



VaporTEK™/VaporTEK-3 Controller Board  
110 V UL® Vapor Recovery Collection System  
for Encore® 500 S

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# Start-Up and Service Manual

## Computer Programs and Documentation

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## Federal Communications Commission (FCC) Warning

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. 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. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

## Approvals

**Gilbarco is an ISO 9001:2008 registered company.**

**Underwriters Laboratories (UL):**

U L File#	Products listed with U L
MH1941	All Gilbarco pumps and dispensers that bear the UL listing mark.
MH8467	Transac System 1000 and PAM 1000
E105106	Dell DHM Minitower
E165027	G-SITE and Passport Systems

**California Air Resources Board (CARB):**

Executive Order #	Product
G-70-52-AM	Balance Vapor Recovery
G-70-150-AE	VaporVac

## National Conference of Weights and Measures (NCWM) - Certificate of Conformance (CoC):

Gilbarco pumps and dispensers are evaluated by NCWM under the National Type Evaluation Program (NTEP). NCWM has issued the following CoC:

CoC#	Product	Model #	CoC#	Product	Model #
02-019	Encore	Nxx	02-036	Legacy	Jxxx
02-020	Eclipse	Exx	02-037	G-SITE Printer (Epson)	PA0307
02-025	Meter - C Series	PA024NC10		G-SITE Distribution Box	PA0306
	Meter - C Series	PA024TC10		G-SITE Keyboard	PA0304
02-029	CRIND	—		G-SITE Mini Tower	PA0301
	TS-1000 Console	—		G-SITE Monitor	PA0303
	TS-1000 Controller	PA0241	G-SITE Printer (Citizen)	PA0308	
02-030	Distribution Box	PA0242	02-038	C+ Meter	T19976
	Meter - EC Series	PA024EC10	02-039	Passport	PA0324
	VaporVac Kits	CV	02-040	Ecometer	T20453
			05-001	Titan	KXXY Series

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C-PAM™	G-SITE® Link™	PAM™ 1000	The Advantage™ Series
Dimension™ Series	G-SITE® Lite™	PAM™ 5000	Titan™
Ecometer™	Highline™	Passport™	Trimline™
Eclipse™	Horizon™	SMART Connect™	Ultra-Hi™
ECR™	InfoScreen™	SMART CRIND™	ValueLine™
e-CRIND™	Insite360™	SMART Meter™	
EMC™	Making Things Better™	SmartPad™	
FlexPay™	MPD™	Super-Hi™	
G-CAT™	MultiLine™	Surge Management System™	

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Encore®
Gilbarco®
Legacy®
Performer®
Transac®
Transac® System 1000
TRIND®
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### Service mark

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# Notice

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## Damage Claims/Lost Equipment

Thoroughly examine all components and units as soon as they are received. If any cartons are damaged or missing, write a complete and detailed description of the damage or shortage on the face of the freight bill. The carrier's agent must verify the inspection and sign the description. Refuse only the damaged product, not the entire shipment.

Gilbarco Veeder-Root must be notified of any damages and/or shortages within 30 days of receipt of the shipment, as stated in the Terms and Conditions.

## Gilbarco Veeder-Root's Preferred Carrier - Missing or Damaged Shipments

When Gilbarco Veeder-Root's preferred carrier is used, proceed as follows:

- 1 Contact Gilbarco Veeder-Root Customer Service within 30 days at 1-800-873-3313 or at [customerservice@veeder.com](mailto:customerservice@veeder.com) to report the specific part numbers and quantities that were missing or received damaged.
- 2 Send the signed Bill of Lading (BOL) noted with the shortage or damage to Gilbarco Veeder-Root Customer Service via e-mail at [customerservice@veeder.com](mailto:customerservice@veeder.com), or fax to 1-800-234-5350.
- 3 Gilbarco Veeder-Root will file the claim with the carrier (signed BOL required showing the shortage will be compared to BOL filed with carrier) and will replace the damaged/missing product at no charge to the customer.
- 4 Customer Service will work with production facility to have the replacement product shipped as soon as possible.

## Customer's Preferred Carrier

It is the customer's responsibility to file a claim with their carrier.

Customer may submit a replacement purchase order. Customer is responsible for all charges and freight associated with replacement order. Customer Service will work with production facility to have the replacement product shipped as soon as possible.

If "lost" equipment is delivered at a later date and is not needed, Gilbarco Veeder-Root will allow a Return to Stock without a restocking fee.

Gilbarco Veeder-Root will NOT be responsible for any compensation when a customer chooses his own carrier.

## Return Shipping

Use existing return policies for your region.

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# 1 – Introduction

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## Purpose

This manual provides start-up and service information for the VaporTEK™ Vapor Recovery System. VaporTEK is a dispenser based, Stage II Vapor Recovery System that collects vapor during vehicle fueling and returns vapor to the Underground Storage Tank (UST). Each VaporTEK system is designed to accommodate two active fueling points simultaneously.

The key performance parameter mandated by regulations is the Air Over Liquid (A/L) Ratio, with “A” being air (actually a vapor-air mixture) and “L” being liquid (or fuel).

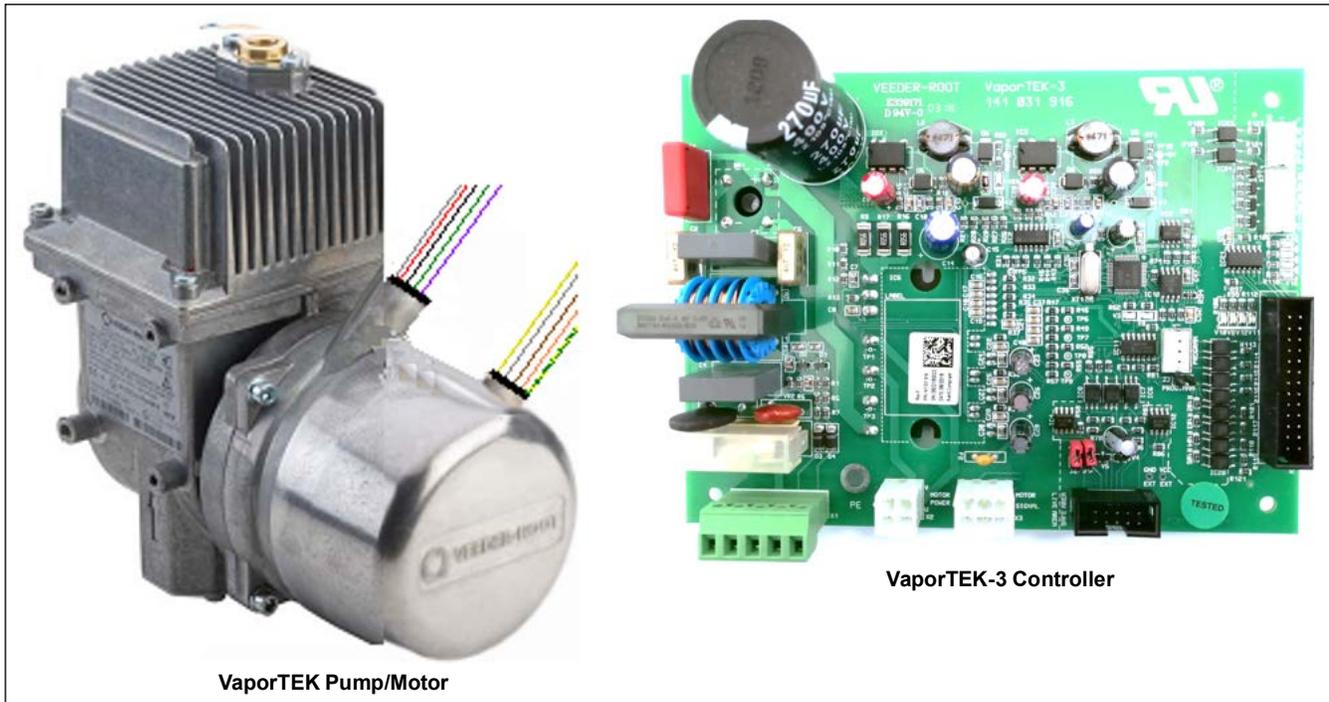
The intent of the system is to collect the same amount of vapor as the fuel being dispensed. However, because the process for capturing vapor is subject to variation from many sources, the regulatory bodies typically allow for some deviation from a one-to-one relationship between delivered fuel and recovered vapor. The regulations for system performance take these variations into account by allowing the A/L Ratio to vary by +/- 5%. That is, values of the A/L Ratio between 95% and 105% are acceptable at a performance of 38 Liters Per Minute (LPM), with the target being 100% (A = L).

For markets where monitoring of system performance is not mandated, the monitoring and control components are not required. This manual describes all the functions related to collection of Vapor Recovery System.

## System Overview

The VaporTEK Vapor Recovery System consists of the basic components shown in [Figure 1-1](#).

**Figure 1-1: Basic Components of VaporTEK Vapor Recovery System**



## Related Documents

Document Number	Title	GOLD <sup>SM</sup> Library
MDE-3804	Encore <sup>®</sup> and Eclipse <sup>®</sup> Start-up/Service Manual	Encore and Eclipse
MDE-3985	Encore Installation Manual	<ul style="list-style-type: none"> <li>• Encore and Eclipse</li> <li>• Encore and Eclipse Installers</li> <li>• Footprints and Elevations</li> </ul>

## Abbreviations and Acronyms

Term	Description
A/L	Air Over Liquid
AVRN	Asian Veeder-Root Nozzle
BLDC	Brushless DC
BOL	Bill of Lading
CC	Command Code
COM	Communication
DEF	Diesel Exhaust Fluid
ECAL	Electronic Calibration
EPV	Electronic Proportional Valve
FC	Function Code
GOLD	Gilbarco Online Documentation
HV	High Voltage
LED	Light Emitting Diode
LPM	Liters Per Minute
NEC®	National Electrical Code
NFPA	National Fire Protection Association
NPT	National Pipe Thread
OSHA	Occupational Safety and Health Administration
PCM	Pulse Correction Module
PCN	Pump Control Node
POS	Point of Sale
STP	Submersible Turbine Pump
UL®	Underwriters Laboratories
USB	Universal Serial Bus
UST	Underground Storage Tank
VAC	Voltage Alternate Current

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## 2 – Important Safety Information

**Notes:** 1) Save this Important Safety Information section in a readily accessible location.

2) Although Diesel Exhaust Fluid (DEF) is non-flammable, Diesel is flammable. Therefore, for DEF cabinets that are attached to Diesel dispensers, follow all the notes in this section that pertain to flammable fuels.

This section introduces the hazards and safety precautions associated with installing, inspecting, maintaining or servicing this product. Before performing any task on this product, read this safety information and the applicable sections in this manual, where additional hazards and safety precautions for your task will be found. Fire, explosion, electrical shock or pressure release could occur and cause death or serious injury, if these safe service procedures are not followed.

### Preliminary Precautions

You are working in a potentially dangerous environment of flammable fuels, vapors, and high voltage or pressures. Only trained or authorized individuals knowledgeable in the related procedures should install, inspect, maintain or service this equipment.

### Emergency Total Electrical Shut-Off

The first and most important information you must know is how to stop all fuel flow to the pump/dispenser and island. Locate the switch or circuit breakers that shut off all power to all fueling equipment, dispensing devices, and Submerged Turbine Pumps (STPs).

 <b>WARNING</b>	
	The EMERGENCY STOP, ALL STOP, and PUMP STOP buttons at the cashier's station WILL NOT shut off electrical power to the pump/dispenser. This means that even if you activate these stops, fuel may continue to flow uncontrolled.
	
You must use the TOTAL ELECTRICAL SHUT-OFF in the case of an emergency and not the console's ALL STOP and PUMP STOP or similar keys.	

### Total Electrical Shut-Off Before Access

Any procedure that requires access to electrical components or the electronics of the dispenser requires total electrical shut off of that unit. Understand the function and location of this switch or circuit breaker before inspecting, installing, maintaining, or servicing Gilbarco equipment.

### Evacuating, Barricading and Shutting Off

Any procedure that requires access to the pump/dispenser or STPs requires the following actions:



- An evacuation of all unauthorized persons and vehicles from the work area
- Use of safety tape, cones or barricades at the affected unit(s)
- A total electrical shut-off of the affected unit(s)

### Read the Manual

Read, understand and follow this manual and any other labels or related materials supplied with this equipment. If you do not understand a procedure, call a Gilbarco Authorized Service Contractor or call the Technical Assistance Center (TAC) at 1-800-743-7501. It is imperative to your safety and the safety of others to understand the procedures before beginning work.

### Follow the Regulations

Applicable information is available in National Fire Protection Association (NFPA) 30A; *Code for Motor Fuel Dispensing Facilities and Repair Garages*, NFPA 70; *National Electrical Code (NEC)*, Occupational Safety and Health Administration (OSHA) regulations and federal, state, and local codes. All these regulations must be followed. Failure to install, inspect, maintain or service this equipment in accordance with these codes, regulations and standards may lead to legal citations with penalties or affect the safe use and operation of the equipment.

### Replacement Parts

Use only genuine Gilbarco replacement parts and retrofit kits on your pump/dispenser. Using parts other than genuine Gilbarco replacement parts could create a safety hazard and violate local regulations.

### Safety Symbols and Warning Words

This section provides important information about warning symbols and boxes.

#### Alert Symbol



This safety alert symbol is used in this manual and on warning labels to alert you to a precaution which must be followed to prevent potential personal safety hazards. Obey safety directives that follow this symbol to avoid possible injury or death.

#### Signal Words

These signal words used in this manual and on warning labels tell you the seriousness of particular safety hazards. The precautions below must be followed to prevent death, injury or damage to the equipment:



**DANGER:** Alerts you to a hazard or unsafe practice which will result in death or serious injury.



**WARNING:** Alerts you to a hazard or unsafe practice that could result in death or serious injury.



**CAUTION with Alert symbol:** Designates a hazard or unsafe practice which may result in minor injury.

**CAUTION without Alert symbol:** Designates a hazard or unsafe practice which may result in property or equipment damage.

### Working With Fuels and Electrical Energy

#### Prevent Explosions and Fires

Fuels and their vapors will explode or burn, if ignited. Spilled or leaking fuels cause vapors. Even filling customer tanks will cause potentially dangerous vapors in the vicinity of the dispenser or island.

DEF is non-flammable. Therefore, explosion and fire safety warnings do not apply to DEF fluid lines.

## Important Safety Information

### No Open Fire



Open flames from matches, lighters, welding torches or other sources can ignite fuels and their vapors.

### No Sparks - No Smoking



Sparks from starting vehicles, starting or using power tools, burning cigarettes, cigars or pipes can also ignite fuels and their vapors. Static electricity, including an electrostatic charge on your body, can cause a spark sufficient to ignite fuel vapors. Every time you get out of a vehicle, touch the metal of your vehicle, to discharge any electrostatic charge before you approach the dispenser island.

### Working Alone

It is highly recommended that someone who is capable of rendering first aid be present during servicing. Familiarize yourself with Cardiopulmonary Resuscitation (CPR) methods, if you work with or around high voltages. This information is available from the American Red Cross. Always advise the station personnel about where you will be working, and caution them not to activate power while you are working on the equipment. Use the OSHA Lockout/Tagout procedures. If you are not familiar with this requirement, refer to this information in the service manual and OSHA documentation.

