earth.

The chassis 'equipment' earth should be connected to the Earth connection on the Field Termination Panel. All loop feeder shielding tails should be connected to the Earth connection on the Field Termination Panel. <u>This must be verified.</u>



This figure displays the interconnection between the LVD chassis and the Field Termination Panel.

2. Front Panels



Power Supply

- Mains Switch & EMC filter
- Fuse – replace only with 3-amp fuse
- Power Supply LEDS – minimum 5Vdc and 12Vdc illuminated (other LEDs according to configuration)
- UPS Option includes Battery LOW and Battery Fail Indicators – second panel from left.

Supervisor

- PS LED power supply
- HB LED – RUN OK (Heartbeat)
- C1-C4 'live' cards
- RX receive
- TX transmit.

Communications

- No display.

Detector Cards

- Switch Channels ON/OFF
- Basic sensitivity HI-LO
- RETUNE – press for retune of loops, upon completion if loop is unoccupied the LED off.
- PS LED – power supply
- HB LED – RUN OK (heartbeat)
- RX Receive instruction FROM supervisor card
- TX Transmit data TO supervisor card
- L1 & L2 Loop pair – illuminate when occupied by vehicle otherwise should be OFF
- LN1 through LN4 – illuminate when respective pair sequence is valid
- Same for other channels.

Software functions facilitate sensitivity 1-10 and individual channel retune. The retune takes approximately 15ms.

3. In-Pavement Sensors and Site Issues

A typical installation is composed of the LVD chassis housed in a weatherproof roadside cabinet and in-road sensors – loops and or piezos. The LVD chassis operational performance is inherently related to the quality of the in-pavement sensors.

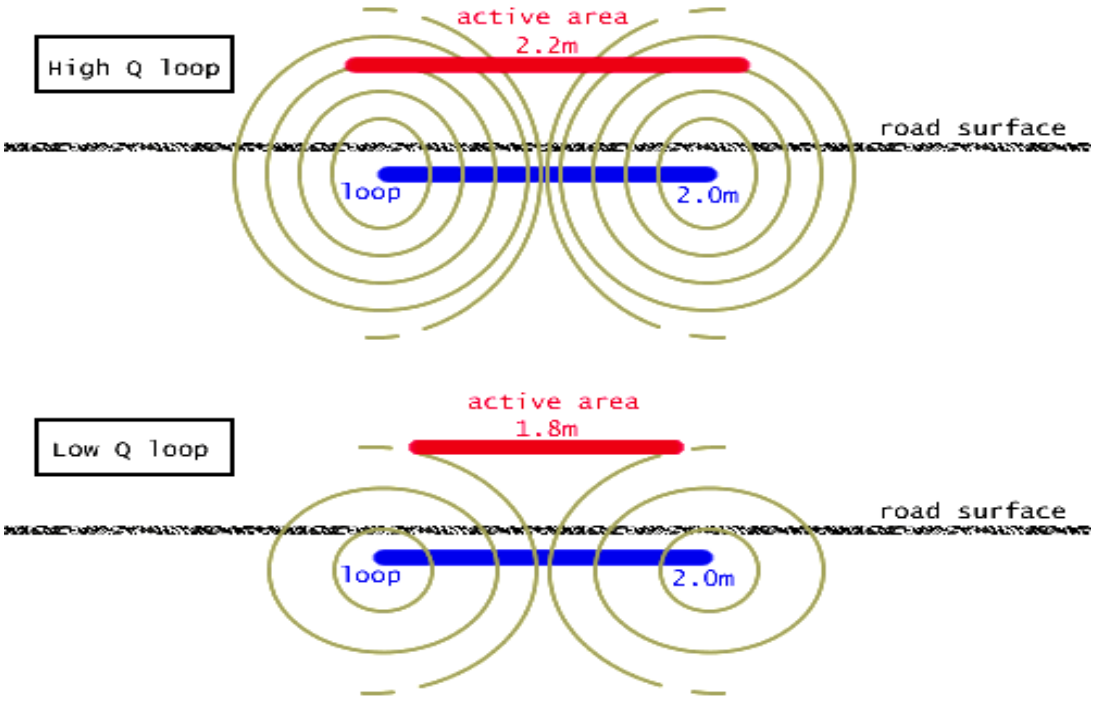
In-pavement loop measurements

The in-pavement loop is typically 2m^2 with 4 turns providing a nominal inductance of 220-230 µH with a combined loop and feeder DC resistance of <2Ω. Piezos are generally chosen to cover the lane (<300mm on each side of the lane). The operation of the equipment cannot be isolated from the performance of the in-road sensors therefore we recommend verification of the electrical characteristics and placement of the loop prior to connection to the LVD chassis.

The field technician can identify the following in-pavement loop characteristics with the LT series loop tester:

- Quickly identify 'short-circuits'
- Quickly identify 'open-circuits'
- The DC Resistance of the loop and feeder
- The Inductance of the combined loop and feeder
- The Tuned frequency of the loop and feeder
- The 'Q' of the combined loop and feeder
- Loop position within the pavement identified from a moving vehicle (maximum speed 110 kph)
- Loop wire (winding) location +/- 1 cm (hand-held operation)
- Loop wire insulation integrity >100 MΩ
- Loop operation incorporating an analogue bar graph display of the actuation.

The 'Q' of the loop should be between 16 and 24 for optimum classification results.



Note on 'Q' calculation (effective performance of the loop)

'Q' for normal vehicle detection may be as low as 6 however for vehicle classification applications and accurate speed detection 'Q' should be greater than 15.

Q or the performance of the loop is effectively the relationship between inductance of the loop and resistance / impedance in the feeder cable hence longer feeders (higher impedance/resistance) need more inductance in the loop for compensation.

The following formula and reference provide a scientific expression:

Q (at resonance) = frequency (radians) x inductance (Henries) / DC Resistance (ohms)

Where Radians = 2 x π x Hz

Reference: *Electronics A Top-down approach to computer-aided circuit design* by Hamley 1994 P904-908

Loop length is the length of the active area of the loop in the direction of travel. The active area is size of the loop electromagnetic field in which a vehicle will change the inductance of the loop above the detection threshold. The size of the active area is determined by the sensitivity of the loop (Q), the depth of the loop, and the sensitivity of the detector.

