Vehicle Location Device – VLD100 Series

User Manual

Version: 1.2.6 May 8, 2001

PowerLOC Technologies Inc.

Dear Customer,

Thank you for purchasing PowerLOC Vehicle Location Device (VLD100 Series). For your safety and optimum performance of the device, please read the instructions in this manual carefully.

Please record the serial number, MAN and MIN codes found on the back of the VLD Module in the space provided below. You will need these numbers for activation of the VLD, and for future refernces.

Unit Serial Number	

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

WARNING!

To satisfy FCC RF exposure rquirements for mobile transmitting devices, a minimum seperation distance must be maintained between the antenna of this device and persons during device operation. Operation at closer than this distance is not recommended. For detailed distance for each module, see Tables 5-1 and 5-2.

CAUTION!

Changes or modifications not expressly approved by PowerLOC voids the user's authority to operate the equipment.

CAUTION!

This equipment has been tested and found to comply with the limits for a Class B digital devices, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Reorient or relocate the receiving antenna; Increase the separation between the equipment and receiver; Consult the dealer or an experienced Automotive/Audio technician for help

CAUTION!

To prevent fire or risk hazard, do not expose the VLD unit to rain or excessive moisture.

CAUTION!

This device should only be used for a vehicle application, and should only be installed by authorized installers. Product warranty is null and void if the device is not installed by an authorized installer.

Table of Contents

Chapter 1 Product Description

Package Contents

The package you purchased includes the following items:

- Vehicle Location Device (VLD) module
- GPS receiver
- Wireless antenna
- Wiring harness
- Alert button (Also referred to as Panic Button)
- Client Software CD
- Documentation - User Manual

Not Included, Optional Items are:

- Cigarette lighter quick connector
- Geo-Fence button
- Auxiliary battery pack
- Computer interface cable (COM) - RS232 P/N PL038-005-01

Optional items can be purchased directly from the Location Service Providers (LSP™), the system installer, or PowerLOC via the Internet.

Figure 1-1 VLD Module and GPS Receiver.

1. VLD module and Wireless antenna (Bottom) **2.** GPS receiver (R. Side) **3.** Wiring harness (Top)

Each of the components shown in Figure 1-1 are described below:

VLD Module

The VLD module is a small black box device approximately 4 cm x 7 cm x 11 cm in size, which contains electronic circuitry and a wireless modem. The box top and bottom construction is made of Dupont Zytel which is a super tough nylon. The key components of the VLD module are described below:

Control Processor: controls all operation and functionality of the unit, tracks pre-defined events, and report violations.

Wireless Modem and RF Module: communicates with the wireless carrier. The type of wireless modem used depends on required functionality and available wireless coverage in Customer's region.

Power Management Circuit: powers the VLD module, the GPS receiver, and charges the auxiliary battery, if applicable.

Two (2) Input Relays: receive inputs from the vehicle – typically Panic Alert and Set/Re-Set Geo-Fence functions.

Two (2) Output Relays: provide control functions in the vehicle. For example: Open Doors, Immobilize Vehicle and activate an Alarm buzzer functions.

I/O Connector: 12-pin connector used to connect to vehicle's battery and connect relays to vehicle's functions.

Auxiliary Battery Connector: 3-pin connector used to connect optional external battery pack.

GPS Connector: (serial port #1) – 9-Pin connector, used to interface with the GPS receiver.

COM Connector: (serial port #2) – 9-Pin connector used to interface with a D-type RS-232 connector on a computer for test and update purposes only.

NOTE: This connector is not used in vehicle installations, unless an LCD display is attached. If interfaced with D-Type connector, than an interface cable (Part number PL38-005-001) is required.

Wireless Antenna

The wireless antenna is used to communicate between the VLD and the Tracker Server. Wireless connectivity is essential for service availability. A wireless antenna may be installed in-vehicle (internal) and out-of-vehicle (external) configuration.

External Antenna: installation will require locating and securing the antenna external to the vehicle. With proper installation, an external antenna is likely to provide the best signal coverage.

Internal Antenna: is attached to the VLD, and simplifies installation. VLD with the antenna must be carefully installed to ensure adequate signal coverage and distance of at least 20 cm from passengers as defined by FCC, Part 15 regulation.

GPS Receiver

The GPS receiver consists of an antenna with a cable, and a magnetic mount. The cable connects to the GPS connector (serial port #1) on the VLD Module.

NOTE: The GPS receiver must be installed with a clear view of the sky, so that the vehicle can be tracked by at least 4 satellites – refer to page 2-1 for additional information.

NOTE: If the VLD is used as an Anti-theft device, the antenna will have to be concealed. Such a mounting arrangement can impact signal reception.

Wiring Harness

The harness has a 12-pin connector which connects the VLD to the various functions in the vehicle.

Alert (Panic) Button

The Alert (Panic) button allows a user to send an emergency signal to the Tracker Server. The emergency signal will be acted upon by a Call Center.

Optional

Cigarette Lighter Quick Connector (optional)

The optional cigarette lighter quick connector (plug) is used for basic installation.

NOTE: Both Power and Ground wires in the wiring harness must be connected to the quick connector, instead of vehicle battery.

Geo-Fence Button (optional)

The optional Geo-Fence button allows the user to Activate and De-Activate the Geo-Fence alarm. Any unauthorized movement of the vehicle, such as theft or towing, will activate an alarm signal to the LSP. The Geo-Fence button can be purchased separately, and installed by the VLD installer.

NOTE: PowerLOC recommends that Geo-Fence button is installed with buzzer to provide feedback on status (Geo-Fence Activated and Geo-Fence De-Activated).

Buzzer (optional)

The buzzer can be connected to an output relay. It provides Audio feedback for three (3) specific situations:

Long Tone - Acknowledge Alert (Panic) signal has been received by the Tracker.

Short Tone - signals that Geo Fence has been Activated around the vehicle.

Two short Tones - signals that GeoFence has been De-Activated from around the vehicle.

Auxiliary Battery Pack (optional)

The optional auxiliary battery pack ensures that the VLD is powered even when the main power supply from vehicle's battery is unavailable. The auxiliary battery pack connects to the battery connector on the VLD, and is recharged by the VLD during normal operation.This is a standard 12V Lead-Acid battery, which can be selected to meet size and service availability requirements.

Client Software CD

The Client Software CD contains all the necessary software for installation and set up of the VLD. Loading and use of the Client Software are described in Chapter 4.

External Power Supply

The vehicle's battery is used to provide the VLD with a +12V power supply and a ground connection. When the vehicle ignition is turned Off, the VLD switches to Energy Save mode, continues to acquire GPS positions and perform wireless communication at a reduced rate.

To manage power consumption, consider the following measures:

1. Install an auxiliary battery pack as a backup power supply.
2. Disconnect the device when the vehicle is secured and will not be used for an extended period of time.

VLD Introduction

PowerLOC Technologies Inc. is an emerging leader in the design and development of wireless Internet-enabled tracking and location services architecture known as L-Biz™. Figure 1-2 shows the L-Biz architecture.

Vehicle location functionality consists of three components – a mobile VLD, the Tracker Server, and the web-enabled Fleet Manager (Client Software). The three components are described below in detail.

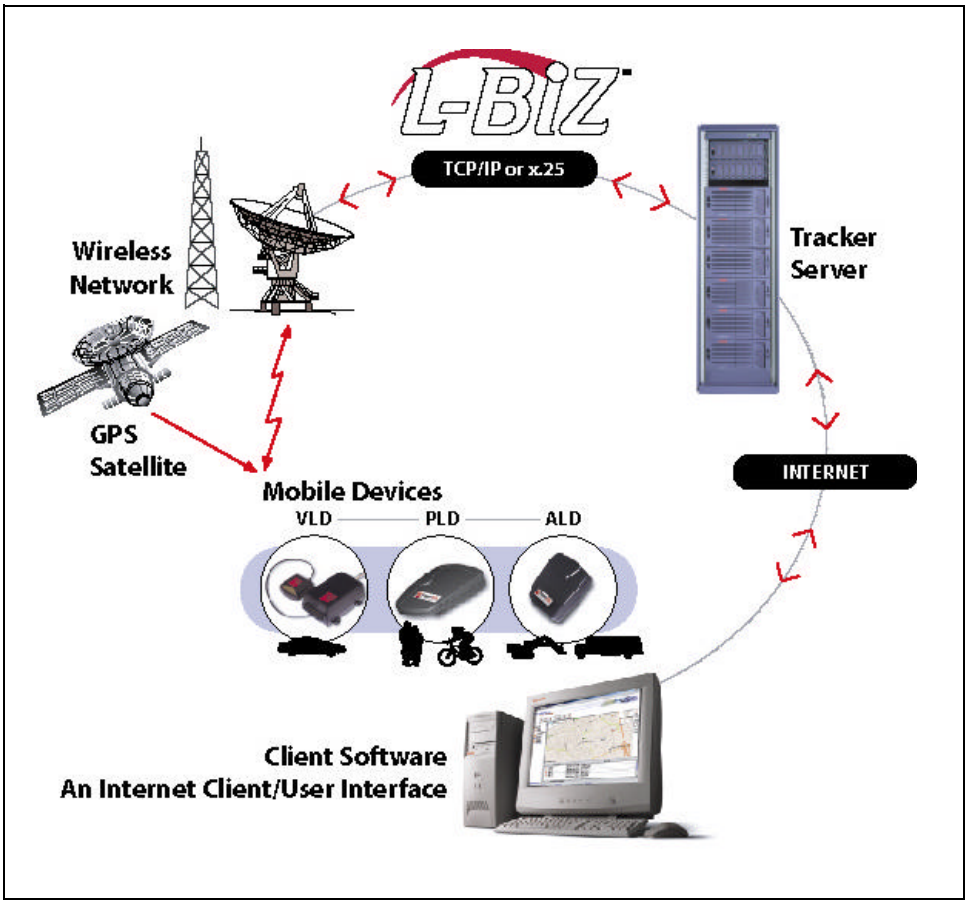

Figure 1-2 PowerLOC's L-Biz Architecture.

Mobile VLD

Mobile VLD allows a user to perform two-way tracking of a single vehicle, or a fleet of vehicles (refer to "Mobile GPS Applications" on page 2–3) using GPS satellites. When installed and activated by an authorized installer, the mobile VLD allows the user to access the following additional features:

Lock/Unlock Doors

VLD can control the driver or passenger door actuators, for vehicle(s) with power lock(s) and will provide the following functionality:

1. Unlock doors if the driver has been accidentally locked out of the vehicle. This feature can be activated by a call to the Call Center.