### Working With Electricity Safely

Ensure that you use safe and established practices in working with electrical devices. Poorly wired devices may cause a fire, explosion or electrical shock. Ensure that grounding connections are properly made. Take care that sealing devices and compounds are in place. Ensure that you do not pinch wires when replacing covers. Follow OSHA Lockout/Tagout requirements. Station employees and service contractors need to understand and comply with this program completely to ensure safety while the equipment is down.

### Hazardous Materials

Some materials present inside electronic enclosures may present a health hazard if not handled correctly. Ensure that you clean hands after handling equipment. Do not place any equipment in the mouth

#### WARNING

In the event of inclement weather, including snow, ice, or flooding that makes driving conditions dangerous, please avoid servicing units. Always use available door stops to secure upper doors against unwanted/unexpected movement, especially during high winds. If necessary, reschedule service to avoid damage to the equipment. Weather may change unexpectedly; be aware of local weather conditions. During service, if conditions develop making service unsafe, close the unit(s) and proceed to a safe location.

#### WARNING

The pump/dispenser contains a chemical known to the State of California to cause cancer.

#### WARNING

The pump/dispenser contains a chemical known to the State of California to cause birth defects or other reproductive harm.



Gilbarco Veeder-Root encourages the recycling of our products. Some products contain electronics, batteries, or other materials that may require special management practices depending on your location. Please refer to your local, state, or country regulations for these requirements.

## In an Emergency

### Inform Emergency Personnel

Compile the following information and inform emergency personnel:

- Location of accident (for example, address, front/back of building, and so on)
- Nature of accident (for example, possible heart attack, run over by car, burns, and so on)
- Age of victim (for example, baby, teenager, middle-age, elderly)
- Whether or not victim has received first aid (for example, stopped bleeding by pressure, and so on)
- Whether or not a victim has vomited (for example, if swallowed or inhaled something, and so on)

#### WARNING



Gasoline/DEF ingested may cause unconsciousness and burns to internal organs. Do not induce vomiting. Keep airway open. Oxygen may be needed at scene. Seek medical advice immediately.

#### WARNING

DEF generates ammonia gas at higher temperatures. When opening enclosed panels, allow the unit to air out to avoid breathing vapors. If respiratory difficulties develop, move victim away from source of exposure and into fresh air. If symptoms persist, seek medical attention.

#### WARNING



Gasoline inhaled may cause unconsciousness and burns to lips, mouth and lungs. Keep airway open. Seek medical advice immediately.

#### WARNING



Gasoline/DEF spilled in eyes may cause burns to eye tissue. Irrigate eyes with water for approximately 15 minutes. Seek medical advice immediately.

#### WARNING



Gasoline/DEF spilled on skin may cause burns. Wash area thoroughly with clear water. Seek medical advice immediately.

#### WARNING

DEF is mildly corrosive. Avoid contact with eyes, skin, and clothing. Ensure that eyewash stations and safety showers are close to the work location. Seek medical advice/recommended treatment if DEF spills into eyes.

**IMPORTANT:** Oxygen may be needed at scene if gasoline has been ingested or inhaled. Seek medical advice immediately.

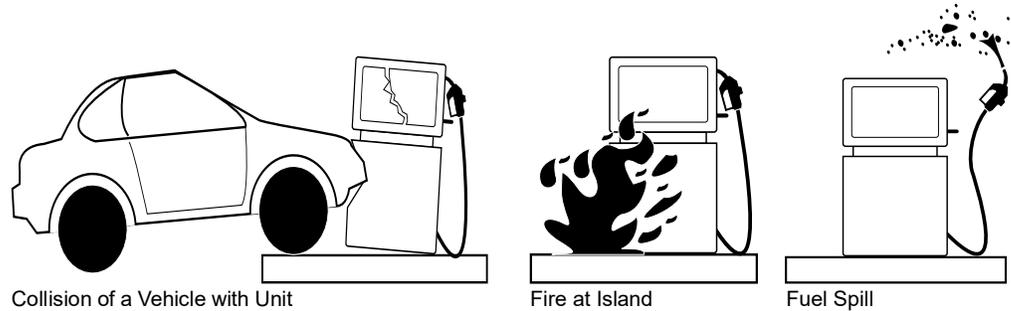
### Lockout/Tagout

Lockout/Tagout covers servicing and maintenance of machines and equipment in which the unexpected energization or start-up of the machine(s) or equipment or release of stored energy could cause injury to employees or personnel. Lockout/Tagout applies to all mechanical, hydraulic, chemical, or other energy, but does not cover electrical hazards. Subpart S of 29 CFR Part 1910 - Electrical Hazards, 29 CFR Part 1910.333 contains specific Lockout/Tagout provision for electrical hazards.

## Hazards and Actions

<span style="font-size: 1.2em;">⚠</span> <b>WARNING</b>	
	<p>Spilled fuels, accidents involving pumps/dispensers, or uncontrolled fuel flow create a serious hazard.</p> <p>Fire or explosion may result, causing serious injury or death.</p>
	<p>Follow established emergency procedures.</p> <p>DEF is non-flammable. However it can create a slip hazard. Clean up spills promptly.</p>

The following actions are recommended regarding these hazards:



- Do not go near a fuel spill or allow anyone else in the area.
- Use station EMERGENCY CUTOFF immediately. Turn off all system circuit breakers to the island(s).
- Do not use console E-STOP, ALL STOP, and PUMP STOP to shut off power. These keys do not remove AC power and do not always stop product flow.
- Take precautions to avoid igniting fuel. Do not allow starting of vehicles in the area. Do not allow open flames, smoking or power tools in the area.
- Do not expose yourself to hazardous conditions such as fire, spilled fuel or exposed wiring.
- Call emergency numbers.

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## 3 – VaporTEK System Description

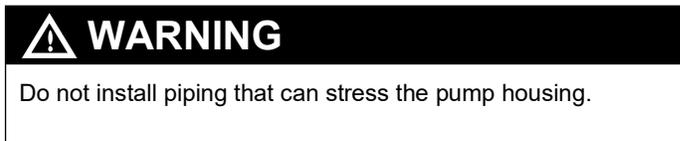
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### VaporTEK Pump

The VaporTEK pump is a variable-speed piston pump capable of drawing up to 120 LPM of vapor through a vapor recovery nozzle and delivering it to the UST at the dispensing site. The piston pump works on the floating piston principle, i.e., piston rod and piston form a rigid unit. On each complete rotation of the shaft, the gas mixture is aspirated at the inlet valve and compressed in the cylinder. The inlet or outlet valve blocks a flow direction, i.e., the aspirated gas mixture is expelled via the outlet side of the pump.

The following are the features/requirements of the VaporTEK pump:

- The ambient and the inlet temperature must not exceed 130 °F (55 °C).
- The gas temperature in the outlet line must not exceed 203 °F (95 °C).
- The maximum pressure with closed discharge shall not exceed 1600 mbar (g) at any speed.
- The inlet/outlet ports have standard National Pipe Thread (NPT) 3/8-inch female threads.



#### **Technical Considerations (Not for Field Representative's Use):**

Use - For use only in products where the acceptability of the combination is determined by Underwriters Laboratories (UL) LLC.

The following are the conditions of acceptability:

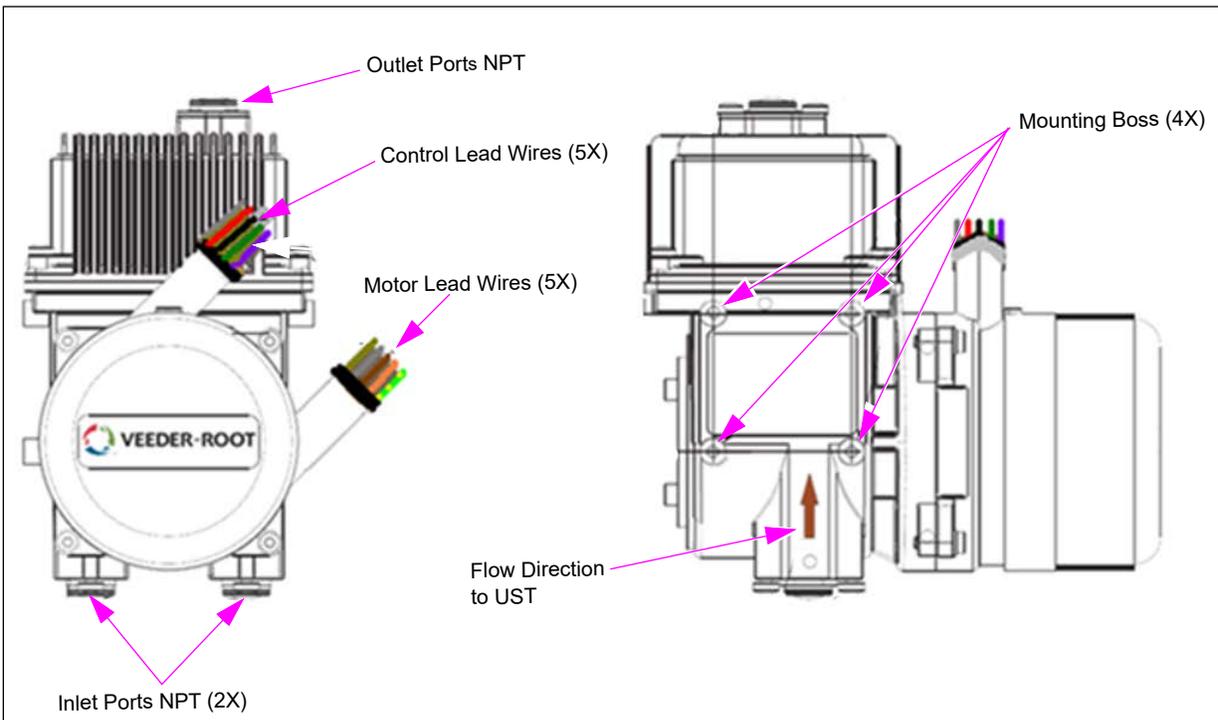
- 1 When mounted in the end-use application, these assemblies are not to be supported by any fluid handling pipes. The suitability of the mounting means of the device are to be reviewed in the end-use.
- 2 These devices are intended for use as part of a Listed retrofit assembly or as a factory installed component for Listed power-operated flammable liquid dispensing devices.
- 3 The suitability of the grounding means of this device with respect to UL 79 Ninth Edition, shall be evaluated in the end-use.
- 4 These pumps are intended to be mounted to the inside of a dispenser housing. Consideration should be given to the need for guards to restrict access to moving parts in the end use.
- 5 This pump has not been evaluated for outdoor use.

## VaporTEK Pump Specifications

The following table lists the VaporTEK pump specifications:

Function	Description
Flow Medium	Gasoline Vapor
Mounting	Four M6 X 1 Mounting Boss (Either Side of Pump)
Motor Type	Synchronous Brushless DC (BLDC) Motor
Voltage (Single)	110 Voltage Alternate Current (VAC) ( $\pm 10\%$ )
Frequency	50/60 Hz
Watts	300 W
Motor Speed	2500 rpm maximum
Maximum Flow Rate	Up to 120 LPM
Noise Level	59 dB (A)

Figure 3-1: VaporTEK Pump Specifications



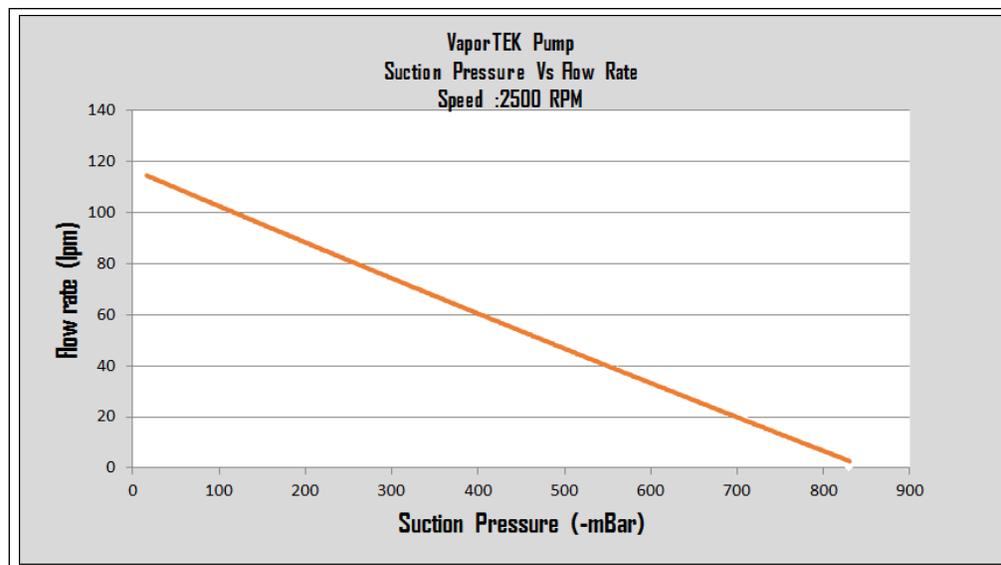
## VaporTEK Pump Operation

The VaporTEK pump is a variable-speed piston pump. The flow rate is proportional to the speed, and the pump achieves maximum flow rate at 2500 rpm.

The inlet and outlet pressure/vacuum also affects the flow. These are determined by the system in which the pump is operating. That is, the restrictions at the inlet to the pump (nozzle, flow meters, tubing, and fittings) and at the outlet of the pump (piping to a sealed UST) limit the flow being delivered. The design point for the VaporTEK pump in the Encore dispenser is approximately 150 mbar inlet vacuum (850 mbar absolute pressure) and 100 mbar outlet pressure (1100 mbar absolute pressure).

The relationship between the pump flow and the suction pressure is shown in [Figure 3-2](#).

**Figure 3-2: Relationship Between Pump Flow Rate and Suction Pressure**



[Figure 3-2](#) shows that the flow at 150 mbar suction pressure and the 100 mbar discharge pressure is approximately 95 LPM. This is the design point of the system. It defines the conditions under which the pump operates with the nozzle wide open, and is illustrated by the small dot on the curve above.

