



I.D. SYSTEMS, INC.

VAC™ – Vehicle Asset Communicator™

A Wireless Fleet Management Device

VAC User's Guide

Version 3.1.x

VAC™ – A WIRELESS FLEET MANAGEMENT DEVICE

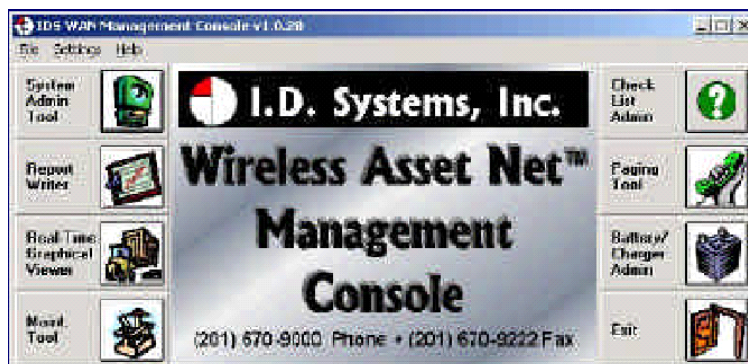
VAC – User's Guide



VAC™



IDS Gateway™



IDS WAN Console™

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Preface

This manual is a user's guide for the VAC (Vehicle Asset Communicator), a Wireless Fleet Management Device developed by I.D. Systems, Inc. This guide provides the instruction necessary for someone to install, operate and maintain the VAC device in a vehicle. *Note: This user's guide may change without notice due to enhancements or changes to VAC.*

Related Documents

Vehicle Survey (Doc. #: 026-1000-01)

Publication History

Version	Date	Changes
2.5.x	9.18.02	Initial
2.6.x	10.25.02	New Modules: Seatbelt monitor & Battery rotation, new installation screens and color coded connector labels
2.7.x	01-03-03	Add Ext Reader Test, Ext LED Test, Security Features
2.8.x	08-07-03	Add Critical OSHA Shutdown, Blank VAC In Motion
3.0.x	11-03-03	Now Using New Enclosure
3.1.x	03-11-04	O/T versions for new enclosure

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FCC Compliance Statement

Compliance Statement (Part 15.19)

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 (Part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Compliance Statement (Part 15.247)

This device complies with Part 15.247 of the FCC rules. Operation is subject to the following condition:

To comply with FCC's RF exposure limits for general population/uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

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Introduction

This manual is a user's guide for the VAC (Vehicle Asset Communicator), a Wireless Fleet Management Device developed by I.D. Systems. This guide will introduce the reader to the VAC and to I.D. Systems' Fleet Management solution. In addition, this guide also includes information about VAC installation procedures, installation options, operator instructions, maintenance procedures, and troubleshooting. The owner and user of a VAC can use this guide to understand how a VAC works and how to interact with it.

The Introduction section covers general information about the IDS Fleet Management System, and what part the VAC device plays in the system. Users of the IDS Fleet Management System should familiarize themselves with this information to better understand the detailed instructions in this guide.

The Installation section provides detailed procedures and guidelines for hardware installation. Electricians, mechanics or maintenance persons responsible for VAC installation or troubleshooting should familiarize themselves with this hardware installation process. This will allow them a better understanding of the interface between the VAC and the vehicle being managed. In addition, those who perform vehicle maintenance will better understand the implications of parts replacement or rewiring. Finally, VAC troubleshooting is more easily understood with an understanding of hardware installation procedures and guidelines. In order to complete VAC installation, maintenance user software, covered in the VAC Operation section is required.

The Standard VAC Operation section explains how the user interacts with the VAC user interface (keypad, display and ID reader). As a mini-computer, the VAC is an interactive device requiring an operator to interact with it. Standard operators (vehicle drivers) must familiarize themselves with the section on Basic Operation, Access Control, Electronics, OSHA Checklists, and Two-Way Text Paging, either through reading the Guide, or through hands-on training. Floor supervisors with special system privileges (Master Users) should also become familiar with the Master User features.

The appendices include additional information for those who have purchased or who maintain the VAC. Appendix A details the physical specifications of the system, which is useful for those who wish to understand how the VAC will work in specific environments. Appendix B is a troubleshooting guide for maintenance personnel to handle issues with the VAC that may arise through installation or operation. Finally, Appendix C covers warranty information for those who have purchased the VAC product.

System Overview

The VAC is part of a comprehensive fleet management solution, integrating access control, vehicle

monitoring, safety, maintenance and communication technology in an industrial vehicle. Within the VAC, a processor is integrated with an RF transceiver and vehicle interface and runs an embedded computer application. Information about the attached vehicle is communicated from the VAC over the wireless infrastructure of Gateways™, to I.D. Systems software (refer to the system diagram in Figure 1).

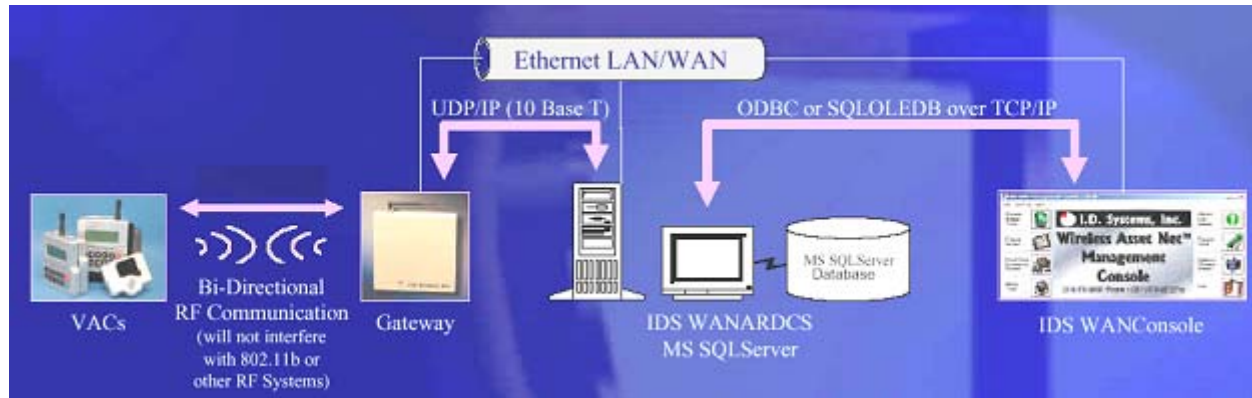


Figure 1: IDS Fleet Management System Diagram

The VAC device both sends and receives information, such as access control updates, pages, updated configuration settings, and scheduled maintenance event information, and interacts with the vehicle's driver using a keypad, display, and optional ID readers.

