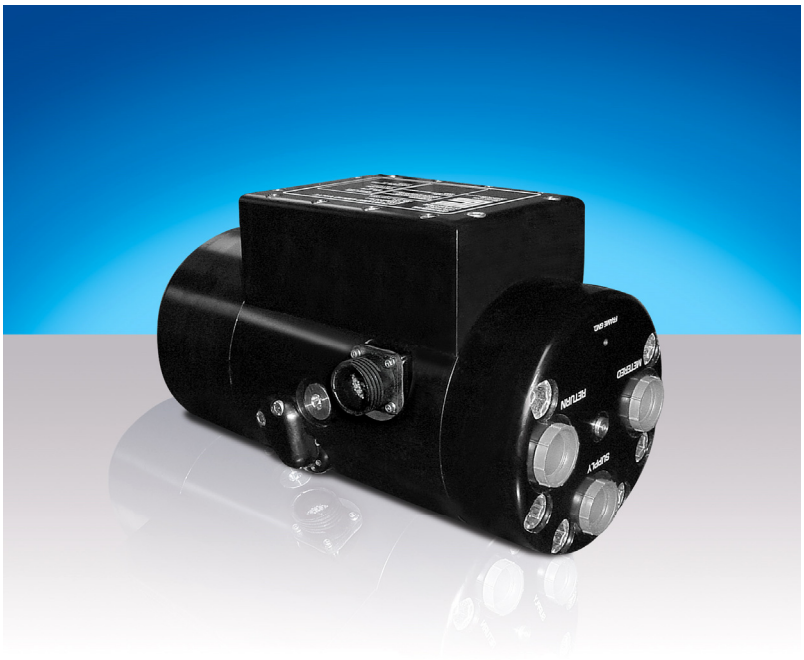
CONTINENTAL CONTROLS CORPORATION

Installation and Operating Manual

Advanced Liquid Valve, ALV10



II 2 G
Ex d IIA T4 Gb
DEKRA 08ATEX0117X

0344

Class I, Div 1, 2, Group D: T4

ISO 9001:2015 CERTIFIED

Preface

This manual provides instruction and maintenance information for the Advanced Liquid Valve, Model ALV10.

It is highly recommended that the user read this manual in its entirety before commencing operations. It is the policy of Continental Controls Corporation that it is neither our intention nor our obligation, to instruct others on how to design or implement engine control systems. Continental Controls Corporation will not assume responsibility for engine controls not designed or installed by our authorized representatives.

This manual is intended to help the end user install and operate the Advanced Liquid Valve, Model ALV10 in the manner in which they were intended and in a way to minimize risk of injury to personnel or damage to engine or equipment.

Do **NOT** attempt to operate the fuel control valve until the contents of this document have been read and are thoroughly understood.

Every attempt has been made to provide sufficient information in this manual for the proper operation and maintenance of the Advanced Liquid Valve, Model ALV10.

All information contained within shall be considered proprietary information and its release to unauthorized personnel is strictly prohibited.

If additional information is required, please contact:

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Safety Warning!

The Continental Controls Liquid Fuel Control Valves are normally used with Diesel #2. Diesel and Air, when combined together, the mixture becomes very combustible. When contained within an enclosure, such as a gas turbine engine or its exhaust system can explode in a violent manner when ignited. It is necessary to always use extreme caution when working with any fuel system.

Controls for Gas Engines should always be designed to provide redundant fuel shut downs. Towards this goal, the Advanced Liquid Valve, Model ALV10 plays an important part in the safety of the whole system. The ALV10 is not the primary control to shut down the engine.

The Advanced Liquid Valve, Model ALV10 is **NOT** a shutoff valve. Shutoff valves should be used in addition to the Advanced Liquid Valve. The fuel system should be designed in such a way that:

1. **No single failure of a component will cause the fuel system to admit fuel to the engine when the engine has been shutdown.**

2. **No single failure can result in grossly over-fueling the engine when attempting to start.**

3. **No fuel is trapped downstream of the ALV10 or potentially leaked into the engine fuel manifold. It is strongly recommended that the engine should be purged of any potential fuel in the fuel manifold prior to turning on the ignition system.**

Failure to follow the above rules may lead to possibly serious damage to equipment or injury to personnel!

WARNING!!!

<u>DO NOT</u> ATTEMP TO REPAIR THE ALV10 FUEL CONTROL VALVE IN THE FIELD. THE ALV10 FUEL CONTROL VALVE MUST BE RETURNED TO CONTINENTAL CONTROLS CORPORATION FOR REPAIR AND SERVICES.

<u>MAINTAIN THE VALVE RETURN LINE AS LESS STRICTED AS POSSIBLE. THE RETURN LINE PRESSURE MUST NOT EXCEED MORE THAN 100-PSIG.</u>

When installing the ALV10 Fuel Control Valve in a Class I Div 1 Group D or EEx d IIA T4 environment; heat resistant rating of 105°C min Cable, Cable Gland, Conduit Seal, and Conduit Wires must be used at the ¾ NPT threaded opening. Installation of all electrical Equipment will be in compliance with the National Electric Code (NEC). Customer is responsible for termination of pigtail wires out of the ¾" NPT Union Harness Assembly on the ALV10.

Compliance with the Essential Health and Safety Requirements has been assured by compliance with: EN 60079-0 : 2006 and EN 60079-1 : 2007

ALV10, indicate fasteners with yield stress equal or greater than 3.45MPa and Contact Original Manufacturer for information on dimensions of flameproof joints

Flamepaths shall be maintained after maintenance and/or repair as specified by manufacturer drawing SK1-04232008

The following instructions apply to equipment covered by certificate number DEKRA 08ATEX0117X:

1 The equipment may be used with flammable gases and vapors with apparatus groups IIA and with temperature class T4 in the ambient temperature range –20ºC to +85ºC.

2 The equipment is only certified for use in ambient temperatures in the range -20°C to +85°C and should not be used outside this range.

3 *Installation shall be carried out by suitably-trained personnel in accordance with the applicable code of practice e.g. EN 60079-14:2007.*

4 Inspection and maintenance of this equipment shall be carried out by suitably trained personnel in accordance with the applicable code of practice e.g. EN 60079-17:2007.

5 *Repair of this equipment shall be carried out by suitably trained personnel in accordance with the applicable code of practice e.g. EN 60079-19:2011.*

6 *Putting into service, use, assembling, and adjustment of the equipment if applicable shall be detailed. Drawings and/or diagrams must be included if they are necessary to complete these tasks.*

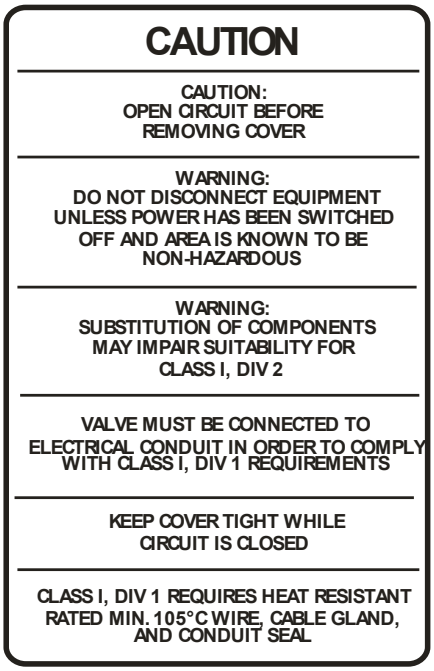
7 *Components to be incorporated into or used as replacement parts of the equipment shall be fitted by suitably trained personnel in accordance with the manufacturer's documentation.*

8 The certification of this equipment relies upon the following materials used in its construction: 304 Stainless Steel, 440C, Anodized Aluminum and Viton Seals.

If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection provided by the equipment is not compromised.

Aggressive substances:	e.g. acidic liquids or gases that may attack metals or solvents that may affect polymeric materials.
Suitable precautions:	e.g. regular checks as part of routine inspections or establishing from the material's data sheets that it is resistant to specific chemicals.

Translations of Caution and Warning of Front Cover



1. **CAUTION: OPEN CIRCUIT BEFORE REMOVING COVER**

   I: ATTENZIONE: APRE CIRCUITO PRIMA DI TOGLIERE COPERCHIO L'L'IL

   G: ACHTUNG: OFFENER KREISLAUF VOR HERAUSNEHMEN VON DECKE

2. **WARNING:DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF AND AREA IS KNOWN TO BE NON-HAZARDOUS**

   I: L'AVVERTIMENTO: NON DISINSERISCE L'APPARECCHIATURA A MENO CHE IL POTERE È STATO DISINSERITO Y L'AREA È SAPUTA PER ESSERE NON RISCHIOSO

   G: WARNEN: SCHALTEN Sie GERÄTE NICHT AB ES SEI DENN NETZSCHALTER AB UND GEBIET IST GEWUSST, SEI ZU SEIN

3. **VALVE MUST BE CONNECTED TO ELECTRICAL CONDUIT IN ORDER TO COMPLY WITH CLASS I, DIV. 1 REQUIREMENTS**

   I: LE VALVOLE COLLEGATE CON UN CONDOTTO SONO CONFORME A DELLE CLASSI I, DIV. 1 REQUISITO

   G: VENTILE HABEN MIT EINER LEITING SICH AN KLASSE I, DIV VERBUNDEN ANHÄLT 1 BEDINGUNG

4. **KEEP COVER TIGHT WHILE CIRCUIT IS CLOSED**

   I: TENERE I COPERCHI STRETTI MENTRE CIRCUITO SONO VIVO

   G: BEHALTEN Sie DECKEN DICHT, WÄHREND KREISLAUF LEBEND IST

5. **CLASS I , DIV 1 REQUIRES HEAT RESISTANT RATED MIN. 105 °C WIRE, CABLE GLAND, AND CONDUIT SEAL**

   I: DELLE CLASSI I, DIV. 1 , Il CALORE CAVO RESISTENTE, LA GLANDOLA DI CAVO, IL SIGILLO DI CONDOTTO, & I FILI METALLICI DI CONDOTTO SARANNO USATI

G: KLASSE I, DIV VERBUNDEN ANHÄLT 1 WÄRME WISERSTANDS FÄHIGES KABEL, KABEL DRÜSE, LEITUNG, LEITUNG ABDICHTUNG, & LEITUNG, DIE DRÄBENUTZT WERDEN WARDEN

Table of Contents

ALV10 Specifications

Flow Capacity:	22,000 lbs/hr [52.33 gpm]
Fuel	Diesel #2, Jet A (Other Fuels upon request)
Applications:	Up to 53,640 horsepower [40 megawatts]
Maximum Operation Pressure:	1,600 psig
Filtrations:	2-3 Micron Absolute
Operating Temperature:	-40° C (-40° F) to +85° C (+185° F) -20° C (-4° F) to +85° C (+185° F) [ATEX]
Response Time:	45 milliseconds 10% - 90% Stroke
Flow Accuracy:	±3.0% of reading or 0.5 % of full scale
Fuel Demand Signal [to Fuel Control Valve]:	4-20 mA (Standard) 0-50 mA (Optional) 0-200 mA (Optional)
Compressor Discharge Pressure (Pcd) Demand Signal [to Fuel Control Valve]:	4-20 mA (Standard) (Imbedded Acceleration)
Fuel Feedback Signal [from Fuel Control Valve]:	4-20 mA (Standard)
Position Feedback Signal [from Fuel Control Valve]:	4-20 mA (Standard)
Power Input:	19-30 Vdc 3.0 A Maximum continuous input current 8.0 A Maximum transient input Current
Electrical Interface:	23pin Canon Connector 3/4" Ridged Conduit, 84" Pigtail Wires
Communication Interface:	RS232 Serial Port
Housing Materials:	6061-T6 Anodized Aluminum
Wetted Materials:	Stainless Steel, 440C, 6061-T6 Anodized Aluminum and Nitrile Seals
Fuel Ports:	-12 SAE O-Ring Ports
Dimensions:	12.1”L x 7.0”H x 6.0”W
Approximate Weight:	36.8 pounds
Certifications:	ATEX, PED and CSA Approved

Terms

Supply	The Liquid Fuel supply fuel to the ALV10.
Metered	The Liquid Fuel metered fuel to engine.
Return	The return line connected to the fuel tank.
Dp	The differential pressure across the valve (Supply minus Metered = 42 psid).

Theory of Operation (Why it works so well)

The ALV10 is the culmination of years of development of an advanced liquid valve with a very high-level mechanical design, sophisticated electronics, and all tied together with superior application specific software. The seamless integration of all of these aspects of design into a single integrated product has helped to establish the ALV10 as the leading controller for gas turbine engines.

Overview

The ALV10 is designed to be used with liquid diesel fired industrial gas turbines from 250 KW to 35 MW. The valve uses a PID closed control loop, with fuel liquid flow being the feedback signal used to close the loop. The ALV10 requires no external actuators or associated muscle producing accessories and plumbing. An onboard computer tracks fuel demand, controls the valve actuator to meet the demand, and calculates fuel flow to insure the adjustment made to meet the demand was correct.

The ALV10 with the embedded acceleration control generally receives a governor signal from the user's PLC engine control system or from the Black Boxes supplied with Solar relay control systems. The signal from the PLC turbine control system is a 4 to 20 mA current loop. The signal from the Main Fuel Actuator Control (one of the Black Boxes) is a 0 to 50 mA current loop. The governor signal (from MFAC) is high (50mA) when the engine speed is less than the speed set point. When the set point is reached the signal decreases (generally to 25mA), causing the amount of fuel to the engine to decrease. The governor control signal resides within the Black Boxes or PLC, not from within the ALV10 valve.

Mechanical Valve Design

Unlike many of the valves used in competing control systems, the ALV10 was specifically designed for gas turbine engines using liquid fuels. It is not a modified pressure regulator, a biasing restrictor, or a valve borrowed from a different market sector or manufacturer. The valve was completely of the designed by Continental Controls Corporation for a specific application. Every valve is manufactured at our plant in San Diego California, including all CNC machined components and electronics assemblies. Following are some key mechanical design features that contribute to the superior performance of the ALV10.

Full Fuel Authority

The ALV10 meters all fuel entering the engine from no flow to full flow. This prevents the valve from running out of range in difficult applications. This feature also enables the valve to change the fuel flow very quickly in response to load transients.

High Speed Actuator

At the heart of the ALV10 is a high-speed, electromechanical, linear actuator that is used to drive the metering spool (piston). The actuator is comprised of a very powerful rare-earth magnet and a precision wound coil attached to the metering spool (piston). When the coil is energized it creates a magnetic field in the opposite direction of that created by the magnet. These opposing forces drive the metering spool in the open direction. The closing force is generated by a stainless steel compression spring, making the valve fail-safe in the closed direction. The actuator is capable of generating forces in excess of 20 pounds and going from the fully closed to the fully open position in less than 50 milliseconds. This gives the valve unprecedented response to the ever-changing demands of the engine.

Pressure Sensor

An integrated pressure transducer constantly monitors the inlet and the outlet pressure of the valve. This pressure sensor is used for diagnostic purpose.

Position Sensor

The performance of the ALV10 is further improved using closed loop position control. An LVDT position sensor continually communicates the metering spool (piston) position to the valve computer. This signal is then compared to the position set point generated by the flow control loop. Any error in position is quickly corrected. This feature improves transient performance and helps eliminate instability caused by flow forces on the metering. The position sensor is also a useful diagnostic tool.

Proportional Control

The ALV10 accomplishes flow control by using two closed loop processes. The first control loop is referred to as the “inner loop” or “position loop”. The position loop is a proportional closed loop control based upon valve position. The ALV10 uses LVDT position sensor that continuously communicates the metering spool position to the valve computer. The purpose of the control loop is to vary the valve position and maintain stability at a fixed position. This control loop is performed every one (1) millisecond

The second control loop is referred to as the “flow control loop”, or “outer loop”. The flow control loop is a proportional and integral control loop based upon measured fuel flow. The purpose of the outer loop is to provide higher speed and better accuracy than what is available on most valves with open loop control. The outer flow control loops output is the setpoint variable for the inner or position loop. This flow control loop is performed every ten (10) millisecond.

Acceleration Gain

The acceleration gain settings of the ALV10 Fuel Control Valve allow the user to supply the appropriate engine speed acceleration model to the valve. The acceleration schedule is based upon the manufacturers calculated schedule for the exact engine type (i.e. a Solar Saturn 20 turbine will have a different schedule than would a Solar Centaur 40). The valve user may

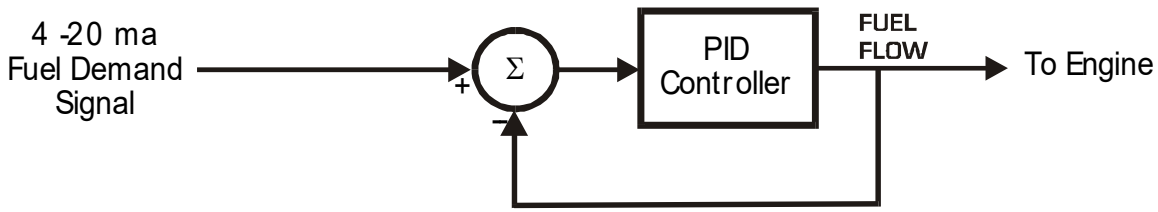
cause their engine to accelerate faster or slower depending on their preferences by adjusting the ACCEL GAIN value.

Acceleration Offset

By adjusting the offset of the acceleration schedule, the user may allow the engine to start at a different fuel flow (ωf) to PCD ratio than was originally determined. This may have the effect of reducing any initial flaring or "booming" within the combustors during an engine start.. Conversely, adjusting the offset may cause the turbine to not start at all.