2. Lock doors if the vehicle has been stolen, to prevent the thief from leaving the vehicle. This feature can be activated by the Call Center.

Geo-Fence Button

Geo-Fence is a virtual rectangular zone set around the vehicle. Geo-Fence can be set (Armed) and reset (unarmed) with a Geo-Fence button. Typically, set and reset are followed by a unique audio tone generated by a buzzer. If the vehicle moves outside of the set zone, a Geo-Fence violatrioon message will be sent to the LSP. Movment outside the zone may be due to theft, towing or unauthorized usage. The VLD can be programmed to send a message and/or operate functions such as flash head lights, immobilize the vehicle etc. .

Immobilize Vehicle

VLD can control the starter circuitry to prevent the vehicle from being restarted. The ignition will not be switched off when the engine is running. This feature can be activated by the Call Center, or pre-programmed to activate if there is a Geo-Fence violation.

Alert (Panic) Button

If an Alert (Panic) button is installed in the vehicle, the VLD can broadcast an emergency distress signal to the Call Center. When the user presses the Alert (Panic) button for 3 seconds, the distress message is broadcasted to the Call Center. The distress message is acknowledged by two short buzzes. The user has to pre-define the nature of support needed. The Call Center can track the distress signal to the vehicle location, speed, and any other available signal and send help.

Geo-Fence Remote Activation

VLD can remotely activate the Geo-Fence feature using a key-less remote entry control unit. Installation may require additional components such as the control unit, which is typical for standard alarm systems.

Crash Detection

Most models of VLD have a built-in accelerometer which can detect positive or negative accelerations, typical of an accident. Once detected the accelerometer information is sent to the Tracker Server and responded too by the Call Center. The Call Center can locate the vehicle and dispatch the necessary emergency services.

Other Remote Activation

The VLD output relays can be connected to various vehicle functions. These can be activated by dispatcher upon user's request. For example: Door Unlock, Immobilize Vehicle, Engine remote Start, Flash head lights etc.

Tracker Server

This powerful server system manages communications with thousands of different types of mobile VLDs. The Tracker software is implemented in Java, and the application is written in XML to conform to industry standards and provide secure communications over the Internet. The Tracker Server is owned and operated by the LSP.

Fleet Manager (Client Software)

The Fleet Manager (Client Software) is part of the L-Biz Solution, which resides on a customer's personal computer (PC). It allows the user to view tracking information over the Internet.

LSP Overview

LSPs are companies that provide the required infrastructure needed to implement PowerLOC's L-Biz solutions. LSPs provide a critical role in the operation of VLDs, and they perform the following functions:

- **Sell, install and after-sale support** of the VLDs

- **Facilitate activation** and **interconnection** with the wireless carrier
- **Provide monthly connectivity and billing services**. The LSP Connectivity Plan is aimed to meet your communication needs. The LSP will provide you with detailed information about your options, and how these reflect your tracking needs.
- **Provide on-going access** to information on your vehicle via the Internet, using the Client Software
- **Provide additional service** such as emergency Call Center. The Call Center services are aimed to enhance your safety and well-being by monitoring emergency calls, or by recognizing and informing you if your vehicle is moved without your consent.

VLD101 and VLD103

The VLD101 is equipped with Aeris.Net wireless Modem. This Data Wireless Network has a very wide cellular coverage all over North America, based on the AMP network. The VLD101 has a limited set of functions and is mostly suitable for security type application. More details are available in the Product Spec.

The VLD103 use the Mobitex Data Wireless network. It is suitable for various applications and has a wide range of functionality. More details are available in the Product Spec.

Table 1-1 Available wireless networks and carriers for North America

Table 1-1 Available Wireless Networks and Carriers.

VLD Model	Wireless Network	Wireless Carrier
VLD101	Aeris	Aeris.Net
VLD103	Mobitex	Cingular Wireless (US)
VLD103	Mobitex	Rogers-AT&T (CAN)

Usage

Environment

Operating Temp. -30^{o} C to +70^{o} C (-22^{o} F to +158^{o} F).

Storage Temp. -40^{o} C to +85^{o} C (-40^{o} F to +185^{o} F).

Humidly 5% to 95% RH Non-condensing at 40^{o}C (104^{o}F)

Vibration SAEJ1211 for chassis mounted device

Warranty

The VLD is covered by a 1-year warranty. See section 5-12 for details.

Repair and Returns

Contact your LSP for repairs to your VLD and to obtain a Return Authorization Number (RAN) to return your VLD.

Contact an authorized installer to remove and re-install the VLD.

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Chapter 2 Introduction To Mobile GPS

Global Positioning System Overview

Global Positioning System (GPS) consists of a constellation of 24 satellites that lie in non-geosynchronous orbits at inclinations of 55^{o} approximately 11,000 miles above the Earth. This constellation, which circles the Earth once every twelve hours, is organized into four sets of satellites that follow each other in a total of six circular orbits.

An observer on the Earth 'sees' between six and eleven satellites at any given time when scanning the skies 5^{o} or more above the local horizon. Only 21 of the 24 satellites are used to provide positioning service; the remaining three are used as backups. This increases the availability and reliability of GPS on a global scale.

GPS satellites are used to calculate the position of a GPS receiver on or above the surface of the Earth by applying simple geometry, combined with some clever computing algorithms. These assist the receiver to determine the correct satellites to use, and resolve any location ambiguity that might arise. Each satellite broadcasts its unique navigation and identification signal that the receiver decodes and uses for calculation purposes.

When GPS algorithms are applied, the longitude, latitude, altitude and speed of the receiver unit can be determined. When this information is then applied to geophysical maps, the absolute location and speed of the receiver unit can be determined at high level of accuracy.

Originally developed by the US military, GPS was made available for civilian use by the US Department of Defense (DoD) in the early 1999s. The GPS system is free-of-charge to use. Anyone who has a GPS receiver can access the GPS satellites to pinpoint the receiver location. Originally civilian usage of GPS was limited to Coarse Acquisition (C/A) code. In May 2000 the C/A restrictions were removed, which resulted in increased accuracy from 30 meter (100 feet) to 3 meters (10 feet). Accuracy depends on number of parameters such as the number of satellites, the quality of antenna's reception, the vehicle's speed and the receiver's computing power.

For PowerLOC L-Biz Architecture, the GPS receiver on board the vehicle determines the absolute location: longitude, latitude, altitude and speed of the vehicle. The VLD records and transmits this information over the wireless network using public wireless carriers such as Cingular Wireless (US), and Rogers AT&T (Canada). The LSP, who hosts the Tracker Server, manages all interfaces to the Client (yourself).

The LSP facilitates the registration and activation of the VLDs, and provides the Client (yourself) with all customer care, billing, and connectivity services.

The Client Software enables you to locate your vehicle and perform additional functions (refer to page 1-3). Similar devices are also available to track people, animals and other assets.

Mobile GPS Applications

Mobile GPS applications are dependent on Customer's needs. The desired functionality will impact installation, activation, service plan and access methodology.

The following applications are typical usages for mobile GPS, which may or may not cover your needs.

Asset Recovery

A VLD can be used to serve as an asset locator, and to protect an asset in case of theft. Typically, such an application is used on an exception basis. The owner of the asset may be the only one to have access to the Client Software, and the user may not know the location of the VLD within the asset. The asset will typically be tracked only on a need-to-know basis, such as failure to meet lease terms, or suspicion of theft.

Single Vehicle Tracking

The VLD can be used to track the vehicle for purposes of safety, location management and anti-theft. The user is likely the owner of the vehicle, and has access to the Client Software. The user/client is able to access vehicle location, speed (on VLD103 only) and perform functions such as Set Geo-Fence. Communication is on an infrequent basis. However, if vehicle is stolen, many messages will be generated. The VLD may be installed in a semi-hidden location. Billing is on a single unit basis.

Fleet Management

VLDs can be installed for fleet management purposes. This implies frequent communication with dispatcher, transfer of vehicle information, and setting of features such as Geo-Fence etc. The VLDs and GPS receivers may be installed in semi-hidden locations. Service plan and billing are likely as fleet usage is aggregated, with detailed billing. The dispatch can view and track multiple vehicles on a single screen. The dispatcher can provide Call Center support.

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Chapter 3 VLD Provisioning

Provisioning Overview

VLD provisioning is required to make sure the VLD is recognized by the Tracker Server, gets the services and can communicate with the Client Software. Provisioning consists of the following two steps:

1. Registration with LSP.
2. Activation over the wireless network.

Registration

Use the following instructions to register information about the VLD, and the Customer in the LSP's Tracker Server database, and to select a service plan, method of payment, and billing information:

1. Connect via the Internet to PowerLOC web page at www.powerloc.com, or your LSP's web page. Identify yourself as a "New User", or an "Existing User with a New Unit".
2. Follow instructions and provide individual data on user and VLD. Provide User ID, Password, Serial Number, MAN or MIN Numbers (Carrier-dependent), and emergency contact details.
3. Select required functionality such as Geo-Fence, Alert (Panic) Button, and Quality of Service (frequency of monitoring). This can be updated after installation is completed.

4. Choose a service plan based on the functionality you require. Provide billing information, and indicate method of payment.

   Clients requiring fleet management services may need to make special arrangements with the LSP for billing options.

Activation

When registration is completed, the LSP contacts the wireless carrier and activates the VLD. The information provided during registration is used in the activation process.

Activation may take between 4 to 24 hours. When activation is completed by the wireless carrier, the LSP and client are notified by e-mail.

If you do not receive notification within 48 hours, contact your LSP.

Chapter 4 Software Installation and Setup

Overview

The VLD Device is tracked and controlled by the Client Software Fleet Manager, which is a Java base XML application. It can be installed on any Personal computer and communicates to the Tracker Server over the Internet. Users of the Client Software are Customers who are looking for individual vehicle or dispatchers who are responsible for a fleet of vehicles. The “Client Software” chapter provides basic information required to start and to use the customer’s application software. The chapter is intended to support the customer in becoming familiar with the Software functionality. Customers are encouraged to explore the various functions and use them to track and monitor their vehicle(s). Some differences in installation and presentation are expected due to individual PC configuration.

Staying Updated

New functionality is likely to be added to your Client Software after the release of this manual.

The LSP will notify customers of changes and updates and will advise you of new Client Software versions and additional functionality. Client Software should be kept at the same version as the Tracker Server software. Downloading new version of the Client Software will be over the Internet from a PowerLOC web page (http://216.18.80.36).

NOTE: The User Manual Version 1.2.6 corresponds to functionality available in Tracker Version 1.2.6.