Installation

WARNINGS

*** Please read this document in its entirety
BEFORE performing any installation. ***

*** Please disconnect main vehicle battery
BEFORE performing any installation. ***

Standard Hardware for Installation

The standard components of the VAC system are installed on every vehicle type (Industrial Electric *and* Internal Combustion). The following is a list of standard equipment that is required to install each VAC system:

- ❑ 900-0144-02: Universal Vehicle Asset Communicator (VAC)
- ❑ 810-0113-0x: VAC-to-PCM Cable
- ❑ 835-0121-01 and -03: Mounting Hardware Assortments
- ❑ 825-0111-01: Vehicle Asset Communicator Mounting Bracket

During hardware installation and system configuration, a test sheet must be filled out and sent (via mail or fax) to I.D. Systems, Inc. to certify that the installation was performed correctly. The test sheet is provided with the hardware.

For technical support, contact I.D. Systems, Inc.:

- ❑ By Phone: (201) 996-9000
- ❑ By Fax: (201) 996-9144
- ❑ By email: support@id-systems.com

Tools Required for Installation (Not Supplied)

In order to install the standard components of the VAC system, certain tools are required. The VAC is mounted rigidly to each vehicle, thus requiring mounting hardware (supplied in Mounting Hardware Assortment kits) and requiring holes to be drilled. In addition to mechanical mounting, some wiring and electrical testing must be performed. Therefore, wire strippers and simple electrical test equipment are required.

- ❑ MOLEX RHT-1991 Ratchet tool or equivalent

- ❑ Minimum 1/4" chuck drill
- ❑ 1/4" drill bit
- ❑ 1 1/4" or 1 1/2" hole saw
- ❑ #10 socket and ratchet (or open-end wrench)
- ❑ Medium sized slotted and Phillips screwdrivers
- ❑ Wire stripper
- ❑ Multimeter and test lead assortment

Note: The system is shipped with a set of hardware used to install the system on a vehicle (Mounting Hardware Assortment kits). The hardware should accommodate most vehicle types. The hardware kit is specified for high vibration industrial applications. I.D. Systems **highly recommends** using the MOLEX RHT-1991 Ratchet tool (or equivalent) for crimping terminals. If using a different tool, I.D. Systems will bear no responsibility for resulting installation failures.

System Connections Overview

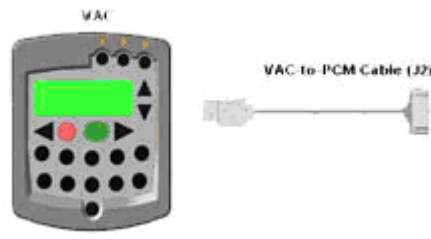


Figure 2: System Diagram

1. VAC: Vehicle Asset Communicator. User interface and intelligent industrial control device. Operators read the display and use the keypad to interact with the vehicle control system. A two-way radio transceiver is embedded within the VAC.
 2. VAC-to-PCM Cable: Cable that connects the VAC to the vehicle's Power and Control system. This cable must route from the VAC mounting location (driver area) to the vehicle (typically the engine/motor compartment).
-
-

Installation Summary

The installation **must be performed** in the order that follows:

- ❑ Installing the VAC (with optional ID reader) [Items 1, 2]
- ❑ Configuring the VAC using On-Screen Display

Before Starting the Installation

Before starting a VAC installation, make sure that all required tools and equipment and the Installation

Verification test sheet are available. If not, **do not proceed with installation**. If all equipment is available, record the following on the installation sheet:

- ❑ The VAC serial number

Installing the VAC (and optional ID Reader)

The VAC contains the driver's user interface to the system and also contains the embedded fleet management software and RF capability. The VAC, therefore, must be mounted in a location that is convenient for operator access (to the keypad, LCD and optional ID reader) and that is optimized for RF performance. The VAC is wired into the vehicle. Therefore, selecting the proper location and verifying correct installation is important to ensure correct functionality.

Selecting the VAC Mounting Location

Notes:

- ❑ The VAC is mounted to the vehicle using the supplied VAC Mounting Bracket (modifications or custom brackets must be approved by I. D. Systems in order to ensure proper functionality).

Procedure:

- ❑ Select a location on the dash area of the vehicle to mount the VAC.
 - The operator of the vehicle should be able to view the VAC's display and access the keypad and optional ID reader while sitting in the vehicle.
 - The VAC should not obscure the operator's line of sight or accessibility to the vehicle.
 - The VAC display should not be obscured.
 - The VAC's antenna should be as far away from the vehicle's chassis as possible (having the antenna close to the metal of the vehicle [less than 3"] attenuates the unit's RF communications).
 - The VAC should be securely affixed to the vehicle and is not adjustable for different operator heights.
- ❑ Select the location on the vehicle to which the bracket should be bolted or welded.

Mounting the VAC

- ❑ If mounting with bolts, use the bracket as a template to drill holes in the vehicle for mounting the VAC bracket. The bracket has to be secured to the vehicle by at least two bolts. Make sure that nothing can be damaged on the vehicle while drilling or welding.
- ❑ If the VAC-to-PCM cable has to run through the dash of the vehicle, drill using a 1¼" hole saw.
- ❑ Assemble the VAC onto the Bracket.
- ❑ If the VAC-to-PCM cable runs through the vehicle's dash, insert a Grommet (supplied) in the hole to prevent the cable from being damaged.

- ❑ Using the attached hex key tighten the hex nuts to secure the swivel points. The bracket is not supposed to be adjustable. Failure of tightening the hex nuts will result in assembly failure.
- ❑ Attach the 9-pin circular connector of the VAC-to-PCM cable (Item 4) to the circular connector on the back of the VAC.
- ❑ Route the VAC-to-PCM cable through the hole in the VAC mounting bracket and route all the way to the vehicle interface location.
 - Use the vehicle's pre-existing cable-routing channels (where other cables are also run throughout the vehicle) to prevent the cable from being damaged during vehicle use or maintenance.

Installing VAC-TO-PCM Harness

The VAC-TO-PCM Harness connects the VAC to the vehicle. Through the harness, the VAC system will get power from the vehicle, and have the ability to receive commands from the vehicle via the I.D. Systems Serial Data Interface (IDSY SDI) protocol. Installation of this cable must be performed according to the instructions below for the VAC system to operate properly.