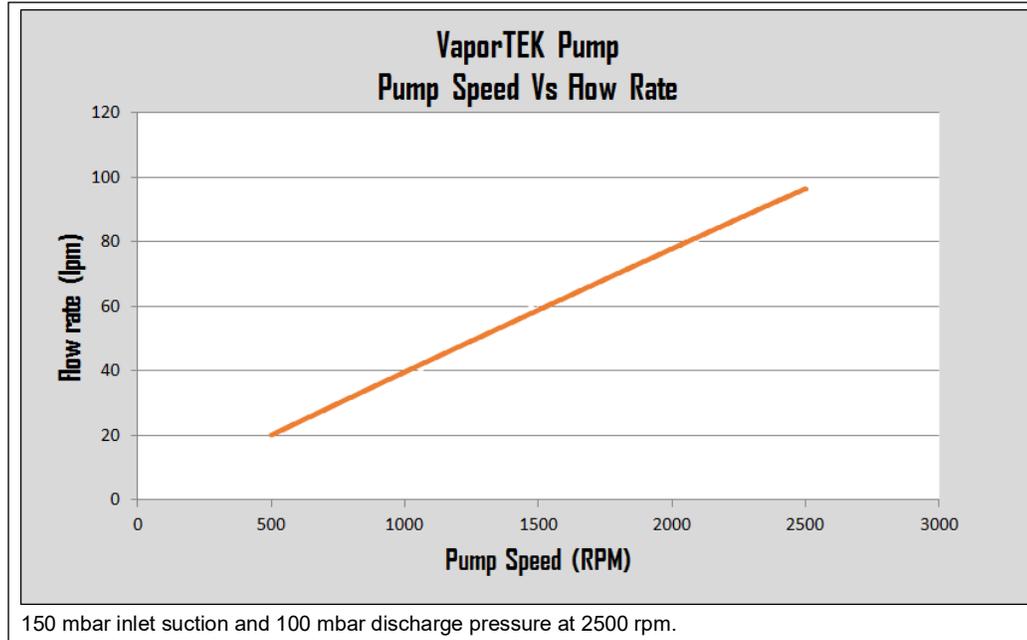
During operation, the inlet vacuum and, to some extent, the vapor flow is controlled by the vapor valve in the nozzle. When the nozzle is fully open, dispensing the maximum amount of fuel and collecting the maximum amount of vapor, the pump draws a vacuum of about 150 mbar through all the other restrictions in the lines. As the nozzle closes, the vacuum increases with the closing of the vapor valve and the vapor flow decreases accordingly.

However, the vapor valve does not control the flow precisely enough to satisfy the regulations that govern the recovery of vapor. In most regions where monitoring of the vapor recovery is mandated, the requirement is that the vapor flow be within 15% of the liquid being dispensed. If the control of the vapor flow were left up to the opening of the vapor valve in the nozzle alone, the vapor collection would frequently go outside the allowable range.

## System Calibration

VaporTEK more precisely controls the amount of vapor being collected so that it is closer to the fuel delivered. It drives the pump at the speed required to deliver the same vapor flow as the fuel. A typical relationship between pump flow and speed at 150 mbar inlet suction pressure and 100 mbar discharge pressure at 2500 rpm is shown in [Figure 3-3](#).

**Figure 3-3: Relationship Between Pump Flow and Speed**



By characterizing the relationship between the pump speed and vapor flow during system setup, or calibration, and then controlling the speed of the pump during operation as dictated by the resulting curve of flow vs. speed, you can maintain the proper A/L Ratio better than by relying solely on the vapor valve in the nozzle.

The Pump Control Node (PCN) in the dispenser outputs pulses proportional to the flow: 136 pulses = 1 LPM. These pulses are delivered to the Point of Sale (POS) system and the dispenser display, and determine how much to charge the customer for the fuel dispensed. These pulses are used by the VaporTEK system to set the vapor flow.

During the calibration process, the VaporTEK Controller Board drives the pump at a series of 15 speed settings between 1200 rpm and 0 rpm from each side separately. From this set of data, it develops a curve that it will use to drive the pump during dispensing.

For example, during the calibration procedure, the pump speed required to deliver 30 LPM is 750 rpm and to deliver 40 LPM it is 1000 rpm. During operation, if the dispenser pumps 35 LPM of fuel, the VaporTEK Controller will drive the pump at approximately 875 rpm to match this flow. Because the computer develops a smooth curve for the vapor flow across the entire operating range of the pump, it can derive a speed setting for any level of fuel flow between zero and the maximum of the dispenser.

## Open-loop vs. Closed-loop Flow Control

For Collection Only systems, the A/L Ratio is controlled with prior knowledge of pump operation, that is, the calibration curve. This is an open-loop control scheme.

In Collection + Monitoring systems, the primary control of the A/L Ratio is the same as in the Collection Only systems, using the calibration curve to set the appropriate pump speed. However, making continuous measurements of the vapor flow allows us to control it more precisely than when the flow is not measured. In addition to using the calibration curve, which drives the pump close to the fuel flow, there is also a closed-loop control function that refines the speed command to deliver an A/L Ratio closer to 100%. This function is performed by a Vapor Monitoring system, which is not a part of this document. For more information about close loop systems using a vapor monitoring system, contact your dispenser supplier.

## Changes in System Performance

The calibration procedure maintains a close relationship between the fuel flow and vapor flow as long as the system performance remains constant. However, the system performance varies over the lifetime of the system. Over time, the seals on the pump piston wear, the system develops slight leaks and restrictions, and other long-term effects cause the flow to change at every speed. The flow can either rise or fall, but it typically falls as the system ages. Thus, the vapor flow will begin to deviate from the fuel flow, and the A/L Ratio will go out of range, initially only on occasion, but eventually often enough that it will repeatedly fall below the allowable. For information about calibrating the system, refer to “[System Calibration](#)” on [page 3-4](#). Whenever the calibration procedure is performed, the computer develops a new curve to use for driving the pump in the future. The system can be recalibrated at any time as required to return the A/L Ratio closer to its target value until the maximum allowable speed of the pump is reached (1200 rpm) for each side, and no more flow is available. At this point, the pump needs to be replaced.

## VaporTEK-3 Controller Board

VaporTEK-3 Controller Board is shown in [Figure 3-4](#) on [page 3-7](#). This is the motor driver that translates a fuel flow into speed information delivered by the RS-422 serial or VVAC-Port Encore 500 S interface connection and drives the motor on this calculated specific speed.

Mode selections for the VaporTEK-3 Controller Board require jumper settings as shown in the following table:

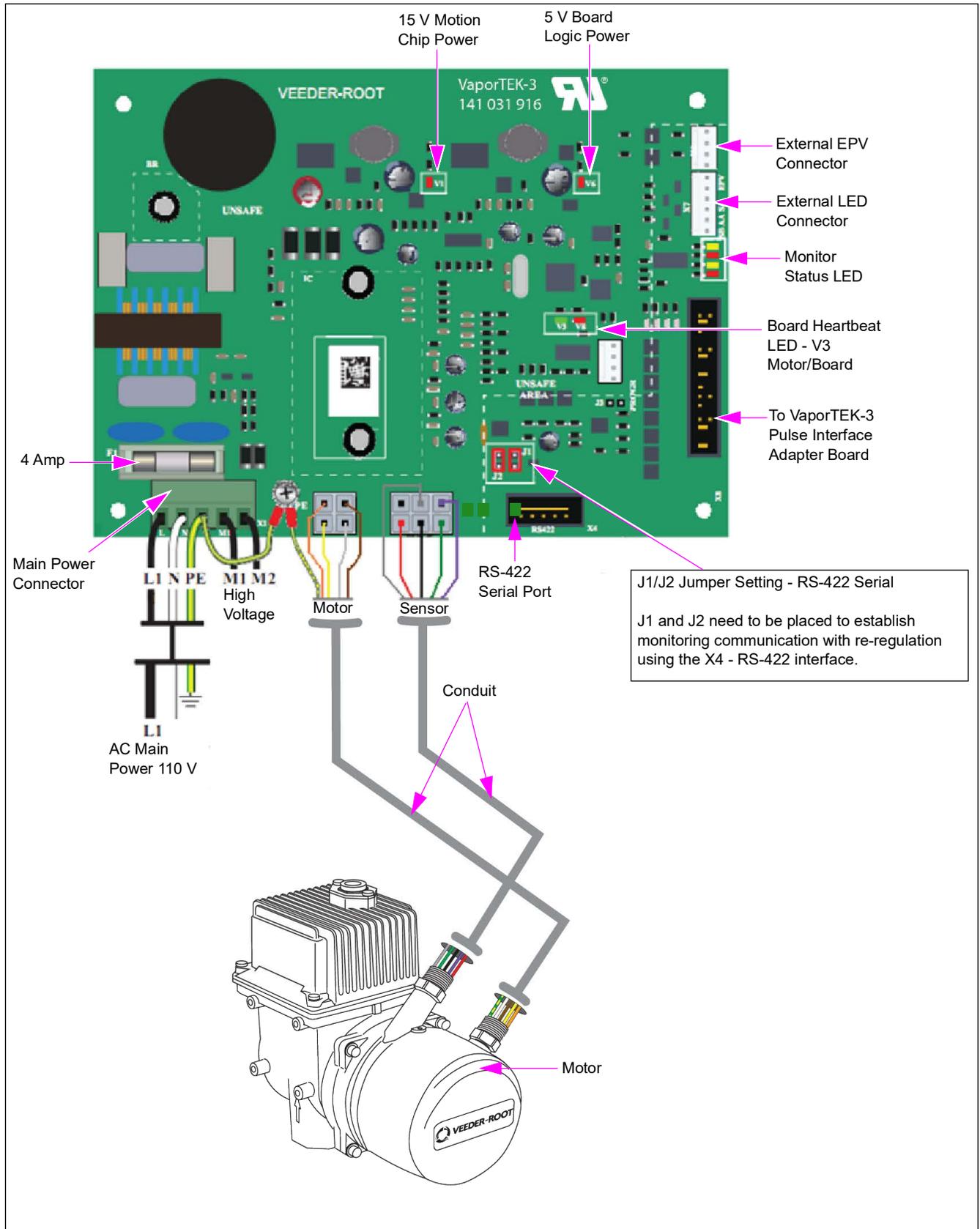
Configuration Type	VaporTEK Controller Mode	Mode Selection		
		J1	J2	J3 - PROG.
VaporTEK Plus	Electronic Signal of Fuel Flow Required	No	No	No
Board Programming Mode	Power OFF/ON Cycle required	No	No	Yes

## VaporTEK Controller Interfaces Connectors

The following table lists the VaporTEK Controller Interface Connectors:

Connector	Description
X1	(L, N, PE) Mains Electricity Connection 110 V AC. X1 - (M1, M2) High Voltage (HV) Inputs
X2	Motor Power (U, V, W) Connection
X3	Motor Sensor Connection
X4	RS-422 Connection to FB1 - Handheld service terminal. Performs system calibration and simulation
X5	Programming connector for software updates and enhanced system debug / setup
X6	External Electronic Proportional Valve (EPV) - Interface connection
X7	External 3 - Color Light Emitting Diode (LED) - Interface connection
X9	VaporTEK Pulse interface pin compatible to Encore 500 S VaporVac® - Port

Figure 3-4: VaporTEK-3 Controller Board



# VaporTEK System Configuration

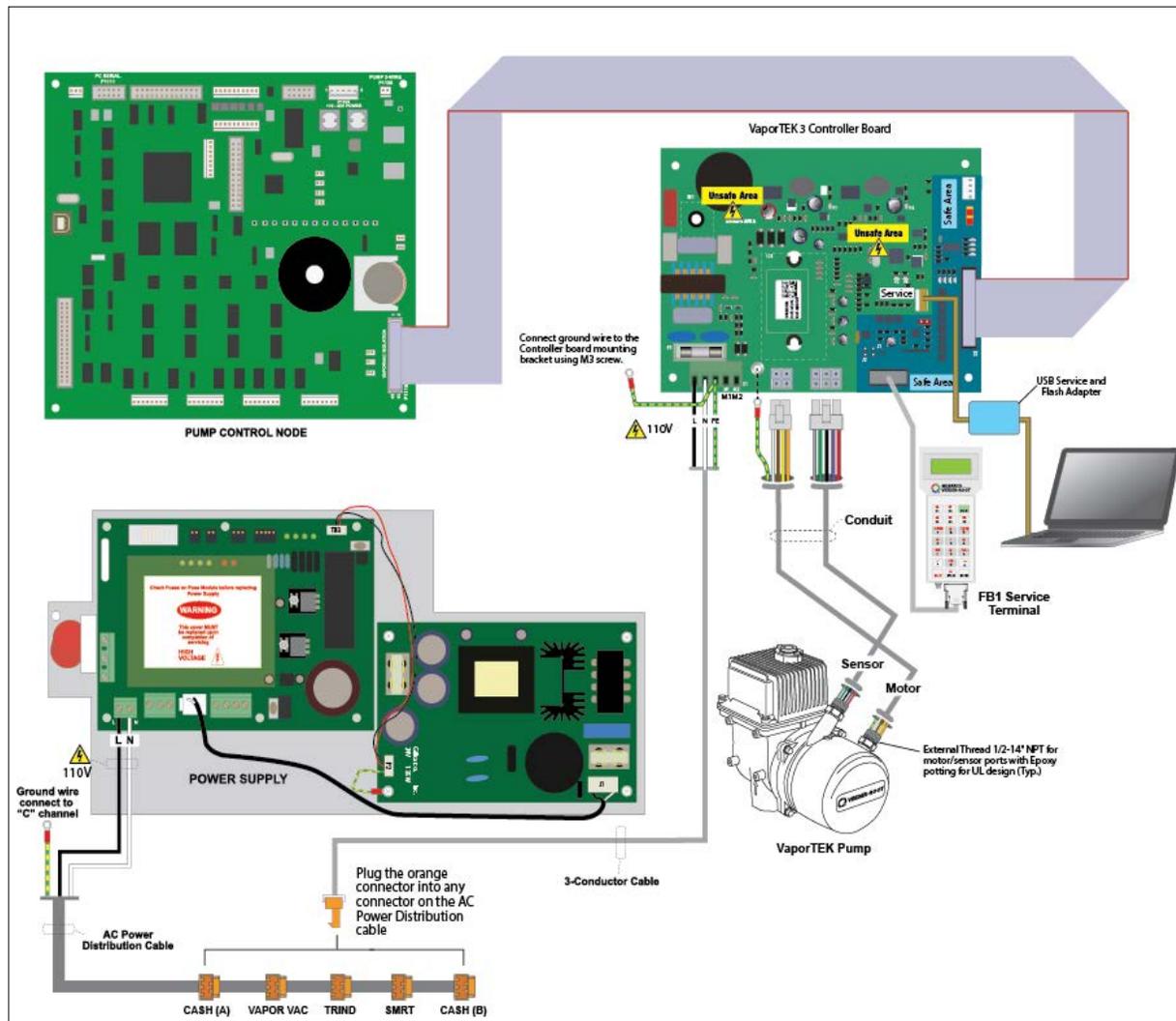
The following table lists the VaporTEK system configurations:

<b>VaporTEK Configuration (Encore 500 Only)</b>	<b>Input Type</b>	<b>Mode of Operation</b>	<b>Required Components</b>	<b>Method of Operation</b>
Collection Only	Liquid Pulse Signal	Variable Speed	VaporTEK-3 Controller	VaporTEK-3 Controller receives liquid pulses from an active encoder or pulse interface (from either side of the dispenser) and calculates the fuel flow rate. This flow rate will be translated into the pump speed.

# 4 – VaporTEK - Encore Wiring Diagrams

## VaporTEK System for Collection Only

Figure 4-1: VaporTEK System for Collection Only



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## 5 – VaporTEK Calibration Start-up Sequence

The start-up procedures for the VaporTEK system are as follows:

- Required equipment (refer to “[VaporTEK Start-up Required Equipment](#)”).
- Programming for vapor recovery (refer to “[Programming Pump 02.8.86 or Later for Collection Only](#)” on [page 5-2](#)).
- External flow meter calibration (refer to “[External Flow Meter Calibration](#)” on [page 5-6](#)).
- Pulse rate setup with FB1 terminal (refer to “[Pulse Rate Setup with FB1 Terminal](#)” on [page 5-8](#)).
- System integrity test (refer to “[System Integrity Test](#)” on [page 5-10](#)).
- System calibration (refer to “[System Calibration](#)” on [page 5-11](#)).