System Requirements

Hardware: Minimum - Pentium 2; 64MB RAM; Fast Internet modem (see note); CD-ROM

Software: Minimum - MS Windows 95

Communication: No HTTP Proxy

NOTE: Tracker connectivity for retrieval of information and Maps depends on the speed of connection to the Internet. Usage of 64Kbs Modems may cause slow retrieval of information. If your connection speed is not sufficient, enquire with the LSP about PowerLOC Web-based Client Software. This package is accessible like a Web Page HTML but provides reduced set of functionality.

User ID and Password

User ID and Password are set by the Client with the LSP during the VLD Device Provisioning and Activation. Changes can be done only by the LSP.

Starting the Client Software

The Client Software is provided on a CD inside the VLD package. The CD has several files:

1. Java Software: File name **j2re1_3_0-win.exe is** also referred to on the web page as **Java 1.3 Runtime Engine.** Version may be changed as the Java Software evolves.
2. Client application software: File name **PowerLoc.exe** is also refers to on the web page as **PowerLoc Client 1.2.6.** Version may be changed as the Client Software software evolves.
3. VLD Product specs: Provided in Acrobat PDF format.
4. PowerLOC video presentation. This file requires loading and installing on your PC. Follow loading instructions. It provides background and quick access to key information but may not include all functionality.
5. User Manual: Provided in Acrobat PDF format.

To install the software

Warning: Make sure to install the JAVA Runttime Environment before the Client Application Software

1. Insert the Client CD in your PC CD-ROM and open the folder.
2. Install (Double-Click) the Java Software. Accept all options and the installation program will install Java on your PC.
3. Install (Double-Click) the Client Software. Accept all options and the installation program will install the Client Software on your PC.
4. If the Client Software version and the Tracker Server are not compatible, you may need to download the latest version. File size is approximately 5Mbytes and download time will depend on communication speed. Updates and new versions are available for download over the Internet from PowerLOC web page (http://216.18.80.36). The LSP Web page will

provide users with valuable information about the latest version and compatibility with the LSP's latest version of Tracker Software.

To start the Client Application

Access the Client Application from the MS Windows Screen using the following sequence:

- Click Program > PowerLOC Client > Fleet Manager
- Click LOGIN
- Enter User ID and Password. User ID and Password are set with the LSP as part of Provisioning.

After a successful login, you will see a default map or the last Map, which you accessed in previous session. Double-Click your fleet name in the Fleet Controller to show your vehicle(s). First time users will see a blank frame.

The Client Software fields are accessed and changed according to the Windows conventions.

- Left-Click to choose an item
- Right-Click to show properties or menu
- Click-Drag to move or re-size fields and tables
- Double-Left-Click to open function
- OK to accept changes
- Cancel to cancel changes
- Pull-Down Menus to access further functionality
- Unavailable fields or Tabs are shaded

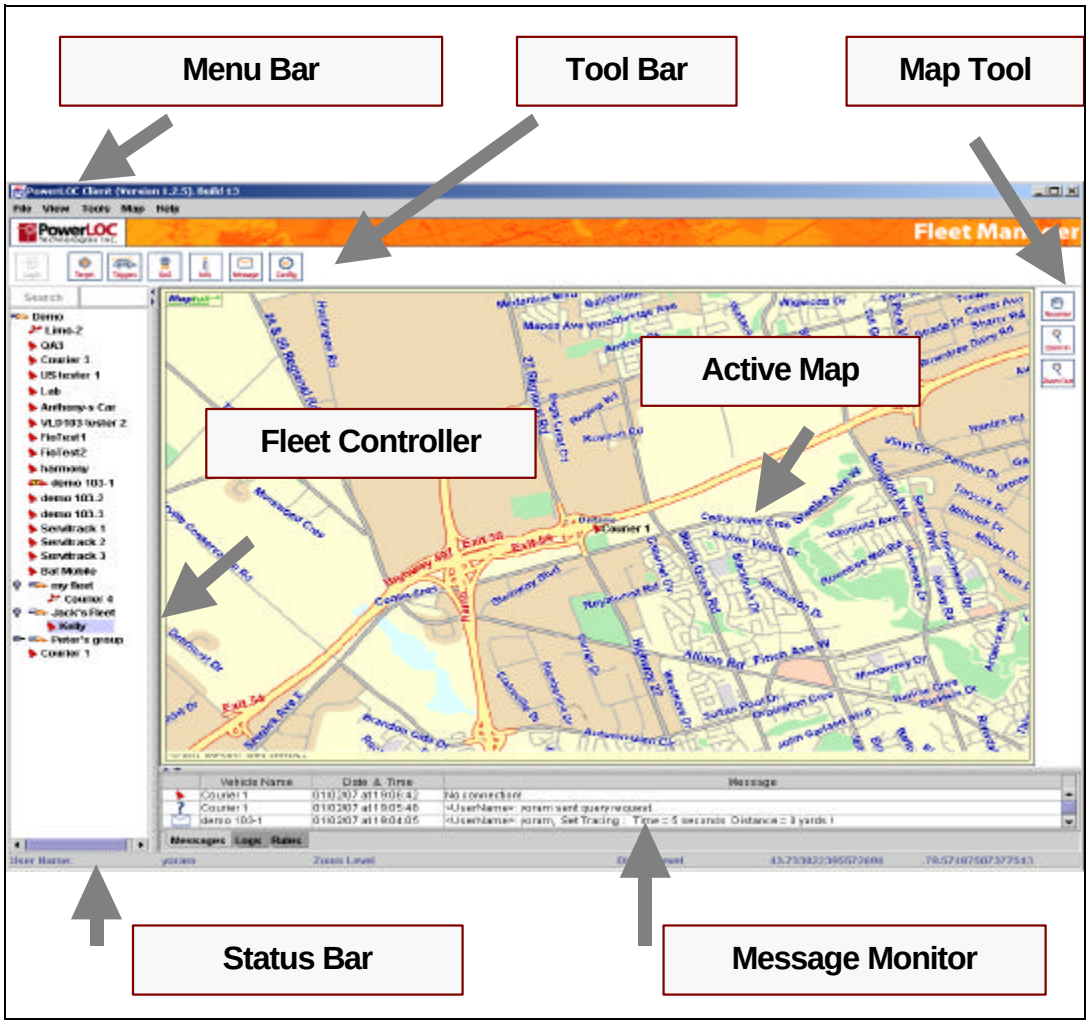


Figure 4-1 The Client Screen

The Client Screen

The Client Screen has seven areas. Most tracking functions can be activated from more than a single screen area or button. For example: By selecting (Left-Click a vehicle) and selecting a specific Button or by opening a vehicle menu (Right-Click a vehicle) and selecting an item from the menu.

Active Map

The Active Map displays every location and has Longitude, Latitude and Altitude details. Basic Map control functions are:

Sizing the Active Map size 1027 x 768. When you first start the application and depending on your monitor size, you may need to reduce and change the active map. If the area is larger than the allowed Map, you may see a blank gray space.

The Map has several **Levels** of details: Street, District, City, Region and Country. Changes in detail level are set by the MAP tab in the Upper Bar.

ReCenter the Map, **Zoom In** and **Zoom Out** can be done by the Fleet Tree, by a selected vehicle and by the MAP tab in the Upper Bar.

Pan Map to the right, left, up or down can be also achieved by placing cursor near the edge of the Map and Click.

Fleet Controller

The Fleet Controller shows your Fleet Name and all the vehicles in it. The vehicle status is reflected by Icons and by Color. Icons and colors may show:

- Blue vehicle represents an OK status; his Icon can be chosen with the Config Tab to any color, other than Red.
- Red vehicle epresents an Unknown status
- Red “raised vehicle” epresents an emergency
- Red Satellite epresents No GPS Location
- Red Communication Dish epresents a “No Wireless Connection”
- Gray vehicle epresents a status of no current GPS but available last known position (message "Here I Was")

Most vehicle functions are available by choosing a vehicle menu.

Vehicle display can be changed by organizing fleet and by choosing different modes of display such as display by vehicle model and display by driver’s name.

- **Search** to Search the Client's fleet for a vehicle by name, code or other field

Follow Mode

- Customer can follow vehicle on the Map by choosing the Follow Mode. In this mode, as the vehicle moves near to the edge of the MAP, the Map will be regenerated and recentered on the vehicle. Customer can get out of the mode by Stop Follow or by choosing another vehicle.