Vehicle Cable Harness

Cable Pin-Out:

Pin	Color	Signal Name	Comments
1	RED	POWER	Power (+)- TO REGULATED 6.5 VDC
2	BLACK	POWERRTN	Power return (-) - TO 6.5 VDC RETURN
3	WHITE	ISEN(-)	IDSY SDI SIMO (OPTIONAL)
4	GREEN	RELAYIN	IDSY SDI SOMI (OPTIONAL)
5	ORANGE	RELAYOUT	IDSY SDI SCLK (OPTIONAL)
6	BLUE	VSEN1(-)	IDSY SDI INT_NCS (OPTIONAL)
7	WHITE/ BLACK	VSEN1(+)	IDSY SDI INTRPT (OPTIONAL)
8	RED/ BLACK	VSEN2(+)	IDSY SDI WAKEUP (OPTIONAL)
9	RED/ BLACK	N/C	<i>NO CONNECT</i>

Selecting the System's Power and Ground Connections

Notes:

- ❑ **The system requires an uninterrupted, regulated 6.5 VDC supply from the vehicle.** The supply should be continuous regardless of the condition of the vehicle. The only time the supply is discontinued is when the vehicle's battery is unplugged.
- ❑ The interface should be the cleanest possible power source, free from noise and damaging voltage spikes.
- ❑ The current draw of the system in normal mode at 6.5 VDC is approximately 0.25 Amperes

Finishing the Installation

System Configuration

In order to complete the installation of the VAC system on a vehicle and to ensure proper operation of the system.

Standard VAC Operation

VAC Overview

The VAC device is the vehicle component of a comprehensive fleet management system provided by I.D. Systems. The VAC incorporates a highly customized computer application, a two-way wireless communications port, and a vehicle power and data interface. The complete fleet management solution also requires other system elements: wireless infrastructure devices, termed Gateways, a server computer running the ARDCS software, and at least one computer running WAN Console software. Combined, the IDS Fleet Management solution provides the following major benefits:

- ❑ Automated compliance with OSHA rules
- ❑ Electronic, paperless OSHA checklists
- ❑ Automated vehicle utilization analysis
- ❑ Operator accountability
- ❑ Real-time vehicle location tracking
- ❑ Enhanced maintenance efficiencies
- ❑ Significant cost savings

To achieve the above benefits, the VAC is designed to implement several critical Fleet Management functions, including:

- ❑ Driver OSHA checklist interface – allowing drivers to identify and communicate vehicle status by answering vehicle-specific safety questions
- ❑ Two-way paging – option that allows drivers to receive and respond to messages sent from plant computers
- ❑ Vehicle Utilization Monitoring – If the vehicle interface permits, provides accurate fleet information through motion sensing, lift sensing, log-on time, and battery monitoring
- ❑ Maintenance Management - predictive forecasting and driver notification of scheduled maintenance
- ❑ Access Control – tracks the current operator using the equipment. If the vehicle interface permits, also prevents unauthorized operators from driving vehicles, using individual driver IDs instead of vehicle keys

As a radio frequency (RF) and computing device, the VAC utilizes the most robust communication protocol in the industry to ensure that all relevant data is communicated with the rest of the system.

When in range of IDS Gateways, the VAC will:

- ❑ Display an ‘in-range’ indicator, letting the driver know that information can currently be communicated
- ❑ Send any stored data, verifying receipt through a robust confirmation process
- ❑ Synchronize with the most up-to-date access control information (add, delete or modify authorized driver information)
- ❑ Receive any updates to vehicle settings, such as battery and impact thresholds, or OSHA questions
- ❑ Update the vehicle’s location, and, if necessary, send a location update to the system

General Operation

Three different groups of operators will interact with the VAC – the standard driver, the Master User driver, and the maintenance/installation user.

The standard driver will perform certain basic functions with the VAC (for Standard Driver Instructions, see Basic Operation: LCD, Keypad, ID Reader on page 16). These features are:

- ❑ Logging onto the vehicle to gain access
 - Identifying himself/herself using an ID (either by typing the ID or through an ID device)
 - Verifying his/her identity using a PIN (if required)
- ❑ Logging off of the vehicle prior to leaving the vehicle unattended
- ❑ Answering OSHA-required safety questions
- ❑ Reading, responding to, and deleting pages (optional)
- ❑ Identifying low vehicle battery condition

The Master User driver can perform the same basic functions with the VAC (For Master User Instructions, see Granting Temporary Access (Master Users) on page on page 33), as well as:

- ❑ Logging onto all vehicles
- ❑ Granting temporary access to a currently unauthorized standard driver

The Maintenance/Installation User can perform the same functions as a Master User driver as well as VAC configuration (For Maintenance Instructions, see **Error! Reference source not found.** on page **Error! Bookmark not defined.**). The additional features include:

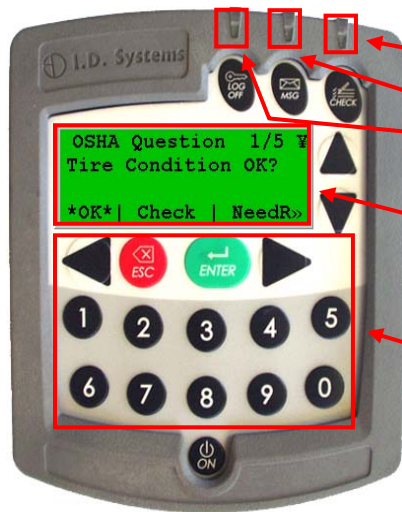
- ❑ Assigning the Vehicle ID to the VAC
- ❑ Enabling and disabling access control
- ❑ Configuring the VAC sensors for motion sensing, lift sensing, and battery sensing

- ❑ Verifying impact sensing

Basic Operation: LCD, Keypad, ID Reader and LEDs

The VAC incorporates a robust 20-key keypad and a 20-by-4 character display that is backlit for 15 seconds when a key is pressed. In addition, certain units are equipped with identification device readers (proximity card, magnetic card, 1-wire memory chip such as an iButton, or smart card). The operator interacts with the VAC using these devices in the following way:

VAC Display and Keypad Basics



LEDs:

- OSHA not filled
- Incoming, unread page
- Access Enabled

LCD Display: (Backlit, 20-by-4 characters)

Screen Contents: To interact with the driver, the VAC uses a backlit display. The same display is used in Menu Selection Mode, Digit Entry Mode and Pager Mode.

Keypad: (20-Key, Rugged with Tactile Keys)

20-Key Keypad: The keypad allows the driver to make menu selections (in Menu Selection Mode), type digits (in Digit Entry Mode) and review and respond to pages (in Pager Mode).

ID Reader

VACs may be equipped with ID Readers for the quick and secure entry of driver ID numbers. ID readers are mounted in the VAC. The ID reader is used:

- ❑ During the Access Control log-in process (to quickly enter the driver ID)
- ❑ During the Access Control log-off process (to quickly log off the current driver)
- ❑ During the Grant Temporary Access process (to enter the ID of the temporarily-authorized driver)


Menu Selection Mode

Most screens on the VAC involve reading displayed text and selecting from menu options. These screens contain four major components:

- ❑ Screen Title: The top line of the display. Indicates the title or subject of the current screen.
- ❑ ¥ (Yen): This symbol is the in-range indicator for the VAC. The faster it blinks, the closer the

VAC is to a Gateway. When in range of a Gateway, a VAC will download any required data and will attempt to upload data. The VAC will continue to function and record data, however, when not in range of a Gateway.