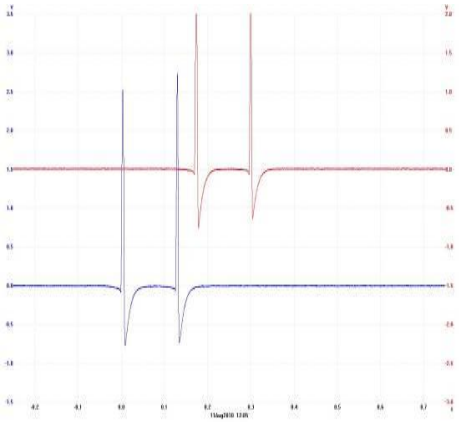
Feeder length should not exceed 200mts – it is good practice to increase the number of turns for longer feeder lengths to compensate for feeder length loss.

Piezo Operation

The PIEZO produces an electrical pulse in response to the application of pressure from vehicle wheels. An oscilloscope or the ETC piezo test meter may be used to confirm normal operation. Refer to the engineering note: ENGNOTE_INSTALLATION_IN-PAVEMENT_PIEZOs for additional information related to installing PIEZOs.

PIEZOs must be installed according to the manufacturer's instructions. PIEZO feeder cable should be a complete unbroken length from the PIEZO to the BNC connector – PIEZO cable can only be joined using appropriate RF co-axial cable techniques. PIEZO sensors are ordered with the correct coaxial feeder length.

By comparing the waveforms that were taken after installation to those taken at each inspection, you can easily track changes in output before they become a problem.



The above figures display typical piezo pulses and a scope kit connected to a LAPTOP for capturing the signal.

Refer also to MSI RoadTrax PIEZO documents for more complete information concerning how PIEZOs function.

4. Simple Operation Observation

Observation of LVD chassis:

- Power supply LEDs status – indicates DC sub supplies operational
- HB – RUN OK (heartbeat) status
- C1-C4 – Card install
- TX & RX activity
- L1 through L8 – loop activity
- LN1 – Detection Actuation Complete and verified.

Step	*Test*	*Result*	
1	*Switch on LVD and wait 5 seconds.* Are +5V and +12V LEDs on? UPS Option – Battery Low & Fail LEDs extinguished	Yes No	Power supply is operating correctly. Power supply is faulty.
2	Is Supervisor PB LED lit?	Yes No	Power supply to Supervisor link is ok. Power supply to Supervisor link is faulty.
3	Is Supervisor HB LED flashing?	Yes No No	Supervisor program is operating correctly. Supervisor program is faulty – reprogram Supervisor and repeat test. Supervisor hardware is faulty
4	What is the status of Supervisor? Are C1 / C2 / C3 / C4 LEDs ON corresponding to the number of active detector cards?	Yes Flash Flash Flash Off	Detector program is operating correctly. Detector program is faulty – reprogram Detector and repeat test. Detector hardware is faulty. Supervisor communications hardware is faulty. Detector is not used.
5	Do Supervisor RX and TX LEDs flash during Host communication?	Yes No	Host communications are working. Host communications have failed: - Host port baud rate is set to incorrect value. - Host port address is not set to 1. - Ethernet port is not setup correctly.
6	*Press retune for each Detector* Are any Detector loop LEDs (L1 – L8) flashing?	Yes Yes Yes	Loop sensor is faulty – test loop. Detector has faulty channel. Number of Lanes is set incorrectly, turning on loops that should not be on.
7	Do the correct Detector LEDs light when a vehicle travels over the corresponding loop?	Yes No No	Detector and loop are operating correctly. Detector has a faulty channel. Loop sensitivity is set too low.

Fundamental operation of the LVD chassis is confirmed through observing these LED illuminations – all 'YES' responses indicate correct functional operation.

NOTE: The LVD configuration will be OVERWRITTEN immediately the STREAMS FP is connected! - ensure that the FP site configuration is correct before connecting.

NOTE: If the interface activity appears to be frozen then press 'Q' to ensure the program is not in a specific function where only nominated input will allow the program to proceed – i.e.., interface is waiting for an 'E' to edit etc.

NOTE: The following sections refer to screen displays. These may vary according to the build version and LVD function of the LVD chassis.

5. Maintenance Port - Console Interface

The LVD provides a terminal interface called the Console Interface to perform local configuration and diagnostic operations. The Console Interface is accessed by connecting to the Console port on the supervisor using a terminal emulator. It consists of several menu driven screens allowing the user to view and edit settings, see individual vehicle data, and diagnose problems.

Host Port Settings

The Console Interface is the only method available to configure the Host Port baud rate and Host address. These settings cannot be changed remotely using the Host port and the Host Communications Protocol, as the settings relate to the Host port.

Details

The Console Interface connection details are shown in the table below.

Console Interface Details:	
Connection Type *Pin 2* *Pin 3* *Pin 5* *Pin 9* *Others*	RS-232 DCE (Female DB9) *TX* *RX* *0V* *+12Vdc* *Not Used*
Baud Rate	115200
Parity	None
Data Bits	8
Stop Bits	1
Flow Control	None
Emulation	ANSI

Connection

To connect to the Console Interface, a computer with an RS-232 port and a terminal emulation program such as HyperTerminal is needed. The following directions show how to setup a connection using HyperTerminal:

1. Connect the computer's serial port to the *Console port* via a straight-through serial cable. If your computer does not have a serial port, a USB to Serial Converter may be used instead.
2. Start up windows and point to *Start* > *Programs* > *Accessories* > *Communications.*
3. Click the HyperTerminal icon to start the program.

4. The *Connection Description* screen will now be displayed, enter a name for the connection. i.e., *LVD.* Click OK.
5. The *Connect To* screen will now be displayed, choose the correct COM port from the drop-down box, and click OK.
6. The *COM Properties* screen will now be displayed. Set *bits per second* to 115200*, *data bits* to 8, *parity* to none, *stop bits* to 1, and very importantly *flow control* to none. Click Ok.
7. HyperTerminal should now be connected. Rather than perform this setup process every time, save the connection by clicking *File > Save As* and choosing an easy to remember location. Next time you want to connect to the LVD, open the saved connection description instead and the HyperTerminal will start with all the old settings.
8. If the connection was successful a rotating cursor will be displayed. If not, try pressing Q.
9. Press any key to bring up the main menu.