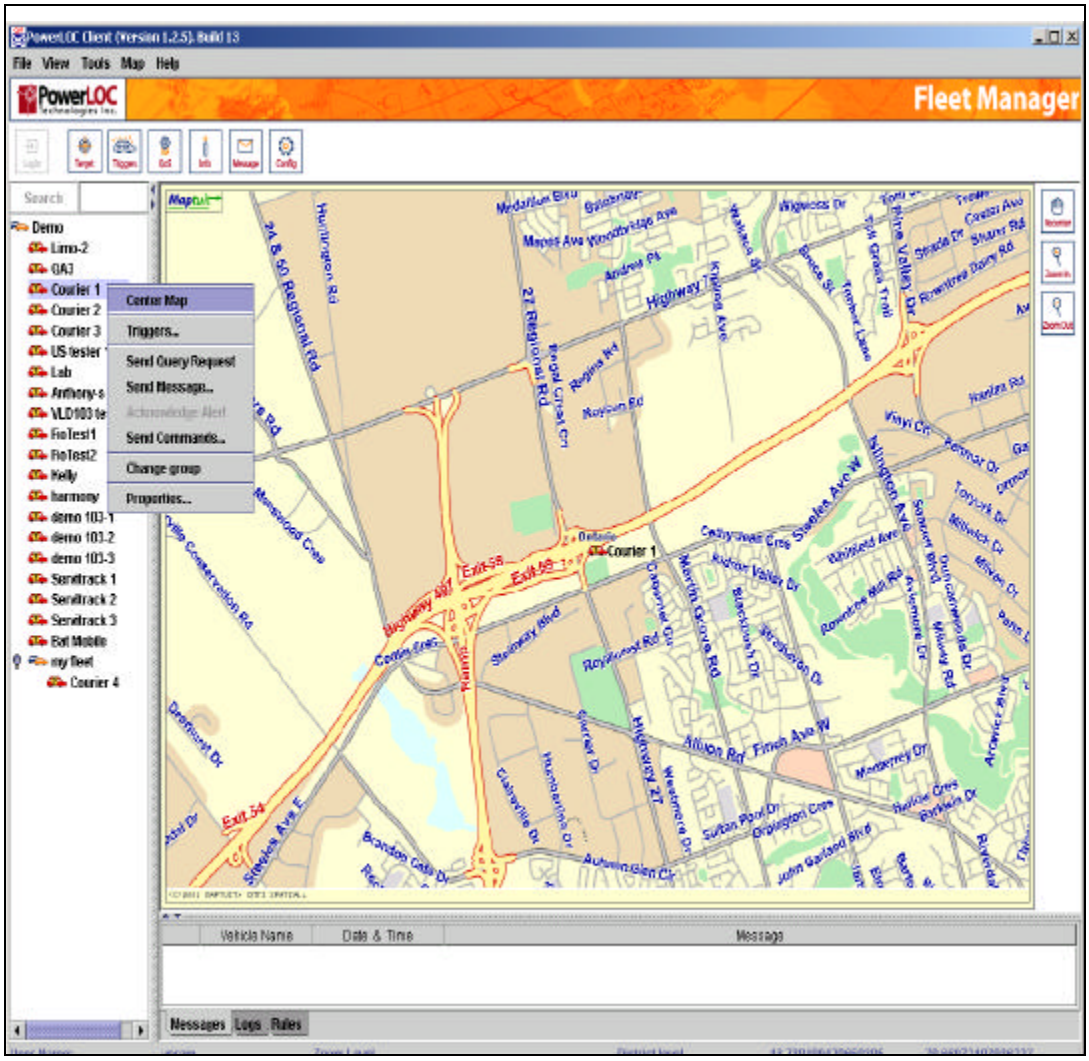


Figure 4-2 Choosing a Vehicle menu

Message Monitor

The Message Monitor shows information about the vehicle. Left-Click to chose a vehicle in the Fleet Controller, Right-Click to select and bring a menu. The menu is similar to the Fleet Tool Bar. Three Presentation Tabs are available. **Messages**, **Logs** and **Rules**. You can choose Tab and use the Upper Menu Bar to select content for Tools and Rules. The message includes an Icon representing the action or status, Vehicle name, Date & Time of communication, Message with the Vehicle status. Tools and Rules show similar information for the individual vehicle tracking and monitoring. Changes of the table are similar to other Software applications and include Up and Down Scroll and change of size and order of Table and fields.

Tool Bar

The Tool Bar has the following Push Buttons:

Login is accessible before Login and shaded after Login has been accomplished.

Target to Center the Map on a selected vehicle

Triggers to set Geo-Fence and Speed parameters

Info to display the properties of the selected vehicle such: General information, Messages, Cargo, Geo-Fence and tracing (QoS) values.

Message to send text messages from the customer to the vehicle. Sending messages requires that the Vehicle is equipped with display capabilities

Config: Change vehicle configuration options has two Tabs – Presentation and Setting.

Presentation: Provide additional set-up information for the vehicle. For example:

1. **Caption: Mobile unit caption** change the information which is provided to the client. By placing the cursor on a vehicle, client can get additional information about the vehicle such as drivers name or MAN (activation number).

2. Mobile unit Icon: select and change the Icons displayed for a vehicle in Normal, Speed and Geo-Fence alerts.

Setting to set display for Metric or Imperial system. This choice is critical when dealing with speed and distances and need to ensure alert is set for the correct system

Remote Connection required for set up of Client Software. To send messages by e-mail, client needs to provide SMTP Host. This information is available from your Internet Service Provider (ISP) or from your IT department. Warning: Do Not Change the other addresses on this screen.

Map Controller

The Map Controller provides the ability to manage the Active Map and Vehicle. It has 3 Buttons:

ReCenter: To center the Active Map on a vehicle which moved out of the center.

Zoom In: To Zoom closer to a desired vehicle so to see more location details.

Zoom Out: To zoom away from the vehicle and view of a larger area.

Menu Bar

Similar to windows functionality with manu bars and tabs..

File to manage the application. Includes:

Logout to logout of the session, without closing the fleet manager

Target to center Map on vehicle; same as target button in the Tool Bar

Properties to change vehicle data; same as Info button in Tool Bar

Exit to Logout and Close the Client Software application

View to track vehicle location, Includes:

ReCenter; Zoom In; Zoom Out which are same as buttons in Fleet Manager functions

History Log enables customer to save and recall Location history records. Functions include: Request Log, Play Log and Delete Log. With the History Log, Customer can chose up to 6 vehicles, select Start time and Duration of the history log, Define a file name to save the History Log. Later, customer can recall the saved file and view the travel route on the Map. The VLD will proceed and capture the Log History. The History Log is very useful for fleet management for monitoring and displaying the route which a vehicle took over an extended period of time.

Status Bar

Includes User ID information and a detailed GPS location of the location of the cursor on the Map.

Functions of the Client Software

The following describes various functions, which can be implement with your Client Software. It is only a partial list. PowerLOC encourages you to explore the capabilities and develop fluency in using the Client application to meet your individual needs.

Finding a vehicle

Right Click your vehicle name and choose Send Query

The Message monitor will show the message being sent and your vehicle(s) response.

Your vehicle response will indicate the status of your vehicle: Status may be Location; "No GPS" or "No Communication" or "Here I Was" for last known GPS fix.

The vehicle status in the Fleet Controller will change to reflect its status. The Active Map will display your vehicle in the last known location.

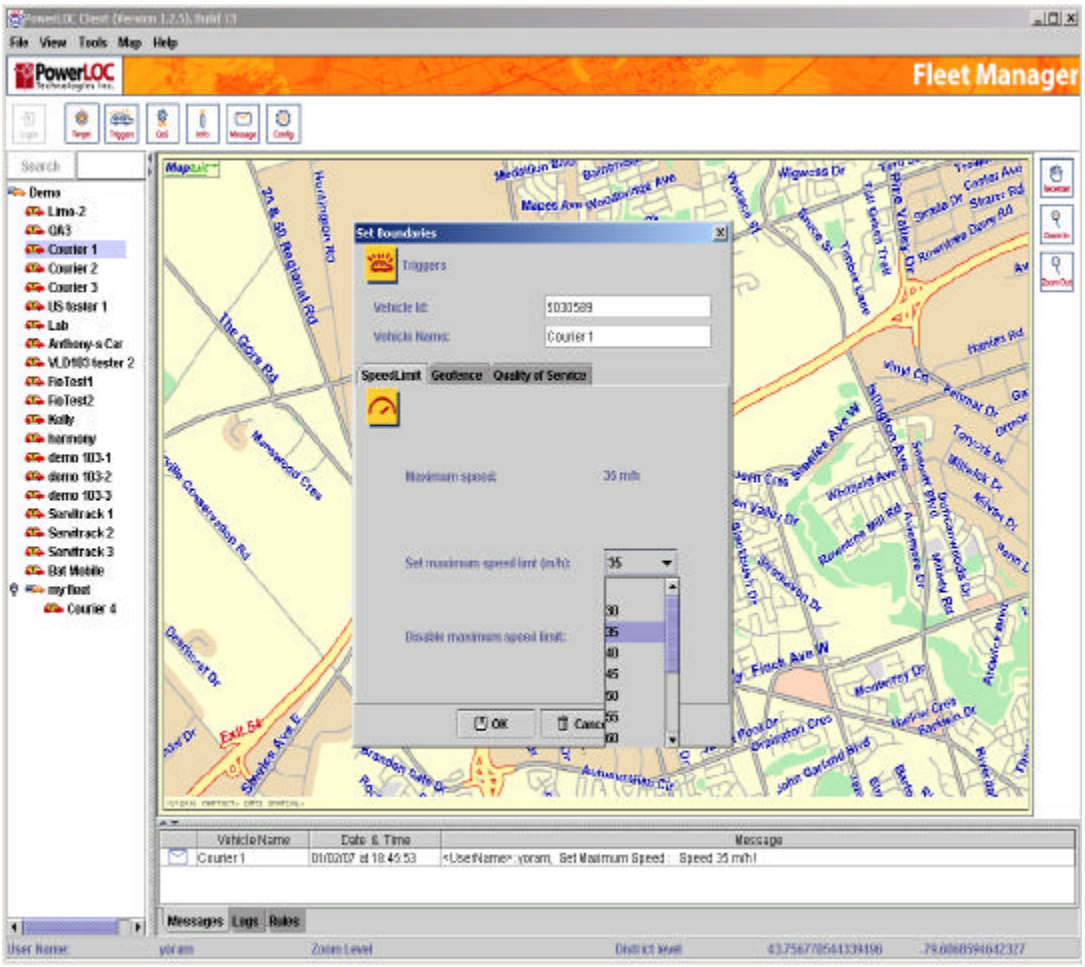
Centering Map

As vehicle moves, you may want to center the Map on its location, to center the Map on a different vehicle in your fleet or to center multiple vehicles of your fleet.

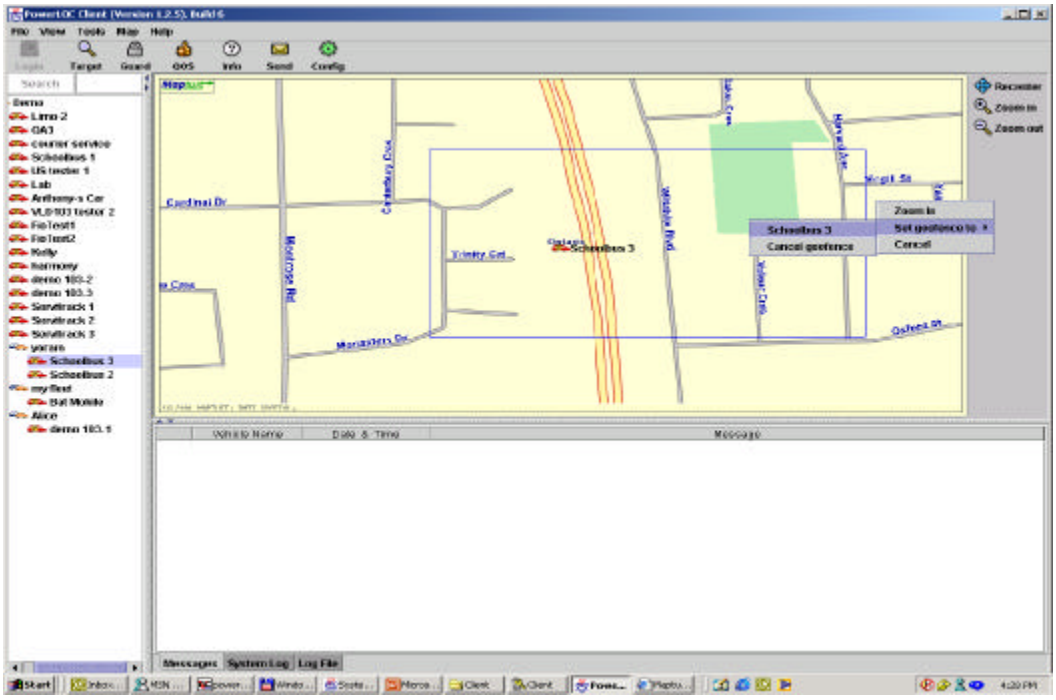
Choose vehicle(s) and Right Click, choose the Center Map option. Map will respond and Center on your vehicle/s. If multiple vehicles in various locations are to be presented, the Map will Zoom-Out to include all.