ALV10 <u>without</u> Acceleration Schedule

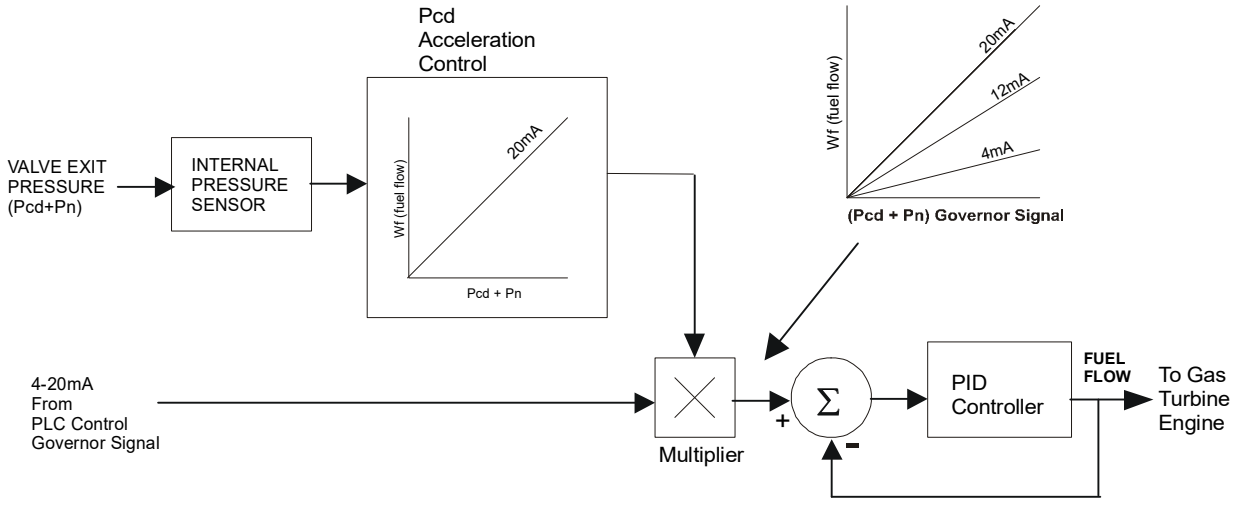
The ALV10 Fuel Control Valve contains a computer that measures the analog input signals from the internal pressure sensors and the associated PLC. The function of the software configuration without the acceleration control is shown in the simplified diagram below.



The 4 to 20 mA signal from the PLC is a fuel demand signal. The computer receives the gas temperature and pressure data from the internal sensors and computes the fuel flow through the valve. The measured fuel flow is compared with the fuel demand signal. The PID controller adjusts the valve-throttling orifice to cause the fuel flow to match the fuel demand. The metered fuel is directly proportional to the fuel demand signal.

ALV10 with Acceleration Schedule

The ALV10 Fuel Control Valve contains a computer that measures the analog input signals from the internal pressure sensors and the associated PLC. The function of the software configuration without the acceleration control is shown in the simplified diagram below.



The compressor discharge pressure (CDP or Pcd) is a good measure of the air flow through the engine, providing that the effective area the orifice (or restriction) of the turbine section is constant, i.e. the engine does not have variable turbine nozzles or devices that change the effective area of the turbine section.

The manufacturer's acceleration fuel schedule is stored in the computer during calibration and is shown in the block diagram as "Pcd Acceleration Schedule". When the governor signal is 20 mA, the valve limits the fuel flow to the value of the function. The acceleration schedule is the maximum fuel that the valve will meter for that Pcd value with a 20 mA input form the PLC.

The 4 to 20 mA signal from the PLC now functions as a governor signal. If the engine is under speed and not temperature limiting, it will be requesting more fuel and will be 20 mA. The acceleration schedule will be controlling the amount of fuel metered to the engine. A 20 mA signal corresponds to an input of 100% into the multiplier. If the temperature limit is reached during acceleration, the 20 mA signal will be cut back by the PID circuit in the temperature control loop. When the speed of the gas producer or the power turbine reach the respective set point, the 20 mA signal will decrease under the control of their PID loop to maintain the speed at the set point.

The fuel schedule with a 20 mA governor signal is the manufacturer's acceleration schedule. As the governor signal decreases the slope of the acceleration schedule also decreases in a proportional manner. A lower schedule is shown on the diagram for a 12 mA governor signal. The valve is calibrated so a 4 mA governor signal provides the

deceleration schedule. The deceleration schedule is provided so that the flame will not blow out if the governor cuts the fuel back all the way.

The advantages of having the acceleration built into the ALV10 fuel valve software are:

- **SAFETY** – The control system cannot over-fuel the engine at any speed because the valve limits the fuel flow to the engine based upon its measured Pcd.
- **VARIABLE GAIN** – The gain of the governor loop is proportional to Pcd or airflow through the engine. The multiplier is in the governor loop and the fuel flow input to the multiplier varies with the Pcd. The loop gain increases as the Pcd increases. This enhances the stability of the speed and temperature control loops.
- **COMPENSATES FOR COMPRESSOR DEGRADATION** – As the compressor gets dirty or wears, the airflow will decrease. With built in acceleration control, the maximum fuel also decreases so that the fuel to air ratio remain constant.

Features of the ALV10 (What makes it better?)

Simplicity is the key. If a system is too difficult to setup, install or use, all of the features in the world won't help.

The ALV10 is extremely easy to setup and use. At its simplest, the user would merely install the valve and they will probably be able to control the engine.

Range

If simplicity is the main feature of the ALV10 a close second is **Range**. Because the ALV10 is a true full authority fuel valve, the range of the ALV10 is much greater than system relying on a pressure regulator with a bypass valve or a restrictor stepper motor.

Closed Loop Flow Control

The ALV10 is an electronic servo valve consisting of a throttling orifice in series with a turbine flowmeter. An internal fuel flowmeter compares the measured fuel flow with the fuel demand signal and adjusts the area of the throttling valve (metering valve) as necessary to make the flow through the valve match the demand.

Fully Automatic Control

The ALV10 is fully automatic. This means that no matter what the operational changes are in the engine, the ALV10 will keep up with the changes. There will be no need to have an operator called out to reset the controller; these will be taken care of automatically.

Variable Dynamic Gain

The ALV10 automatically adjusts the amount of gain applied based on the stroke of the valve. This means that if the valve is barely being stroked, the gains are barely applied, as the stroke increases, so do the gains. At maximum stroke the gains are still appropriate for this amount of stroke. This unique control technique allows the ALV10 to control effectively at start, light loads or fully loaded.

Communications

Communications have been greatly simplified in the ALV10. The Valve is RS-232 Modbus compatible. Complete setup, monitoring, and control can come from an external PLC Control System via Modbus communications.

Installation Instructions

When installing the ALV10 Fuel Control Valve, the possibility exists that welding slag or tubing cuttings, or other debris may fall into the valve assembly if allowed to enter the ALV10. If this occurs, the ALV10 may not function properly, due to the debris in the valve assembly.

The ALV10 Valve Dos and Don'ts

The ALV10 should be inspected immediately after unpacking. Check for any damage that may have occurred during shipping. If there are any questions regarding the physical integrity of the valve and requires repairs and services, call Continental Controls immediately.

NOTE: If possible, keep the original valves' shipping container. If future transportation or storage of the valve is necessary, this container will provide the optimum protection.

1. Always provide good filtration to the ALV10. Dirty fuel would cause the valve not to work properly and could damage the internal components.
2. Supply the valve with 24Vdc with 5 amps at the valve. Using small gauge wire may cause a large voltage drop resulting in an inadequate power at the valve.
3. Avoid ground loops when connecting the ALV10.
4. The flow demand signal on the ALV10 is **NOT** loop powered**.**
5. Never install valve wires within the same conduit as items such as igniter wires or large solenoid wires.
6. If installing a "Loader style" valve on a Solar Centaur engine, install a vent to allow the relay logic to perform the shut off valve verification.
7. Never paint the valve.
8. Do not install the valve in such a manner where condensate may build up inside the electronics housing.

The Advanced Liquid Valve, Model ALV10 is designed to be installed on Liquid Gas Turbine Engines.

Safety Warning

The ALV10 Fuel Control Valve is to meter liquid fuel only and should not be used as a main fuel system shutoff valve. A separate fuel shutoff valve must be installed UPSTREAM of the ALV10.

Pre-Installation Inspections

The liquid-metering valve should be inspected immediately after unpacking. Check for any damage that may have occurred during shipping. If there are any questions regarding the physical integrity of the valve, call Continental Controls immediately.

NOTE: If possible, keep the original valves' shipping container. If future transportation or storage of the valve is necessary, this container will provide the optimum protection.

Ensure that the ALV10 received matches the model number and configuration of the fuel valve to the packing list and if possible, to the purchase order. The top plate of the ALV10 contains information pertinent to that particular valve, i.e. embedded acceleration schedule.

General Considerations

When considering where to place the ALV10 Fuel Control Valve it is recommended that several issues be kept in mind.

- The valve should be located away from any extreme sources of heat. Operating ambient temperature is –20 to +85°C. Temperatures higher than this will require special precautions from the manufacturer.
- Supply liquid fuel temperature will not have an effect on the flow of fuel through the acceptable operating temperature range of the valve (see above).

Hazardous Area Requirements

Hazardous locations are those areas where a potential for explosion and fire exist because of flammable gases, vapors or finely pulverized dusts in the atmosphere, or because of the presence of easily ignitable fibers or flying (NEC; articles 500 – 517, CEC; section 18).

Because of the necessary requirements, the wiring methods to be used are through threaded, ridged metal conduit with termination fittings approved for the location. The entire assembly is to be explosion-proof and where necessary, to employ flexible connections approved for Class I Division 1.

Electrical Connections

The following section applies to the electrical requirements of the installation of the ALV10 Fuel Control Valve. All efforts should be made to conform to the applicable electrical code concerning hazardous environment installations.

When installing the ALV10 Fuel Control Valve in a Class I Div 1 Group D or EEx d IIA T4 environment; heat resistant rating of 105°C min Cable, Cable Gland, Conduit Seal, and Conduit Wires must be used at the ¾ NPT threaded opening. Installation of all electrical Equipment will be in compliance with the National Electric Code (NEC).

Conduit Connections

The ALV10 is supplied with ¾" conduit seal with setting compound assembly that is placed immediately to the entrance of the valve housing. For ambient temperatures over 70 C. the wiring and setting compound in the conduit seal shall be suitable for at least 95 C.

CAUTION: The system power should be OFF before any of the valve wiring is connected or disconnected. Failure to do so may result in damage to your turbine system and/or the ALV10.

Power Supply

To power the ALV10 Fuel Control Valve, +19 to +30Vdc is required from the station instrumentation power (+24Vdc typical). A 5 amps power supply is required to operate single ALV10.

Fuel System Requirements

One possible fuel system method is shown in Appendix 1. Some turbines may require different components and/or configuration. If you have any questions about installation contact Continental Controls Corporation before starting the turbine.

The fuel system shown in Appendix 1 has the following components:

Boost Pump

This pump is the centrifugal type and it is electric motor driven. Its function is to maintain a positive pressure to the inlet of the high-pressure pump.

Low Pressure Filter

This is the first filter in the system and may be of the duplex type. The rating of the low-pressure filter should be 2 micron nominal.

High Pressure Filter

This filter is after the high-pressure pump and is used to catch any wear particles from the high-pressure pump. Its rating should be 2 – 5 micron nominal.

High Pressure Pump

This pump is ideally a positive displacement design and can be driven by the engine or an electric motor. Engine driven pumps must provide a flow 20% greater than the flow setting of the valve throughout its range and a maximum of no more than 60 gpm. Motor driven pumps must flow 20% greater than the maximum valve setting and no more than 60 gpm.

Pressure Relief Valve

This valve protects the system in case of a blocked line. The valve shall bypass all pump flow at 1100 psig or less.

Shutoff Solenoid Valve

This valve provides the main shutoff capability. This valve shall be fail safe closed. The valve shall have a Cv > 2.

Check Valve

The check valve prevents compressor discharge pressure from forcing contaminate backwards through the fuel system. The check valve should have a cracking pressure < 10 psig and a Cv > 2.

Purge Valve

The purge valve is used for purging the fuel nozzles during start up and shutdown. It shall be connected to a purge tank. All piping and valves shall be rated for a minimum operating pressure of 2000 psig.

Communication Setup Instructions

The following instruction is to assist you on how to set up the hyper terminal window in order to communicate with the ALV10.

Valve Viewer Software Overview

ALV10 Valve Viewer is a Microsoft Windows based application used for interfacing the advanced liquid valve.

ALV10 Valve Viewer application provides real time monitoring of control functions in ALV10, gives the user overall control over the ALV10 functionality, serves as diagnostic tool helping to detect, and evaluate problems related to fuel control and emissions reduction on natural gas engines.

ALV10 Valve Viewer is an intuitive, user-friendly software tool which offers an array of advanced Features like easy setup of all user-definable set-points in the ALV10, monitoring key data points, optional data logging, playback of history files, settings report, zoom feature, and other.

Communication Setup

Communication Port Properties

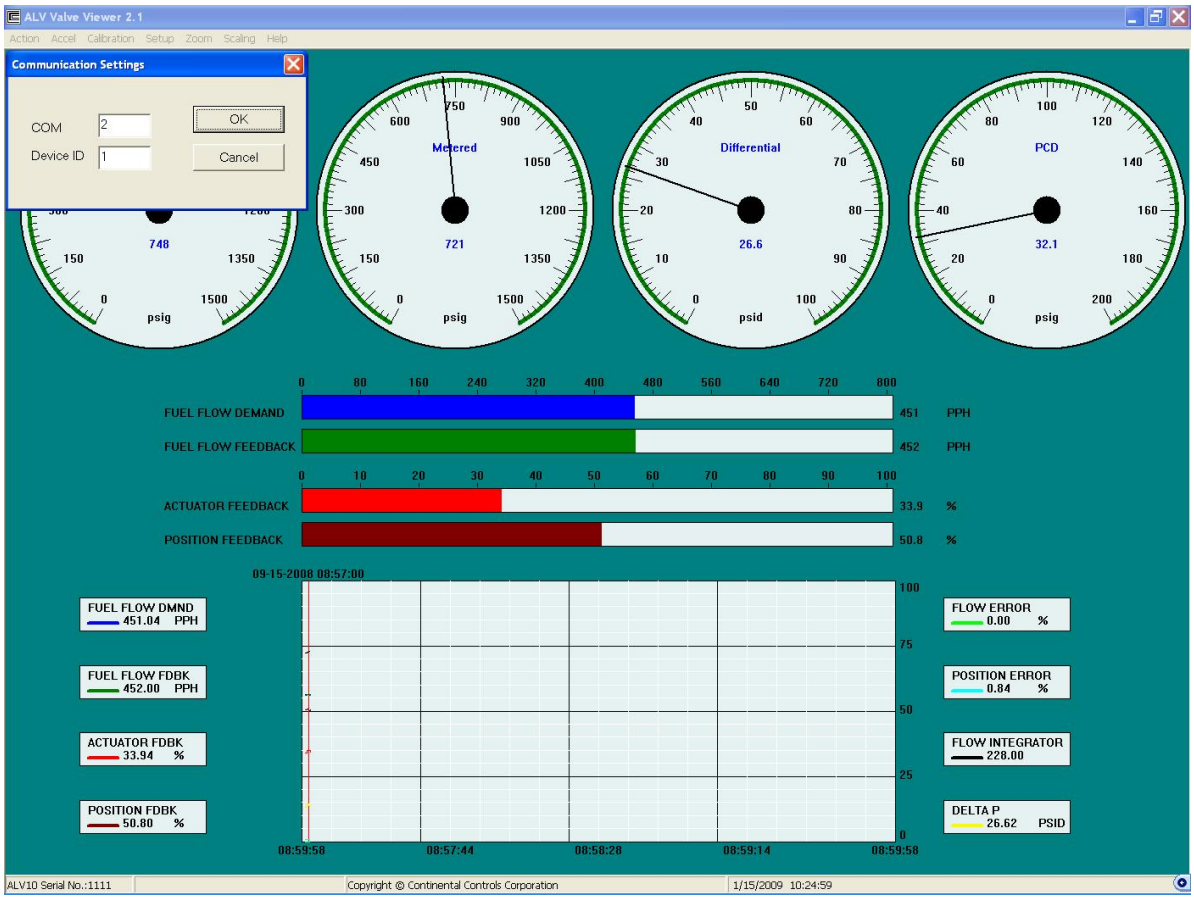
Main Menu -> Comm Setup

ALV10 Valve Viewer automatically establishes communications with ALV10 using default communication port **COM 1** and **Device ID 1.** However, it is possible to specify different communication port and/or device id.

Communication setup guide:

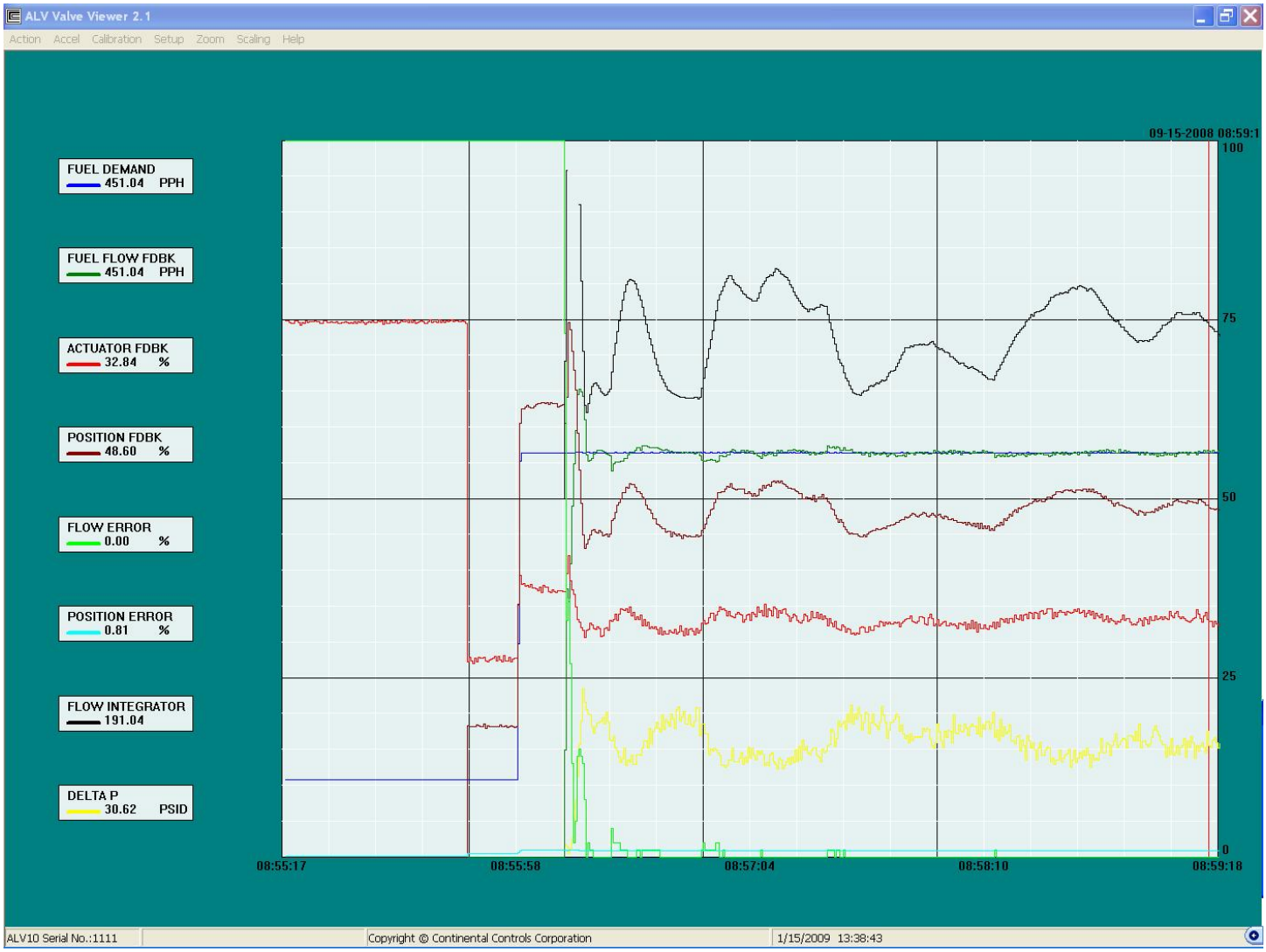
1. Go to Setup -> Comm Port
2. Communication Port dialog box should open up.
3. Enter communication port number and device id.
4. Press OK to apply changes. Communication Port Properties dialog box will open up automatically. Do not change any settings! Press OK to close the dialog box.