- ❑ Screen Data: The second and third lines contain screen data. If there are more than two lines of screen data, the up and down arrows (keys 2 and 7) must be pressed to scroll through the data.
- ❑ Menu Options: The bottom line of screen. Available menu options are listed, separated by | characters.
 - Asterisked *selection* shows response that will be selected by pressing ENTER key
 - Change *selection* by pressing right arrow or left arrow keys
 - >> indicates more responses available by scrolling with right arrow key
 - << (not shown) indicates more responses available by scrolling with left arrow key
 - After highlighting *selection*, press ENTER key to confirm selection and proceed automatically to the next screen.

<p>Keypad: (20-Key, Rugged with Tactile Keys)</p> <p>Up-arrow and down arrow scroll through screen data.</p> <p>Left-arrow and right arrow scroll through menu options</p> <p>ESC: Return to previous screen</p> <p>ENTER: Confirm the currently highlighted selection.</p>		<p>LCD Display: (Backlit, 20-by-4 characters)</p> <p>Screen Title: First line indicates title or subject of current screen</p> <p>¥ – ‘Yen:’ In-range indicator. The faster this blinks, the better the receipt of data from Gateways.</p> <p>Screen Data: Second and third lines contain screen data.</p> <p>Menu Options: Appear along the bottom line of screen, separated by characters</p>
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Digit Entry Mode

For VAC screens, which ask for a numerical entry, the digit entry mode screen will appear. These screens contain two major components:

- ❑ Screen Title: The top line of the display. Indicates the title or subject of the current screen.
- ❑ Numerical Data: The second line contains the numerical data. A default value will appear of the correct data length when entering this screen.
 - A blinking cursor shows the current cursor location for data entry.
 - Enter digits by typing desired number, 0-9 using the keypad
 - Backspace using the Left Arrow key.
 - Pressing ESC key will return to the previous screen.
 - Press ENTER key to confirm numerical entry. The entry will consist of each digit

displayed on the screen (typed as well as default digits, EXACTLY AS THEY APPEAR ON THE SCREEN. For example, if '0000' appears on the screen, and the user presses 2 then 1, the screen will read '2100'. In this case, 2100 will be submitted if the ENTER key is pressed).

- Therefore, to keep the default entry without making a change, simply press ENTER without pressing any digits.
-

**LCD Display: (Backlit, 20-by-4 characters)**

Screen Title: First line indicates title or subject of current screen

Numerical Data: Second line contains numerical data (Note: Password screen uses asterisks (*) to hide entered data). Third line may contain helpful information.

Keypad: (20-Key, Rugged with Tactile Keys)

ENTER: Press this key to confirm the current entry

Left Arrow: Press this key to back up one space

ESC: Press this key to return to previous screen

0-9: Press these keys to enter a digit at the current cursor location

Access Control (All Users): Logging on and off the Vehicle

Access Control Overview

One feature of the VAC is to prevent unauthorized access to the VAC, and, optionally, the vehicle. Each VAC is assigned a vehicle number (often similar to the number marked on the side of the vehicle), and that number has an associated authorization list that contains valid drivers and, for each driver, the times of day and days of week for which they are allowed drive that particular vehicle. The VAC stores the authorization list and is updated, if changes have been made, when in radio range of any Gateway.

In order for vehicle access control to prevent vehicle access, it is required that the vehicle comply with the I.D. Systems Serial Data Interface protocol. For a compliant vehicle, unless the VAC is in 'bypass mode,' all Standard, Master User and Maintenance drivers must log into the VAC to gain access to the vehicle. Once authorized, the driver may also be required to use a key to start or drive vehicle.

Whether or not access is controlled by the VAC, once logged onto (or 'assigned to') a VAC, the driver is

responsible for the vehicle. Therefore, it is imperative that drivers do not leave assigned vehicles unattended. If, however, a driver forgets to log off, the VAC is configured to ‘time out’ after a configurable period of non-use. (system-wide default: twenty minutes, changed via the ARDCS – Beacon). While this idle-timeout feature is a fail-safe, it will not prevent another driver from taking an assigned vehicle during the time prior to the time-out. In addition, the idle-timeout feature may be disabled for the entire system (via ARDCS Beacon) or **set on a** vehicle a vehicle-by-vehicle basis (via System Admin Tool – Modify Vehicle – **Advanced Settings**).

Drivers identify themselves to the VAC for access to a vehicle using their Access ID number. To enter that number, the driver either uses the keypad or an ID device (such as a proximity card, smart card, magnetic card, or iButton). The ID method is usually chosen to match that which the driver already uses for other access control purposes (such as doorway entry). The Access ID number may not be the same as the employee ID number, depending on the methodology used at the facility. The Access ID numbers are linked to the drivers using the Console’s System Admin Tool.

Driver IDs are associated with VAC IDs using groups. Authorization groups are created using the Console’s System Admin Tool. Both vehicles and drivers are added to groups. When a driver belongs to the same group as a vehicle, and if that group is granted an authorization for the current time of day/day of week, then the driver may gain access to the vehicle. All driver, group and authorization time information is configured with the System Admin Tool and stored on each VAC. Initial configuration and ongoing updates occur wirelessly and automatically, when VACs are in range of Gateways.

Logging onto the VAC



If VAC screen is blank (only on certain internal combustion vehicles), turn vehicle ignition key on.



Follow instructions on how to enter driver’s ID (either by typing driver ID or presenting an ID card – proximity, magnetic stripe, smart-card or

iButton)

Config: (if applicable) Allows a Maintenance User to log in without an ID card; for keypad-only systems, this menu option does not appear.



A PIN code will then be requested (if the system is configured to have PIN). Use the numeric keys to enter PIN. After entering PIN (hidden by **** characters for security), press ENTER key. If no PIN is required, press ENTER when prompted with default PIN of 0000.



If driver ID and PIN are authorized, vehicle start-up will be enabled and driver can use vehicle. VAC screen will prompt driver to complete OSHA vehicle inspection checklist. If driver is not authorized, see Denial of Login on page 21.



Driver Type(optional)

The type of driver access is displayed on the top line once authorized, indicating, for example, whether the current user is a standard, authorized user (shown), a master user, an administrative user, etc. The displayed options are:

- Authorized User: Standard user
- Master User
- Temp User: User assigned temporarily by a Master User
- MAINT User: Logged in using system-configured maintenance ID and PIN
- ADMIN User: Logged in using system-configured maintenance ID and PIN
- MAINT (H) User: Logged in using default maintenance ID and PIN (only available on new VACs prior to first database synchronization)
- ADMIN (H) User: Logged in using default administrative ID and PIN (only available on new VACs prior to first database synchronization)
- All Users: System is in bypass mode, allowing any ID to start the vehicle (Security LED will be flashing)
- All Trained: System is in bypass mode, allowing any valid driver ID to start the vehicle (Security LED will be flashing)

Denial of Login



Login Denial Screen

Violation Code: Number in parenthesis indicates the reason for denial. See explanations in table below.