** Older chassis operate at 19,200 baud.*

Select the function required from the menu and/or sub-menu(s)
For example, (R) Real time clock
Date and Time data will then be available to modify.

Entering Settings

While editing settings using the Console Interface, you will be prompted to enter values for each setting. This is performed by typing the value and pressing enter. Characters may be deleted by pressing the backspace key. If you wish to leave a setting unchanged, simply press enter without typing anything, or delete what you have typed, and press enter.

Start Up

If connected to the Console Interface when the LVD is switched on, a start-up message will appear. The start-up message displays the Site Name of the LVD and initialisation messages. For example, the figure below displays the successful start-up messages for an LVD with the Site Name VDS401:

```
+- -
| ETG Loop Vehicle Detector - Build: ELK 6.11.28          04:23:48 - 28/11/06
+- -

Start-up, VDS401

- Detector comms initialised
- Host comms initialised
- Statistics initialised

\
```

The start-up message may vary according to the version and function of the LVD chassis.
Upon start up the details described above will display followed by a rotating oblique \ | /

If the start-up message does not appear then the main program has been corrupted. Reprogram the Supervisor using the latest firmware. Reprogramming instructions are found in the document *LVD Reprogramming*.

- The Console Interface will quit to the start up screen after 5 minutes of no user interaction

- The Console Interface will display the rotating oblique \ | / if connected to an operational chassis
- Function selection is guided by the screen display i.e.., below any function may be selected by selecting the corresponding alphabetical letter in brackets ( ). Within functions data may be edited by selecting 'E' for edit
- '<Enter Key>' for step but no change
- 'B' facilitates a backwards step
- 'Q' for quit to start up screen.

It is good practice to press "Q" when completed any function selection. If the interface activity appears to be frozen then press 'Q' to ensure the program is not in a specific function where only nominated input will allow the program to proceed – i.e., waiting for an 'E' to edit.

Main Menu

The Main Menu looks like (may vary with different firmware versions):

```
+- -
| ETG Loop Vehicle Detector - Build: ELK 6.11.28          04:23:48 - 28/11/06
+- -
| Main menu:
+- -
| (S) - Settings
| (D) – Load settings
| (V) – Vehicle Transactions
| (L) – Lane Transactions
| (F) – Filtered Transactions
| (R) - Real time clock
| (Q) - Quit
+- -
```

The build version of the Supervisor firmware and the current date and time are shown on the top line of the display. In the example above, the build version is ELK 6.11.28 and the time is 4:23:48 on the 28th November 2006. The menu may vary according to the build version.

An immediate function selection to observe chassis operation – select function 'V'

Vehicle Transactions

Press V, L or F to show individual vehicle transactions. In vehicle transaction mode, every time a vehicle is detected, the vehicle data is printed to the screen. Pressing 'V' provides all lanes, pressing 'L' provides a lane summary and pressing 'F' allows the user to select a specific lane for observation. An example is displayed on the following page:

```
+- -
| ETG Loop Vehicle Detector - Build: ELK 6.11.28          10:34:00 - 28/11/06
+- -
Vehicle Transaction mode, press any key to quit

VEH: 10:34:05  L: 1   S: 98   Ln: 45   Hd: 69    P: 1   C: 2  E: 1
VEH: 10:34:05  L: 2   S: 100  Ln: 45   Hd: 39    P: 1   C: 2  E: 1
VEH: 10:34:25  L: 1   S: 105  Ln: 143  Hd: 200   P: 2   C: 6  E: 1
```

For example, the last vehicle transaction in the screen example above is for a vehicle detected at 10:34:25 in lane 1, travelling at 105 km/h, 14.3m long, 20.0s headway, with 2 loop profile peaks and a class of 6.

This display may vary to include classification or WIM data elements according to firmware version and LVD chassis function.

Vehicle Transaction mode will quit after 15 min of no user interaction. The table below describes each field in the vehicle data:

Field	*Description*
VEH:	Indicates a vehicle record and is followed by the current time.
L:	Lane the vehicle is travelling in.
S:	Speed of the vehicle (km/h)
Ln:	Length of the vehicle (dm)
Hd:	Headway since the last vehicle (1/10s)
P:	Number of loop profile peaks.
C:	Classification of vehicle, as determined by classification parameters.
E:	The error in speed measurement (km/h)

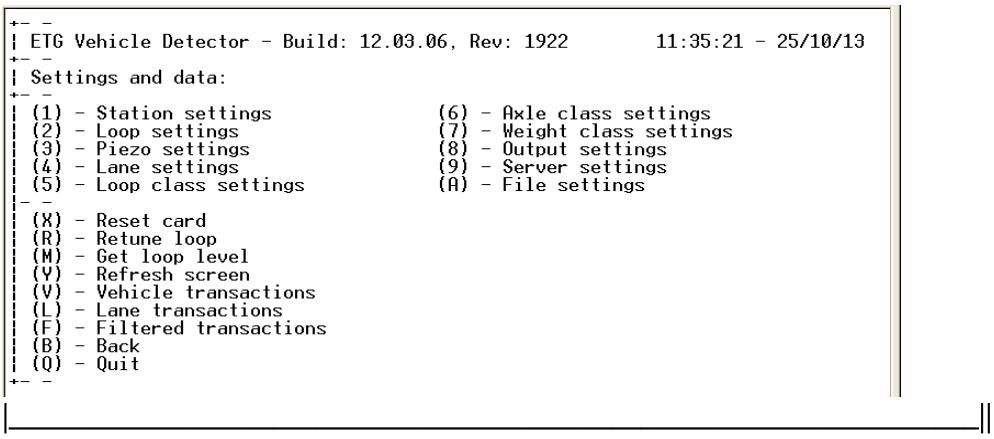
Observations

At this stage it is not imperative that the data is accurate however:

- Lane activity should reflect site configuration – i.e.., active lanes
- Lane activity should be consistent i.e.., speeds etc.
- Lane activity should correlate to observation of vehicle activity in respective lane.

Select Settings

To select functions associated with the operation of the LVD chassis select settings. A menu of all functions will be displayed for the specific firmware version and operational function of the LVD chassis. This may vary according to the build version.