### VaporTEK Start-up Required Equipment

The following are the required equipment for the initial setup:

Description	Part Number
Burkert Flow Meter with Elaflex-style Nozzle Adapter, and Rubber Hose between Adapter and Meter.	M13351A001
FB1 Handheld Terminal (includes 15-pin to RS-422 cable supplied with unit).	M13353A001
Nozzle Adapter to collect vapor (varies with nozzle manufacturer) for Gilbarco Veeder-Root Asian Veeder-Root Nozzle (AVRN)/ICVN and OPW 12VW.	579290-001 (Veeder-Root PN)

*Note: Only the correct adapter can be used for system calibration.*

## Programming Pump 02.8.86 or Later for Collection Only

### IMPORTANT INFORMATION

- Windows XP® has HyperTerminal resident on the computer. For any laptop system newer than Windows XP, use M16 Flasher.
- For dispenser/pump programming, refer to *MDE-3804 Encore and Eclipse Start-up/Service Manual*.

### Error Codes

The following table lists the error codes associated with VaporTEK:

Error Code	Description
6042	Vaporix alarm side A.
6043	Vaporix alarm side B.
6044	Vaporix option is set, but board is not detected.
6045	Shutdown warning side A (show on the dispenser log file).
6046	Shutdown warning side B (show on the dispenser log file).
6047	Vaporix board is detected, but option is not set.

Vapor recovery units require two special programming steps. First, the PCN must be set up to provide output pulses to the VaporTEK interface using Command Code (CC) **91**, Function Code (FC) **3**. Then, the fuel density must be set using CC **75**.

### Accessing Dispenser Programming

To gain access to dispenser programming and bypass the dispenser security feature, proceed as follows:

- 1 Disconnect the two-wire communication cable from the pump node at P1109.
- 2 Cycle power to the dispenser and wait for five minutes after unit has completely booted up.
- 3 Press **F1** on the manager keypad. If you get a double beep when pressing F1, then you need to wait longer. If the double beep continues even after eight minutes, verify step 1 and perform step 2 again. Once successful, the main display will be flashing 8888 after F1 is pressed.

## Programming Dispenser

After accessing the dispenser for programming, proceed as follows:

*Note: Ensure that the newest PCN software has been installed prior to Programming the Dispenser.*

- 1 Press **F1** on the manager keypad.
- 2 Press **0 > 1 > 2 > 8 > Enter** (display flashes 0000).
- 3 Press **91 > Enter** (top right-side digit blinks).
- 4 Press **3 > Enter** to set Vapor Recovery.
- 5 Press **3 > Enter** for VaporTEK without shutdown **OR**  
Press **4 > Enter** for VaporTEK with shutdown.  
*Note: The VaporTEK error codes work correctly only if CC 91 is set to 4.*
- 6 Turn Electronic Calibration (ECAL) switch to right.
- 7 Press **F1**. The VaporVac is now set for vapor collection only.

Next, the fuel density must be programmed:

*Note: See [Figure 5-1](#) on [page 5-4](#) for a diagram of side, product, and meter locations.*

- 8 Press **75 > Enter**.
- 9 Press **(Side Number) > Enter** to select Side.
- 10 Press **(Product Code from Table) > Enter** to select Meter.

### Meter Layout Chart

Product Code	Meter Number (Side 1)	Meter Number (Side 2)
1	1	2
2	5	6
3	4	3
4	8	7

- 11 Press **(Value from Table) > Enter** to select Fuel Density.

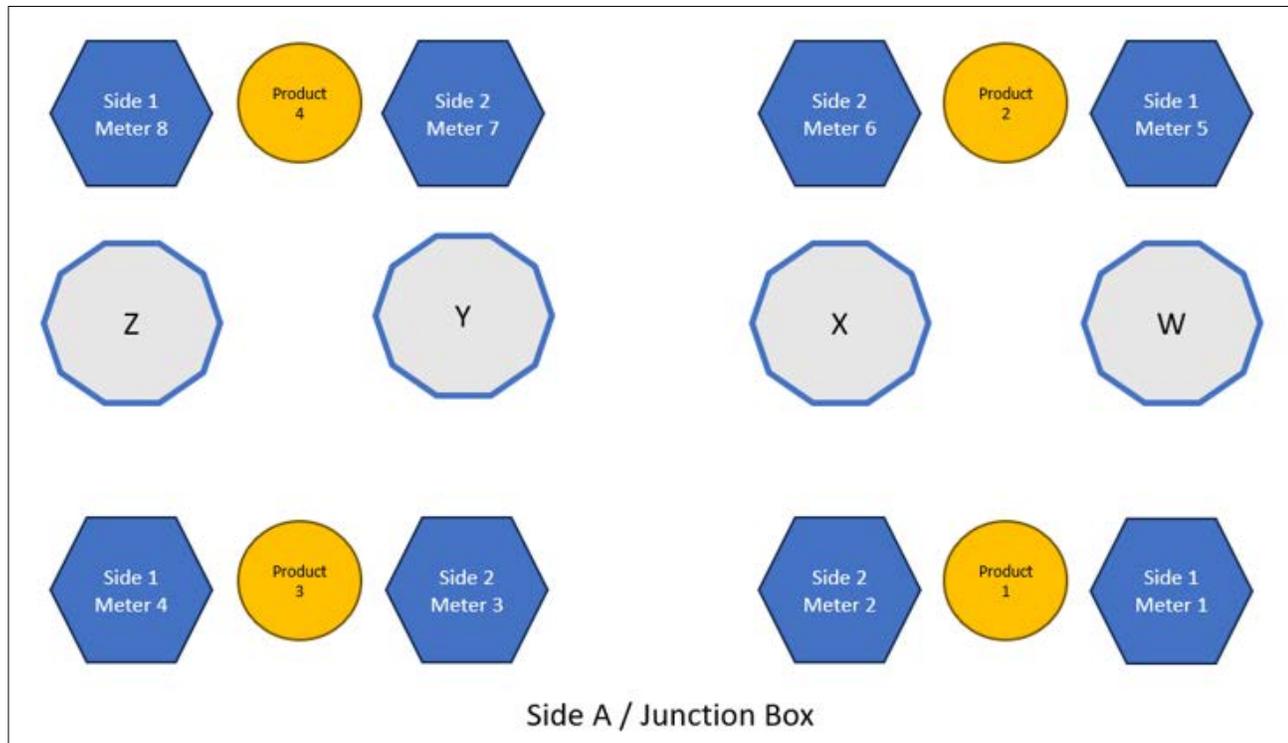
*Note: Fuel density is used to set Vapor Recovery function as mentioned in the following table:*

Value	Type	Vapor Recovery
0	Not Set (Default)	No
1	Gasoline	Yes
2	Diesel	No
3	DEF	No
4	Ethanol	Yes

- 12 Return ECAL switch to left.

13 Press **F2** to return to idle state.

**Figure 5-1: Diagram of Sides, Products, and Meters**

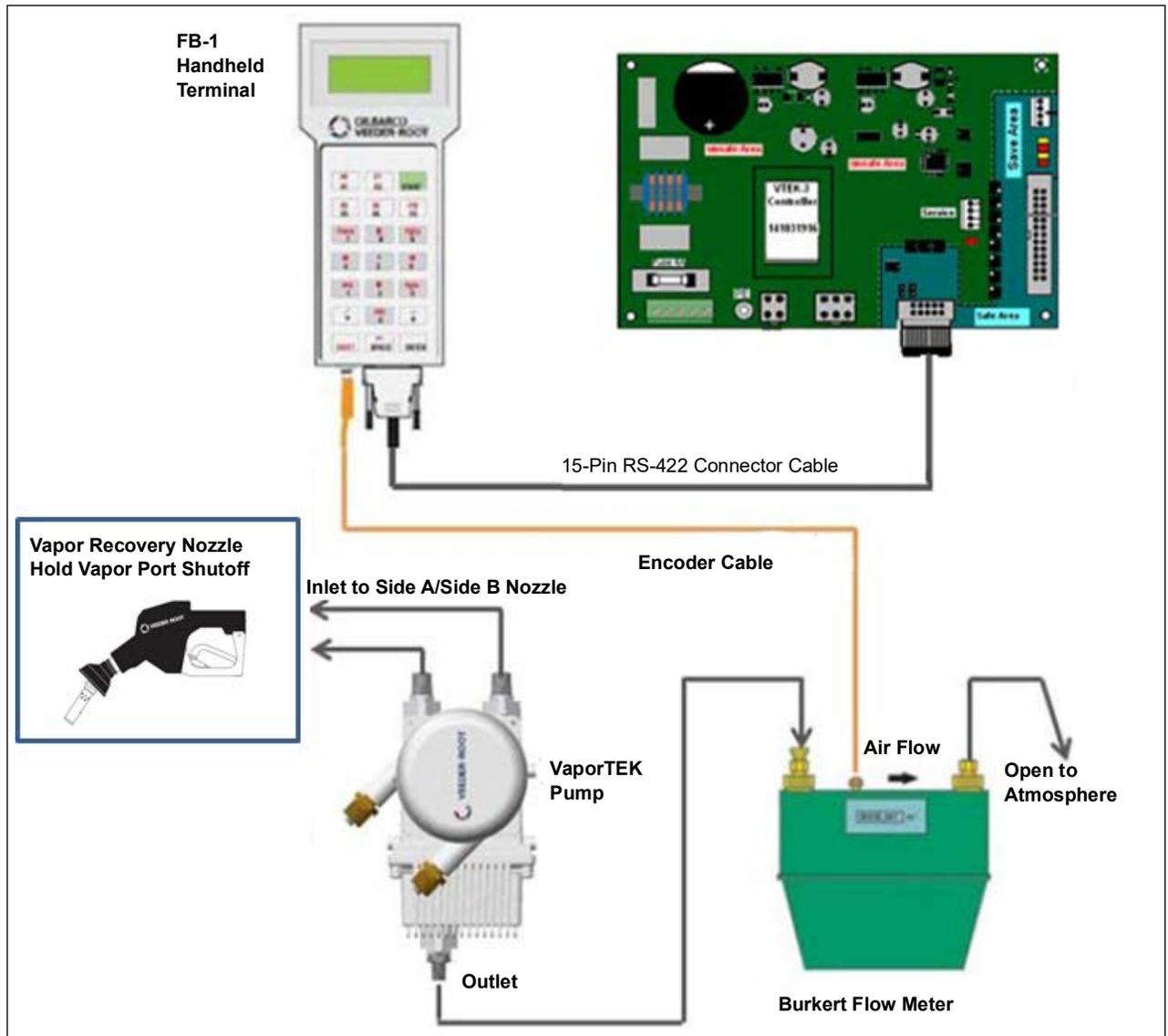


## System Integrity Testing Setup

The relationship between vapor flow and pump speed must be consistent for the system to comply with regulatory requirements. This relationship will be accurate only if the system is operating correctly when it is calibrated. If there are opportunities for air to enter the system (leaks), restrictions to flow (blockages), and improper electrical connections or faulty hardware, the pump will not deliver the proper vapor flow.

A short test is performed before calibrating the system to verify its integrity. The setup for system integrity test is shown in [Figure 5-2 on page 5-5](#).

Figure 5-2: System Integrity Testing Setup Diagram



- 1 Verify that the power is available at the VaporTEK-3 Controller by confirming LED V1 and V6 (red) are on and LED V3 (green) is flashing.
- 2 Connect the FB1 terminal to RS-422 connector on the VaporTEK-3 Controller (see [Figure 5-2](#) on [page 5-5](#)).
- 3 Connect the gas meter encoder cable to FB1 terminal.
- 4 Connect the hoses to gas meter.
- 5 Ensure that the nozzle is shut off (vapor valve closed) to perform the leak test.

The following table lists the FB1 terminal key descriptions:

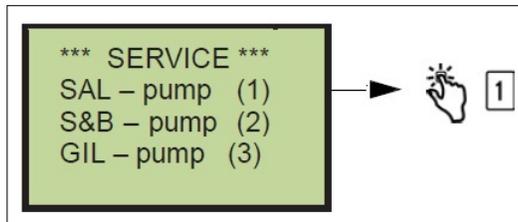
Key	Description
START	Power ON the FB1 Terminal
ENTER	Confirm Selection
SHIFT	Cancel Selection

## External Flow Meter Calibration

External flow meter calibration must be completed before conducting a system calibration. To calibrate the external flow meter, proceed as follows:

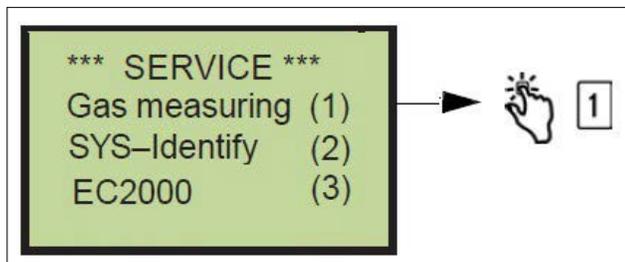
- 1 Press the **Start** button until the following screen opens, and then press **1**.

**Figure 5-3: Gas Meter Calibration - Screen 1**



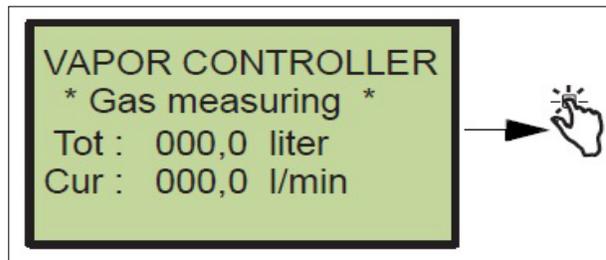
- 2 Press **1** when the following screen opens.

**Figure 5-4: Gas Meter Calibration - Screen 2**



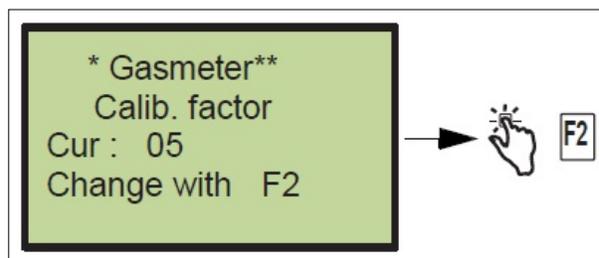
- Press **F5** when the following screen opens.

**Figure 5-5: Gas Meter Calibration - Screen 3**



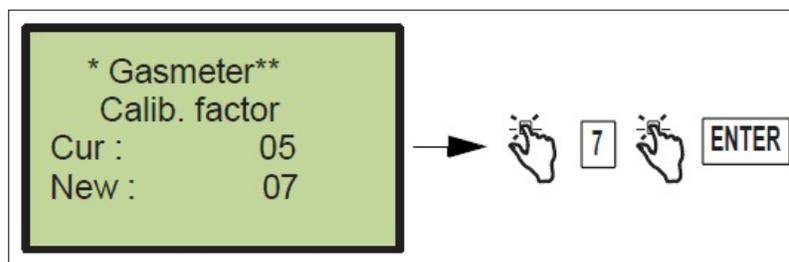
- Match the Calib. factor (calibration factor) on the gas meter (see [Figure 5-8](#)) with the following display on the FB1 terminal (see [Figure 5-6](#)). If the calibration factor already matches, press **ENTER**. If not, press **F2** to change the calibration factor.