In all cases, operator should press the ENTER key to restart the login process.

Violation Code	Reason for Login Denial	Explanation
1	Not currently authorized.	Driver is not authorized for that time period on that vehicle (set using Console's System Admin Tool), but would otherwise be

Violation Code	Reason for Login Denial	Explanation
		authorized. A Master User can add this driver using the Temporary Access feature (see Granting Temporary Access (Master Users) on page 33)
2	Not authorized on this day.	Driver is not authorized for that day on that vehicle (set using Console's System Admin Tool), but would otherwise be authorized. A Master User can add this driver using the Temporary Access feature (see Granting Temporary Access (Master Users) on page 33)
3	Not authorized on vehicle.	Driver is not authorized for that particular vehicle (set using Console's System Admin Tool), but he/she is authorized for other vehicles. A Master User can add this driver using the Temporary Access feature (see Granting Temporary Access (Master Users) on page 33)
4	Invalid password.	PIN code does not match driver ID (set using Console's System Admin Tool).
5	Invalid driver ID.	Driver is not registered in the authorized access control database (set using Console's System Admin Tool), or driver's medical, training or certification date has expired (set using Console's System Admin Tool). A Master User CAN NOT add this driver using the Temporary Access feature (see Granting Temporary Access (Master Users) on page 33)
6	Wrong login method.	Operator tries to enter ID by keypad on a VAC configured with an ID reader.
7	Critical OSHA Interlock (Optional)	The Vehicle has been disabled for regular users because a "Critical" safety item response was selected.
8	Embedded Users Disabled (Optional)	The embedded logins used to configure VACs prior to synchronization will be disabled once the vehicle completes its first synchronization. This error appears when attempting to manually type in an embedded login id.
9	Vehicle is out of service or has no valid authorizations	The vehicle has been taken out of service via the WAN Console or does not belong to a group with a valid authorization.

NOTE: Repeated failure to log into the VAC will trigger an alert on the ARDCS which can

be emailed or sent by pager to specified personnel (See ARDCS User's Guide).

Logging Off of the VAC

WARNING: When an operator leaves a vehicle, the operator is still responsible for that vehicle until he/she logs off (or until the authorization times out) – See Access Control Overview above.



To log off of the vehicle, first come to a stop. While not in motion, press the “LOGOFF” button. Logging off will be prevented if in motion.

You can also logoff by presenting an ID device to the ID Reader. The ID device does not need to belong to the current driver to log off the current driver.



When the driver successfully logs off the vehicle, the Main Screen will appear.

Electronic OSHA Safety Checklists (All Users)

An important safety and maintenance-related feature of the VAC is to provide on-screen, on-vehicle electronic vehicle inspection checklists. As required by the OSHA, vehicle-specific questions must be answered by each vehicle driver, once per shift, for each vehicle he/she drives. The VAC provides a simple-to-use, convenient, automated way of answering these questions.

Once an authorized driver logs onto a VAC, the VAC becomes operational. The driver is then prompted to answer OSHA questions via a blinking indicator (on the LCD screen and via the LED on the attached Proximity Card Reader). The driver must enter the OSHA Question mode and answer each question in order for the OSHA requirement to be fulfilled. Once completed, subsequent logons during the shift, on the same vehicle by the same driver, will not prompt for OSHA checklist completion. If another driver uses the same vehicle during the same shift, he/she will be required to answer OSHA questions. Similarly, if the same driver uses a different vehicle during the same shift, he/she will be required to answer OSHA

questions. The duration of the shift is configurable (default: 14 hours; configurable only prior to receipt of VAC units).

The OSHA question screen mode lists customizable questions, specific to the vehicle on which the VAC is installed. The driver is expected to answer each question after performing the required inspection task. The questions and responses can be changed wirelessly at any time by using the Console's OSHA Checklist Tool. The questions can be tailored to the specific vehicle or vehicle type, while each response can be configured as Normal, Warning or Critical (see Console's System Admin Tool).

The VAC stores responses to OSHA questions and communicates them when in radio range of any Gateway. Warning and Critical responses can be sent, via email or page, directly to maintenance by the ARDCS (See ARDCS User's Guide). This real-time notification allows drivers to identify and transmit vehicle safety issues directly to maintenance employees without driving the vehicle to the maintenance area. This leads to more proactive response to vehicle issues, resulting in a safer fleet of vehicles. In addition, when the vehicle is brought in for preventative maintenance, a report can be run using the Console's Report Tool which lists all outstanding driver-identified safety issues so that a complete vehicle repair can be performed.

Optionally, Critical responses can trigger a safety-initiated log-off, termed Critical OSHA Interlock. In this mode, the VAC will prevent log-in to all normal, authorized operators (excluding Master and Maintenance users) until an authorized supervisor reactivates the vehicle using the WAN Console. This feature is incorporated to prevent vehicle use after a potentially dangerous condition has been identified.

OSHA Question Mode

OSHA checklist questions can be answered at any time after logging on to a vehicle. If a new maintenance item occurs after a driver has already completed his/her responses, the driver can still re-enter OSHA responses, which will log and alert maintenance of the previously unidentified issue.



After a successful login, the VAC screen will show this message. If OSHA questions have not been completed, >OSHA< will continually flash.

The operator should simply press the “CHECK” button.

The first checklist question will then appear, with multiple-choice responses.

Note: some vehicles are also configured with an LED that will flash to remind operators and nearby personnel that the checklist is unfilled.



OSHA vehicle checklist screens:

Question # / of total # of questions.

Text of question.

Available responses along bottom line of screen, separated by | characters (>> indicates more responses available by scrolling with right arrow key).

Asterisked *selection* shows selected response.

Press right or left arrow keys to change *selection*

Press ENTER key to confirm current selection and proceed to the next question.

Press ESC to go back one question.



When the last question has been answered, the checklist has been completed successfully, and the screen will indicate: - OSHA complete! -

If operator tries to exit checklist before it is complete (by pressing the ESC key), the screen will show this message. Exiting prior to completion will not fulfill the OSHA requirement and responses will be lost.

To exit the checklist, operator chooses *Yes* by pressing ENTER.

To resume working on the checklist, press the right arrow key to select *No* and then press ENTER.

Critical OSHA Shutdown (Optional)

When a user replies with a critical response to an OSHA question, and upon the completion of the entire checklist, the user is logged off immediately and the VAC remains disabled for standard users. Only Master and Maintenance users will be able to log on until the vehicle is reactivated from the WAN Console by an authorized person. As a result of this feature, users are required to complete their safety checklists in a safe location, in case of a VAC deactivation.