Basic Site Configuration

The LVD must be configured with the correct settings for the specific installation site including the site name and format. Configuration includes designation of single loops or paired loops which determines the traffic functions. Measurements related to loop size and separation are critical to accurately determining vehicle speed and length. Settings are stored in non-volatile memory and remain after power off. Settings do not need to be reloaded unless the specifics of the site change.

NOTE: The LVD configuration will be OVERWRITTEN immediately the STREAMS FP is connected! - ensure that the FP configuration is correct before connecting.

The following sections detail each configuration step when setting up the LVD.

Step 1 - Initial Configuration – Verify Station Settings

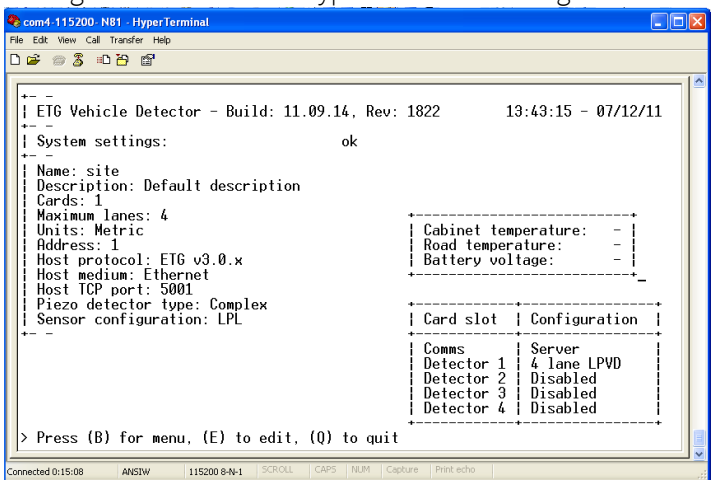
Station Settings – primary functions that define the site.

Method	*Command*
Console Interface	Main Menu → Settings and Data → Station Settings → Edit

Once the Host port communications settings have been configured, all other further settings can be configured using the Console Interface or the Host Communications Protocol. The next two settings that should be configured are Site Name and Number of Lanes.
These settings are likely to be changed if a chassis is exchanged on site, name, description, and lane numbers etc.

- Site Name - *is an 8-byte ASCII identifier for the LPVD. Each LPVD should have a unique Site Name.*
- Number of Lanes - *The Number of Lanes determines the lane configuration for the LPVD. Setting the Number of Lanes automatically configures the Loop State, Lane Pairing and Lane Direction for every loop and lane in the System.*

The figure below shows a typical Station Settings screen:



The table below explains each of the parameters above:

Parameter	*Description*	*Editable*
Name	8-byte name of the unit. The name is used to identify each unit individually. When downloading records using the LPVD Data Logger, this name is the first part of the record file name.	Yes
Description	An alpha-numeric field describing the site or site location	Yes
Cards	Number of detector cards	Yes
Max Lanes	Number of lanes setting used to configure the number of active lanes	No
Units	Metric or Imperial	yes
Address	Station address 1-255.	Yes
Host Protocol	ETG v3.0.x or . . . . (alternative)	Yes
Host Medium	Ethernet or (RS-232) or . . .	No

Host TCP Port	Allocated port number typically 5001 (1–65535)	Yes
Piezo Detector Type	Basic or Complex(default)	No
Sensor Config	Loop PIEZO Loop or Loop Loop or PIEZO PIEZO etc	

Card Slot – Configuration

Enable Server Comms Card - Selection is either full Server card or Ethernet Module.
Detector 'X' (card numbers) configuration which has been factory set as per order.

Display Data

Cabinet Temperature	Deg. Centigrade (if available)
Road Temperature	Deg Centigrade (if available)
Battery Voltage	Volts (if available)

Step 2 – Real Time Clock

The Real Time Clock is used for timestamping of automatically sent traffic data and events. It should be set to the current date and time. The Real Time Clock will need to be updated if there is a time change due to daylight savings. The real time clock menu allows you to set the date and time of the LVD.

Enter in a value for the date and time fields or leave them blank to leave the field unchanged. For example, the screen below shows setting the time to 11:59:30 and date to 10/06/2006. Note that the date format is dd/mm/yyyy.

```
+- -
| ETG Loop Vehicle Detector - Build: ELK 6.11.28          04:23:48 - 28/11/06
+- -
| Set real time clock
+- -
Date and time is: 28/11/06 4:23:49

Enter day: 10
Enter month: 12
Enter year: 2006
Enter hours: 11
Enter minutes: 59
Enter seconds: 30

Date and time is now: 10/12/06 11:59:30

Setup complete
+- Press any key to continue
```

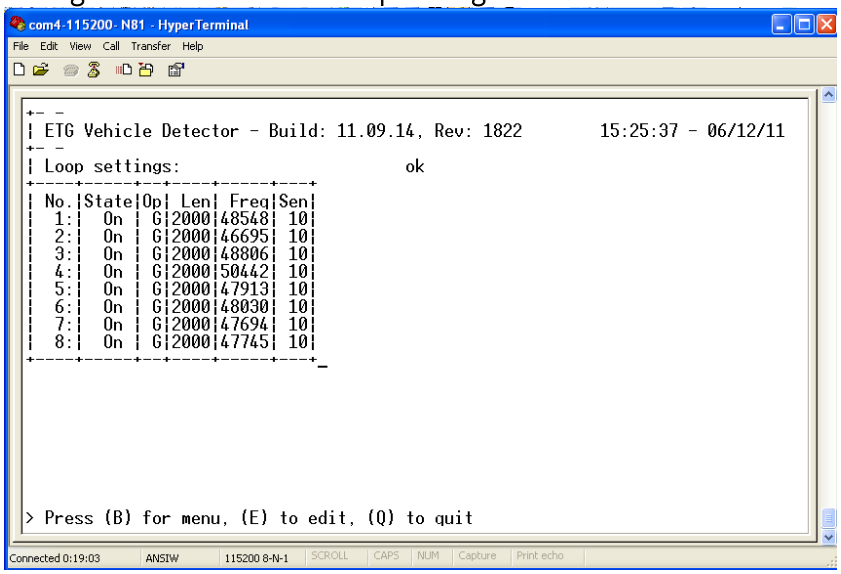
Step 3 – Loop configuration

Loop configuration involves three settings:

Method	*Command*
Console Interface	Main Menu → Settings and Data → Loop Settings → Edit *When prompted to enter Loop State, simply press enter without typing a value as the Loop State should be left unchanged.*

Loop State - *is automatically configured when the Number of Lanes is set and should not need to be changed.*
Loop Sensitivity - *should be set to 10 (maximum) unless inter-card crosstalk is experienced.*
Loop Length - *should be set to the length of the loop in the direction of travel in the lane. Typical values are 1500mm or 2000mm.*

The figure below shows the Loop Settings screen:



The table below explains each of the parameters above:

Parameter	*Description*	*Editable*
No.	The loop number the parameters refer to. A '!' in the No. column indicates if the corresponding loop has failed. i.e., loop 4 in the above example.	N/A
State	State of the loop – on or off.	Yes
Op	Operational status of each loop: G: Loop is functioning normally O: Loop is open circuit S: Loop is short circuit C: There are no communications with the detector card for this loop	No
Len	Length of the loop (mm)	Yes
Freq	The frequency of the loop signal (Hz)	No
Sen	The sensitivity of the loop from 1 (minimum) to 10 (maximum) 10 is the recommended setting.	Yes

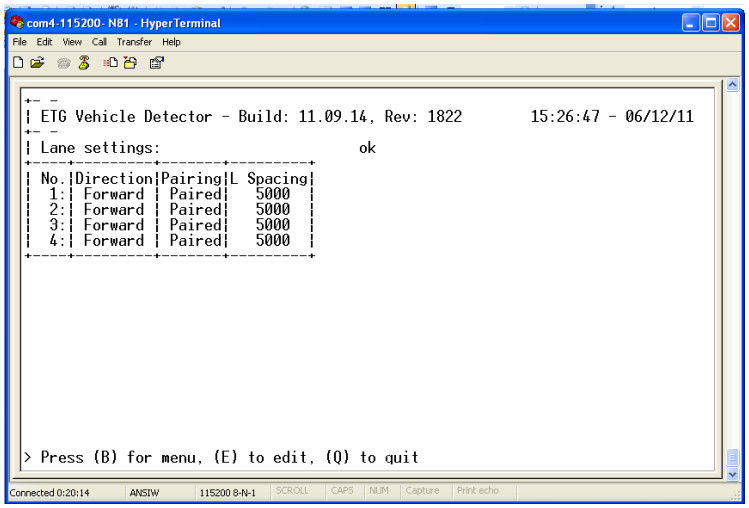
Step 4 – Lane configuration

Lane configuration involves three settings which are critical to fundamental incident detection: speed, vehicle length.

Method	*Command*
Console Interface	Main Menu → Settings and Data → Lane Settings → Edit *When prompted to enter Lane Pairing, simply press enter without typing a value as the Loop State should be left unchanged.*

Lane Direction - *is forward if the loops are installed in the correct location.*
Lane Pairing - *should be set to paired for all lanes.*
Loop Spacing - is *the distance between the leading edge of the leading loop and the leading edge of the lagging loop in the lane. Typical values are 5000mm or 7000mm.*

The figure below shows the Lane Settings screen:

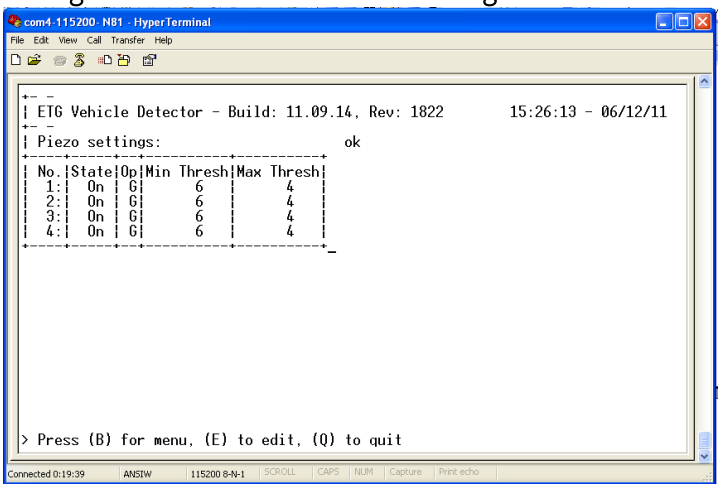


The table below explains each of the parameters:

Parameter	*Description*	*Editable*
No.	The lane number the parameters refer to. A '!' in the No. column indicates if either of the loops in that lane has failed. i.e., lane 4 in the above example.	N/A
Direction	Direction of the lane – forward or reverse.	Yes
Pairing	Pairing of the loop pair for that lane – single or paired. The loop pairing is normally set to paired – typically 1,2 & 3,4 etc.	Yes
Spacing	Loop spacing (mm).	Yes

Step 5 – Piezo configuration

The figure below shows the PIEZO Settings screen:



The table below explains each of the parameters above:

Parameter	*Description*	*Editable*
No.	The piezo number the parameters refer to. A '!' in the No. column indicates if the corresponding piezo has failed. i.e., piezo 4 in the above example.	N/A
State	State of the piezo – on or off.	Yes
Op	Operational status G = good	
Min Threshold	The sensitivity threshold MINIMUM of the PIEZO	Yes
Max Threshold	The sensitivity threshold MAXIMUM of the PIEZO	Yes

Step 6 –Classification - loop

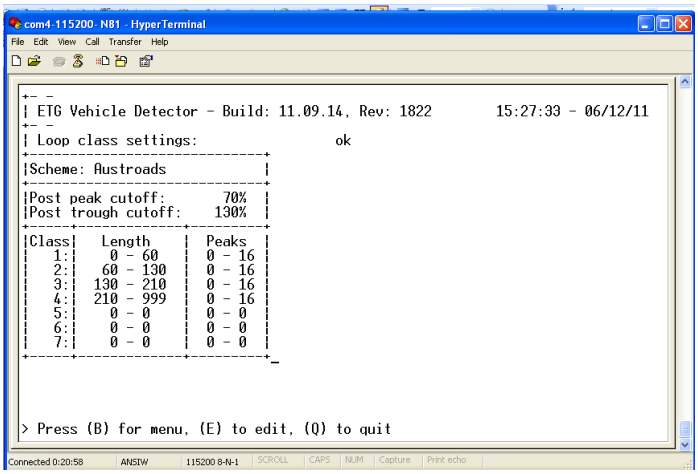
Loop based vehicle classification configuration involves two overall settings, and four for each classification bin. Recommended settings are displayed below (AUSTROADS 4 bin).
Two factors in determining loop-based classification are:

- Minimum Length and Maximum Length
- Vehicle length and number of metal mass detection Peaks.