ALV10 Valve Viewer will apply new settings to establish communications with the ALV10.



Default communication port settings:

- Bits per second: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: None



Zoom Feature

Zoom In

Choose this option to enlarge the view of the chart in order to see key data points in better resolution.

Zoom Out

Choose this option to switch back to normal view.

Technical and Troubleshooting Procedures

The following instruction are some technical procedures to help you in various areas when trying to gather or view valve settings.

Valve Viewer Software Overview

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Communication Setup Procedure

The purpose of this procedure is to establish communication via Modbus RS232 with the ALV10 using Valve Viewer. Install the latest Valve Viewer into your computer. If you don't have copy of the ALV10 Valve Viewer software, you need to obtain it from Continental Controls Corporation.

1. Make sure the ALV10 communication wires are connected via RS232 to a notebook. In order to communicate with the ALV10, RS232 cable with mini grabber at one end is required. In the RS232, the following pins are used for the following operations:

    7. Pin 2 of the DB9 is used for Transmitting (Tx)
    8. Pin 3 of the DB9 is used for Receiving (Rx)
    9. Pin 5 of the DB9 is used for Common

    In the ALV10 cable, the Green Wire is for Transmitting (Tx), the Brown Wire is for Receiving (Rx), and the Black Wire is for Common. Thus connect the above specified wires to the proper pins of the DB9 of the RS232.

2. Ensure Power to the valve is on. Only to the PWB Board (white and gray wires).

3. Open ALV10 Valve Viewer. If you have an early version Valve Viewer, you need to obtain the latest ALV10 Valve Viewer (2.3.1) from Continental Controls Corp.

Communication Port Properties

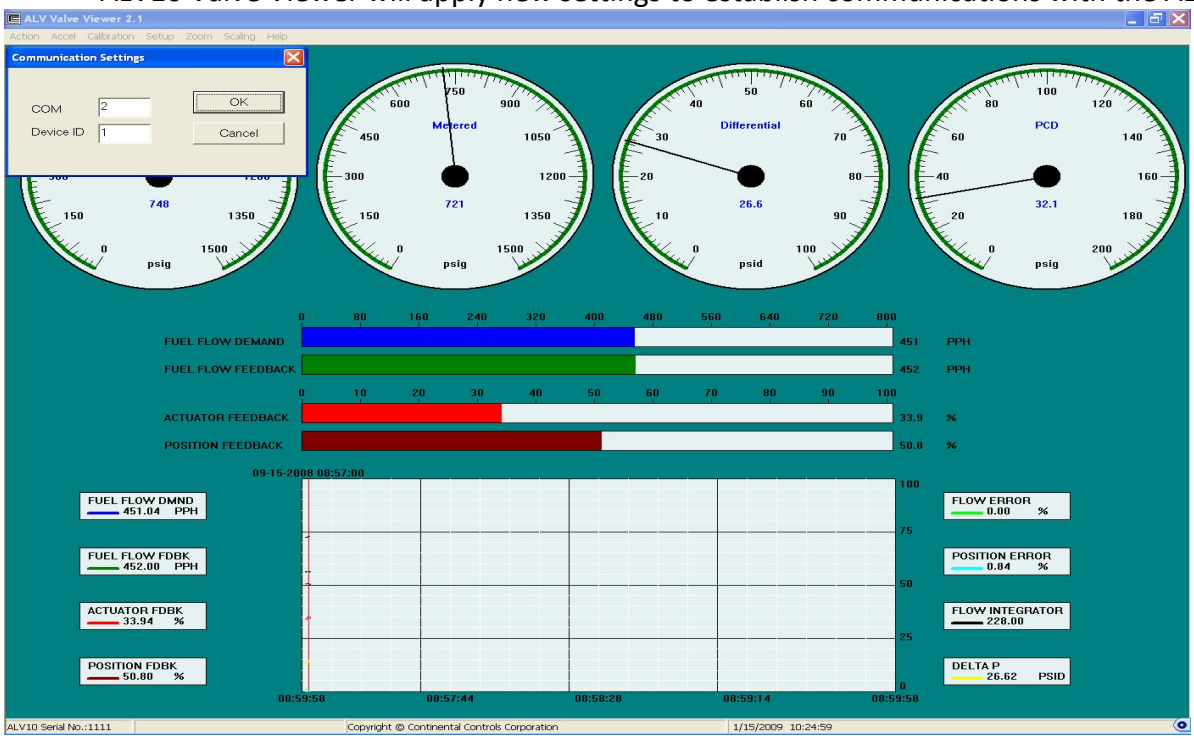
Main Menu -> Comm Setup

ALV10 Valve Viewer automatically establishes communications with ALV10 using default communication port **COM 1** and **Device ID 1.** However, it is possible to specify different communication port and/or device id.

Communication setup guide:

1. Go to Setup -> Comm Port
2. Communication Port dialog box should open up.
3. Enter communication port number and device id.
4. Press OK to apply changes. Communication Port Properties dialog box will open up automatically. Do not change any settings! Press OK to close the dialog box.

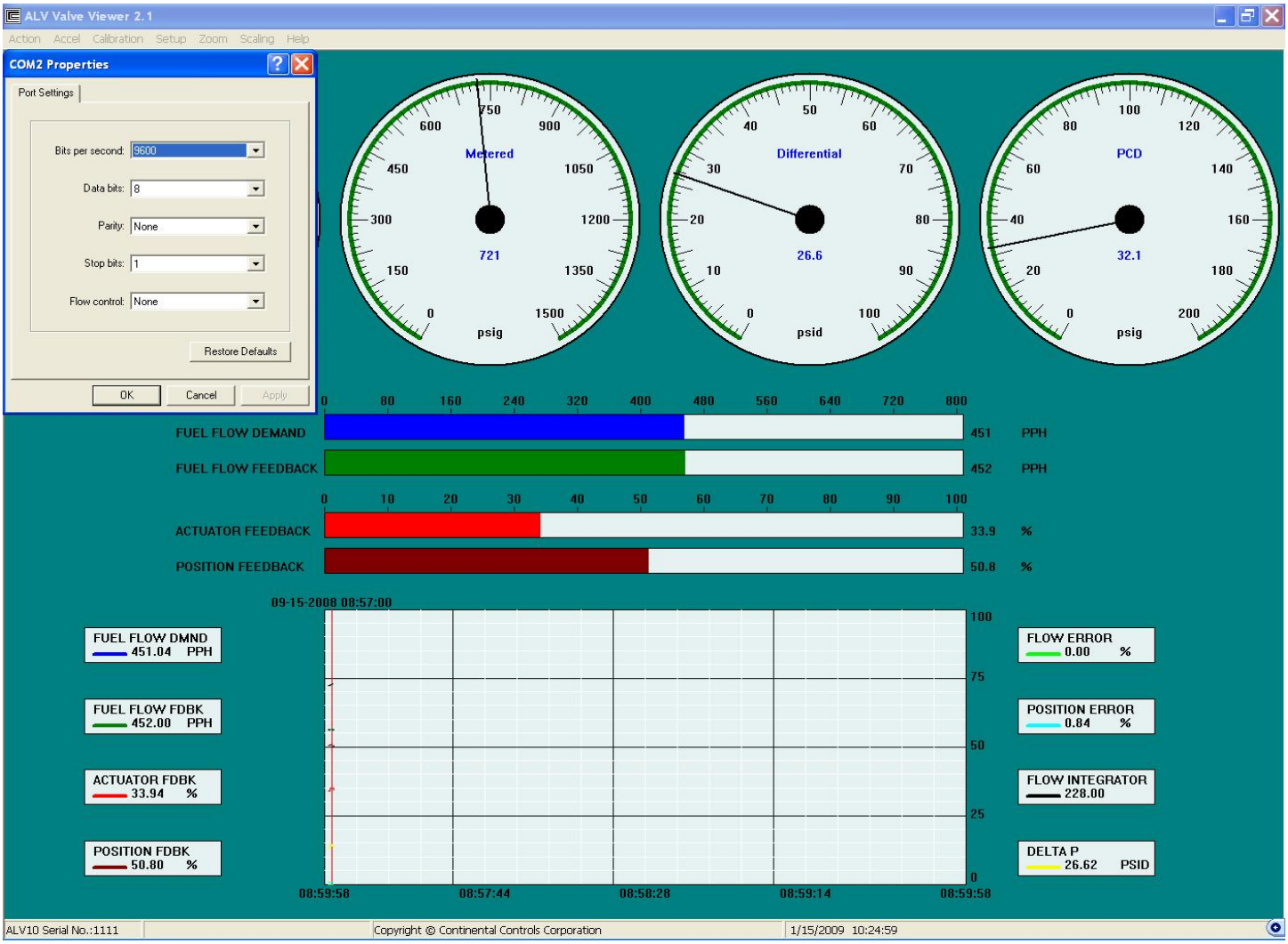
ALV10 Valve Viewer will apply new settings to establish communications with the ALV10.



Default communication port settings:

- Bits per second: 9600

- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: None



Uploading Factory Calibration Settings Procedure

The purpose of uploading the ALV10 factory calibration settings into the computer is to save/backup the factory settings so when making minor adjustment to valve calibration settings, you will have the original factory settings saved.

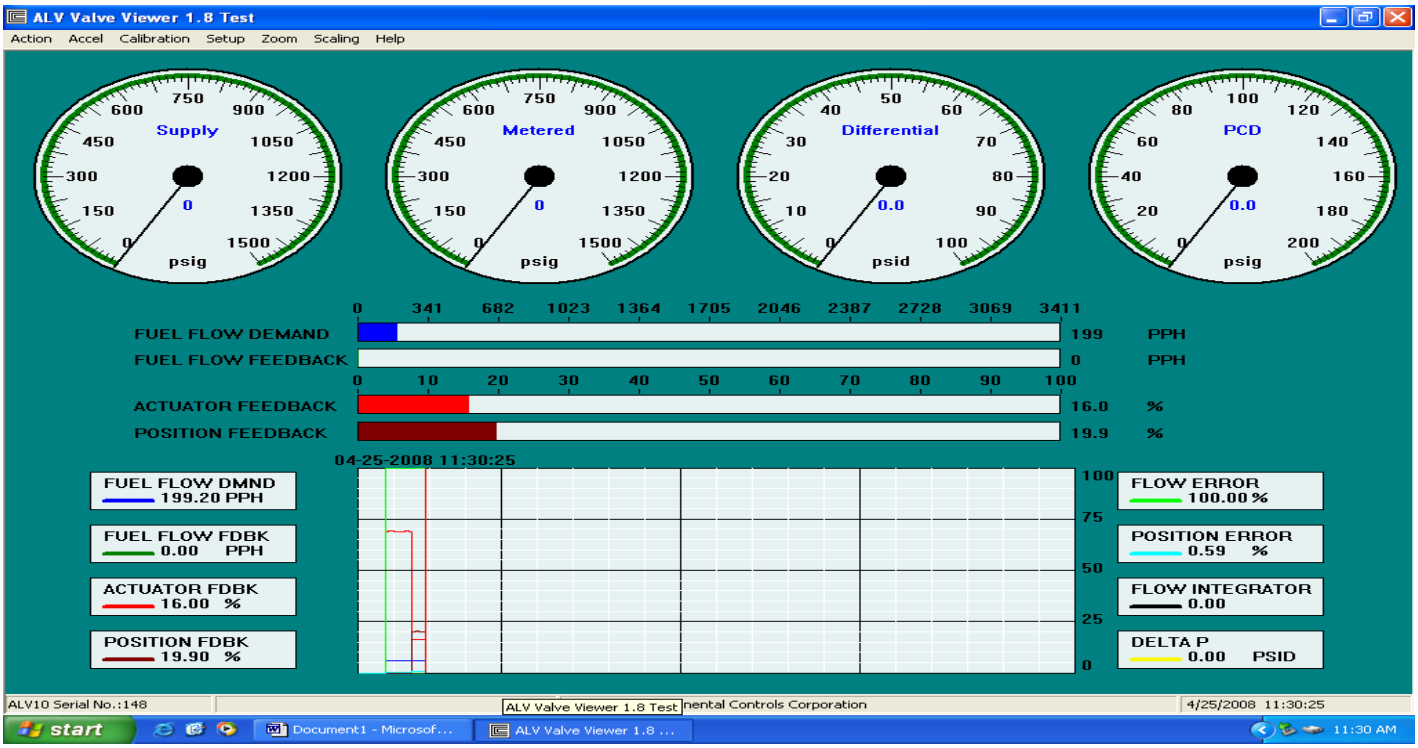
1. In order to communicate with the ALV10, RS232 cable with mini grabber at one end is required. In the RS232, the following pins are used for the following operations:
    a. Pin 2 of the DB9 is used for Transmitting (Tx)
    b. Pin 3 of the DB9 is used for Receiving (Rx)
    c. Pin 5 of the DB9 is used for Common

In the ALV10 cable, the Green Wire is for Transmitting (Tx), the Brown Wire is for Receiving (Rx), and the Black Wire is for Common.

Thus connect the above specified wires to the proper pins of the DB9 of the RS232.

2. Once the RS232 is connected to the ALV10 Communication wires, now make sure that the power to the ALV10 is on. Verify that with the volt meter.

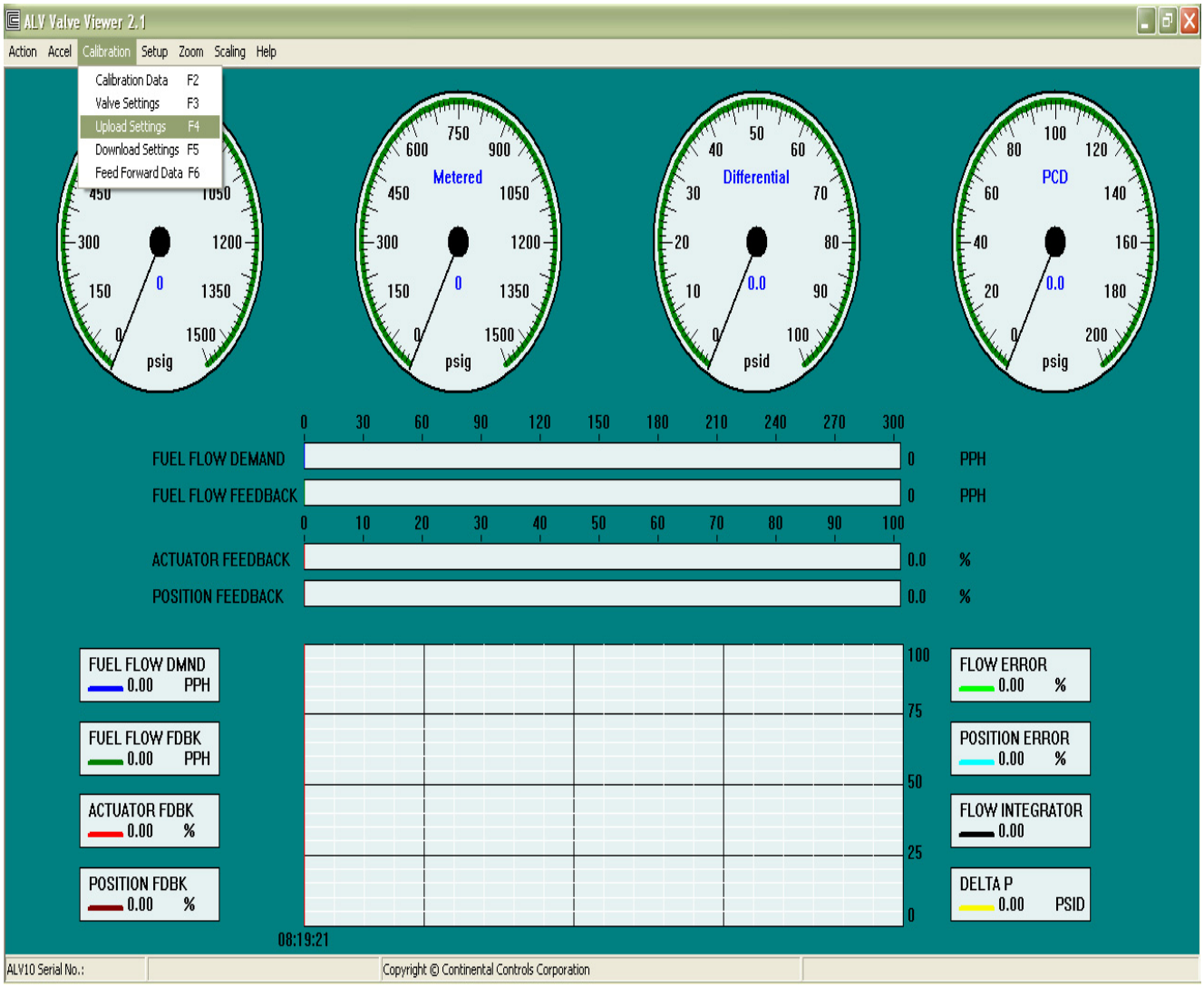
3. Once the ALV10 Power is verified, open the ALV10 Valve Viewer Software program by double-click on the ALV10 Valve Viewer shortcut on your desktop.