Two-Way Text Paging (All Users)

A useful feature of the VAC is two-way text messaging ('Pager'). Using the Console's Paging Tool (See Console User's Guide), software users can send messages from their computer to operators or vehicles. The messages will be stored in the VAC's Pager Inbox (up to ten) for review by the driver. Messages sent from the Paging Tool can be directed to drivers in several ways, including:

- ❑ **Vehicle Pages:** The destination is a particular vehicle, identified by vehicle number. The page will be in the Inbox of any driver operating the vehicle until it is deleted or expires.
- ❑ **Driver Pages:** The destination is a particular driver; therefore, the page will be in the Inbox of the VAC that the driver is assigned to, until the page is deleted or expires. If the driver logs off of a vehicle with a Driver page without deleting it and before expiration, the page will 'follow' the driver to the next vehicle he/she logs on to.
- ❑ **Group Pages:** The destination is a group vehicles or drivers, identified by vehicle or driver group (See the explanation of groups in Access Control Overview on page 18). The page will be sent out to all vehicles or drivers in the group and behave the same as a Vehicle or Driver page, respectively.
- ❑ **Broadcast Pages:** The page will appear in every vehicle's Inbox, regardless of the driver operating the vehicle until it is deleted or expires.

When there are pages in the Inbox, the driver can enter Pager mode to review the pages. Pager mode allows a driver to scan the Inbox and selectively read or delete pages. The driver may enter Pager mode only when their vehicle is idle for safety reasons.

Pages are transmitted from the database to the Gateway nearest the destination VAC. If the VAC moves to a new Gateway area prior to receiving the page, the page will be transmitted to new Gateway. If the VAC confirms receipt of the page and if there is room in its Inbox, the page will be stored on the VAC and the page indicator will blink. The new page will be identified with an 'unread' indicator. If a page expires before being stored on the intended VAC (indicated in the Console's Paging Tool), the sender must resend the page.

After responding to pages, drivers may drive their vehicle near a Gateway (driver will see ¥ indicator on VAC display) to ensure that their responses get back to the sender as soon as possible. Regardless, all responses are stored on the VAC for upload as soon as the VAC can communicate with any Gateway.

All pages have standard options for reading, deleting and exiting the page text. Pages may or may not have additional responses for the driver to select from. Regardless, all pages create acknowledgements which are sent back to the sender when the VAC comes in range of a Gateway, including:

- ❑ Received: The time that the VAC received the page.
- ❑ Read: The time that a page was read by the driver.
- ❑ Deleted: The time a page was deleted by the driver.
- ❑ Expired: The time that the page expired without being read.
- ❑ Any responses, and the times that the responses were input by the driver.

Viewing and Responding to Text Pages



MSG LED will blink in the event of a page.

On the main VAC screen, a flashing '- page -' indicator (small letters) informs the operator that a message has been received.

To view the message Inbox, press the MSG key.

Pager screen: (Inbox)

“XX /Y Y” shows sequence # of message selected / out of total # of messages

Flashing cursor indicates which message is selected.

Message status indicators:
Old (read) message: “√”
New (unread) message: “□”



“New: #” shows how many new, unread messages have been received.

Each message summary line shows: Status Indicator (“□” in this case, for “unread”), Message Subject (“Maintenance” in this case) and Time Sent (24-hour format, “09:36” in this case).

Note: only two message summary lines fit on the screen at a time. To scroll through the entire Inbox, use the Up and Down arrow keys.

To Read a Message: Scroll up or down until flashing cursor is on desired message; make sure *View* is selected (use right / left arrow keys if necessary to select); then press ENTER key. Message Detail screen will appear.

To Delete a Message: Scroll up or down until flashing cursor is on message to be deleted; make sure *Del* is selected (using right/left arrow keys); then press ENTER key.

To Return to Main Screen: Select *Exit* using right/left arrow keys; then press ENTER key.

Message Detail screen:



Full Menu Text

If message does not all fit on screen, the *More* menu option is automatically highlighted. Press ENTER key to view the rest of the message. At the bottom of the message, the *Top* option appears. Press ENTER key to return to the beginning of the message.

To Delete Message: Select *Del* by scrolling with right/left arrow keys, then press ENTER key.

To Return to Pager screen: Select *Back* and press ENTER — or just press ESC key.



If a message requires a response, the on-screen menu will also display the multiple-choice response options available (in addition to the default options listed in step 3).

Select desired response *option* using right/left arrow keys, then press the ENTER key to log and transmit response.

Note: in some cases, a certain response (e.g. “Accept”, in reply to a work order) will prompt another level of response options (e.g. “Complete”, to confirm the work ordered has been completed). Also, some responses may automatically delete the page, while others do not. The sender of the page configures these settings.

Vehicle Utilization Monitoring (All Users)

One feature of the VAC is its monitoring of vehicle utilization. Vehicle monitoring requires that the vehicle comply with the I.D. Systems Serial Data Interface protocol. For a compliant vehicle, a VAC will record utilization data both when a driver is logged on and when the vehicle is unassigned. Vehicle monitoring is invisible to the driver of the vehicle and requires no interaction for collection and transmission of utilization data. The VAC will store utilization data in internal memory and transmit that data to any IDS Gateway when in communication range. The data is then automatically downloaded and stored in the IDS Database via the ARDCS software (see ARDCS - Data Listener).

Utilization information for a compliant vehicle includes the following:

- ❑ Current Driver: The driver currently logged onto the vehicle
- ❑ Motion: Received via the vehicle serial interface port, when the vehicle is in motion
- ❑ Lift: Received via the vehicle serial interface port, and recorded when the lift motor is engaged
- ❑ Engine On (Internal Combustion Only): Received via the vehicle serial interface port, and recorded when the engine is on but the vehicle is in neutral.
- ❑ Assigned Time: Recorded while a driver is logged onto the vehicle.
- ❑ Location: Recorded while moving throughout a facility, when in range of IDS Gateways.

Utilization data is often used to create reports and graphs (see the Console's Report Tool) to analyze and improve fleet utilization. In addition, the Console's Graphical Viewer provides a visual representation of the current and historical location, status, and utilization of vehicles, and allows for filtering of vehicles to identify and locate unassigned vehicles.

Motion Safety Feature (Optional – Standard and Master Users)

A feature may be enabled in which the VAC's display and keypad will become inoperative when the VAC senses that the vehicle is in motion. This feature requires that the VAC is monitoring vehicle motion via its serial data interface. It is used to prevent drivers from interacting with the VAC during vehicle operation, a possible safety hazard. When logged in, Standard or Master users' displays will become blank, and a single, blinking cursor will appear on the display when the vehicle is in motion. Additionally, the keypad will be inoperative. Upon stopping, the display will resume on the same screen as when it went blank.