**Figure 5-6: Gas Meter Calibration - Screen 4**



- Enter the Calib. factor (calibration factor) shown on the gas meter and press **Enter** when the following screen opens (for example, 07 is now the new factor).

**Figure 5-7: Gas Meter Calibration - Screen 5**



**Figure 5-8: Burkert Gas Meter Calibration Factor**



# Pulse Rate Setup with FB1 Terminal

## Pulse Rate Setup on VaporTEK Controller

The VaporTEK interface receives pulses from an active encoder and calculates the current flow rate by using adjusted pulse rate - Range: 50 to 200 pulses/liter (1 U.S. Gallon = 3.785 liters). The pulse rate for a VaporTEK interface should be set to 136 pulses/liter for Encore 500 S.

If the dispenser is running, the FB1 terminal will show the current petrol flow rate on the FB1's display by using the FB1 - Sub menu item "Fuel flow (3)" (see step 4 on page 5-9).

You need to use the procedure explained in "Pulse Rate Setup with FB1" to verify the pulse rate is 136 pulses/liter. It cannot be set to any other number on an Encore dispenser.

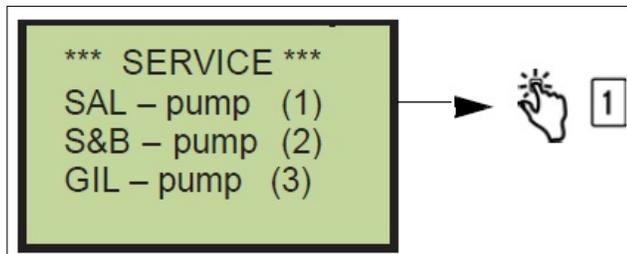
The pulse rate adjustment can be set up either using the FB1 service terminal connected to the VaporTEK interface or a laptop connected to the VaporTEK interface.

## Pulse Rate Setup with FB1

To set up the pulse rate on the FB1 terminal, proceed as follows:

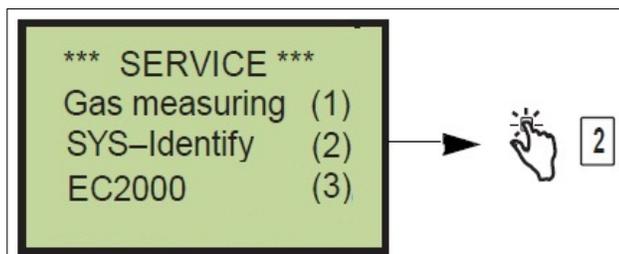
- 1 Switch on the FB1. Wait until the menu shown in Figure 5-9 is displayed, then press 1.

**Figure 5-9: Pulse Rate Setup - Screen 1**



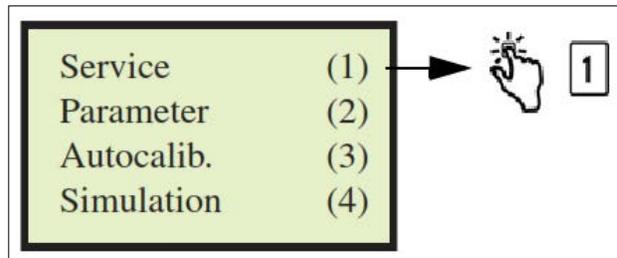
- 2 When the screen shown in Figure 5-10 opens, press 2.

**Figure 5-10: Pulse Rate Setup - Screen 2**



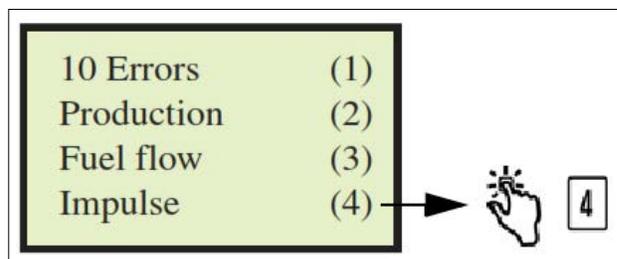
- 3 When the screen shown in [Figure 5-11](#) opens, press **1**.

**Figure 5-11: Pulse Rate Setup - Screen 3**



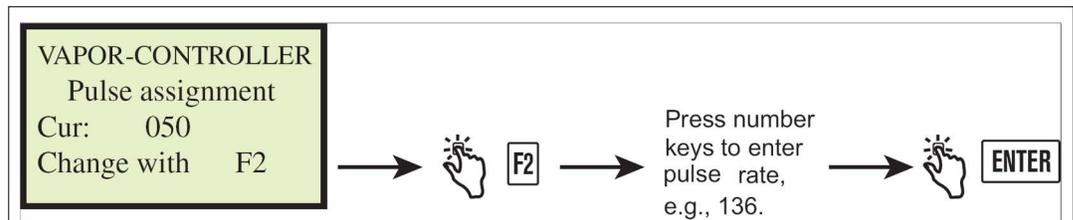
- 4 When the screen shown in [Figure 5-12](#) opens, press **4**.

**Figure 5-12: Pulse Rate Setup - Screen 4**



- 5 When the screen shown in [Figure 5-13](#) opens, press **F2** followed by the required number keys (press the respective number keys to enter the pulse rate) and press **Enter**.

**Figure 5-13: Pulse Rate Setup - Screen 5**



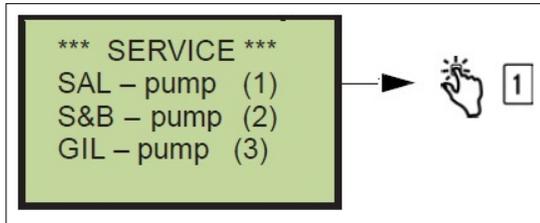
- 6 Enter the pulse rate **136** for Encore 500 S dispensers.

# System Integrity Test

To perform the system integrity test, proceed as follows:

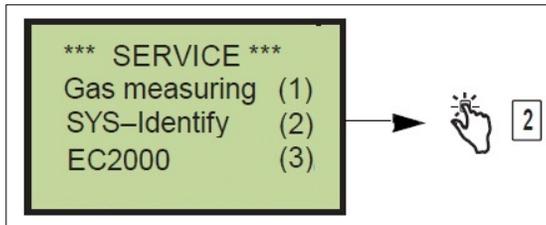
- 1 Press the **Start** button (green button) on the FB1 terminal until the following screen opens and then press **1**.

**Figure 5-14: System Integrity Test - Service Screen**



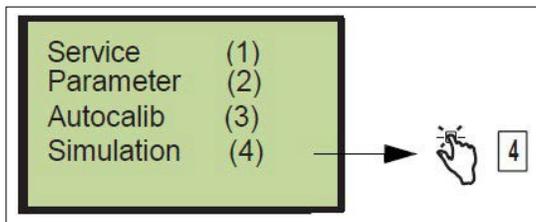
- 2 When the screen shown in [Figure 5-15](#) opens, press **2**.

**Figure 5-15: Identifying System Screen**



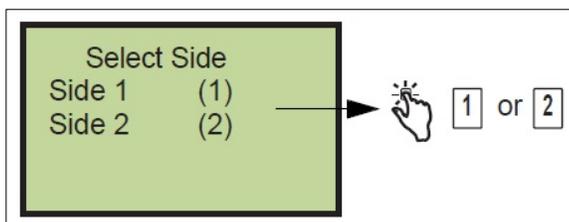
- 3 When the screen shown in [Figure 5-16](#) opens, press **4** to start the simulation.

**Figure 5-16: Simulation with FB1 Screen**



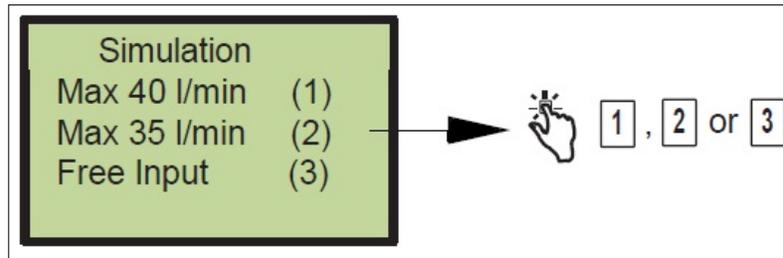
- 4 Select the dispenser side (1 or 2) that you want to simulate.

**Figure 5-17: Selecting Side Screen**



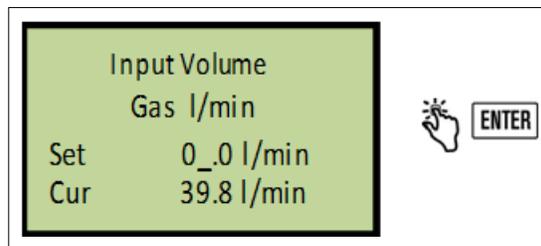
- Press **3** to select Free Input and then press **Enter**.

**Figure 5-18: Selecting Free Input Screen**



- Enter a flow value of **90** LPM at the position of the cursor and then press **Enter**.

**Figure 5-19: Input Volume Screen**



When the flow-rate input is provided through the FB1 terminal, the VaporTEK pump starts, if greater than 6 LPM.

- If the flow from the pump is “0 LPM”, the system is working properly without any leak. If the value is above zero, there is a leak that must be resolved before the calibration test is performed.

To diagnose and resolve the issue, refer to “[Troubleshooting and Analysis](#)” on [page 6-1](#).

## System Calibration

To calibrate the system, proceed as follows:

- Verify that the power is available at the VaporTEK-3 Controller by confirming LED V1 and V6 (red) are ON and LED V3 (green) is flashing.
- Connect the FB1 terminal to the RS-422 connector on the VaporTEK-3 Controller.  
*Note: Ensure that the FB1 Terminal has batteries switched ON.*
- Connect the gas meter encoder cable to FB1 terminal.
- Connect the hoses to gas meter.
- Remove the nozzle from the dispenser holder and secure the A/L nozzle adapter to the spout of the nozzle. The A/L nozzle adapter O-rings prevent air leakage into the nozzle’s vapor collection holes (see [Figure 5-20](#) on [page 5-12](#)). After ensuring the nozzle shutoff port is not covered by the adapter body, tighten the two knurled end rings to secure the adapter to the nozzle.

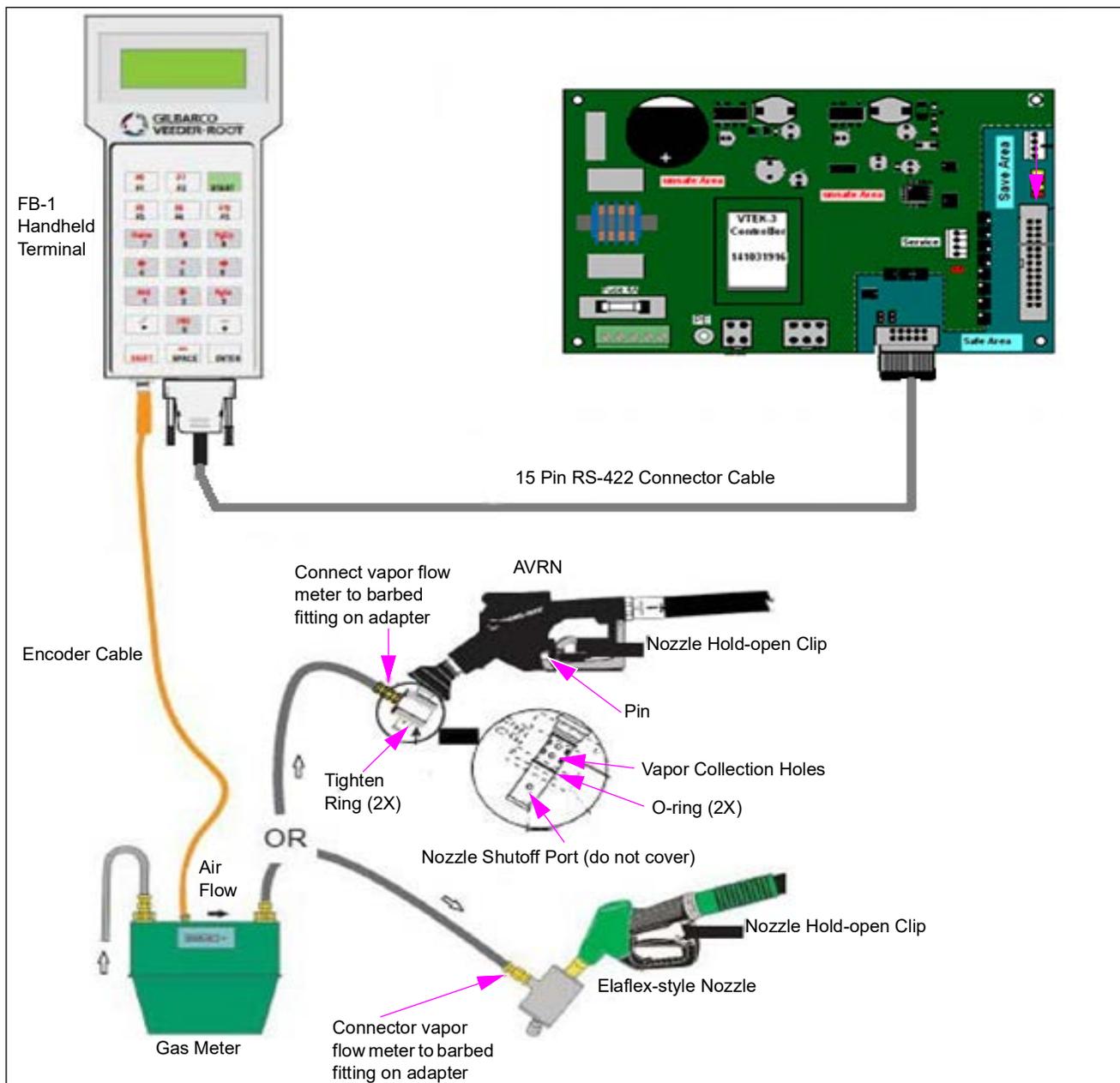
- Open the vapor valve on the AVRN by depressing the lever and inserting a pin in the location shown in Figure 5-20.

*Note: For methods on how to open the nozzle vapor valve on non-Gilbarco Veeder-Root nozzles, refer to the manufacturer's manual.*

The following table lists the FB1 terminal key descriptions:

Key	Description
START	Power ON the FB1 terminal
ENTER	Confirm selection
SHIFT	Cancel selection

**Figure 5-20: System Calibration Setup Diagram**

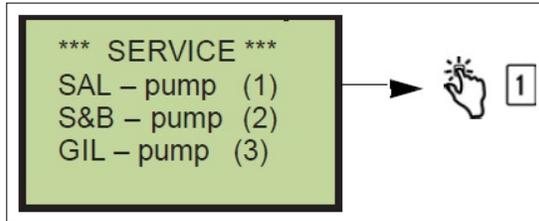


Ensure that the nozzle vapor valve is open and the external meter is connected (see Figure 5-20).