Setting Vehicle Parameters

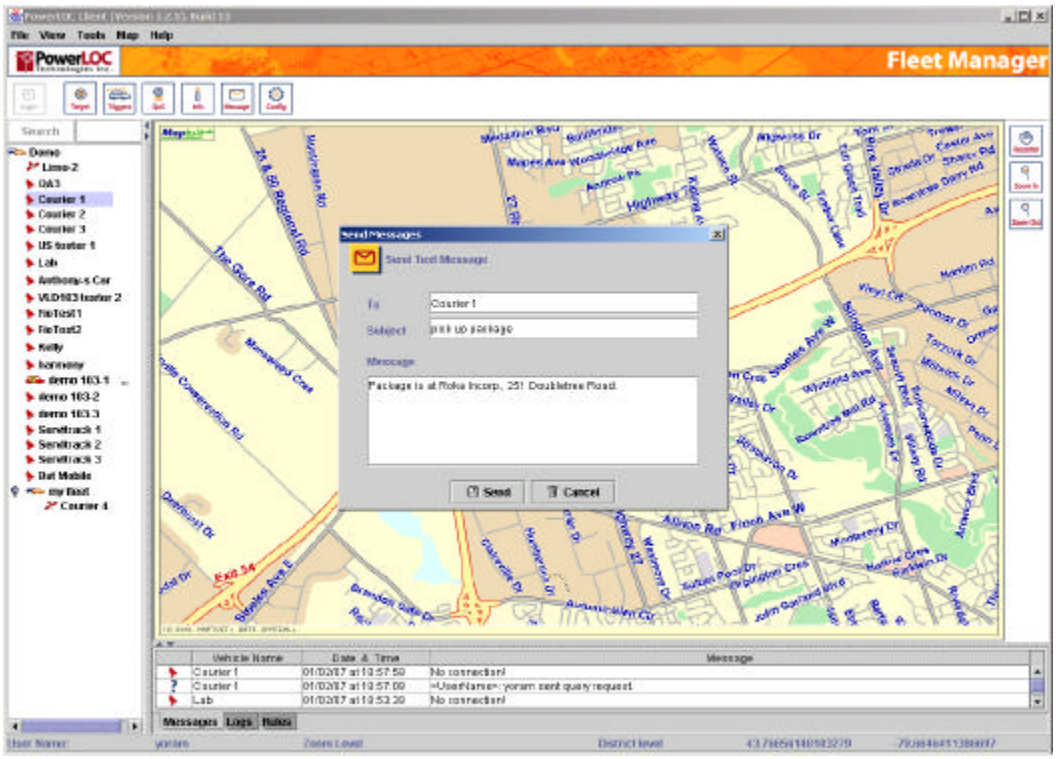
Following are several Screen Shots which are helpful in understanding the Client Software.



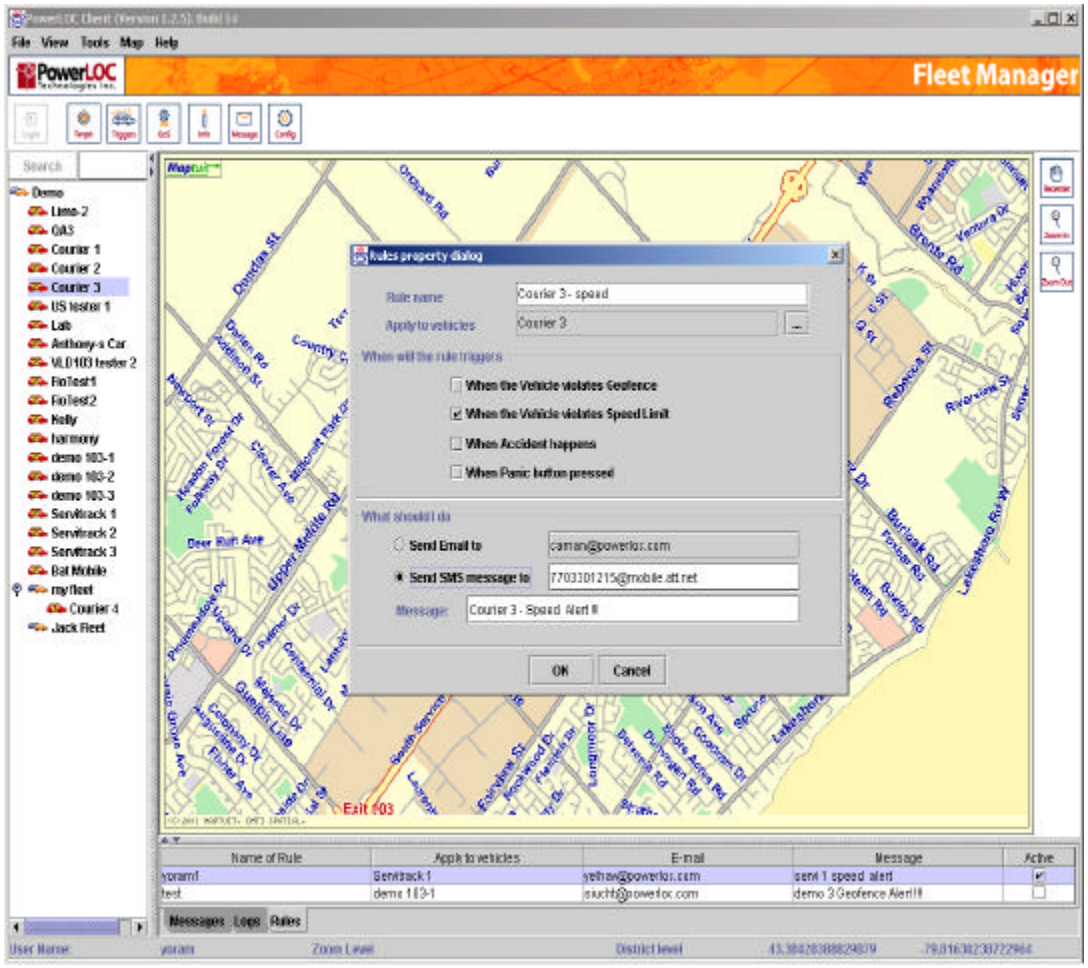
Screen Shot 4-1: Setting vehicle speed



Screen Shot 4-2 : Setting a Vehicle Geo-Fence by drawing a rectangle around the vehicle



Screen Shot 4-3: Send Message to Vehicle



Screen Shot 4-4: Changing Tracking Rules

Working with Vehicle List

- To view your list of vehicles: ***double-click*** on **PowerLOC** on the left side of the map.
- To add a group name: ***left-click*** on PowerLOC, ***right-click*** once, select **Add Group…**
- To move a vehicle to a different group: ***left-click*** on the vehicle name, ***right-click*** once, ***left-click*** on **Change group**.

- To sort the vehicle list by vehicle name: ***right-click*** on the group name, and ***left-click*** on Sort > Sort By Name.

Working with Map Functions

Zooming In: To select a pre-set zoom level: ***left-click*** on the **Map** pull-down menu. There are five pre-set zoom levels to choose from:

Street Level – zoomed in to 1-2 city blocks.

District Level – shows an area of several city blocks.

City Level – shows the entire city and its surrounding area.

Region Level – an area several hundred miles across.

Country Level – a continent wide view.

To zoom in on the map by a small increment first re-center the map so the point of interest you wish to zoom in on is centered on the map (see Re-center map below). ***Left-click*** on the **Zoom In** icon on the right side of the map.

To zoom out on the map by a small increment first re-center the map so the point of interest you wish to zoom out on is centered on the map (see Re-center map below). ***Left-click*** on the **Zoom Out** icon on the right side of the map.

To determine a custom zoom level***, left-click and drag*** a box around the area you wish to zoom in on. ***Right-click*** anywhere on the map, but not on a vehicle icon or name. ***Left-click*** on **Zoom in**.

Panning

To **Pan North**, **South**, **East** or **West**: ***left-click*** on the **Map** pull-down menu. Select **Pan North**, **Pan South, Pan East** or **Pan West**.

Re-center Map

To re-center the map: ***left-click*** on the **Recenter** icon to the right of the map window, then ***left-click*** on the map where you wish for the map to be centered.

Zoom In on a Specific Vehicle

To zoom in and center the map on a specific vehicle: ***left-click*** on the vehicle name on the vehicle list, ***right-click*** once, ***left-click*** on **Center Map**; or ***double-click*** on the vehicle name on the vehicle list. If the Fleet Manager has not received a location for the vehicle, you must first query the vehicle's location.

Zoom In on a Group of Vehicles

On the vehicle list, ***left-click*** on the group name you wish to center on the map. ***Right-click*** once, and ***left-click*** on **Center this group in the map**.

Locating Vehicles

To locate a vehicle which is not actively transmitting it's location, send a query request to that vehicle. To send a query request: ***right-click*** on the vehicle name on the vehicle list, ***left-click*** on **Send Query Request**.

To send a query request to a group of vehicles: ***right-click*** on the group name that you wish to query, and ***left-click*** on **Send Query Request**.

Working with Trigger Functions

Trigger function depends on the VLD, the VLD101 has a sub-set of functionality while the VLD103 has a full set of functionality. The VLD operates in a variety of modes – Stand-by, Exception, or Tracing, or a combination of the above. For example, the device may be set to transmit if it violates a Geo-Fence or if it violates a Speed Limit (VLD103 only). Users can change the operation mode settings for the VLD with the Fleet Manager software. The LSP using dispatchers and Call Centers has further application functions such frequency of reporting, using the Customer care Application (CCA) SW. For example, using these functionality, the VLD can report its location at predefined time intervals or every time it moves a predefined distance.

Stand-by Mode

In Stand-by mode the VLD waits for a query request from the user, then responds by sending its position. It does not use any airtime except when it is sending a response. The VLD will always operate in Stand-by mode, as long as 12V DC is powering it. If power to the VLD103 is interrupted, it will resume operation in Stand-by mode.