Note: Maintenance users can always see their display and use their keypad, permitting them to address VAC installation or reconfiguration, even when motion-sensing is not properly configured.

Battery Rotation (Optional Module - All Users)

The Battery Rotation module optimizes vehicle battery life by maintaining the state of each battery in the system and automatically suggesting replacements for discharged vehicle batteries. When a battery has sufficiently discharged and should be replaced, the battery rotation module is used by the vehicle operator to request a replacement for this battery.

With a prox-card assigned to each battery, the system can validate whether the operator followed the recommendation or took an alternate (for example, if the recommended battery is damaged). After a vehicle is powered down for more than 30 seconds (minimum for a valid battery swap), the VAC requires the operator to present a valid battery prox-card when logging in. This prox-card should be attached to the newly added battery. The VAC validates the prox-card and only accepts cards that represent actual batteries.

Configuration of the module and corrections to battery assignments are made through the WANConsole's Battery Rotation Tool (see WANConsole User's Guide). The system supports corrective action through a graphical user interface, on any computer installed with the Console, for reassigning batteries to chargers and vehicles, and for taking equipment out-of-service as needed.

The system expects that discharged batteries are placed on the same charger from which the new battery is taken. Note that if the actual swap was not a 'swap-in-place', the charger number associated with the discharged battery will be incorrect (though the charging area will still be correct). Note that if an operator did not follow a recommendation, but performed a manual swap (e.g. by driving to the nearest charging area and manually looking for an appropriate, charged battery), recommendations sent to other drivers for

a short time period (default: five minutes) may contain incorrect charger data, unless corrective action is taken through the WANConsole's Battery Rotation Tool.

Battery Request:



Battery Request:

When >LOW BATT< blinks on the VAC screen, the operator selects 'BattReq' to receive a battery recommendation.



Battery Request Status:

A 'Requesting..' indicator blinks until communication has been established with a nearby Gateway



Battery Recommendation:

Up to two battery recommendations will arrive in a page. The Page indicator will blink. Select ***Pager*** from the main driving screen and press **ENTER** to view the Battery page.

4

Battery Recommendation - Detail:



To view each recommendation, scroll down (see Two-Way Text Paging guide).

Charger Area name designates a nearby charger location.

Chrg: the charger number for depositing the discharged battery (currently on the vehicle)

Batt: the battery ID of the recommended battery.

Battery Validation:



Battery Validation:

After an operator presents his/her prox-card, the operator is prompted to present a valid Battery Prox-card.

Touch the prox-card or prox-fob attached to the newly added battery to the VAC's prox-reader to proceed. (Note: Only valid battery prox ID's will be accepted)

If there is no prox-card or prox-fob on the new battery, contact maintenance to proceed.

Battery Request Troubleshooting:

If the ‘Requesting.’ indicator continues to blink for more than 10 seconds, operator should attempt to move vehicle closer to a Gateway.

If operator is near a Gateway but the ‘Requesting.’ indicator blinks for more than 30 seconds, there is most likely a problem with that Gateway. The operator should move to another Gateway or consider proceeding with a manual swap. An administrator should be alerted to this condition.

If the ‘Requesting.’ indicator disappears, but no page arrives on the VAC for 30 seconds after the request is submitted, the network is likely to be down, or the ARDCS is not running. The operator should consider proceeding with a manual swap. An administrator should be alerted to this condition.

Security Module (Optional Module - All Users)

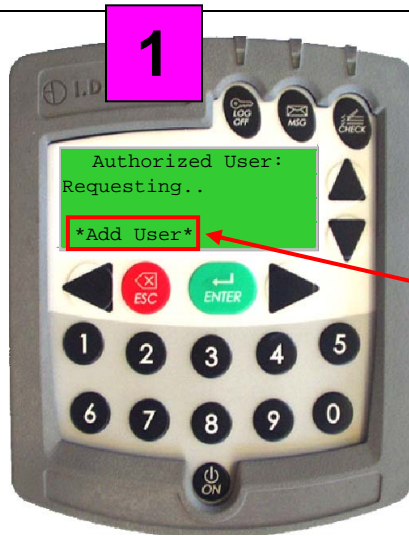
An optional module geared towards demands of high security installations analyzes individual vehicle use and posts warnings on the ARDCS and on the vehicle when suspicious activities take place.

Using the high security module, system-wide “forbidden zones” can be set up using the Console (see WANConsole User’s Guide) and also pre-programmed into the VAC. If any vehicle enters such a zone, an alert will immediately be raised on the ARDCS (see ARDCS User’s Guide) and Graphical Viewer (see WANConsole User’s Guide). In addition, an attached Security LED and on-screen text will indicate the source of the security issue as follows:

Security Issue	LED Blink Rate (repeated)	LCD Text
Gateway Location Prohibited Area	Fast Blink (Critical Issue)	S-Zone
VAC Out of Range	Slow Blink (Warning)	O-Zone
Authorization is in Emergency Mode	Slow Blink (Warning)	Access

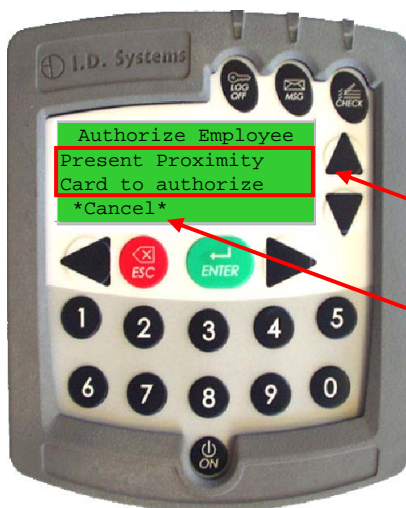
Granting Temporary Access (Master Users)

A Master User is granted access to all vehicles in the system. In addition, a Master User can assign access for a period of 24 hours to a driver in the system that is not authorized for a particular piece of equipment. For example, if a trained forklift driver from the Receiving department needs to use a Shipping vehicle, a Master User can temporarily grant access on the Shipping vehicle to the trained driver. Note: The driver must already be a valid driver in the system to receive temporary access; unrecognized ID numbers will still not be valid. The duration of temporary access is configurable (default: 12 hours; configurable prior to shipping VACs).



On the main VAC screen, a Master User will have an option to *Add User*.