To calibrate the system using the FB1 terminal, proceed as follows:

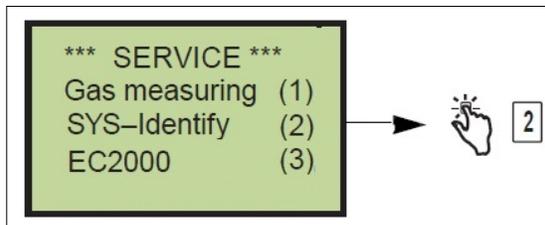
- 1 Press the **Start** button until the screen shown in [Figure 5-21](#) opens, and then press **1**.

**Figure 5-21: System Calibration - Service Screen**



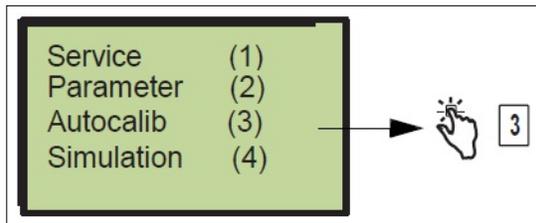
- 2 Press **2** when the following screen opens (see [Figure 5-22](#)).

**Figure 5-22: Identifying System Screen**



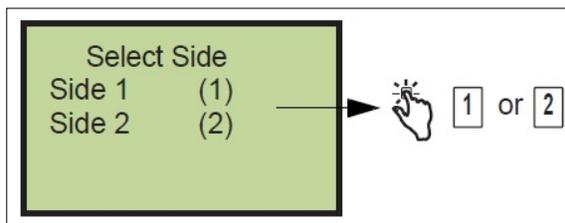
- 3 Press **3** to start the Autocalib (auto calibration) when the following screen opens (see [Figure 5-23](#)).

**Figure 5-23: Auto Calibration Using FB1 Screen**



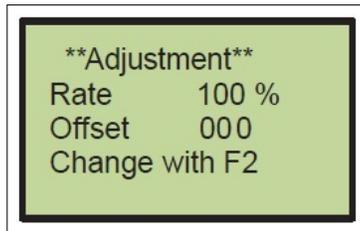
- 4 Select the dispenser side (1 or 2) that you want to calibrate.

**Figure 5-24: Selecting Side Screen**



- 5 Set the A/L Ratio rate.

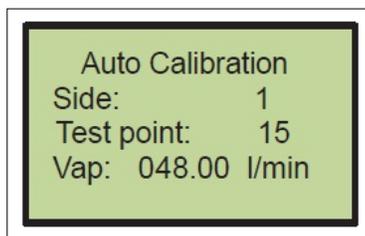
**Figure 5-25: Setting A/L Ratio Rate Screen**



Ensure that the nozzle vapor valve is open and the external meter is connected (see [Figure 5-20](#) on [page 5-12](#)).

- 6 Press **Enter** and wait while the auto calibration proceeds through 15 test points.

**Figure 5-26: Auto Calibration - Test Point Screen**



The auto calibration procedure will complete at test point 1.

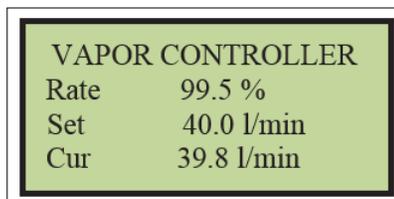
If tests stop before completing, perform the following:

- Recheck all connections.
- Ensure that the pump is turning ON.
- Verify that the O-rings are not missing.

After the system calibration is completed, the calibration result needs to be verified using dry simulation.

- 7 Press **Shift** to go back to the previous screen. Follow the procedure on system integrity test steps 3 through 5 on [page 5-9](#). The FB1 terminal starts the simulation and displays the results as shown in [Figure 5-27](#). Refer to the following notes for information regarding proper range. Select the side to be verified and insert a fuel performance value to analyze the Vapor performance shown on the Rate (A/L-Ratio).

**Figure 5-27: Auto Calibration Using FB1 Vapor Controller Screen**



*Notes: 1) The rate displayed on the FB1 terminal must be within the legislated range established by local regulations.*

*2) If the value is not within the legislated range, change the A/L Ratio rate accordingly to meet the requirements.*

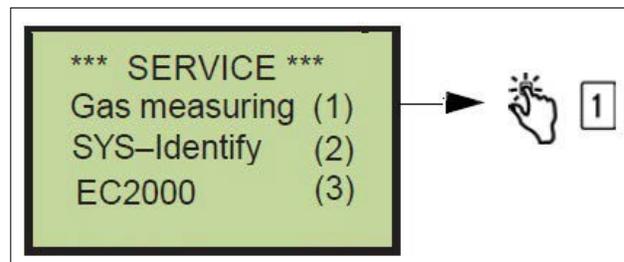
*3) Perform the auto calibration individually on both sides of the dispenser.*

# OPW 12VW Nozzle - Wet Calibration

To calibrate the system with OPW 12VW Nozzle in wet mode, proceed as follows:

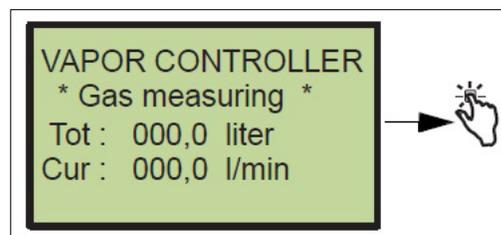
- 1 Verify that the power is available at the VaporTEK-3 Controller by confirming LED V1 and V6 (red) are on and LED V3 (green) is flashing.
- 2 Connect the FB1 terminal to the RS-422 connector X 4 on the VaporTEK-3 Controller.
- 3 Connect the gas meter encoder cable to FB1 terminal.
- 4 Connect the hoses to gas meter.
- 5 Remove the nozzle from the dispenser holder and secure the A/L nozzle adapter to the spout of OPW nozzle, as appropriate. The A/L nozzle adapter O-rings prevent air leakage into the nozzle's vapor collection holes (see [Figure 5-20](#) on [page 5-12](#)). After ensuring the nozzle shutoff port is not covered by the adapter body, tighten the two knurled end rings to secure the adapter to the nozzle.
- 6 On FB1 Terminal, select the Vapor measure function as shown in [Figure 5-28](#).

**Figure 5-28: Wet Calibration Using FB1 Screen - 1**



- 7 Press **ENTER** to reset the liter totalizer.

**Figure 5-29: Wet Calibration Using FB1 Screen - 2**

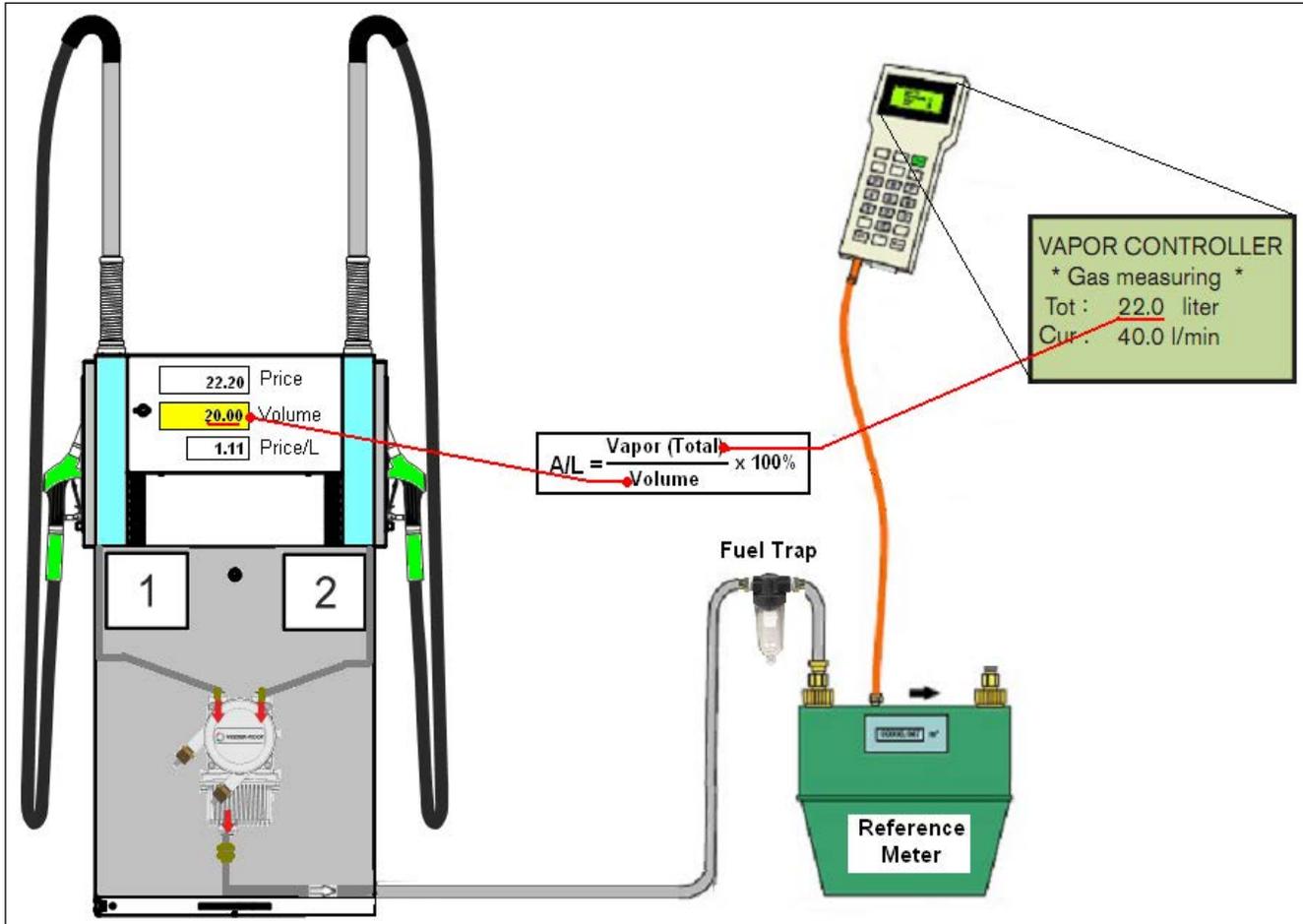


- 8 Start a normal transaction and deliver at least 10 liters fuel volume in a test vessel.
- 9 Stop the transaction and replace the nozzle to the nozzle hook.

10 Compare the fuel and vapor total results of transaction. Calculate the A/L-Ratio as follows:

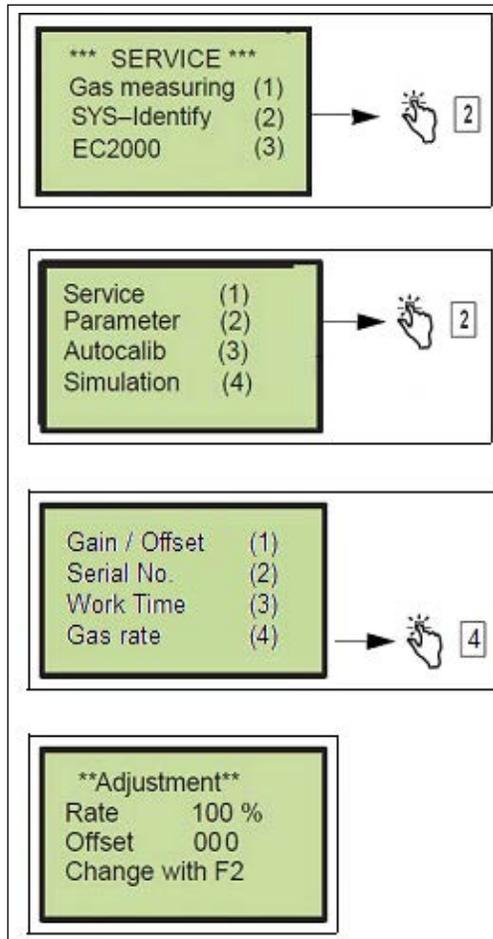
$$A/L [\%] = \text{Vapor [FB1-Total]} / \text{Fuel Volume [Dispenser Display]} \times 100\%$$

Figure 5-30: Calculating A/L Ratio



- 11 If the calculated A/L-Ratio measured on high clip performance (38 LPM) is out of range (95% to 105%) then correct the A/L-Ratio setup on VaporTEK-3 Controller using FB1 Terminal to meet the regulations.

**Figure 5-31: A/L Rate Adjustment**



- 12 Press **F2** and adjust the Gas Rate (A/L-Ratio) according to the wet test result. Set the offset parameter to zero and confirm these modification by pressing **ENTER**.
- 13 Evaluate the A/L-Ratio on further two wet transactions. One at max. performance point (high nozzle clip) at roughly 38 LPM and another transaction on half performance point at 20 LPM. The results should be in the following ranges:
- Max. performance: at 38 LPM 95%-105%
  - Half. performance: at 20 LPM 90%-110%

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## 6 – Troubleshooting and Analysis

### Required Equipment

The following equipment is required for troubleshooting and analysis:

Description	Part Number
Burkert Flow Meter with Elaflex-style Nozzle Adapter, and Rubber Hose between Adapter and Meter	M13351A001
FB1 Handheld Terminal (includes 15-pin to RS-422 cable supplied with unit)	M13353A001
VaporTEK-Universal Serial Bus (USB) Flash Adapter Interface (Isolated)	141057636
Nozzle Adapter to collect vapor (varies with nozzle manufacturer) for Gilbarco Veeder-Root AVR/ICVN and OPW 12VW	579290-001

*Note: Only the correct adapter can be used for system calibration.*

### Troubleshooting Tools

The following tool is available for advanced troubleshooting and analysis:

- VaporTEK Programming software (refer to “[VaporTEK Software](#)”)

### VaporTEK Software

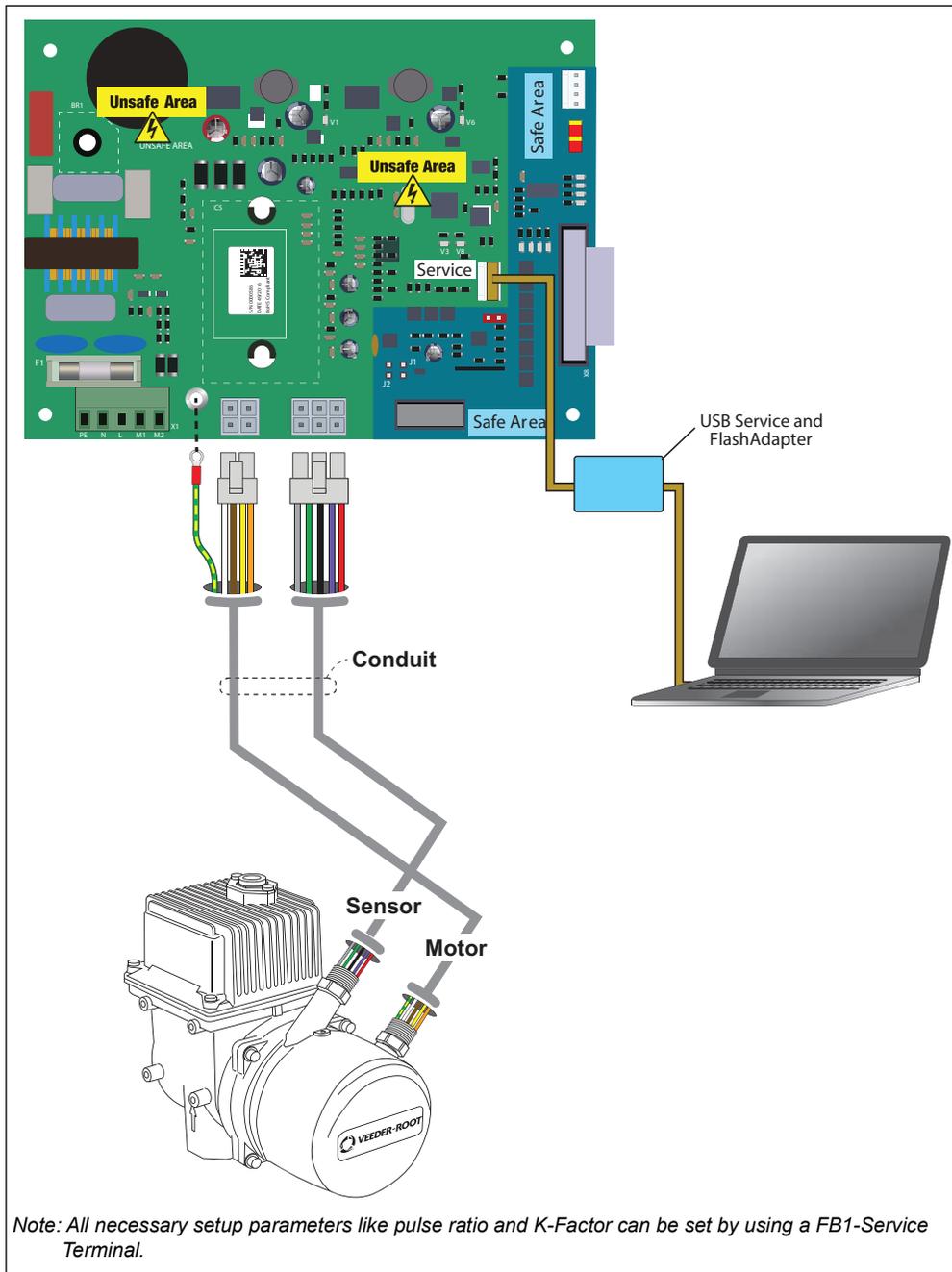
By connecting a laptop with a terminal emulator (HyperTerminal or equivalent) to the computer on the VaporTEK “PROGRAM” Connector, a site technician can access all the setup parameters and view enhanced service information from VaporTEK-3 Controller Board in real time.