To set the VLD103 in Stand-by mode: ***right-click*** on the vehicle name on the vehicle list, ***left-click*** on **Triggers**, select **On Request**.

The VLD101 is in stand-by mode unless changed by Customer Care Application (CCA) to report loction every predefined time interval.

Exception Mode

In exception mode the VLD103 monitors the vehicle's location and speed and transmits an alert with its location if a geo-fence is violated or a speed limit is broken. Geo-Fences and speed limits can be set with the Fleet Manager software.

The VLD101 does not report speed and speed violation.

Setting a Geo-Fence via Client S/W

When setting the Geo-Fence make sure you have an updated location for the vehicle you are setting the geo-fence on. The geo-fence will be set to the last position that the Tracker has received. If the vehicle has moved since the last time the Tracker received a position, it will likely be outside of the geo-fence that you set, resulting an immediate violation when the geo-fence is applied.

To set a geo-fence on the current location of the vehicle: **Stand*right-click*** on the vehicle on the vehicle list, ***left-click*** on **Triggers**, ***left-click*** on Geo-Fence, ***left-click*** on **50 yards** and scroll down to select the radius of the geo-fence. ***Left-click*** on **OK** to apply the geo-fence, or ***left-click*** on **Cancel** to ignore it.

To define a geo-fence on the map: ***left-click*** on the vehicle name for which you wish to set the geo-fence. ***Left-click and drag*** a box on the map to define the geo-fence perimeter. ***Right-click*** on the map (but not on a vehicle icon or name), position the mouse pointer on **Set Geo-Fence to?**, and select the vehicle name.

The VLD101 and VLD103 can set a small Geo-Fence around the vehicle as an Anti-Theft device. This small Geo-Fence can be set by pressing the Geo-Fence Button. It can be un-set by a second pressing on the Geo-Fence button.

Setting the Speed Limit

The VLD103 can be set to monitor the vehicle's speed and transmit an alert if a specified speed limit is exceeded.

Tracing Mode

In tracing mode the VLD103 will transmit the vehicle's location at regular time intervals, or every time the vehicle moves a certain distance, or a combination of the two. When tracing is set with the **Fleet Manager** software, the command is sent to the VLD103 by wireless network, and the setting is applied to the mobile unit itself. Your VLD103

- To set the VLD103 in Tracing mode: ***right-click*** on the vehicle name on the vehicle list, ***left-click*** on **Triggers**, ***left-click*** on **Quality of Service**.
- To set tracing by time interval: ***left-click*** on **On Request**, scroll down and ***left-click*** on the time interval you require.
- To set tracing by distance: ***left-click*** on the **enable distance** box, ***left-click*** on **50m**, scroll down and select the distance interval you require.
- ***Left-click*** on **OK** to apply your settings to the mobile device. ***Left-click*** on **Cancel** to ignore the settings.

Communicati -on with VLD

If the VLD103 installed in a specific vehicle is equipped with a user interface (an optional LCD display or printer), you can send messages to that user. VLD103 that does not have a user interface will receive the message, but will have no way to display it to the user.

- To send a message to a mobile unit: ***right-click*** on the name of the vehicle you wish to send a message to, ***left-click*** on **Send Message**. Enter the subject of your message in the subject line, and type your message in the field below

Send Commands

The VLD has the ability to control vehicle operations such as remotely unlocking doors and sounding the horn. In order to be able to perform these functions, the VLD has to be wired into the vehicle interface during installation. This requires a qualified automobile alarm system installer to complete the installation.

To activate a vehicle function: ***right-click*** on the name of the vehicle you wish to operate a function on, and ***left-click*** on **Send Command**.

Chapter 5 Installation Guidelines and Testing

Installation Overview

WARNING!

To satisfy FCC RF exposure rquirements for mobile transmitting devices, a minimum seperation distance, as per tables 5-1 and 5-2, must be maintained between the antenna of this device and persons during device operation. Operation at closer than this distance is not recommended.

CAUTION!

Installation should only be performed by an authorized installer. Product warranty is null and void if the device is not installed by an authorized installer.

CAUTION!

Changes or modifications not expressly approved by PowerLOC voids the user's authority to operate the equipment.

Before starting installation test the VLD device to ensure that it is working. The VLD device should be provisioned and activated before installation is started. PowerLOC suggests that you connect the device to power and query the VLD via the Client Software before installation.

A wiring harness is supplied with the device. Additional mounting hardware such as screws, tie-wraps, fuses etc., must be provided by the installer to meet the vehicle's specific requirements. To reduce the risk of electrical schokck, connect the +12V harness wire last. Then plug the harness connector into the VLD.

Installing the device consists of four steps:

1. Install GPS receiver and wireless antenna.
2. Installing the wiring harness
3. Install the VLD Module.
4. Connect the wiring harness and the VLD Module.

The following distance guidelines must be followed when installing the Wireless Antenna. The provided Wireless Antenna has Gain of 3.5 dbi. If a different antenna is used, check the manufacturer's

specifications sheet for gain information.

Table 5-1 VLD101 Antena Minimum Safety Distance from occupants

Antenna Gain (dbi)	Min. Safety Distance (cm)	Min. Safety Distance (in)
≤ 1	24	9 1/2
>1 and ≤ 2	27	10 3/4
>2 and ≤ 3	30	12
>3 and ≤ 4	34	13 1/2
>4 and ≤ 5	38	15 1/4
>5 and ≤ 6	42	16 3/4

Table 5-2 VLD103 Antenna Minimum Safety Distance from occupants

Antenna Gain (dbi)	Min. Safety Distance (cm)	Min. Safety Distance (in)
≤ 1	20	8
>1 and ≤ 2	21	8 1/4
>2 and ≤ 3	24	9 1/2
>3 and ≤ 4	26	10 1/4
>4 and ≤ 5	29	11 1/2
>5 and ≤ 6	33	13

Installing GPS Receiver & Wireless Antenna

The GPS receiver is location-sensitive, and must have a clear view of the sky. The receiver should be installed in a horizontal plane to enhance the quality of reception – for example on the dashboard, under the windshield, and behind the rear seat – refer to Figure 5-1. The GPS receiver can be concealed under a cover, providing it is non-metallic. For hidden applications, the GPS receiver can also be installed under the front dashboard with reduced reception, providing the dashboard does not have a metallic composition. Ensure the GPS unit faces up and use a bracket to fasten the GPS receiver in place.

The wireless antenna comes with an internal or an external antenna. The internal (in-vehicle) antenna may be hidden from site, but it should be installed away from metallic objects. For Anti-theft applications, it is recommended to hide the VLD module and an internal antenna. Hidden antennas are likely to offer reduced coverage. .

Alternatively an external antenna can be mounted outside the vehicle. It is likely to provide a better coverage and is suggested for fleet management applications.

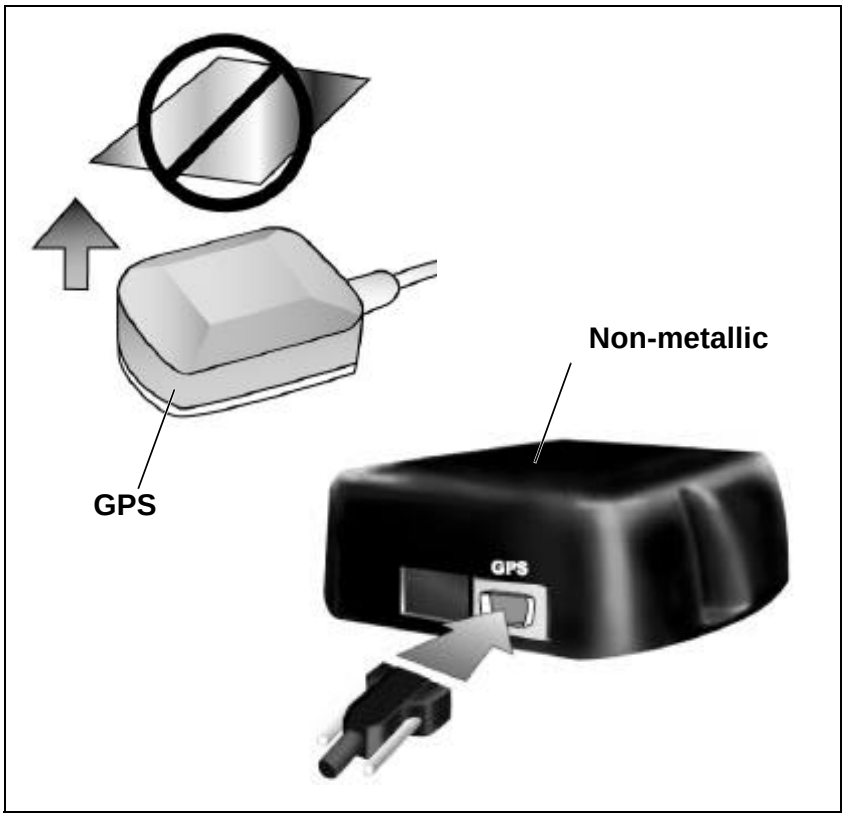


Figure 5-1 GPS Receiver Installation.

Installing VLD Module

The VLD module can be installed in a hidden location such as underneath the dashboard, in the trunk or under a vehicle seat. Bolt it down firmly or attach with tie-wrap to the vehicle.

The VLD has two 8-pin connectors, marked GPS and COM make sure that GPS antenna is connected to the GPS connector. The COM connector is an RS-232 port and is used for testing and 2-way messaging.

NOTE: VLD with an internal accelerometer (VLD models that end with an "A" – for example, VLD103A) should be mounted horizontally for the accelerometer to work properly. For all other VLD models, the orientation is not critical.

NOTE: In order to detect high acceleration/deceleration rates that are typical of a crash, it is important to securely fasten the VLD module to the vehicle.

Connect the 8-pin connector from the GPS receiver to the 8-pin connector marked “GPS” on the VLD module. Make sure that the cable is hidden. If the VLD has an external wireless antenna, connect the antenna to the VLD module, and secure it.

Basic Installation

End-User may self install the unit by connecting it via a cigarette lighter plug adopter. This plug is not provided with the VLD and can be purchased from supplier of electronic and automotives electronical parts. Connect the plug to the Harness as described in table 5-3. Once plug is connected, it can be pluged into vehicle cigarette lighter. Basic Installation does not include connection of input and output relays to vehicle functions.

Standard Installation

An authorized installer will connect the VLD module, using the Harness and in accordance with table 5-3. Standard instalation may include connection of Input and Output relays to vehicle functions..

General Notes

Water and Moisture: Keep the VLD module away from exposure to rain and all moisture.