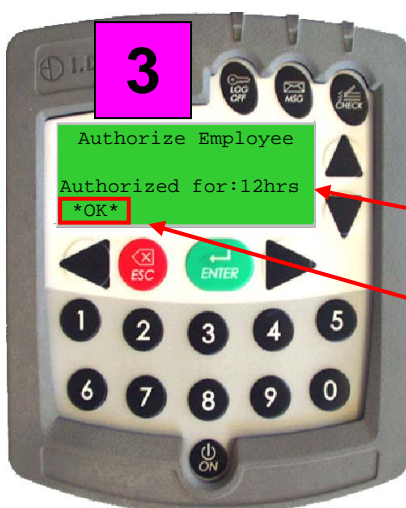
To temporarily add an existing driver to a vehicle to which they do not normally have access, scroll to *Add User* using the right/left arrow keys, and then press the ENTER key.



Add User screen:

Once in the Add User screen, a User ID can be entered which will then be granted temporary access to the vehicle. Then enter the User ID, follow the prompt (requires typing the user ID for keypad systems or using the driver's ID device).

To return without adding a temporary user, scroll to *Cancel*, and press the ENTER key.



Add User Confirmation screen:

Once the ID of the temporary driver is added, the confirmation screen will indicate the duration of temporary access.

When done, select *OK* and press the ENTER key to return to Master User's main VAC screen.

Appendix A

Electrical

Typical Vehicle Battery Current Draw	Min	Nominal	Max
12 Volt Vehicle (mA)	200	240	270
24 Volt Vehicle (mA)	120	150	180
36 Volt Vehicle (mA)	100	120	140
48 Volt Vehicle (mA)	80	100	120

Power Interface	Min	Nominal	Max
Supply Voltage (V)	5.5	6.5	9

Memory/Other

Memory/Other	Spec
RAM	256 KB
RAM type	Battery-backed SRAM
Flash	512 KB
Real-time clock	Onboard, 1 sec/day accuracy, updated automatically via RF
Utilization history storage (RAM)	Approx. 1 month
Location history storage (RAM)	Approx. 10 days

Communication

Radio Frequency	Min	Nominal	Max
Frequency	902.6	915	927.2
Output power (dBm)	-40	-4	0
Modulation	-	FSK	-

Frequency Agility	-	Narrow band, adjustable frequency	-
Communication Data Rate	-	39 KBaud	-
Communication Scheme	-	CSMA/CD	-
Antenna	-	Embedded, omni-directional	-

User Interface

User Interface	Spec
Keypad – keys	20
Keypad – type	Membrane/polyester
LCD – display type	STN
LCD – characters	80 (20 x 4)
Backlight	LED

Proximity Card	Spec
Proximity Card Type	HID only
Environmental Spec	IP65
Interface	6 wire F/2F

iButton	Spec
iButton Type	DS19
Environmental Spec	IP65

Status LED Indicators (Prox Only)	Spec
Access indicator	Green
OSHA indicator	Amber
Paging indicator	Red

Environmental

VAC	Spec
Operating Temperature	-35 C to +70 C
Storage Temperature	-40 C to +85 C
Humidity	95% RH (condensing)
Environmental Sealing	NEMA 4x, Mil-Std-810E Method 506.3 Procedure III, IP56
Vibration	SAE J1455, Heavy Duty Truck Chassis Mount (1-1000 Hz, 1.02 GRMS)

Mounting

VAC	Spec
Bracket	IDS-supplied
Bracket angle (°)	Universal swivel Bracket provided
Electrical considerations	Isolated from chassis required
Mounting method	10-32 screws, bolts (supplied)
Mounting holes	2 x 10-32 holes for bracket, 1x 1" round hole for cable

Appendix B

VAC™ Error Code Guide

Error Code: E3301

- a. The above message indicates that the memory back up battery residing in the VAC has failed.
- b. Turn OFF the power of the unit by removing the VAC-to-PCM cable from the VAC for about 1 min.
- c. Power up the unit. If the problem persists, replace the VAC and verify that the error message is not displayed. If it is still displayed, contact I.D. Systems, Inc. technical support.

Appendix C

Warranty Information

Limited Warranty

I.D. Systems, Inc. (IDS) warrants the IDS-manufactured VAC™ (“VAC”) against defects in material and workmanship under normal use for a period of time determined via purchase order (typically 90 days from the date of purchase).

At no charge to the purchaser of a VAC, IDS will, at its option, either repair the VAC with new or reconditioned parts or replace the VAC with a new or reconditioned one during the warranty period provided it is returned in accordance with the terms of this warranty. Replaced parts or boards are warranted for the balance of the original applicable warranty period. All replaced parts of a VAC shall become the property of IDS.

This express limited warranty is extended by IDS to the original purchaser only and is not assignable or transferable to any other party. This is the complete warranty for the VAC product manufactured by IDS. IDS assumes no obligations or liability for additions or modifications to this warranty unless made in writing and signed by an officer of IDS. Unless made in a separate agreement between IDS and the original purchaser, IDS does not warrant the installation, maintenance or service of a VAC.

IDS cannot be responsible in any way for any ancillary equipment not furnished by IDS which is attached to or used in connection with VAC or for the operation of VAC with any ancillary equipment and all such equipment if expressly excluded from this warranty unless authorized. Because each system is unique, IDS disclaims liability for range, coverage or operation of the system as a whole under this warranty.

This Warranty Does Not Cover:

1. Defects or damage from misuse, accident, water, or neglect.
2. Defects or damage resulting from the use of VAC in other than its normal and customary manner.
3. Defects or damage from improper testing, installation, operation, maintenance, alteration,

modification, or adjustment.

4. Unauthorized VAC modifications, disassemblies or repairs, which adversely affect performance of VAC or interfere with IDS's normal warranty inspection and testing of VAC to verify any warranty claim.
5. VACs, if the serial number has been removed, altered or made illegible.
6. Shipping charges to the repair depot.
7. Any illegal or unauthorized alterations of the software/firmware in VAC which affect the operation or functionality in accordance with IDS's published specifications at the time VAC was initially distributed from IDS.
8. Scratches or other cosmetic damage to VAC surfaces that does not effect the operation of VAC.
9. Normal and customary wear and tear.

General Provisions:

This warranty sets forth the full extent of IDS's responsibilities regarding VAC repair, replacement or refund of the purchase price at IDS's options, is the exclusive remedy. THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER EXPRESS WARRANTIES. IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED TO THE DURATION OF THIS LIMITED WARRANTY. IN NO EVENT SHALL IDS BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT, FOR ANY LOSS OF USE, LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS, LOST PROFITS OR SAVINGS OR OTHER INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE VAC, TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

To Get Warranty Service or Returned Material Authorization:

You must provide proof of purchase (bearing the date of purchase and the VAC serial number) in

order to receive warranty service or RMA and, also, deliver and send the VAC, shipping and insurance prepaid, to an authorized warranty service location. Warranty service will be provided by one of IDS's authorized warranty service locations or by IDS itself. Obtain warranty service or an RMA by contacting the company, which sold you the VAC (distributor or dealer). You may also call IDS at 201-996-9000 for warranty service or RMA information.