The schedule for establishing Loop Classification needs to be consistent across the complete organization therefore the description of vehicle class bins is set by the System Manager. The user may select to adjust the vehicle length fields and the number of peaks associated with each vehicle bin type. For example, a car and trailer may have only two peaks. The peaks are defined by the signal cut offs for a 'rise' (peak) and a dip (trough).

Method	*Command*
Console Interface	Option 5

The figure below shows the Loop Class settings – displaying AUSTROADS 4 BIN.



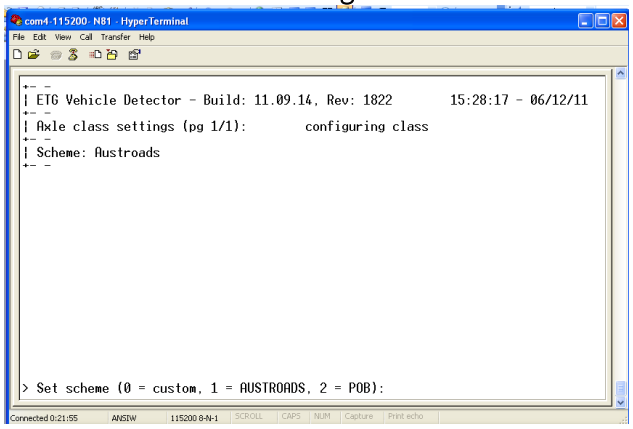
- E: facilitates setting thresholds or BINS (primary question)
- THRESHOLDS: Enter the peak and the trough levels as percentage 0-100% (sets the levels of wave formation to determine what is an actual peak)
- BINS: Select a bin 1 through 7 and enter minimum vehicle length and maximum vehicle length. Select the minimum number of peaks and the maximum number of peaks i.e., a car and a trailer will have two peaks.

Step 7 – Classification - Axle

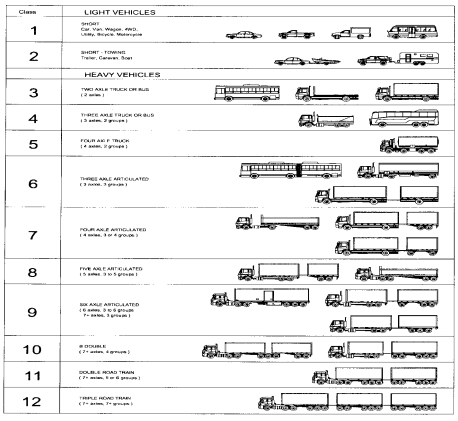
Axle based vehicle classification configuration involves a pre-set configuration. The RTA utilizes the AUSTROADS 12 BIN classification table, and the operator confirms that this table has been selected. The user may also utilize custom configurations or POB which is an enhanced AUSTROADS version o include additional B double classes. Refer to manual for instructions on creating a custom table. This function would be preconfigured, and it is unlikely that this would be changed in the field.

Method	*Command*
Console Interface	Option 6

Selection of Axle Class settings



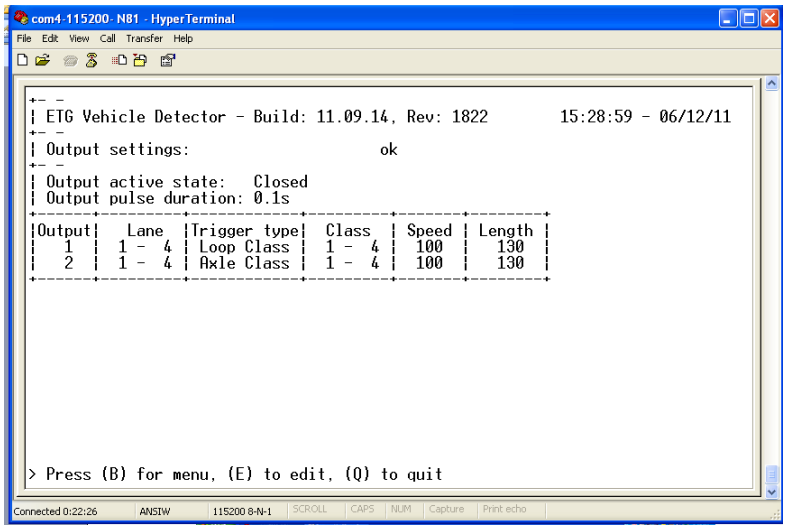
Austroads Vehicle Classifications



Axle based Vehicle Classification Options:

- Austroads: - 12 BIN classification Schedule is a configured default, simply select 1
- POB: - is an extended AUSTROADS with additional classification for selected 'B' Double vehicles
- CUSTOM: - To create a user defined custom schedule select – 0 (for custom select).

Step 8 - Output settings (optional)

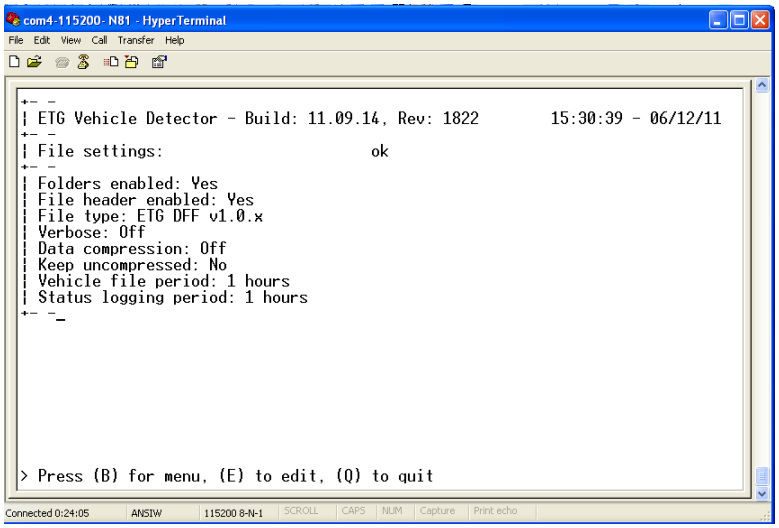


The output trigger may be used to actuate a camera facility or a VMS message display. The output trigger may be configured as a digital state (Hi '1' or Lo '0') and may be actuated by type of vehicle, class of vehicle, speed, or length – through selected lane nomination. Refer to the manual for further details.