Screen 1

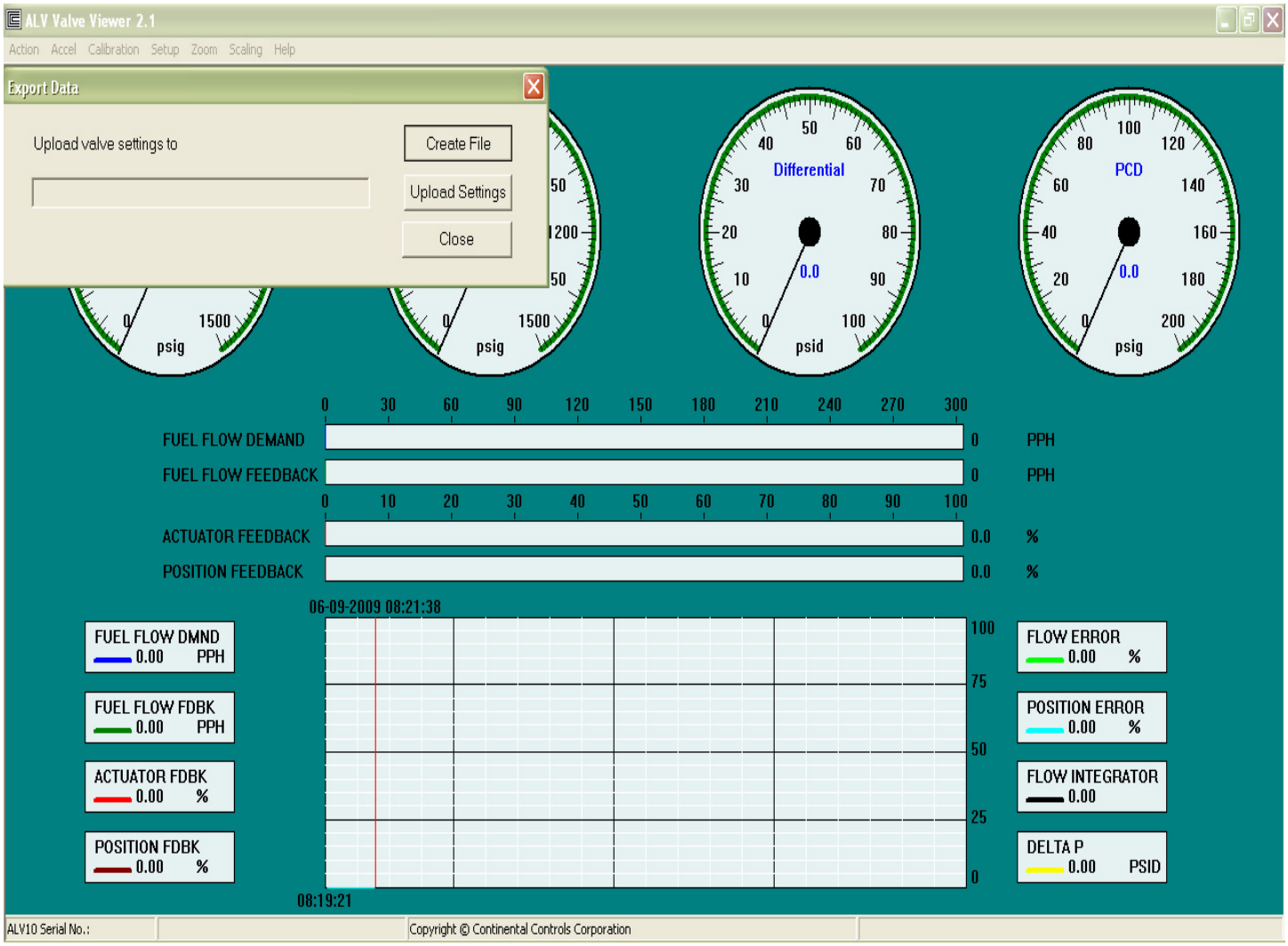
4. On the Main Screen of **"ALV10 Valve Viewer"** (see **screen 1**) select "**Calibration"**.

5. From the Calibration Menu select **"Upload Settings F4"** option. (see **Screen 2**)



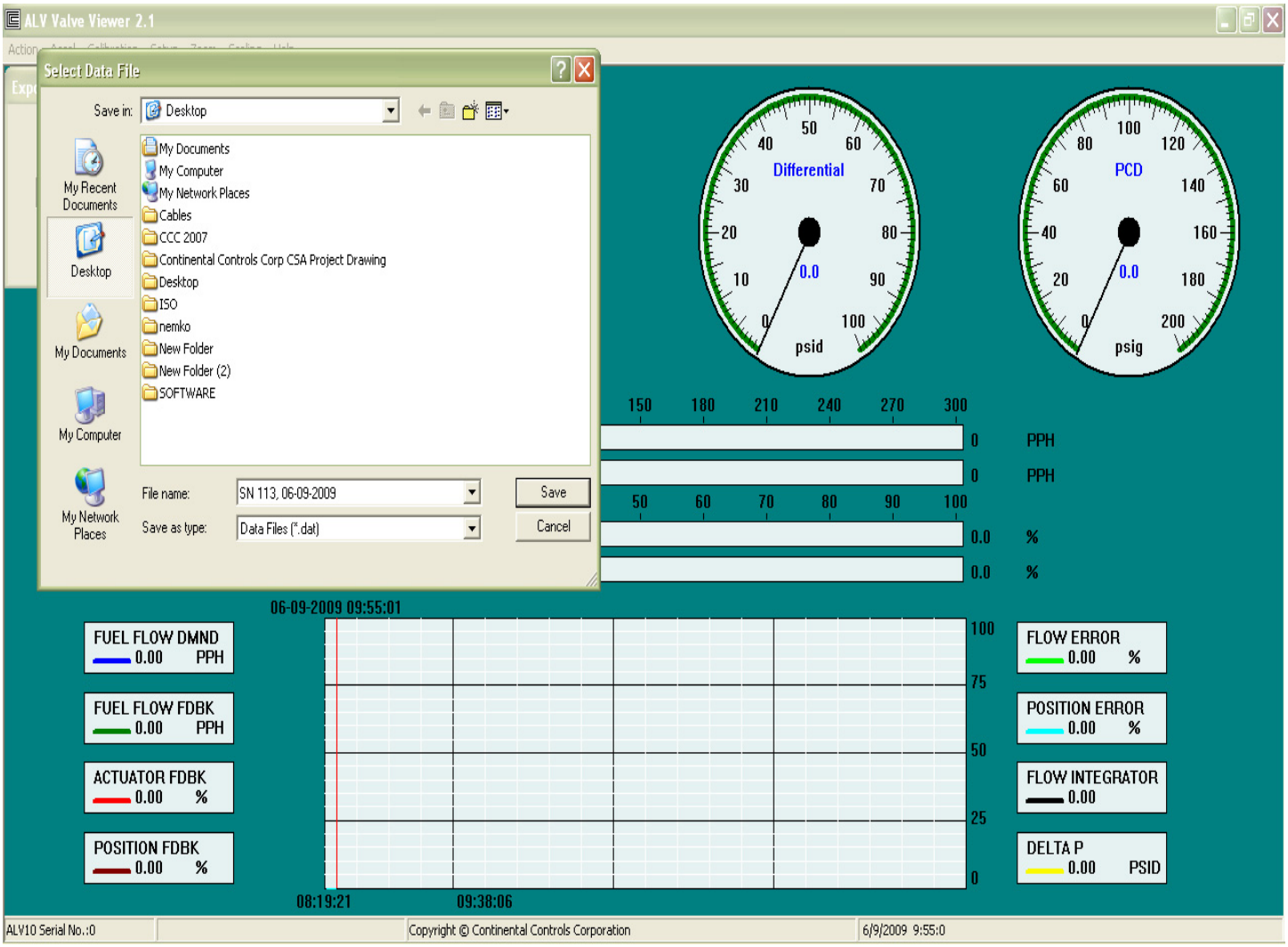
Screen 2

6. Once the **“Upload Settings F4”** option is selected. Now Click on **“Create File”** on the Export Data screen (see **Screen 3**)



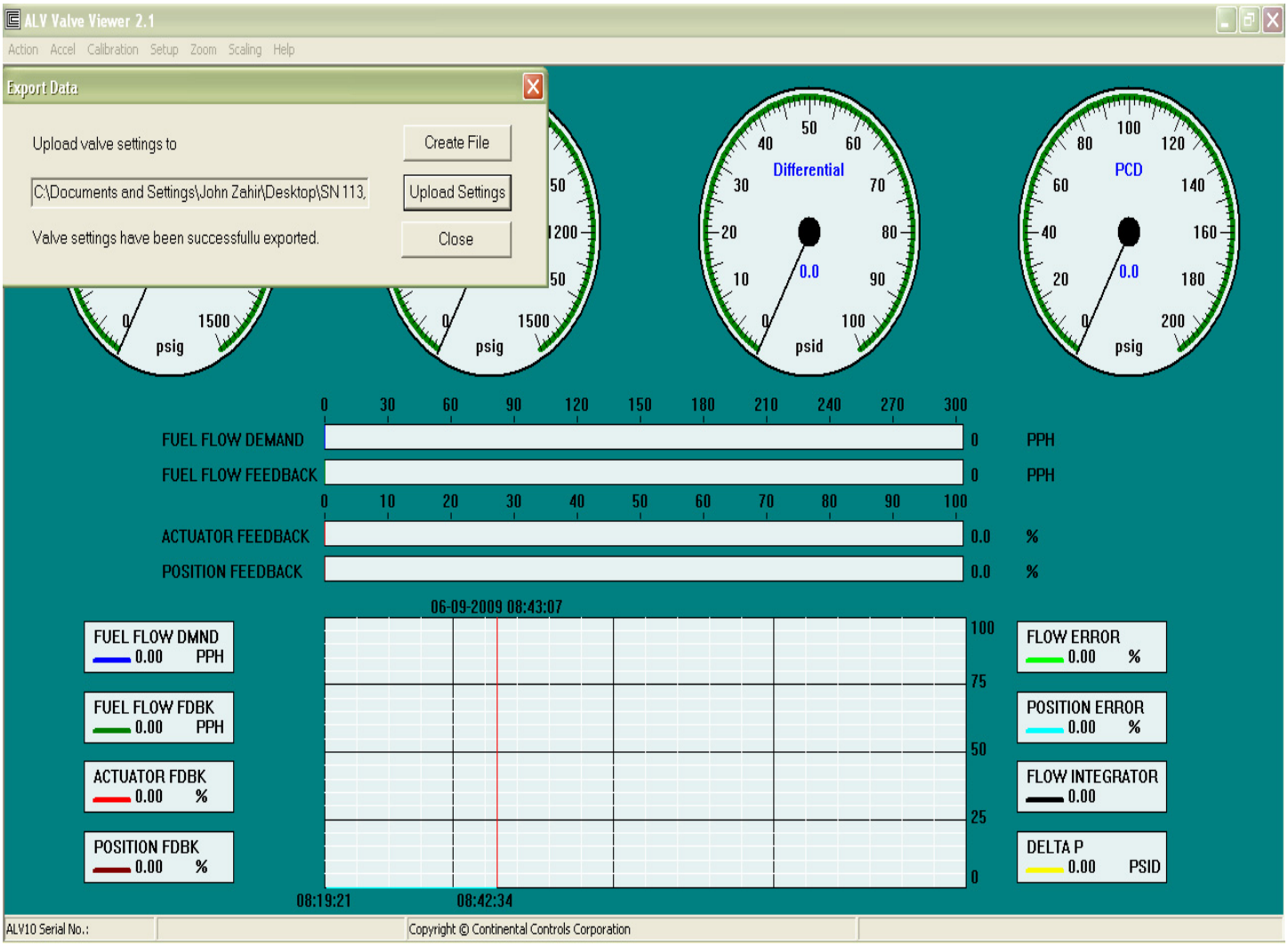
Screen 3

7. Once the “Create File” is clicked, “Select Data File” screen appears (see Screen 4). Give a name by writing it on the “File Name” location (see Screen 4). It’s a good idea to name the file the same as the valve serial number and include the date the file was uploaded. **For example:** ALV10 SN 113 data is to be uploaded, the name given to the uploaded data file is: **SN 113.** Once the name is writing in the file name section **(see screen 4),** then click **“Save”.**



Screen 4

8. Once the name is given to file and the **"Save"** is clicked (see **Screen 4**), now **"Export Data"** screen appears (see **Screen 5**). Click on **"Uploading Settings"** (see **Screen 5**). When **"Uploading Settings"** is clicked, on the bottom of the **"Export Data"** screen (see **Screen 5**), the following message would show: **"Valve Settings have been successfully exported"** (see **Screen 5**). **Now you're done with Uploading/Saving the ALV10 Factory Calibration Settings into the computer.**



Screen 5

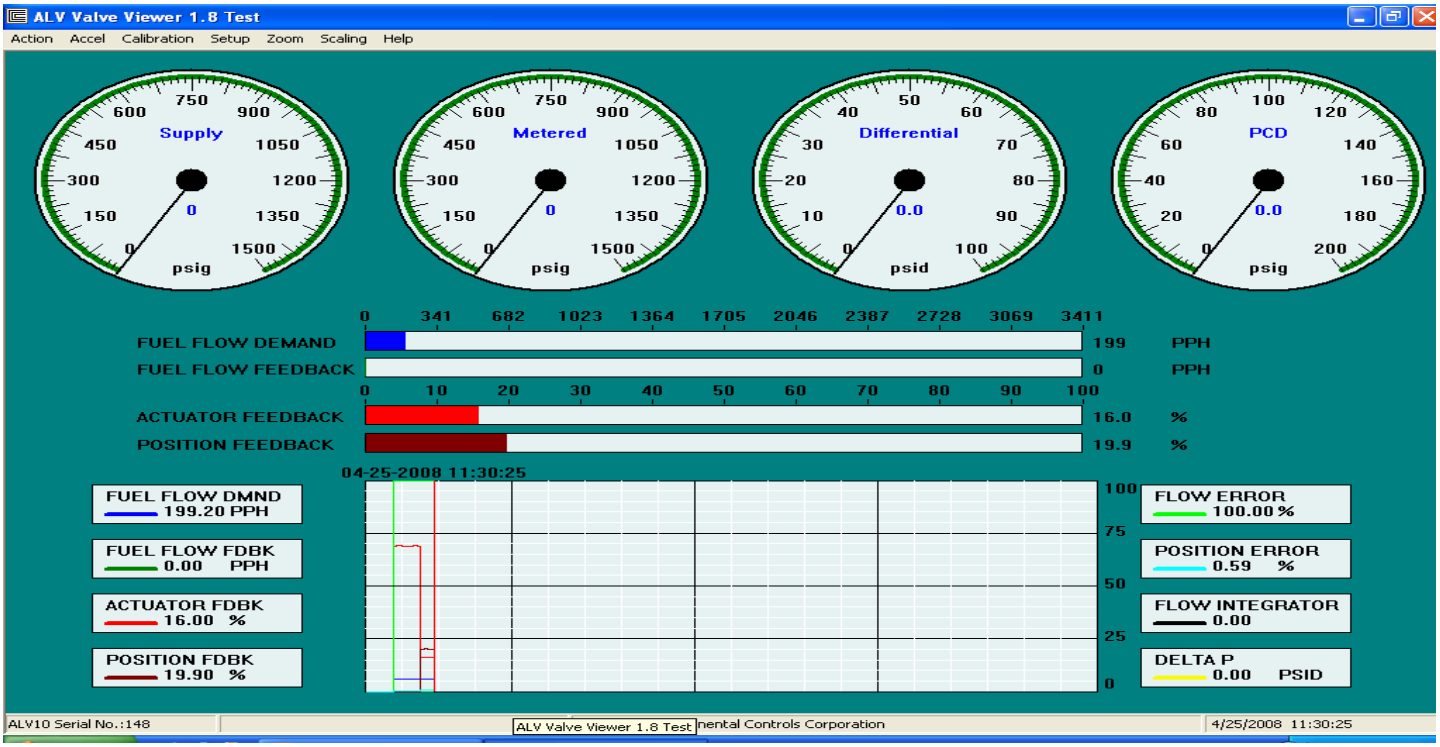
Downloading Factory Calibration Settings Procedure

The purpose of downloading the ALV10 factory calibration settings into the ALV10, when a new calibration settings are used or when the existing calibration settings in the valve have been changed to undesired value and saved, then the original factory calibration settings can be downloaded in the ALV10 from a computer using ALV10 Valve Viewer Software.

1. In order to communicate with the ALV10, RS232 cable with mini grabber at one end is required. In the RS232, the following pins are used for the following operations:
   a. Pin 2 of the DB9 is used for Transmitting (Tx)
   b. Pin 3 of the DB9 is used for Receiving (Rx)
   c. Pin 5 of the DB9 is used for Common

   In the ALV10 cable, the Green Wire is for Transmitting (Tx), the Brown Wire is for Receiving (Rx), and the Black Wire is for Common. Thus connect the above specified wires to the proper pins of the DB9 of the RS232.