#### **WARNING**

Use only this special isolated USB Adapter to connect the laptop to the VaporTEK-3 Controller Board. P/N: 141 057 636 (see [Figure 6-1](#) on [page 6-2](#)).

**Note: Shut down the 115 V AC Main power to the VaporTEK Controller Board and wait at least 30 seconds for power down before the flash adapter can be plugged into the PROGRAM-Connector. Check the LED V1 and V6 to ensure that the power is down. Do not touch any board components if main power is ON.**

Figure 6-1: Programming VaporTEK Software

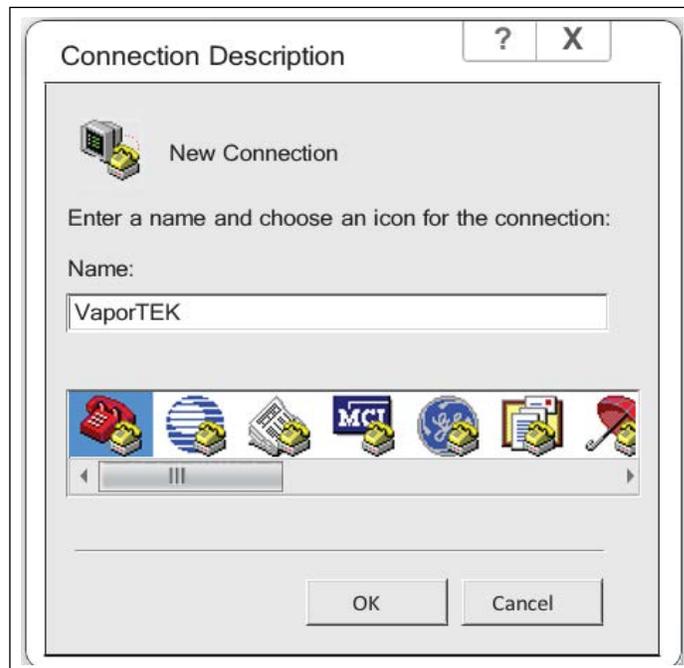


To program the VaporTEK software, proceed as follows:

- 1 On your laptop, open a terminal emulator such as HyperTerminal (can be downloaded from the Internet).

Once the HyperTerminal menu screen opens, click **File** in the menu bar and select **New Connection**.

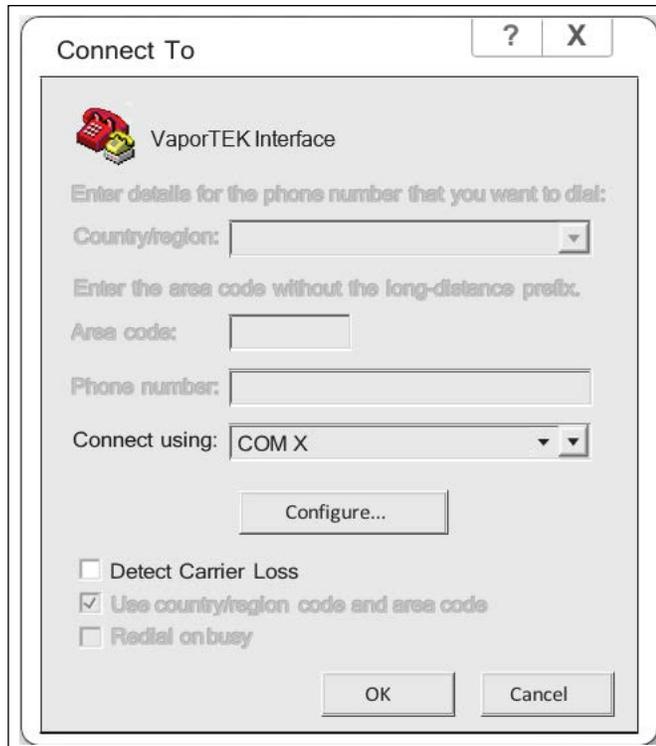
**Figure 6-2: Connection Description**



- 2 In the Connection Description dialog box Name field, enter **VaporTEK**. Click **OK** (see [Figure 6-2](#)).

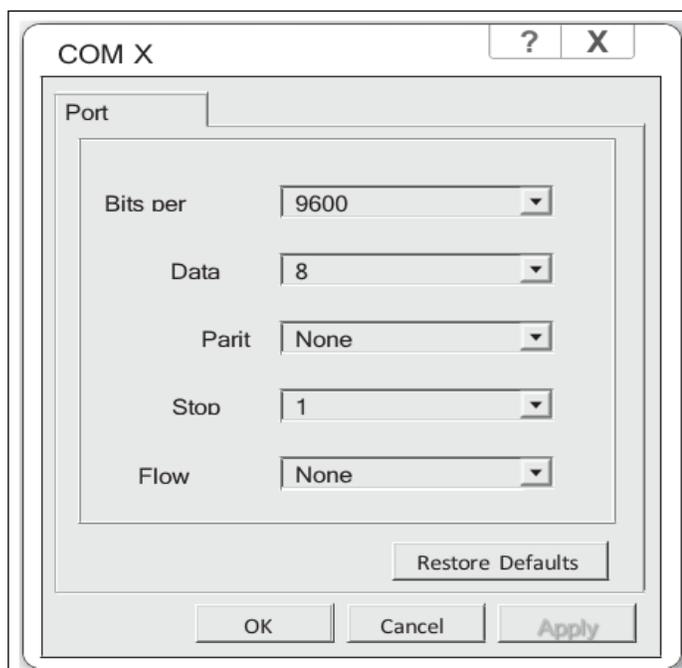
- 3 Select the appropriate Communication (COM) port on your laptop (COM X in [Figure 6-3](#)). To verify COM port, go to **Control Panel/System/Device Manager** and select ports. Check to see which COM port says USB 2.0. Click **OK**.

**Figure 6-3: Selecting Appropriate COM**



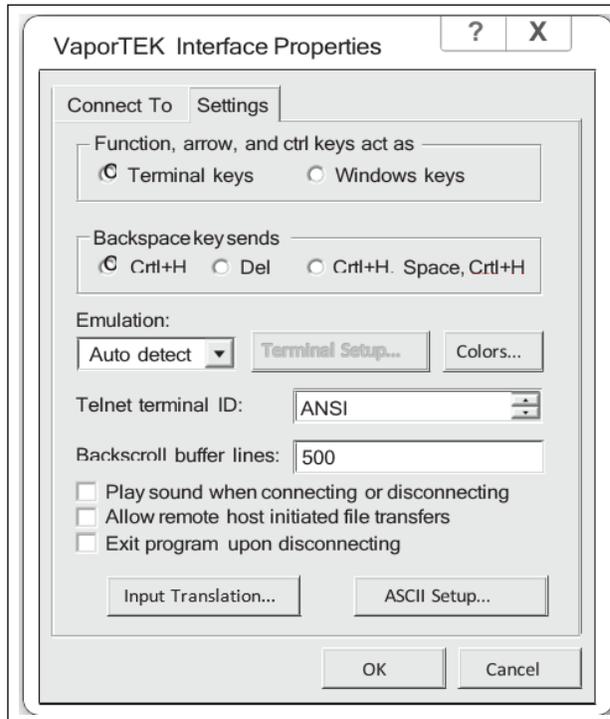
- 4 In the COM Properties dialog box (COM X in [Figure 6-4](#)), set the port setting fields as shown in [Figure 6-4](#) and click **OK**.

**Figure 6-4: Port Setting Fields**



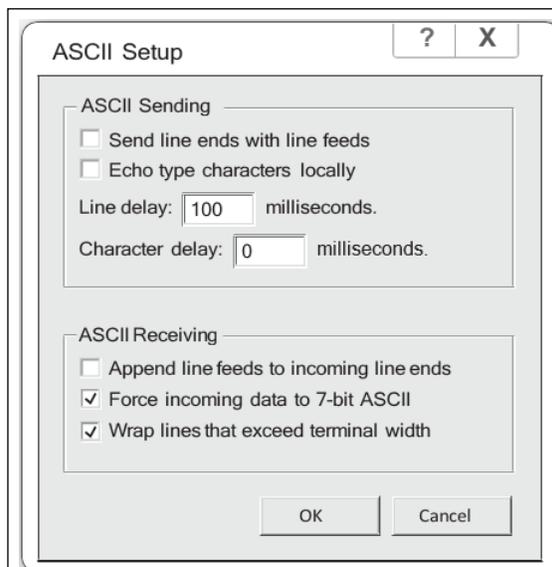
- 5 Click **File** in the HyperTerminal window and select **Properties**, then click the **Settings** tab to open the dialog box shown in [Figure 6-5](#). Ensure that all settings match the example shown in [Figure 6-5](#).

**Figure 6-5: VaporTEK Interface Properties**



- 6 Click **File** in the HyperTerminal window and select **Properties**, then click the **Settings** tab to open the dialog box shown in [Figure 6-6](#). Ensure that all settings match the example shown in [Figure 6-6](#).
- 7 Click **ASCII Setup** button and set the properties as shown in [Figure 6-6](#).

**Figure 6-6: ASCII Setup**



- 8 Click **OK** to return to the main terminal window of HyperTerminal and click to connect.
- 9 Switch on the main power or type “m” on the laptop to active the display screen. The screen in [Figure 6-7](#) opens after power up.

**Figure 6-7: VaporTEK Main Display Screen**

```

*****
* VTEK_3 Motor Controller *
* ----- *
* SW 1.02 *
* Chip Version M16C26A *
* Device No: 000000621 *
* Prod.Date: 24/03/2016 *
* VaporTEK - Motor *
* ( SK700 ) *
* VTEK-Board Revision C *
*****

Pulse rate [Imp/l] = 100
Pulse Prescaler = 1
Pulse Prescaler x Pulse rate = 100 pulse/l

Run Status:
-----
Status 1 Idle

Status 2 Idle
    
```

- 10 Type “m” on your keyboard to display the implemented main menu.

**Figure 6-8: VaporTEK Main Menu Screen**

```

*****
* VTEK_3 Motor Controller *
* ----- *
* Chip Version M16C26A *
* Device No: 000000621 *
* Prod.Date: 24/03/2016 *
* VaporTEK - Motor *
* VTEK-Board Revision C *
*****
*****
* MAIN MENU *
*****
1. Show Config and Monitor Status
2. Set Config
3. Set Factory defaults
4. Debug Mode
5. Show Calibration Table
6. A/L - Ratio
7. Pulse - Ratio
8. Reregulation factors
9. VaporTEK - Function Test
0. Store Valve Reduction Points
h. Show Hot Keys

Please select:
    
```

- 11 Press 1 to display the configuration currently set.

**Figure 6-9: Current Configuration**

```

5. Show Calibration Table
6. A/L - Ratio
7. Pulse - Ratio
8. Reregulation factors
9. VaporTEK - Function Test
0. Store Valve Reduction Points
h. Show Hot Keys

Please select:

1. Show Config and Monitor Status
-----
Pump Motor Type: VaporTEK
VTEK-RS422 Type: Slave Device

HV Nozzle Speed: M1 = 2500 rpm
HV Nozzle Speed: M2 = 2500 rpm

Mon Status Side A: UNKNOWN
Mon Status Side B: UNKNOWN

RRF Side A = 100
RRF Side B = 100
    
```

- 12 Press 2 to set configuration. The Set Configuration submenu shows how the motor speed value can be assigned to HV- Signals M1 and M2 Inputs. **This menu requires this safety code: 33154.**

Once the HV Input M1 or M2 becomes active, the motor runs with the setup speed. If both HV-Signals become active, the motor runs with the speed that is the sum of the single speed values of M1 and M2.

If the result of speed value is higher than the max value, then the max speed (2500 rpm) will be the setting.

**Figure 6-10: Setting Configuration**

```

2. Set Config
-----
Please Insert Pin Safety Code: 
Pump Motor Type: VaporTEK
VTEK-RS422 Type: Slave Device

HV Nozzle Speed: M1 = 2500 rpm
HV Nozzle Speed: M2 = 2500 rpm

Set M1 - Input performance (0...250RPM x10):100
Set M2 - Input performance (0...250RPM x10):100

Do you want to save it?[Y/N]: y
Config has been stored successfully

Pump Motor Type: VaporTEK
VTEK-RS422 Type: Slave Device

HV Nozzle Speed: M1 = 1000 rpm
HV Nozzle Speed: M2 = 1000 rpm
    
```

- 13 Press 3 to set factory defaults. This function sets all configuration parameters to default conditions. This item can be used if the board has an undefined malfunction.

**This menu requires safety code as: 33154.** The factory defaults are:

- M1 and M2 H/V-Inputs are set default 1200 rpm
- The Pulse Ratio is set to 136 p/l
- The A/L - Ratio is set to 100%

**Figure 6-11: Setting Factory Defaults**

```

*****
*           MAIN MENU           *
*****
1. Show Config and Monitor Status
2. Set Config
3. Set Factory defaults
4. Debug Mode
5. Show Calibration Table
6. A/L - Ratio
7. Pulse - Ratio
8. Reregulation factors
9. VaporTEK - Function Test
0. Store Valve Reduction Points
h. Show Hot Keys

Please select:

3. Set Factory defaults
-----
Are you sure? [Y/N] _
    
```

- 14 Press 4 to enter the Debug Mode. This submenu shows all debug mode options. Press “f” to toggle between fuel flow debug mode ON and OFF. If the debug mode is ON the screen will show the fuel flow rate when a transaction is running. During flow debug-mode, no other mode can be activated.