Ventilation and Condensation: The GPS receiver and the VLD module generate heat, which must be allowed to dissipate. Allow a 10 cm (4 in) gap between these components and other hot surfaces, and avoid installing them near excessive heat sources such as a vehicle heater or the engine.

Spills: The VLD is enclosed, but not hermetically sealed. Care should be taken to ensure that liquids are not spilled on the VLD.

Magnetic Field: The VLD should be installed away from any device that generates strong magnetic fields.

Service: The VLD should be serviced by a qualified service personnel when:

1. There is physical damage to the device.
2. No reception and communication, as confirmed by the LSP.
3. The device does not appear to operate normally or exhibit a marked change in performance.
4. The device has been exposed to rain, or other liquid and demonstrates abnormal performance.
5. When advised by PowerLOC.

The user should not attempt to service the device – refer to a qualified service personnel.

Wiring the VLD Module

The VLD module has four external connectors:

- I/O - Interfaces to the vehicle wiring harness, including vehicle's battery, Alert (Panic) button, door locks etc.
- GPS – Interfaces to the GPS receiver
- COM – Interfaces to a computer for testing and updates

- BAT – Interfaces to auxiliary battery pack

All auxiliary equipment such as Alert (Panic) button and door lock connectors, should be installed after the vehicles fuse box in accordance with vehicle safety standards..

Wiring Harness Description

Table 5-3 describes the configuration of the wires in the wiring harness.

Table 5-3 Wiring Harness Description.

Connector	Pin	Designation	Color	Function
I/O	1	GND	Black	Connect to Vehicle Ground
I/O	2	+12V	Red	Connect to Vehicle power, after Fuse Box
I/O	3	- IN 1	Green	Negative Input #1
I/O	4	+IN 1	White	Positive Input #1
I/O	5	- IN 2	Brown	Negative Input #2
I/O	6	+IN 2	Blue	Positive Input #2
I/O	7	NC 1	Orange	Normally Close Output #1
I/O	8	NO 1	Yellow	Normally Open Output #1
I/O	9	COM 1	Violet	Common Output #1

Table 5-3 Wiring Harness Description.

Connector	Pin	Designation	Color	Function
I/O	10	NC 2	Gray	Normally Close Output #2
I/O	11	NO 2	Pink	Normally Open Output #2
I/O	12	COM 2	Tan	Common Output #2
Battery	3-Pin			Auxiliary battery Connector
GPS	8 - Pin			GPS Antenna Connector
COM (RS-232)	1	DCD		Carrier data Select
COM (RS-232)	2	RD		Receive Data
COM (RS-232)	3	TD		Transmit data
COM (RS-232)	4	DTR		Data Terminal ready
COM (RS-232)	5	SG		Signal Ground
COM (RS-232)	6	DSR		Data Set ready

Table 5-3 Wiring Harness Description.

Connector	Pin	Designation	Color	Function
COM (RS-232)	7	RTS		Request to Send
COM (RS-232)	8	CTS		Clear To Send

I/O Connector

Figure 5-2 shows the contacts of the 12-pin I/O connector.

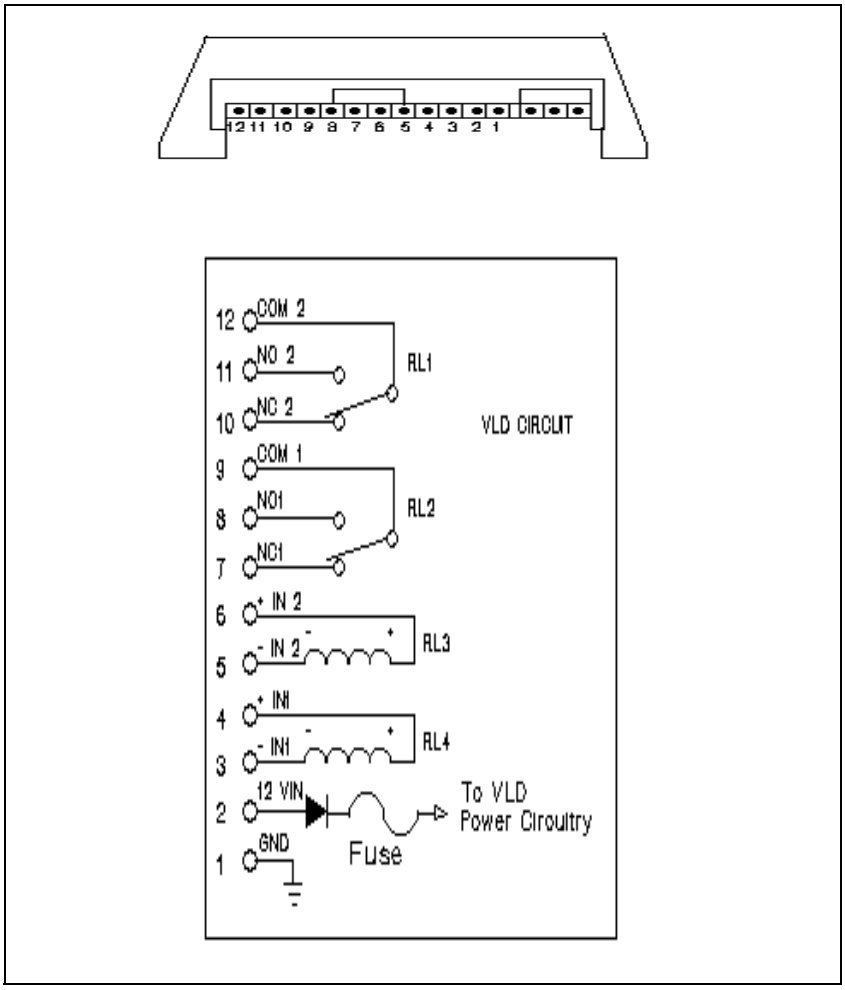


Figure 5-2 12-Pin I/O Connector.

The following is a list of the I/O contacts:

Pin 1 – Black, Ground. Connect to chassis ground.

Pin 2 – Red, +12V. Connect to constant +12V, after a 10A Fuse.

Pin 3 – Green. Negative input (-) to VLD Relay #4 (RL4). Use to provide a negative input for a Panic Button, Geo-Fence or a Remote key entry.

Pin 4 – White. Positive input (+) to VLD Relay #4 (RL4). Use to provide a positive input for a Panic Button, Geo-Fence or a Remote key entry.

Pin 5 – Brown. Negative input (-) to VLD Relay #3 (RL3). Use to provide a negative input for a Panic Button, Geo-Fence or a Remote key entry.

Pin 6 – Blue. Positive input (+) to VLD Relay #3 (RL3). Use to provide a positive input for a Panic Button, Geo-Fence or a Remote key entry.

Pin 7 – Orange. Normal Close (NC1) output from VLD Relay #2 (RL2). Use to provide a activate output such as Vehicle Immobilizer, Vehicle Horn, Door Lock, Light Flashing etc.

Pin 8 – Yellow. Normal Open (NO1) output from VLD Relay #2 (RL2). Use to provide a activate output such as Pin 7, which require a Normally Open circuit.

Pin 9 – Violet. Common (COM1) output from VLD Relay #2 (RL2). This output should be connected if Pin 7 and / or Pin 8 are connected.

Pin 10 – Gray. Normal Close (NC2) output from VLD Relay #1 (RL1). Use to provide a activate output such as Pin 7, but different outputs.

Pin 11 – Pink. Normal Open (NO1) output from VLD Relay #1 (RL1). Use to provide a activate output such as Pin 10, which require a Normally open connection.

Pin 12 – Tan. Common (COM1) output from VLD Relay #1 (RL1). This output should be connected if Pin 10 and / or Pin 11 are connected.

GPS Connector

The GPS receiver connects to the GPS 9-pin connector.

COM Connector

Requires a 9-Pin to D-Type cable (optional). Connects to a PC for test purposes and to an LCD display for messaging.

Auxiliary Battery Connector

Connects an auxiliary battery pack with the 3-pin connector. The matching connector comes with the battery pack.

Optional Connections

The following are optional connections for external alarms and functions:

Door Lock: The driver and/or passenger door actuators can be connected to the VLD to:

1. Unlock doors if driver has been accidentally locked out of the vehicle.
2. Lock the doors if the vehicle has been stolen, to prevent the thief from leaving the vehicle.

Immobilize Vehicle: Control the starter circuitry to prevent the vehicle from being restarted when there is a Geo-Fence violation. For safety reason, the ignition will not be switched off when the engine is running.

Alert (Panic) Button: Install the Alert (Panic) button so that it is partly hidden yet within the reach of the user.

Remote Activation: Connect the VLD to a remote control unit to allow Geo-Fence to be activated by a key-less remote control unit. This may be done using an existing remote control unit.

Internal Accelerometer: VLD100 units with an internal accelerometer must be installed horizontally and securely fastened for the accelerometer to function properly.

NOTE: To function properly, the accelerometer must be installed on a level horizontal plane, and fastened securely.

Head Lights Control: VLDs can be configured to flash the head lights. This can be activated when there is a Geo-Fence violation or as an Anti-Theft device.

Cigarette Lighter Quick Connector: The VLD can be powered using the vehicle's cigarette lighter socket. This would be handy when the user does not wish to have a permanent installation, and only wants to have basic features such as GPS location. This allows the unit to be moved around from vehicle to vehicle, as required.

Auxiliary Battery Pack: An auxiliary battery pack can be used to ensure that power is available even when the vehicle battery is disconnected, or monitor an asset which does not have a +12V power supply.

Geo-Fence: Geo-Fence is virtual rectangle area around the vehicle that can be monitored to detect any movement of the vehicle. Geo-Fence can range from 50 meter to 500 meters. Typically, Geo-Fence is set to 50 meters to detect vehicle unauthorized movement i.e. for Anti-Theft.

Testing

Once installation of VLD and antennas are completed, test the VLD using the following instructions:

1. Use the Client Software to confirm that the VLD device appears on LSP Map screen at the appropriate location. Alternatively, call the LSP and verify that the device is recognized, and registered on their Tracker Server.
2. Drive the vehicle and confirm with the LSP that the VLD is tracked. This ensures that the display and the actual location of vehicle are correlated, and that the vehicle's speed is also monitored correctly.
3. Activate additional functionality such as Panic Button, Geo-Fence and Speed alert. Ensure alarms and alerts are monitored correctly on the LSP Map.

Self-Testing

Once installation is completed, you should access your vehicle via the Client Software, or directly on the Web.

Check that you can find your vehicle, and are familiar with the various tracking options.