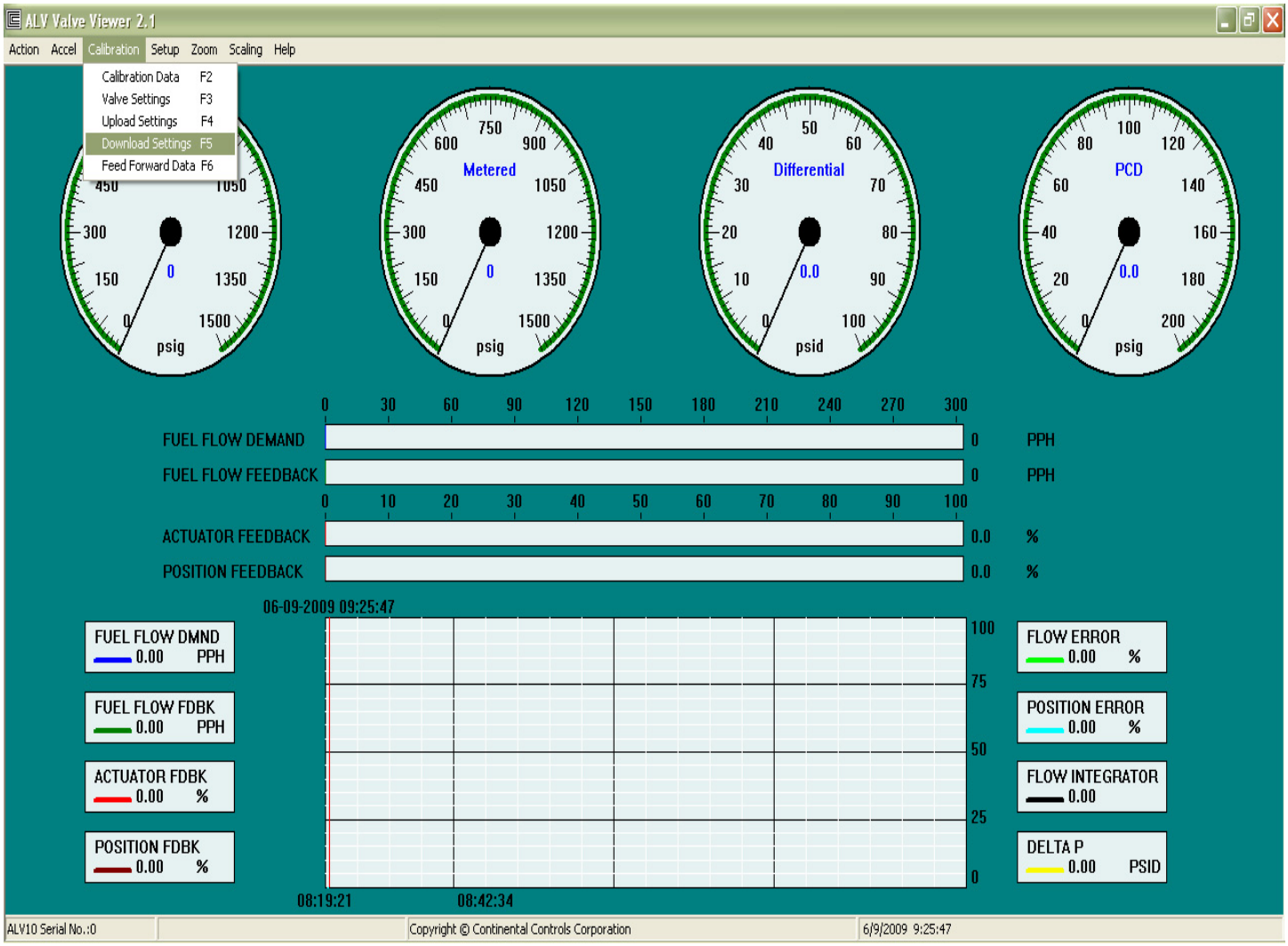
2. Once the RS232 is connected to the ALV10 Communication wires, now make sure that the power to the ALV10 is on. Verify that with the volt meter.
3. Once the ALV10 Power is verified, open the ALV10 Valve Viewer Software program by double-clicking on the ALV10 Valve Viewer shortcut on your desktop.



Screen 1

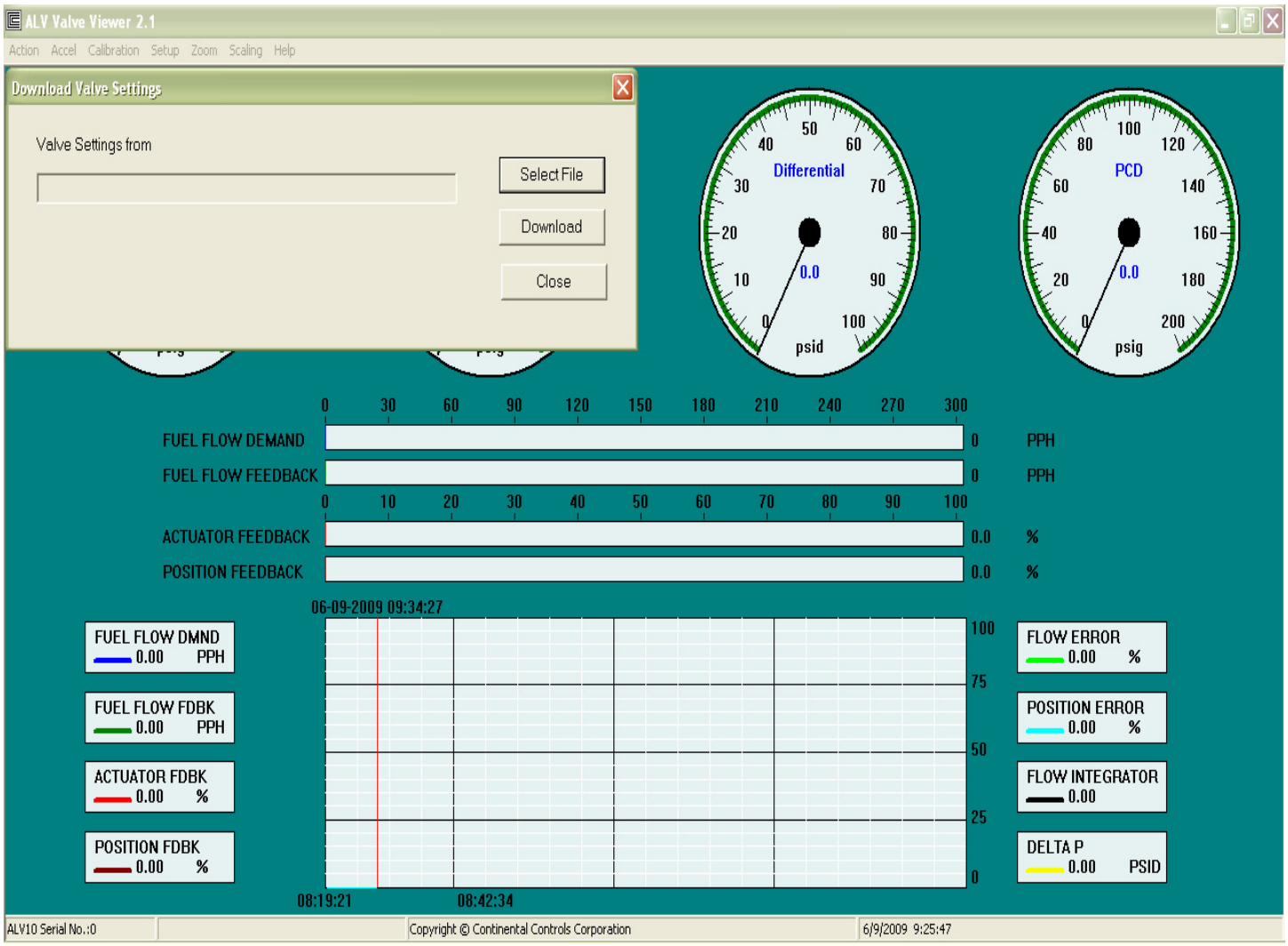
4. On the Main Screen of **“ALV10 Valve Viewer”** (see **screen 1**) select ”**Calibration”**.

5. From the Calibration Menu select **“Download Settings F5”** option. (see **Screen 2**)



Screen 2

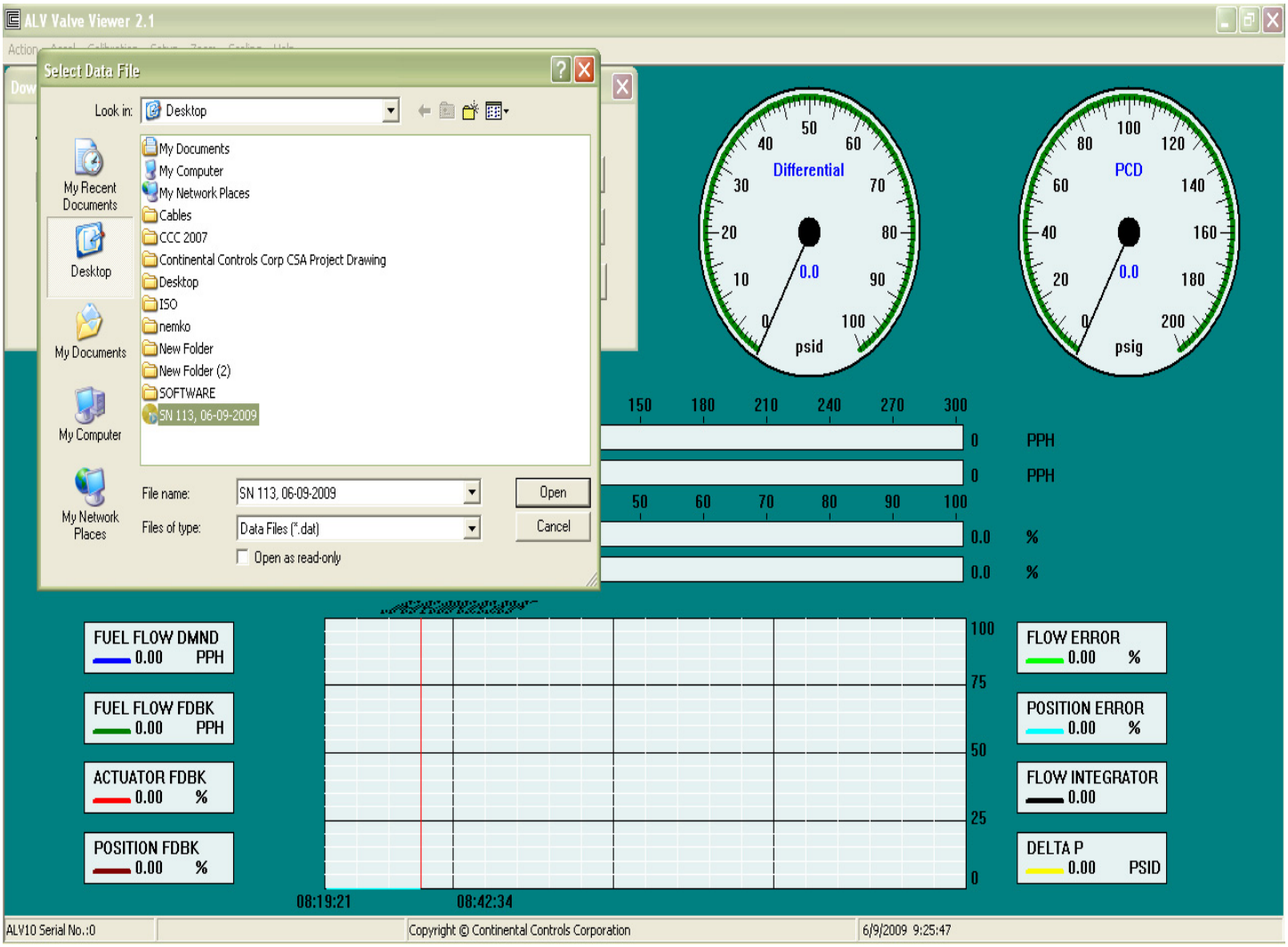
6. Once the **“Download Settings F5”** option is selected. Now click on **“Select file”**



on the **“Download Valve Settings”** screen (see **Screen 3**).

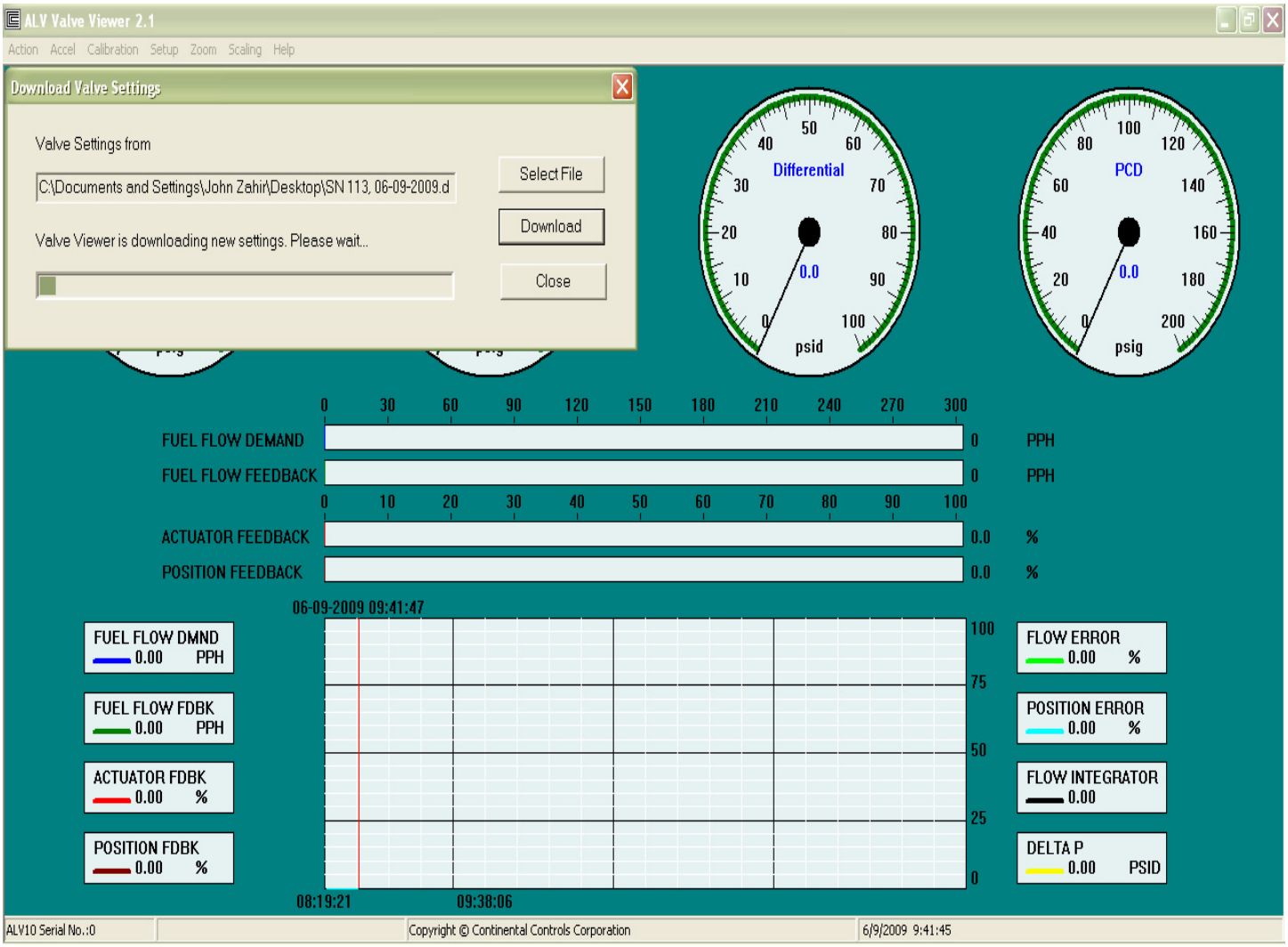
Screen 3

7. Once the **“Select file”** is clicked on the **“Download Valve Settings”** screen (see **Screen 3**), a **“Select Data File”** screen appears (see **Screen 4**). Locate the ALV10 Calibration settings file and select it. Then click on **“Open”** on the **“Select Data File”** screen (see **Screen 4**)



Screen 4

8. After the calibration settings file is selected and **“Open”** is clicked on the **“Select Data File”** screen (see **Screen 4**). Then **“Download Valve Settings”** screen appears (see **Screen 5**). On the **“Download Valve Settings”** screen, click on **“Download”** (see **Screen 5**). Wait till the calibration settings are downloaded and then click “Close” on **“Download Valve Settings”** screen (see **Screen 5**). Now you’re done with downloading the ALV10 Factory Calibration Settings into the ALV10.



Screen 5

Factory Original Settings Procedure

The purpose of this instruction is to view the factory calibration settings. If need to, make changes to Demand Gain/Offset, Minimum Pressure Settings and/or Minimum Flow settings. All other calibration settings are not to be tampered with. If any other calibration settings are changed, the valve would not behave per factory recommendation and it can result in Turbine destruction along with the valve. It's very important that when making anything changes, that Continental Controls Corporation is notified unless you are trained by Continental Controls Corporation.

1. Make sure the ALV10 communication wires are connected via RS232 to a notebook. In order to communicate with the ALV10, RS232 cable with mini grabber at one end is required. In the RS232, the following pins are used for the following operations:

    a. Pin 2 of the DB9 is used for Transmitting (Tx)
    b. Pin 3 of the DB9 is used for Receiving (Rx)
    c. Pin 5 of the DB9 is used for Common

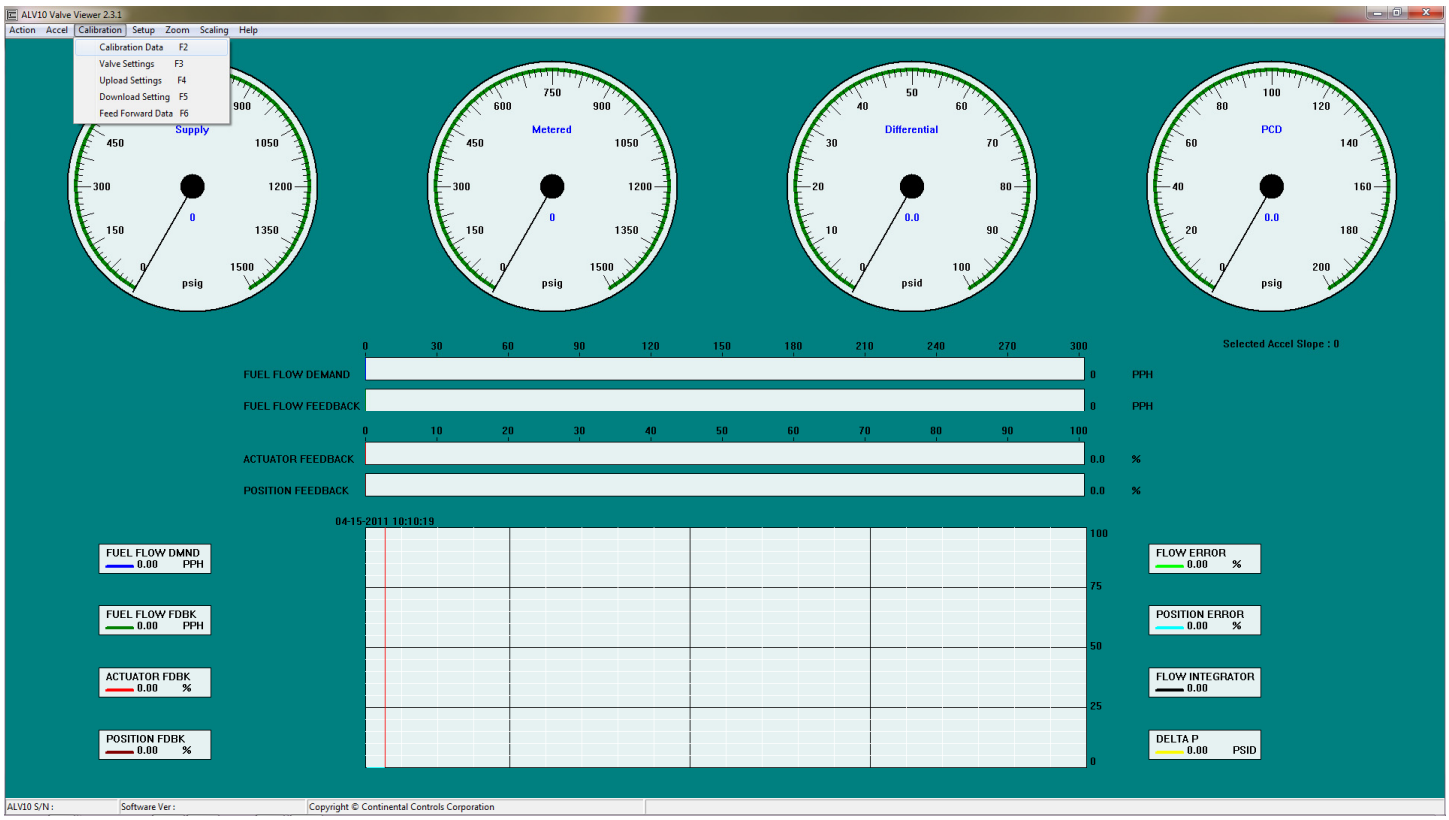
    In the ALV10 cable, the Green Wire is for Transmitting (Tx), the Brown Wire is for Receiving (Rx), and the Black Wire is for Common. Thus connect the above specified wires to the proper pins of the DB9 of the RS232.