The following advanced functions are not likely to be altered on site.

Step 9 - File Settings

The file settings facilitate user configuration of the data file – This attribute is nominated by the network manager and should not be altered in the field. This configuration provides a specification for how the data is stored on the compact flash disk. The format of this data must match the network parameters to enable the file to be interpreted.

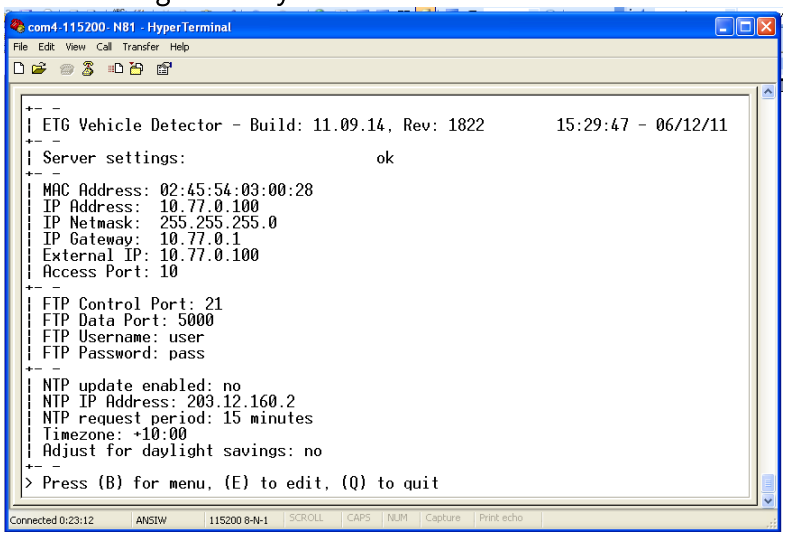


Step 10 – Server Settings

The SERVER settings enable web connection or local LAPTOP connection via the Ethernet port.

The SERVER settings for your network have been predetermined by the network manager. The settings displayed above are factory default settings only. To enable connection via ETHERNET your LAPTOP will need to be configured into the range of this device with typical an IP address plus or minus 1 i.e., 100 is the chassis your LAPTOP address could be 101 etc.

Server Settings – factory default



Step 11 – Setup Complete proceed to Verification.

Setup is now complete. Using the Console Interface, the settings can be checked by navigating to each settings menu and verifying the table of data shown on the screen.

Verification

Once the LVD is setup and installed, the installation should be verified.

The following steps test LVD start up, vehicle detection, vehicle measurement and recording, and communications.

Note: The screen displays may vary for different configuration. The Build and revision number will vary between systems.

Test 1 – Start Up

This test checks if the LVD is operating correctly.

1. Connect to the Console Interface with a Terminal Emulator such as HyperTerminal.
2. Switch on the LVD. If it is already on, switch it off for 5 seconds then switch it on again.
3. The main program will now start up. A start up message similar to the following will be displayed:

```
+- -
| ETG Loop Vehicle Detector - Build: ELK 6.11.28          04:23:48 - 28/11/06
+- -

start up, VDS401

- Detector comms initialised
- Host comms initialised
- Statistics initialised

\
```

➡ If the start up message does not appear then the main program has been corrupted. Reprogram the Supervisor using the latest firmware. Reprogramming instructions are found in the document *LVD Reprogramming*.

4. Check the Power Supply +12V LED is on. This indicates the Power Supply is generating +12V needed for the detectors.
5. Check the Power Supply +5V LED is on. This indicates the Power Supply is generating +5V needed for the supervisor and detectors.
6. Check the Supervisor PS (Power Supply) LED is on. This indicates the supervisor has power.
7. Check the Supervisor HB (Heartbeat) LED is flashing. This indicates the supervisor is operating correctly.
8. Check the Supervisor C1 / C2 / C3 / C4 LEDs are lit if their respective detector cards are present. This indicates the Detector(s) are communicating with the Supervisor. If the LED is flashing, then there is a problem with the corresponding Detector card.

Test 2 – Vehicle Detection

This test checks if any loops are faulty and if the loops are detecting correctly.

1. Connect to the Console Interface and turn on the LVD as before.
2. Press the Retune button(s) to retune all the loops.
3. Check the detection indicator LEDs, L1 – L8 for Detector 1 and L9 – L16 for Detector 2. Each LED corresponds to a loop and should be off when there is no vehicle over the corresponding loop, and on if there is.
4. If a LED is flashing continuously, it indicates the loop is faulty.
5. To check the status of the faulty loop, use the Console Interface. Navigate to the Loop Settings menu (Main Menu → Settings → Loop Settings). The Loop Settings will now be shown, it looks like the figure below:

```
+- -
| ETG Loop Vehicle Detector - Build: ELK 6.11.28          04:23:48 - 28/11/06
+- -
| Loop settings:       loop failure!
+----+-----+--+----+-----+---+
| No.|State|Op| Len| Freq|Sen|
|  1:|  On | G|2000|40003| 10|
|  2:|  On | G|2000|39784|  9|
|! 3:|  On | S|2000|     |  8|
|  4:|  On | G|2000|39522|  8|
|  5:|  On | G|2000|39714| 10|
|  6:|  On | G|2000|39390| 10|
|! 7:|  On | O|2000|     | 10|
|  8:|  On | G|2000|39181| 10|
+----+-----+--+----+-----+---+
```

The No. column is the loop number, and the Op column is the operational status of the loop. It can have 4 values:

- G Good, the loop is operating correctly.
- O Open circuit, the loop is unconnected or damaged.
- S Short circuit, there is a short on the loop or a fault in the Detector circuitry.
- C Comms failure, the Supervisor cannot communicate with Detector for this loop.