**Figure 6-12: Debugging Modes**

```

9. VaporTEK - Function Test
0. Store Valve Reduction Points
h. Show Hot Keys

Please select:

4. Debug Mode
-----
Press 'f' to toggle to real time fuel Flow
Press 'd' to debug Motor Hall Sensor Signals
Press 't' to toggle between flow and speed mode
Press 's' to show the current Motor Speed

Show Real time flow is on

Status 2 Busy

Flow 2 = 6 l/min   Set Speed = 0120 rpm   Real Speed = 0010 rpm
Flow 2 = 22 l/min  Set Speed = 0440 rpm   Real Speed = 0444 rpm
Flow 2 = 22 l/min  Set Speed = 0440 rpm   Real Speed = 0421 rpm
Flow 2 = 1 l/min   Set Speed = 0000 rpm   Real Speed = 0000 rpm
Status 2 Idle
    
```

When the VaporTEK Pump Unit starts running (> 5 LPM), the fuel flow and the related motor speed information are shown on the terminal screen. Motor activation using M1 and M2 HV inputs do not support this debug mode. Use “s” mode to obtain the speed and power information. Press “s” in order to show the power consumption data of the motor.

**Figure 6-13: Terminal Screen**

```

***** Motor Data *****
STATE      SPEED      POWER
RUN        0449 RPM    0020 Watts    0120 V(DC)    0164 mA(DC)
RUN        0481 RPM    0016 Watts    0119 V(DC)    0128 mA(DC)
RUN        0470 RPM    0022 Watts    0118 V(DC)    0192 mA(DC)
Motor Data off

Status 2 Idle
    
```

- 15 Press 5 to show the calibration table. The factory set calibration table is displayed when connected for the first time; thereafter, the table shows the latest calibrated table values created by autocalibration.

**Figure 6-14: Calibration Table**

```

5. Calibration Table
-----
MP      Flow A  Flow B  Speed
[No]   [l/min] [l/min] [rpm]
-----
0       0       0       0
1       4       4       80
2       8       8       160
3       12      12      240
4       16      16      320
5       20      20      400
6       24      24      480
7       28      28      560
8       32      32      640
9       36      36      720
10      40      40      800
11      44      44      880
12      48      48      960
13      52      52      1040
14      56      56      1120
15      60      60      1200
    
```

- 16 Press 6 to display A/L Ratio. Subitem 6 can be used to modify the A/L - Ratio. Set A/L - Ratio according to the value that is mentioned on the certificate as K-Factor (110%).  
*Note: Set Speed Offset to "0".*

**Figure 6-15: A/L Ratio**

```

6. A/L - Ratio
-----
Recover-Ratio      Speed-Offset
   101%             0

do you want to change it [Y/N]? Y
Recover Ratio = 101
   new Ratio = 110
Speed Offset = 0
   new Offset = 0

Data have been written successfully

Recover-Ratio      Speed-Offset
   110%             0
    
```

- 17 Press 7 to display Pulse - Ratio setup. This subitem allows a modification of Pulse Ratio. The pulse ratio defines the fuel flow rate, which must match the dispenser flow rate. Refer to the dispenser manufacturer’s manual to input the correct pulse ratio.

**Figure 6-16: Pulse - Ratio Setup**

```

7. Pulse - Ratio
-----
Pulse rate [Imp/l] = 100
Pulse Prescaler = 1
Pulse Prescaler x Pulse rate = 100 pulse/l

do you want to change these [Y/N]? Y

Input Pulse Ratio [pulse/l] (10 - 250):136
New Pulse Prescaler(1..10 ):1

Data have been written successfully

Pulse rate [Imp/l] = 136
Pulse Prescaler = 1
Pulse Prescaler x Pulse rate = 136 pulse/l
    
```

- 18 Press **8** to display Reregulation factors. Use item 8 to review the reregulation factors. Those will be controlled by the intelligent reregulation of monitoring and impact the vapor performance per side. The permitted reregulation range is (85 - 125). A factor value of 100 represents 100%.

**Figure 6-17: Reregulation Setup**

```

8.Show Reregulation factors
-----
side A = 100
side B = 100

do you want to change these [Y/N]? N
    
```

- 19 Press **9** for Function Test. Do not select this function because the test procedure requires special function test equipment and is intended to be used on the factory line end tester.
- 20 Press **h** to display Hot Keys. [Figure 6-18](#) shows all other available keys.

**Figure 6-18: HotKeys**

```

**** Hot-Keys ****
-----
'm' show the Main Menu
'h' show this Help Menu
'f' toggle ON/OFF real time fuel Flow
's' show Motor Speed and Status
    
```

## System Conditions That Can Be Ignored

The following system conditions can be ignored:

- **Environmental and Fuel Conditions** - As the temperature changes, the concentration of the vapor changes as well. The pump speed is set to match the liquid flow during the calibration procedure, but the pump flow will vary with vapor concentration and other related factors. As the temperature varies with environmental conditions, as the fuel formulation changes seasonally, and as other conditions cause the vapor concentration to change, the flow of the vapor will deviate from the calibration curve. There are two reasons some of these deviations can be ignored:
  - The variations due to these causes alone are too small to drive the A/L Ratio out of range.
  - The system has an automatic regulation feature that compensates for short-term variations and drives the A/L Ratio closer to 100%.
- **Improper Use of the Nozzle** - This will happen routinely, but should not cause the A/L Ratio to deviate by more than a few percent, and should not occur for ten consecutive transactions. This is one reason the regulations are written to allow for the A/L Ratio to deviate by more than +/- 5% at 38 LPM or +/- 10% on half performance point.
- **Minor Variations in Pump Performance** - The relationship between pump speed and vapor flow will change as the pump wears over time. As discussed above, the pump speed is based on the relationship that exists between pump speed and vapor flow when the last calibration was performed. As the pump performance changes (due to seal wear, system pressure drop, and so on), the amount of vapor flow will differ from the fuel flow, and the A/L Ratio will vary accordingly. However, this is a long-term effect. It will take many months before the A/L Ratio goes out of range from this cause.

There also will be short-term variations in pump performance that cause some scatter in the A/L Ratio results. This is usually too small to drive the A/L Ratio out of range. Therefore, short-term variation due to this cause should be expected and can be ignored. The longer-term performance changes due to system wear will eventually cause the system to require recalibration. For more information on recalibration, refer to [“System Conditions That Require Attention”](#) on page 6-13.

# System Conditions That Require Attention

## Long-term System Wear

Minor (and probably random) variations in pump performance will cause the A/L Ratio to vary about its target of 100%, possibly causing it to go out of its allowable range occasionally. These are not a cause for system shutdown and do not pose any concern to service personnel, as they should not persist for ten consecutive transactions.

However, after a significant period of time (on the order of years), the system will eventually go out of calibration. That is, the relationship between pump speed and flow will change, the vapor flow will deviate from the fuel flow, and the A/L Ratio will deviate from its target.

However, as opposed to short-term variations, which will likely cause the A/L Ratio to deviate in both directions about its average (above and below), long-term system wear will most likely cause the A/L Ratio to trend inexorably downward. While there still will be short-term variability superimposed on this long-term trend, once the wear becomes significant enough, the A/L Ratio will drop out of the allowable range altogether and not return.

The remedy for this condition is simple, as it is not uncommon for this situation to occur. The pump was designed with flow capacity well in excess of the maximum fuel flow of the dispenser. Therefore, when the operating point of the pump changes due to wear, recalibration will bring the pump flow back to the acceptable level. That is, the pump will need to be run at a higher speed to deliver the same flow that it previously delivered at a slower speed. The calibration routine described in “[External Flow Meter Calibration](#)” on [page 5-6](#) will drive the pump to run faster than it had when it was previously calibrated, and the system will operate in compliance for a significant period of time before it will again require calibration. At some point in time, the maximum capacity of the pump will be reached, and calibrating will no longer bring the vapor flow up to the same level as the fuel flow. At this point, the pump will need to be replaced.

## Air Leaks

The detection of air leaks differs depending on whether the leak is on the nozzle side vs. the dispenser (effectively, outside vs. inside the dispenser).

## Nozzle-side Leaks

If there is an air leak on the nozzle side (outside) of the dispenser, the system will generate no error but simulation on a multi-dispenser with more than one gasoline products with vapor flow will detect a nozzle leak. Connect the reference Burkert Meter to the discharge side of pumping unit and make a simulation with 40 LPM. If the meter starts counting, then a leakage on the vacuum side is detected.

The vapor pump is connected to both sides of the dispenser at the same time. During operation, the pump draws vapor through the side of the dispenser that is flowing liquid, and no vapor flows through the opposite side, provided the nozzle on that side is not also dispensing as well. However, if there is a leak between the nozzle and the flow meter (i.e., anywhere in the nozzle, hose, breakaway, swivel, etc.), air will enter the system when the pump begins to draw a vacuum.

## Dispenser-side Leaks

Air leaks on the dispenser side of the flow meter are less likely to occur, and will be detected by the system only if they are large. Because these leaks will be “downstream” of the flow meter, they will not be sensed directly. However, they can, if large enough, cause the dispenser to shut down, and they can be detected by careful examination of the flow data in the log.

During a running transaction, the vapor pump is set up to a certain speed that will draw the same flow of vapor as of the fuel being dispensed. When there is no leak in the system, all of the vapor will flow along a single path through the nozzle and hose, then through the vapor tubing, and pump.

Because the system was calibrated with this same setup, the amount of flow that the pump will draw at any given speed will always be about the same. However, if an air leak develops on the opposite side where no transaction is running, then the system will draw air from the leaking point, which reduces the vapor performance on the active fueling point. A test with max simulation value of 99 LPM will show a maximal vapor performance, but if this performance is lower than expected, then the leakage point needs to be detected before a vapor pump replacement is required.

As discussed above, long-term pump wear will likely cause the A/L Ratio to drop below the low end of the allowable range, just as an air leak on the dispenser side of the flow meter will. However, pump wear and the resulting decrease in flow will affect both sides of the dispenser, whereas an air leak will presumably be on only one side. Therefore, the way to tell the difference between these two situations is to examine the data from both sides of the dispenser. If the A/L Ratio has dropped below the low end of the allowable range on both sides of the dispenser, the likely cause is long-term pump wear, and the solution is to recalibrate the system. If it occurs on only one side, the cause is likely an air leak between the flow meter and the pump on the side where the A/L Ratio has dropped out of range.

# Troubleshooting Guide for VaporTEK Pump

The following table lists the troubleshooting guidelines for VaporTEK pump:

Problem	Cause	Corrective Procedure
Pump Fails to Start	No power to VaporTEK-3 controller	Verify power circuit breaker is switched ON/verify input voltage rating and wiring is correct.
	F1 fuse (T4A) blown out on the VaporTEK-3 Controller	Replace F1 fuse rated for 250 V/T4A.
	VaporTEK pump motor/sensor lead wires to VaporTEK-3 Controller wired incorrectly	Incorrect wiring will damage both VaporTEK pump and the controller. Check the motor/sensor cable connections. Verify the cables are connected as per the appropriate schematic in the " <a href="#">VaporTEK - Encore Wiring Diagrams</a> " on <a href="#">page 4-1</a> . Replace both VaporTEK pump and controller, if wired incorrectly.
	Incorrect jumper setting	Verify that the jumper J3 "PROGRAM" is not set (set = Flash mode).
	No input fuel pulses	Check pulse input wiring on VaporTEK-3 Controller. Also, verify input LEDs (LED V3 isn't flashing fast which means no fuel flow).
	No communication between VaporTEK-3 dispenser main controller	Verify the 26-pin ribbon flat cable or replace it. Check pulse LED V9-V12 if these are flashing during a very slow transaction.
	Flow rate below 6 LPM	Increase fuel flow rate beyond 6 LPM.
	Blocked Vapor Pumping Unit	Remove the motor from the pumping unit and let it run. If the pumping unit is clogged try to release the clog or replace the pumping unit.
	Temperature in the dispenser electronic cabinet is lower than the rating.	Install appropriate heater as defined by the dispenser manufacturer.
	Temperature in the hydraulics area of the dispenser is lower than the VaporTEK pump rating	Starting torque friction beyond motor capability. Install the appropriate heater as defined by the dispenser manufacturer.
Low Flow Rate	Pump thermal protector trips - ambient temperature above rated temperature of the product	Verify proper ventilation for the VaporTEK pump. Wait for a couple of minutes before starting the pump again.
	Defective VaporTEK-3 Controller	Replace VaporTEK-3 Controller.
	Blocked inlet or outlet line	Clean inlet or outlet line if clogged and follow the purging procedure.
	Incorrect fuel pulse rate	Verify and enter correct fuel pulse rate.
High Flow Rate	System out of calibration	Autocalibrate the system.
	Vapor valve not fully opened or restriction in the hanging hardware components (nozzle, proportional valves, hose, or any other product)	Open vapor valve fully. Remove restriction or replace component.
High Noise And Vibration	Incorrect fuel pulse rate	Verify and enter correct fuel pulse rate.
	System out of calibration	Autocalibrate the system.
Pump fails to start/Low Flow Rate	VaporTEK pump mounting onto dispenser is loose	Tighten. Ensure that the vibration mounts and hardware is secure. Secure the pump more rigidly. Use vibration dampeners, if necessary. Without success, replace pumping unit.
	Gasoline pooled in the vapor return line.	Motor discharge piping should have a slope of 1/8" (3.175mm) per foot of vapor line or minimum 1-degree slope.

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---

# Glossary

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## D

**Dispenser** - Dispensing device that uses the Submersible Turbine Pump (STP) in storage tank to move fuel from storage tank to the fuel outlet.

**Dongle** - Vaporix error clearing tool.

**Dry Testing** - Correctness of the Vapor Recovery System is quickly tested without the real fuel flow.

## G

**Gas Flow Rate Meter** - Equipment that is connected to the gas inlet of the nozzle by a flexible tube and an adapter to read the gas flow.

## V

**Vapor flow** - Speed of the vapor, when the nozzle is opened for the fuel.

**Vapor Recovery Systems** - Uses a vapor pump for the suction of vapor.

**Vaporix Pulse Correction Module (PCM)** - Control module for pulse controlled Vapor Recovery Systems, which can correct physically caused drift effects of the vapor recovery rate (for example, through temperature variations or swelling hoses and seals). It extends and improves the function of pulse controlled Vapor Recovery Systems.

**VaporTEK Interface** - Dual-sided board that provides an electrical interface between the fuel dispenser and the VaporTEK controller.

## U

**Underground Storage Tank** - Storage area below the ground level to store the fuel for dispensing.

## P

**Pump** - Uses self-contained pumping unit and motor to move fuel from storage tank.

## W

**Wet Testing** - Correctness of the Vapor Recovery System is quickly tested with the real fuel flow.

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Encore® 500 S Start-Up and Service Manual · September 2024