2. Ensure Power to the valve is on. Only to the PWB Board (white and gray wires).

3. Before making any changes to the factory original settings, it's very important that the original factory settings be backed-up into your computer. If for some reason, a setting is changed and the customer needs to go back to the original factory settings, you can re-download the original factory settings into the ALV10. In order to upload the original factory settings, please follow the procedure in file name "Uploading, Downloading ALV10 Calibration Settings, 06-09-2009".

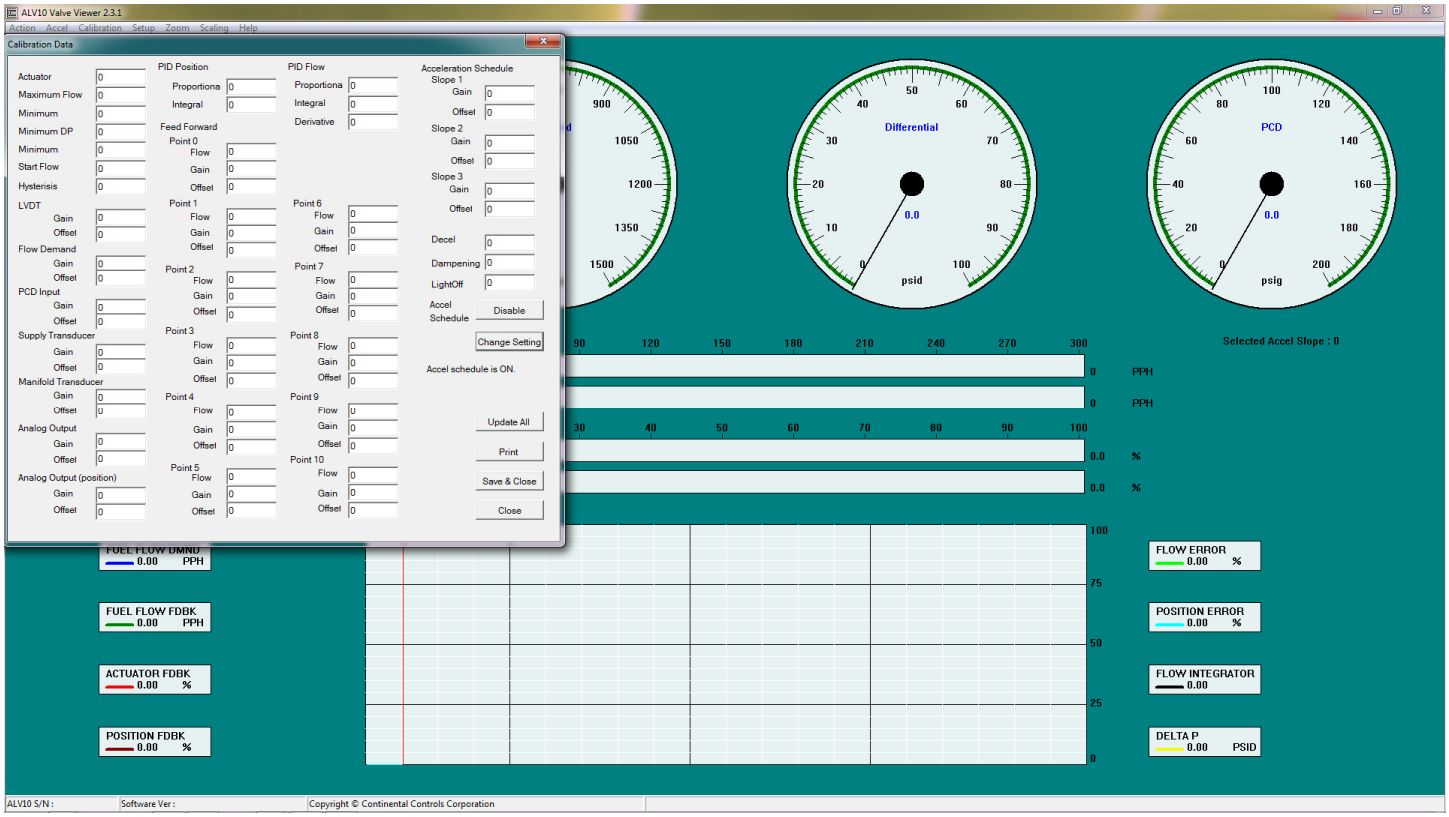
4. Open ALV10 Valve Viewer. If you have an early version Valve Viewer, you need to obtain the latest ALV10 Valve Viewer from Continental Controls Corp.

5. When ALV10 Valve Viewer is opened, on the top right corner of the valve viewer, pull down the “Calibration” menu. Select “Calibration Data”(see screen 1 below). [You can also hit the function key “F2” in your notebook to go to the calibration data]



Screen 1

6. After the “Calibration Data” screen is opened, now you can view all the factory calibration settings. If changes are to be made, re-read the above first paragraph. If any settings are changes and you don’t want to save the settings, the simply click on the “close” button on the “Calibration Data” without saving. If a desired settings are changed and want to save it into the ALV10, then click on “save & Close” button. Again, changing any settings without any knowledge of the ALV10 can result in equipment damage and serious injury or even death. Please consult Continental



Controls. (see screen 2 below)

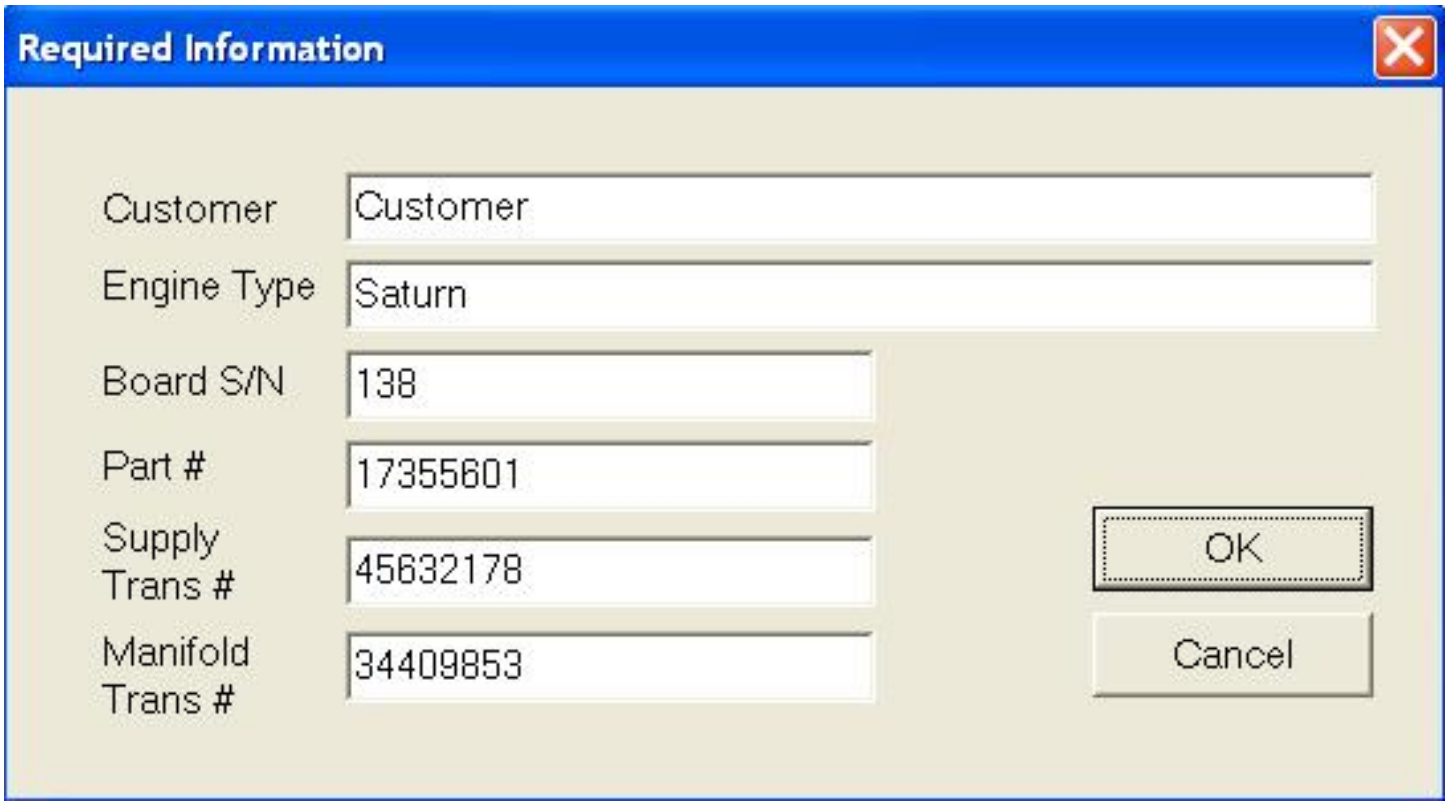
Screen 2

7. The factory original or modified valve settings can be printed or create a pdf formate file. Print ALV10 Traveler Report, containing current ALV10 settings.

Main Menu -> Calibration -> Calibration Data

Print Guide:

1. Press Print button.
2. Enter ALV10 S/N, P/N, etc.
3. Click OK to select Printer in the Printer dialog box.



4. Click OK to print the report.

Screen 3

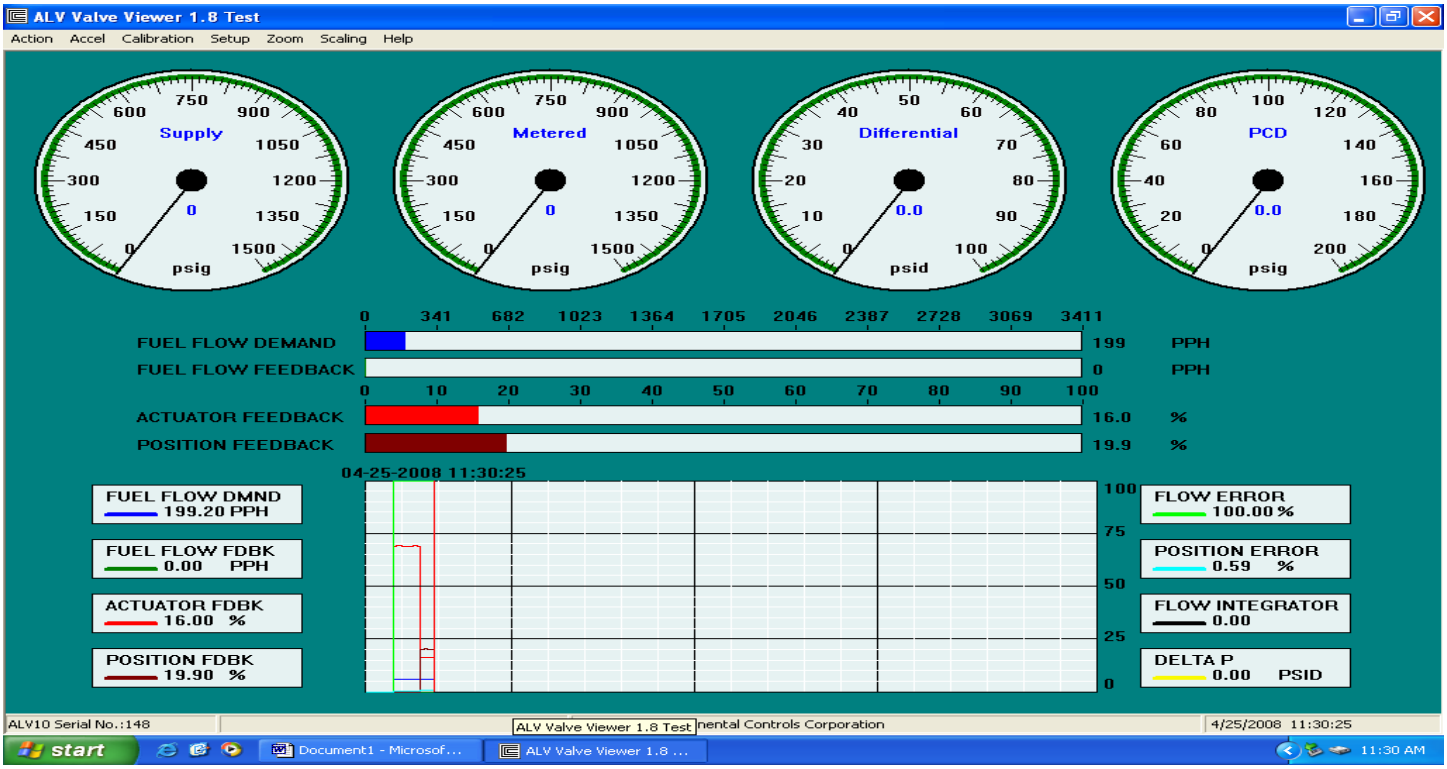
Disabling Acceleration Schedule and Adjusting Flow Demand Procedure

The purpose of this instruction is to disable the acceleration schedule in the ALV10 and re-calibrate the 4-20 mA fuel flow demand input.

1. In order to communicate with the ALV10, RS232 cable with mini grabber at one end is required. In the RS232, the following pins are used for the following operations:
   a. Pin 2 of the DB9 is used for Transmitting (Tx)
   b. Pin 3 of the DB9 is used for Receiving (Rx)
   c. Pin 5 of the DB9 is used for Common

   In the ALV10 cable, the Green Wire is for Transmitting (Tx), the Brown Wire is for Receiving (Rx), and the Black Wire is for Common. Thus connect the above specified wires to the proper pins of the DB9 of the RS232.

2. Once the RS232 is connected to the ALV10 Communication wires, now make sure that the power to the ALV10 is on. Verify that with the volt meter.
3. Once the ALV10 Power is verified, open the ALV10 Valve Viewer Software program by double-clicking on the ALV10 Valve Viewer shortcut on your desktop.