- Check that when a vehicle travels over each loop pair that the corresponding LEDs for the loop pair light, and light in the correct order.
- Check that when a vehicle travels over a loop pair that the corresponding LN LED flashes once for that lane.

  For example, in a two lane system, a vehicle traveling in the correct direction in lane 1 should cause L1 to light, followed shortly after by L2, then LN1 will flash to indicate a vehicle was processed.

  Similarly a vehicle travelling in the correct direction in lane 3 in a 4 lane system should cause L5 to light, followed shortly by L6, then LN3 will flash.

Test 3 – Communication

This test checks that the Host system can communicate with the LVD.
Verify that the TX / RX LEDS are illuminating on the Chassis Supervisor Card. This indicates that the FP is communicating with the LVD chassis. Verify also through TMC

The TMR FP Emulator may be connected to the remote host port (using the console cable) and is used to confirm operation of the port prior to connecting the FP – for operational details refer to ENGINEERING NOTE: FP Emulator.

Test 4 – Vehicle Activity Measurement Performance

This test checks that vehicles are being measured correctly. The exact screen display may vary according to the build version and function of the LVD chassis.

➡ In highly congested traffic, measurements may be unreliable and therefore this test should only be performed when there is smooth flowing traffic.

1. Connect to the Console Interface and turn on the LVD as before.
2. Select the Vehicle Transaction mode from the Console Interface. (Main Menu → Vehicle Transactions)
3. Vehicle Transaction mode will display a line of vehicle data every time a vehicle is detected. The display may vary according to the build version and LVD chassis function. For example:

```
VEH: 10:34:05  L: 1   S: 98   Ln: 45   Hd: 69    P: 1   C: 2  E: 1
VEH: 10:34:05  L: 2   S: 100  Ln: 45   Hd: 39    P: 1   C: 2  E: 1
VEH: 10:34:25  L: 1   S: 105  Ln: 143  Hd: 200   P: 2   C: 6  E: 1
```

The table below describes each field in the vehicle data:

Field	*Description*
VEH:	Indicates a vehicle record and is followed by the current time.
L:	Lane the vehicle is travelling in.
S:	Speed of the vehicle (km/h)
Ln:	Length of the vehicle (dm)
Hd:	Headway since the last vehicle (1/10s)
P:	Number of loop profile peaks.
C:	Classification of vehicle, as determined by classification parameters.
E:	The error in speed measurement (km/h)

4. Check that vehicles are being detected by verifying a vehicle transaction is displayed for every time a vehicle is detected.
5. Verify the displayed speed of the vehicle is close to the actual speed of the vehicle. A simple estimation based on the road speed limit and average speed may be adequate. If the displayed speed is significantly different, then the loop spacing for the lane may be incorrect.
6. Verify the displayed length of the vehicle is close to the actual length of the vehicle. A simple estimation based on knowledge of typical vehicle shapes should be adequate. A family sedan is usually 4.5m – 5.2m long, and an articulated truck is usually 17m – 19m long. Note that motorbikes are usually measured as less than 1m long, due to the small

metal content and is not an error. Estimation is therefore most reliable with family sedans. If the displayed length is significantly different, then the loop spacing, and loop length values may be incorrect.

7. The headway measurement does not depend on any adjustable parameters and is usually correct.
8. Verify the display number of loop profile peaks matches that which is expected for the vehicle measured. Loop profile peaks typically correspond to large portions of metal in the vehicle. For example, a truck with articulated trailer typically has 2 loop profile peaks. If the displayed number of loop profile peaks is incorrect, the post peak cut-off and the post trough cut-off may need to be adjusted.
9. Verify the classification of the vehicle matches that which is expected for the vehicle measured, based on the classification settings entered.
10. Check that the speed measurement error value is low compared to the speed of the vehicle. For example, a vehicle travelling at 100km/h should typically have a speed measurement error around 2 or less. If the error is high, the loops may not have been installed with the same length or the loops are not very sensitive.

6. Simple ON-SITE Maintenance Process

Observation of LVD Chassis. LEDs indication:

- Power supply LEDs status
- HB – RUN OK (heartbeat) status
- TX & RX activity?
- L1 through L8
- LN1

Step	*Test*	*Result*	
1	*Switch on LVD and wait 5 seconds.* Are +5V and +12V LEDs on? UPS Option Battery Low & Battery Fail – extinguished?	Yes-On No	Power supply is operating correctly. Power supply is faulty.
2	Is Supervisor PB LED lit?	Yes-On No	Power supply to Supervisor link is ok. Power supply to Supervisor link is faulty.
3	Is Supervisor HB LED flashing?	Yes-On No No	Supervisor program is operating correctly. Supervisor program is faulty – reprogram Supervisor and repeat test. Supervisor hardware is faulty
4	What is the status of Supervisor C1 / C2 / C3 / C4 LED?	Yes-On Flash Flash Flash Off	Detector program is operating correctly. Detector program is faulty – reprogram Detector and repeat test. Detector hardware is faulty. Supervisor communications hardware is faulty. Detector is not used.
5	Do Supervisor RX and TX LEDs flash during Host communication?	Yes No	Host communications are working. Host communications have failed: - Host port baud rate is set to incorrect value. - Host port address is not set to 1. - Ethernet port is not setup correctly.

6	*Press retune for each Detector* Are any Detector loop LEDs (L1 – L8) flashing?	Yes Yes Yes	Loop sensor is faulty – test loop. Detector has faulty channel. Number of Lanes is set incorrectly, turning on loops that should not be on.
7	Do the correct Detector LEDs light when a vehicle travels over the corresponding loop?	Yes No No	Detector and loop are operating correctly. Detector has a faulty channel. Loop sensitivity is set too low.

Module Replacement

- Switch Chassis OFF – 'Hot Swapping' cards may cause hardware failure and / or data corruption.
- Remove remote connection to avoid transfer of corrupted data.
- Unscrew knurled securing screws
- Remove card – using handles where provided
- Replace card
- A replacement supervisor card may require reconfiguring of site details -
- A detector card may require retune.

NOTE: The cards file has been designed for 'secure card fit' and some cards especially the detector card having two 64way DIN sockets is quite difficult to remove.

- END OF DOCUMENT -