Warranty Card

Once testing is completed, the installer should fill out the on-line Installation Report, or fill an Installation Report and mail it along with the Warranty Card to PowerLOC. Incomplete Warranty Card or missing Installation Report will null and void the warranty.

Limited Warranty

1. Limited Product Warranty: PowerLOC (PLT) warrants to the Buyer that the Products shall substantially conform to PLT's specification for a period of one (1) year from the date of the original purchase by the end user (the "Warranty Period"). As PLT's sole obligation and Buyer's exclusive remedy for any breach of warranty, PLT agrees, at its sole option, to (i) use reasonable efforts to repair the Product with new or refurbished replacement parts: (ii) replace the Product with a new or refurbished unit; or (iii) refund the purchase price, provided Buyer returns the defective Products to PLT with proof of purchase and PLT's authorization.

PLT's warranty hereunder does not apply in case of any damage caused by accident, abuse, misuse, misapplication, or alternation of any kind performed by anyone other than PLT. The Products are not designed or licensed for use in mission-critical application or in hazardous environment requiring fail-safe controlss, including without limitation operation of nuclear facilities, aircraft navigation or communication systems, air traffic control, and life support or weapons systems. Without limiting the generality of the foregoing, PLT specifically disclaims any express or implied warranty or condition of fitness for such purposes.

PLT's warranty does not in any event, apply to physical damage to the surface of the Product or to replacement, PLT shall have no obligation with respect to any data stored in the Product.

Except as expressly provided in this section, PLT makes no warranties for includes any conditions with respect to the products, express or implied, including, but not limited to, the implied warranties or conditions of merchantability, fitness for a particular purpose and noninfringement.

2. Liability Limitation in no event shall PLT be liable to buyer for, and buyer hereby waives any indirect, special, incidental, or consequential damages connection with the transactions contemplated by this agreement, whether or not such damages were foreseen or theirlikelihood disclose. PLT shall not be liable to buyer or any third party claiming through buyer, for any damages of any kind in excess of the amounts paid by buyer under the terms of this agreement with respect to the products giving rise to such damages. Some juridictions do not allow the exclusion of or limitation on implied conditions, warranties, or damages, so some of the foregoing may not apply to buyer.

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Appendix A I/O Interface Examples

Example 1

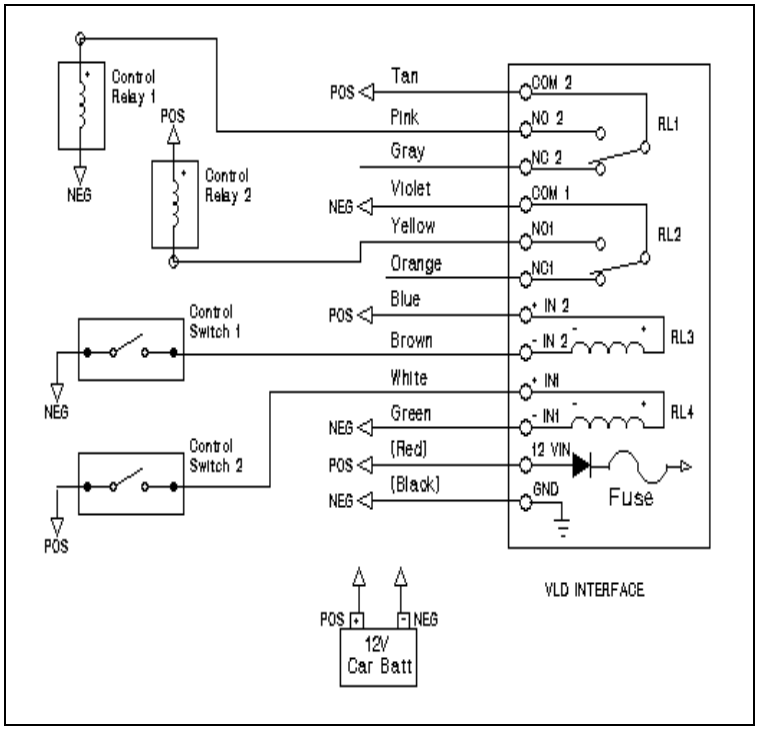

Figure A-1 Negative and Positive References.

Example 2

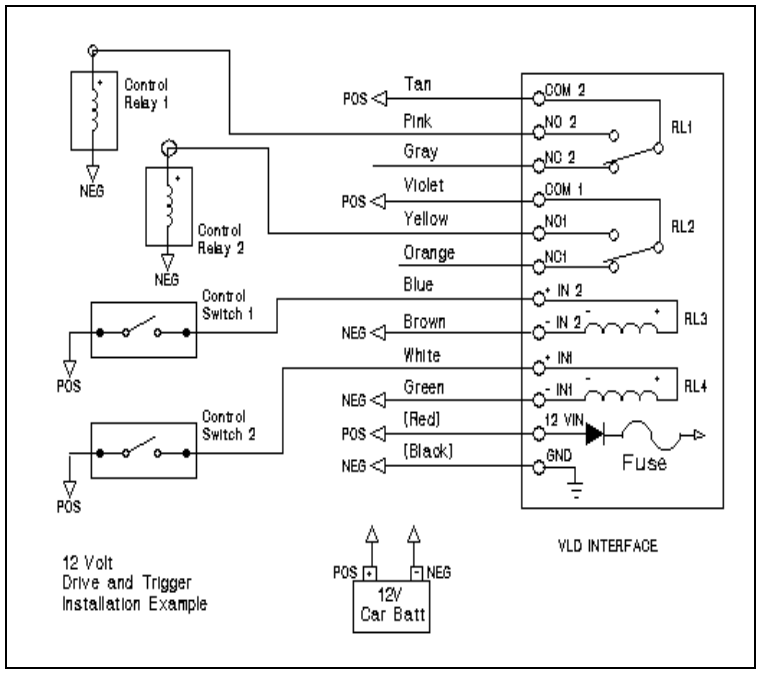

Figure A-2 Input Relay Negative, Output Relay Positive.

Example 3

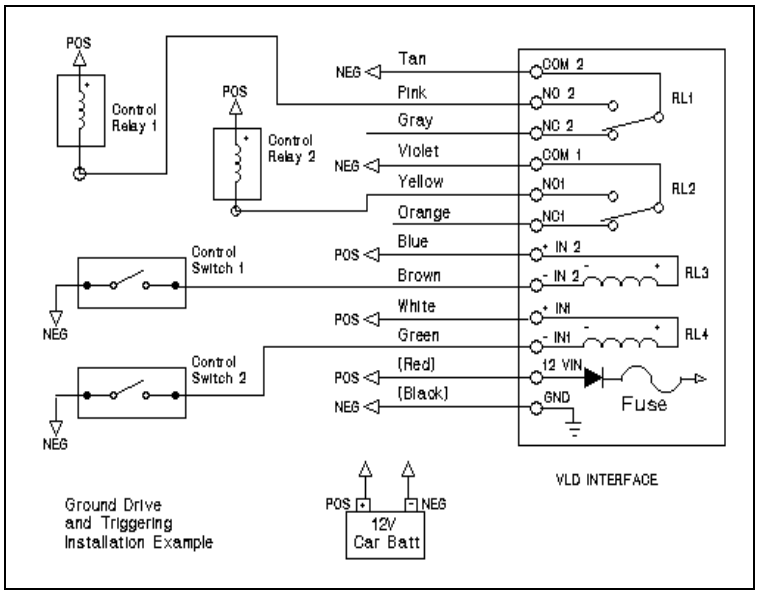

Figure A-3 Input Relay Positive, Output relay Negative

Example 4

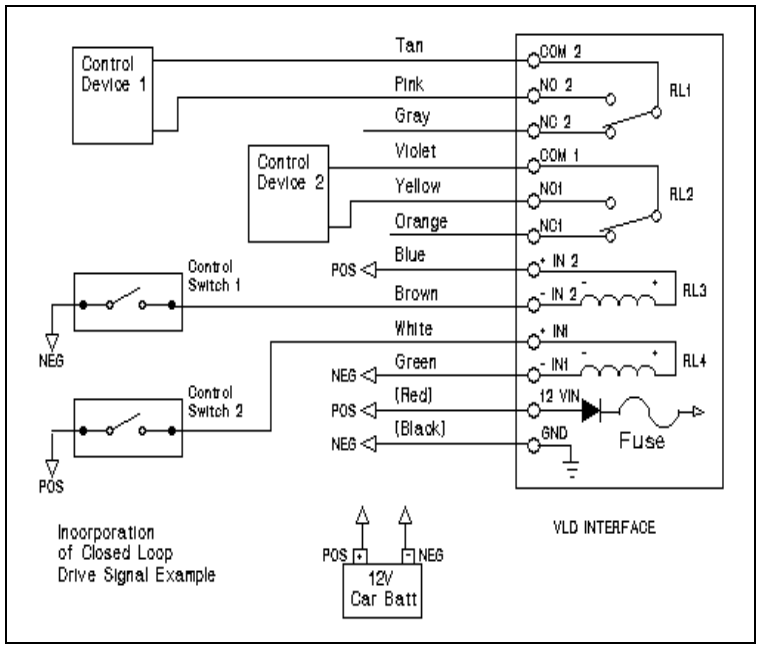

Figure A-4 Closed Loop Signal

Example 5

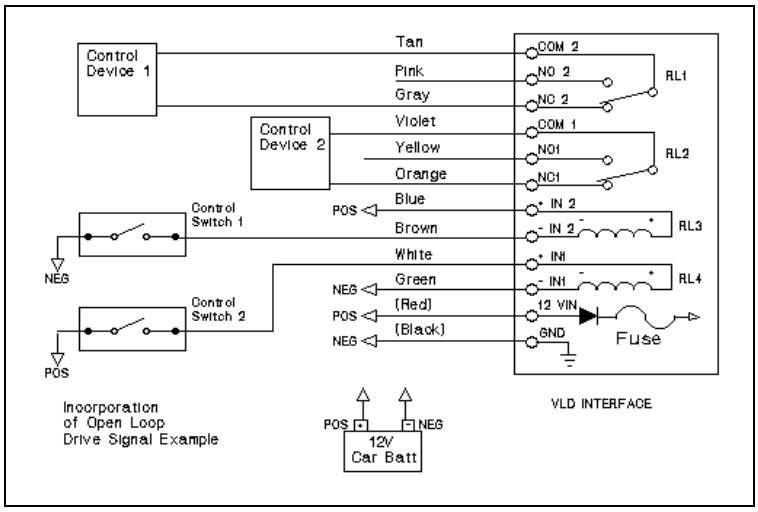

Figure A-5 Closed loop Signal

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