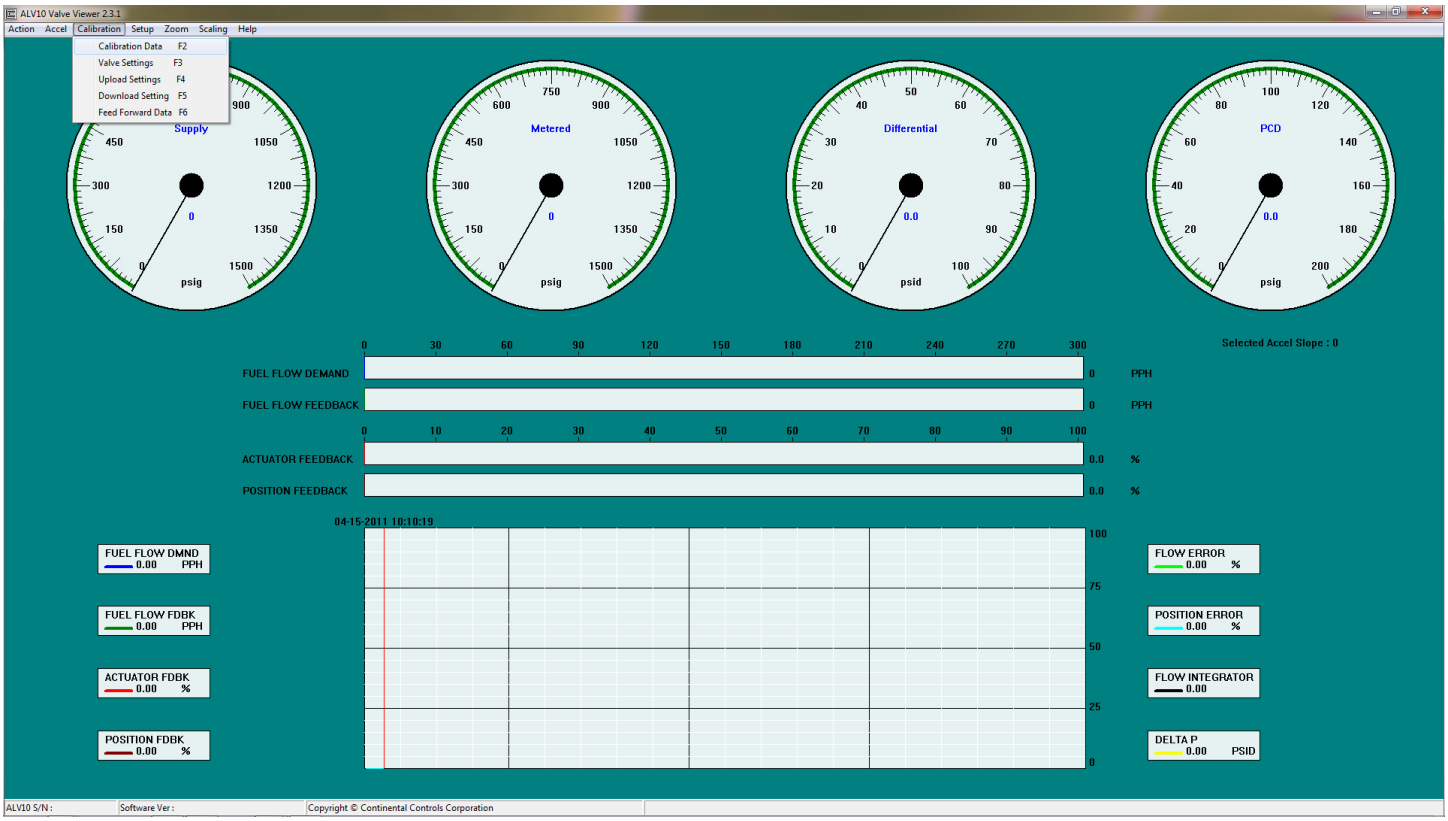


Screen 1

4. Ensure Power to the valve is on. Only to the PWB Board (white and gray wires).

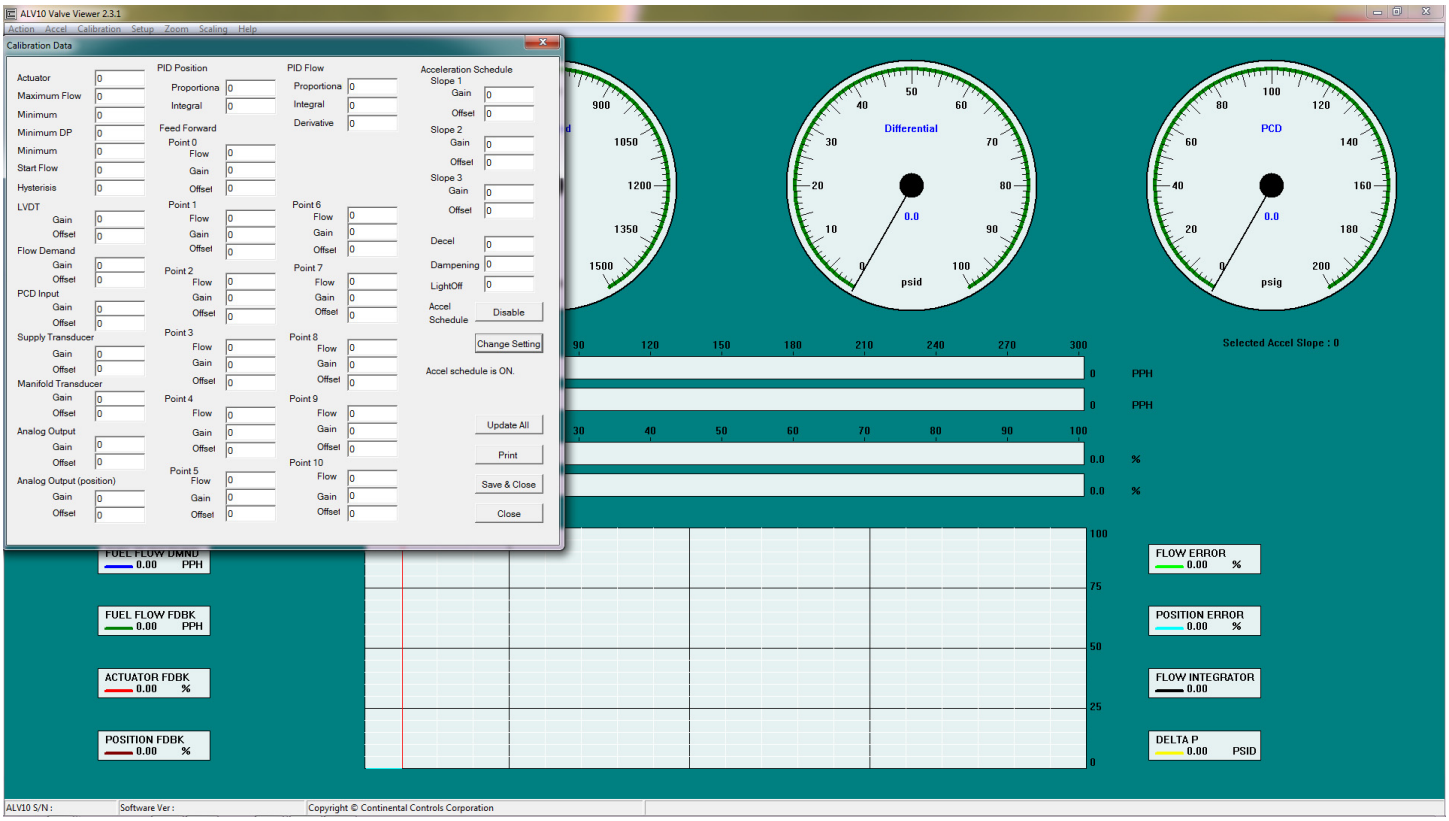
5. Open ALV10 Valve Viewer. If you have an early version Valve Viewer, you need to obtain the latest ALV10 Valve Viewer from Continental Controls Corp.

6. When ALV10 Valve Viewer is opened, on the top right corner of the valve viewer, pull down the “Calibration” menu. Select “Calibration Data”(see screen 2 below). [You can also hit the function key “F2” in your notebook to go to the calibration data]



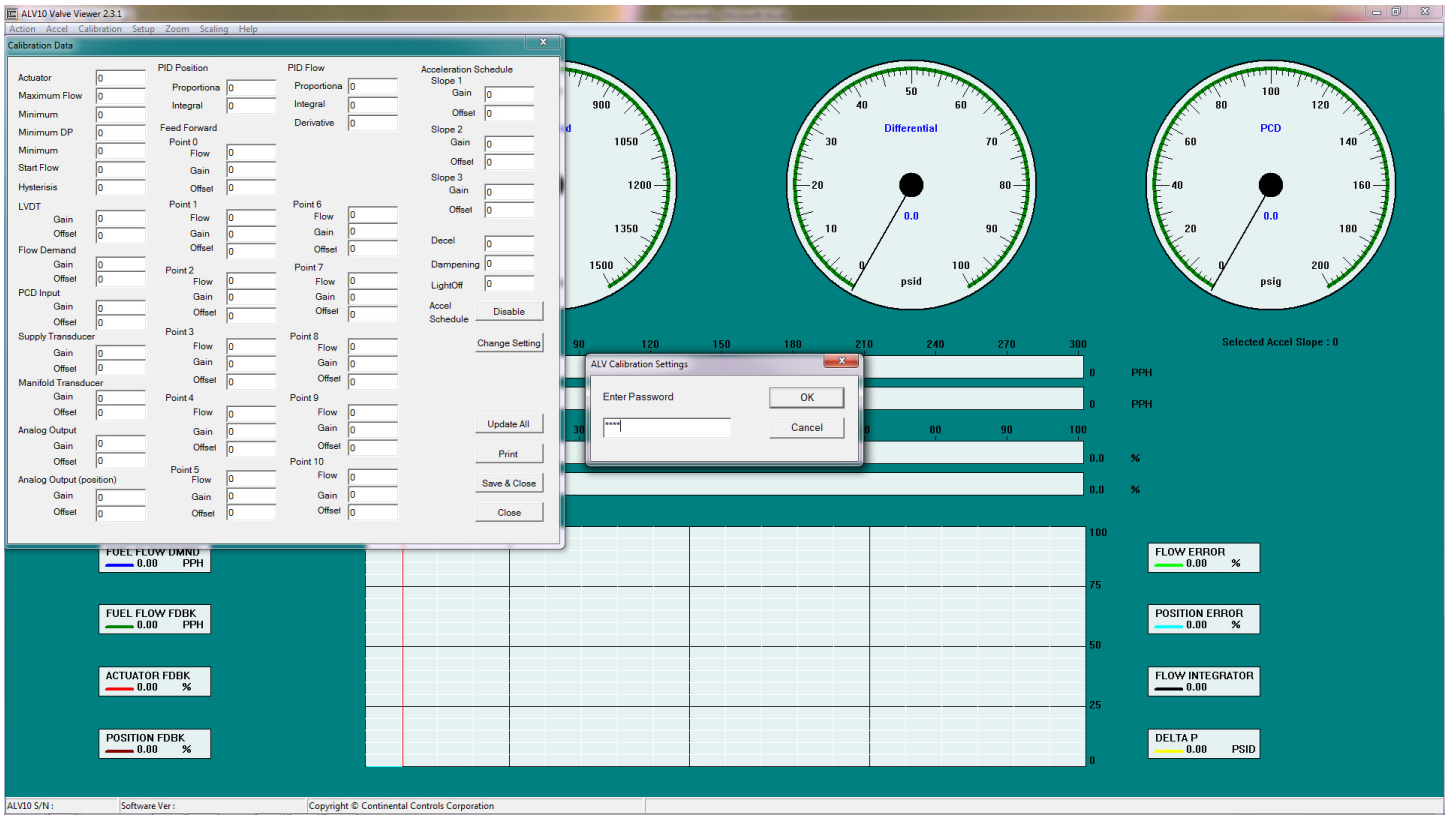
Screen 2

7. After the “Calibration Data” screen is opened, below the Acceleration Schedule” settings, click on the tab called “Disable” Accel. Schedule. (see Screen 3 below)



Screen 3

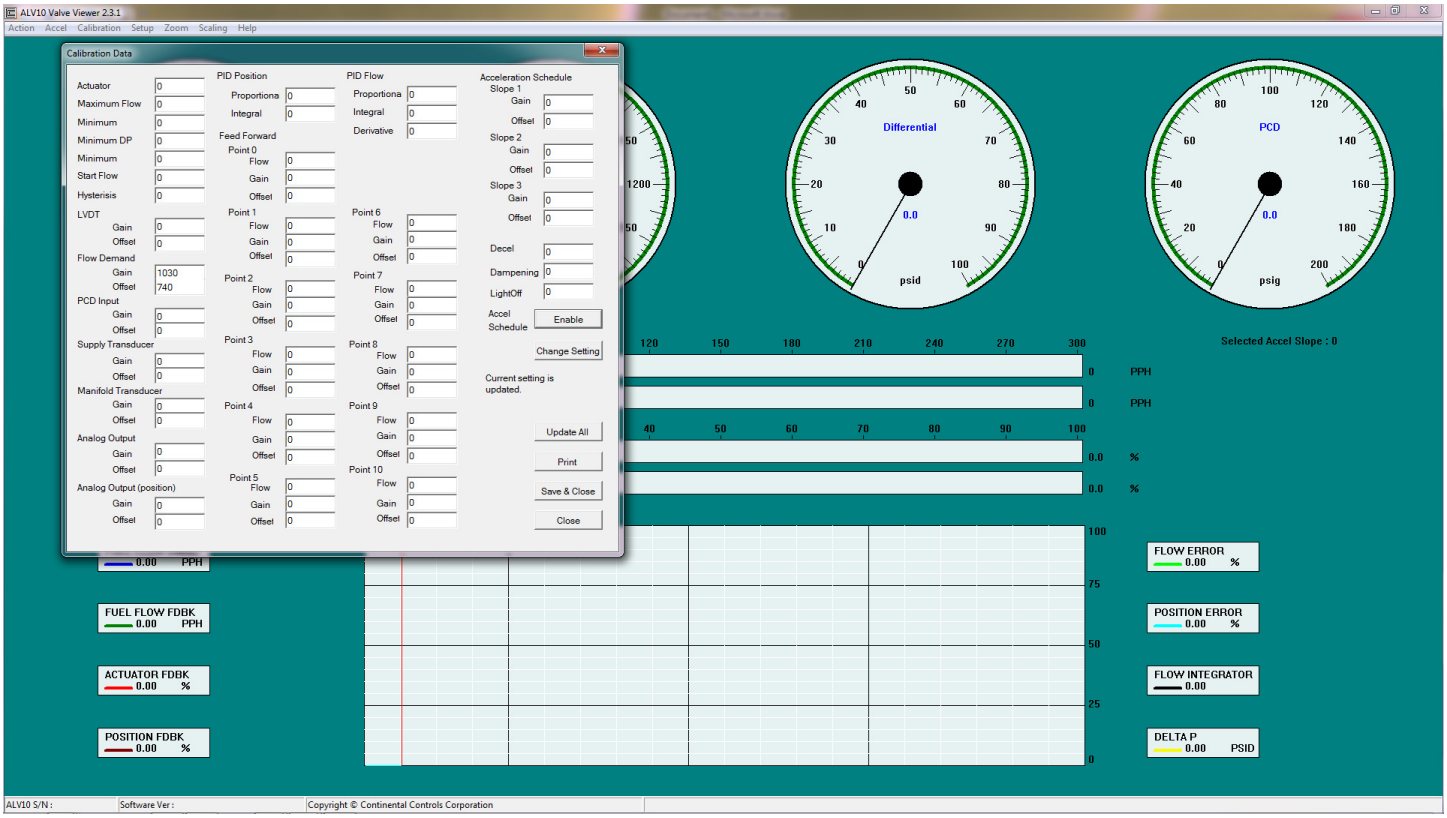
8. After the “Disable” Tab is clicked, a window will pop and ask you to enter password. Type in 1133 for a password. Then click ok. A second window will appear “Assistance” and click ok on that too. Then a message will appear on the calibration data screen indicating that the acceleration schedule is off. (see screen 4 below)



Screen 4

9. After the acceleration schedule is turned off, now it's time to calibrate the 4-20 mA fuel flow demand input signal. You will need a 4-20 mA signal generator and connect it to the blue and white/blue wires of the ALV10. Blue wire is the 4-20 mA source signals and white/blue is the 4-20 mA Common. In the "Calibration Data" screen, change the Flow demand gain to 1030 and then click "change setting" tab. Then change the Flow demand offset to 740 and then click "change setting" tab. When both values are changed, then click the "save & close" tab to save the settings. Then using your 4-20 mA signal generator, command the valve to 5 mA and verify that at 5 mA your flow demand is equal to the start flow for the turbine. If the flow demand in lbs/hour at 5 mA does not equal to the start flow, then adjust the "Flow Demand Offset" till the 5 mA Demand equals to the start flow in lbs/hour. Then Command the valve to 20 mA and verify that at 20 mA, your flow demand signal is equal to the maximum fuel flow for the turbine. To obtain maximum fuel flow, see "maximum flow" in the "calibration data". If the flow demand in lbs/hour at 20 mA does not equal to the maximum fuel flow, then adjust the "Flow Demand Gain" till the 20 mA Demand equals to the maximum fuel flow in lbs/hour.

10. After the 4-20 mA fuel flow demand is calibrated and all verification is made. Now back up and save the valve calibration settings in the notebook desktop or in folder. Follow step 5 thru 9.



Retrieving Log File Procedure

The purpose of this instruction is to disable the acceleration schedule in the ALV10 and re-calibrate the 4-20 mA fuel flow demand input.

This instruction is written to assist in retrieving the real time data logged while the valve was operating. The log file is important piece of data when troubleshooting valve and when observing valve behavior during operation.

Log file is automatically generated and saved into your personal computer when the valve viewer software is opened and valve obtains communication with your personal computer.

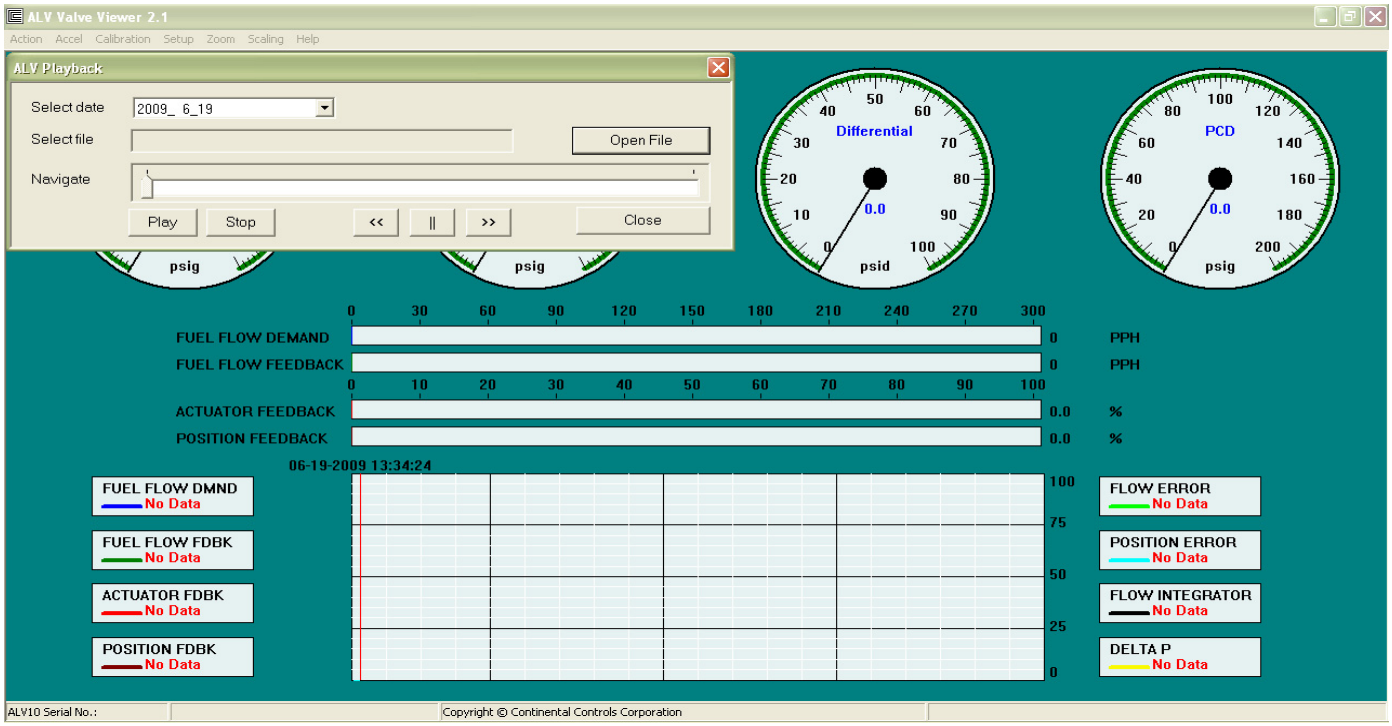
Example: Log file format as follows:

SN147_2008_9_8_17

SN147: is the valve serial number when valve viewer was run.
_2009_9_8 : is the year, month and day when the log file is generated
_17 : is the log file number when the file is generated.

The real time data (Log) File is saved in the following directory in the computer:

- Go to “My Computer” on the desktop
- Then go to “C Drive”
- In the “C Drive”, go to “Program Files”
- Then in the “Program Files”, go to “CCCLiquidValve” folder.



- In the “CCCLiquidValve” folder, select the file needed to analyze or email to the factory.
- This is the directory path for the log file:
  C:\Program Files\CCCLiquidValve

Playing Log File

1. Log File
2. Main Menu -> Action -> Log File
3. Optional real time data logging allows storing the crucial information on a PC running Windows OS software. Data logging is enabled by default.
4. Playback
5. Main Menu -> Action -> Playback
6. This feature enables the user to play back all the history files in order to detect and evaluate problems related to liquid fuel control valve model ALV10 for gas turbines.
7. Playback guide:
8. Select a date from the drop down calendar menu.
9. Click Open File to select a log file, created on the specified date.
10. Playback Setup dialog box should open up.
11. Select a date from the drop-down menu to display available log files.
12. Press Open File button to select a log file.
13. Playback track bar is ready to navigate.
14. For easy navigation use Play, Stop, Rewind, Pause, Fast Forward buttons.

Accessories and Options - Operation and Installation

The ALV10 interface cable is a custom cable, which includes all necessary wires between the ALV10 and PLC interface. The wire is sized appropriately for it's use and the wires are color-coded. One end of cable includes a quick disconnect connector which meets the CSA requirements for Class I Div 2 Hazardous environment applications.

Options:

The following options are available:

- **ALV10 with ¾" NPT Union Harness Assembly**: The ALV10 Fuel Control Valve is equipped with potted ¾" NPT union harness assembly. The pig tails wires out of the ¾" npt union harness assembly is terminated at a separate junction box by customer. This ALV10 with ¾" npt union harness assembly meets the CSA Requirements for Class I Division 1 Group D applications and the European Standards for use in potentially explosive atmosphere EEx d IIA, ATEX.
- **ALV10 with 23-pin Connector**: This valve meets the CSA Requirements for Class I Division 2 applications. This valve uses a custom cable made for the ALV10. The cable is twisted paired shielded Class I Division 2 and the wires are color coded.
- **ALV10 Interface Cable**: The Interface cable will only work for ALV10 made for Class I Division 2 application. The interface Cable meets or exceeds Class I Division 2 Requirements for CSA.

Product Warranty

Continental Controls Corporation warrants that all goods furnished by CCC are free from defects in workmanship and material as of the time and place of delivery.
As a matter of general warranty policy, CCC honors an original buyer's warranty claim in the event of failure within 12 months of shipment to the end-user, when the equipment has been installed and operated under normal conditions and in accordance with installation instructions contained in the operating manual and generally accepted operating practices.

All warranty work must be performed and CCC's manufacturing facility in San Diego. The customer is responsible for shipment or delivery of the product to the CCC facility. CCC will pay return ground freight. The customer will pay any expedited freight fees.

Preventative Maintenance

The ALV10 has been designed to operate reliably with a minimum amount of maintenance. To ensure optimum performance, periodic inspection and cleaning is necessary.

External Visual Inspection

Inspect the exterior of the valve for loose connections, frayed wires, or major structural damage. Ideally, the valve should be checked on a weekly basis.

Cleaning

Exterior cleaning will aid in the visual inspection of the external casing and ensure good connections. Ethyl alcohol or mild soapy water can be used as cleaning agents. It is recommended that the valve be cleaned every 60 days. If environmental conditions are extremely dirty, more frequent cleaning will be necessary.

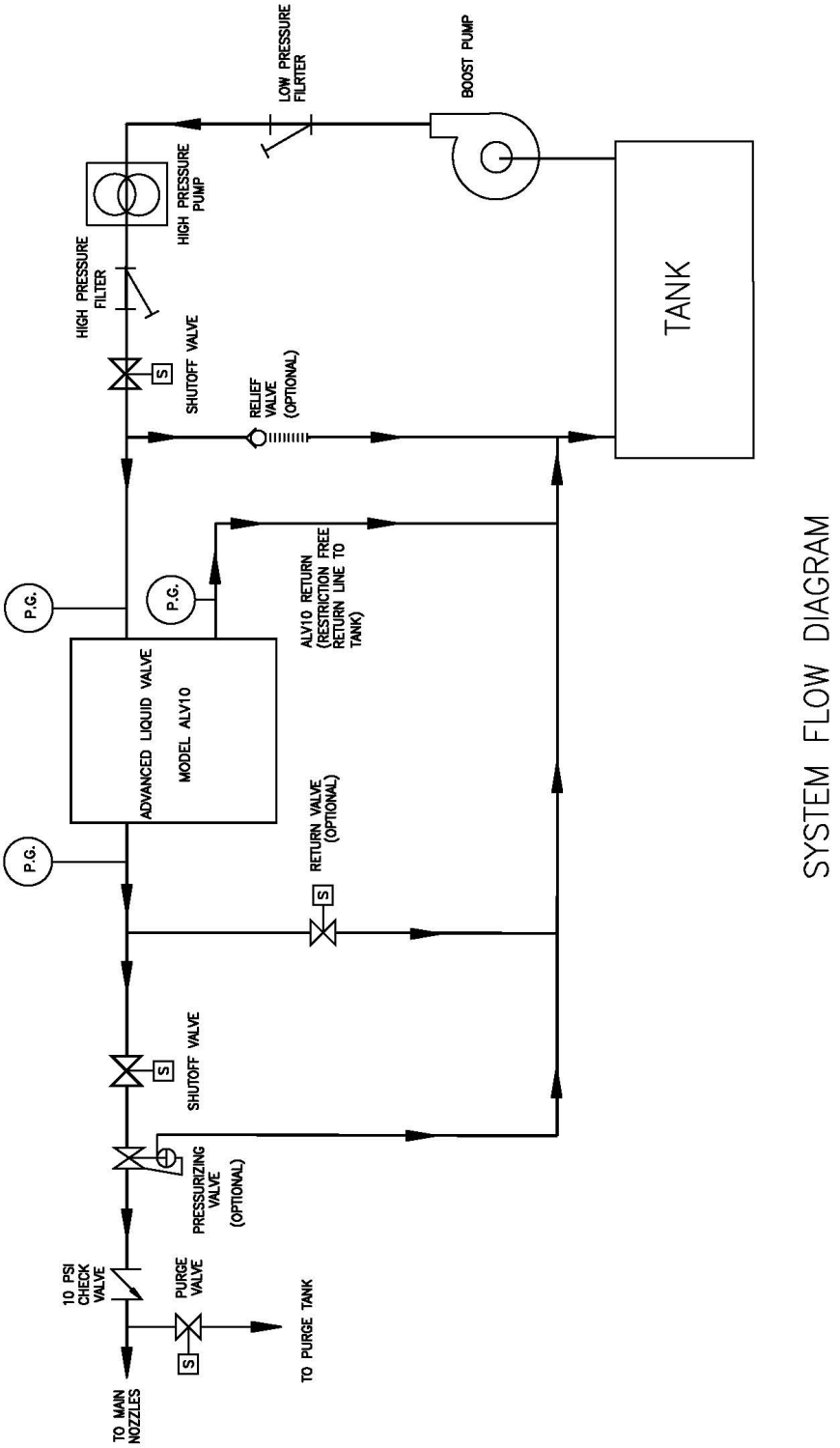
Maintenance Log

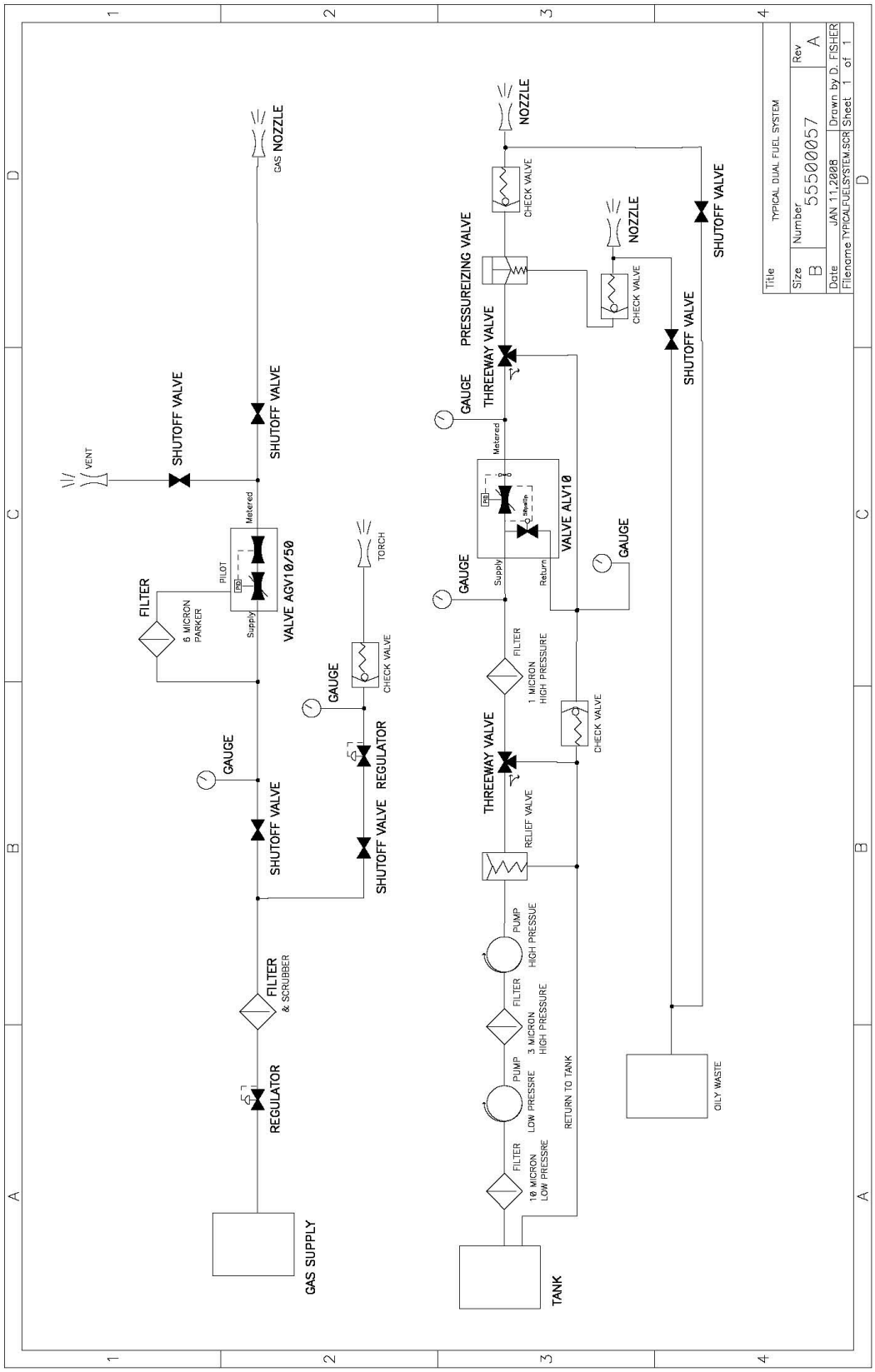
To facilitate troubleshooting and to establish service schedules, maintenance log should be kept on the liquid fuel metering valve.

Calibration

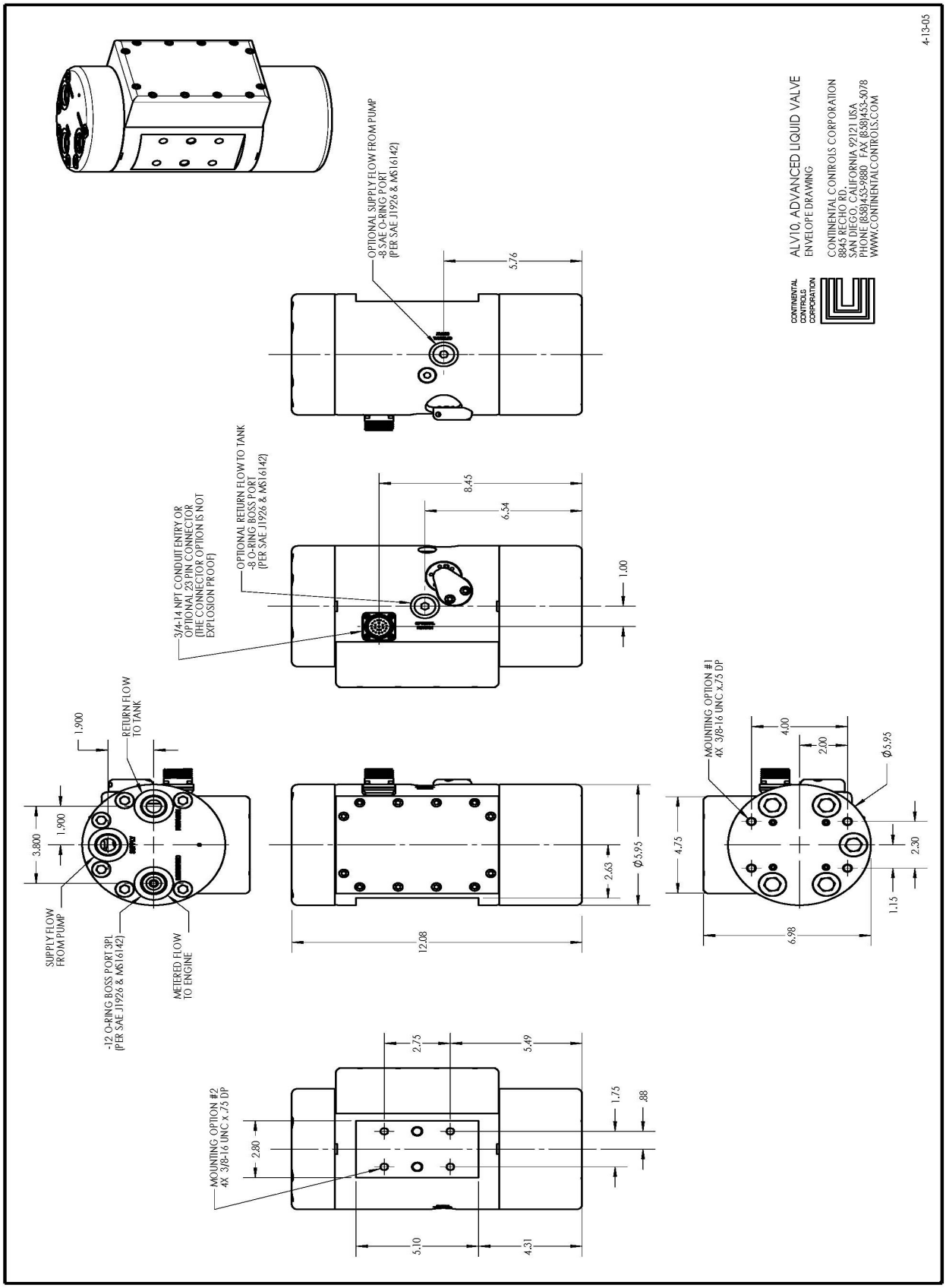
Flow calibration of the ALV10 is performed prior to shipment. Since calibration of the valve requires equipment not normally available in the field, it is recommended that the valve be returned to Continental Controls if adjustment is necessary.

Appendix 1: Fuel System Schematic

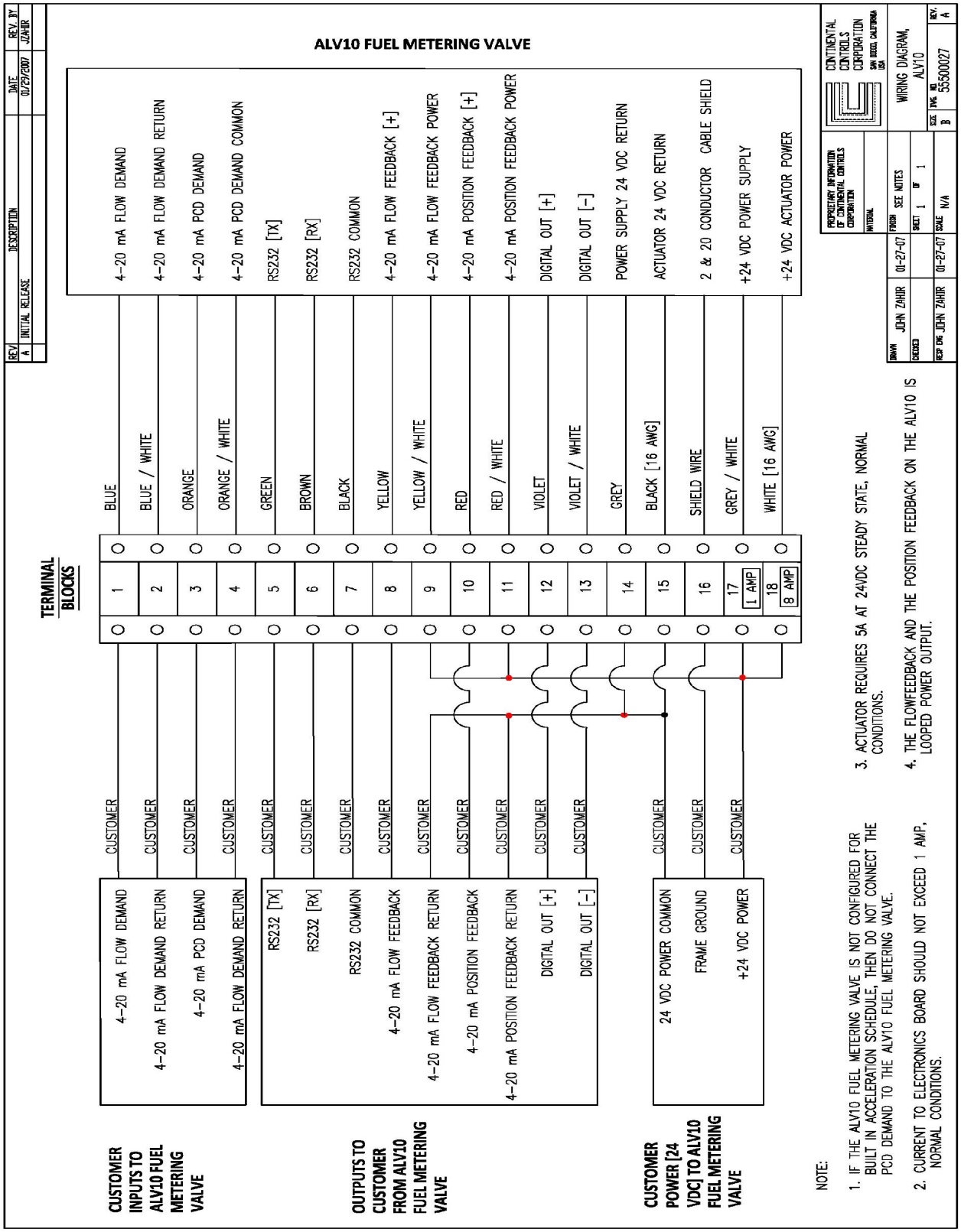


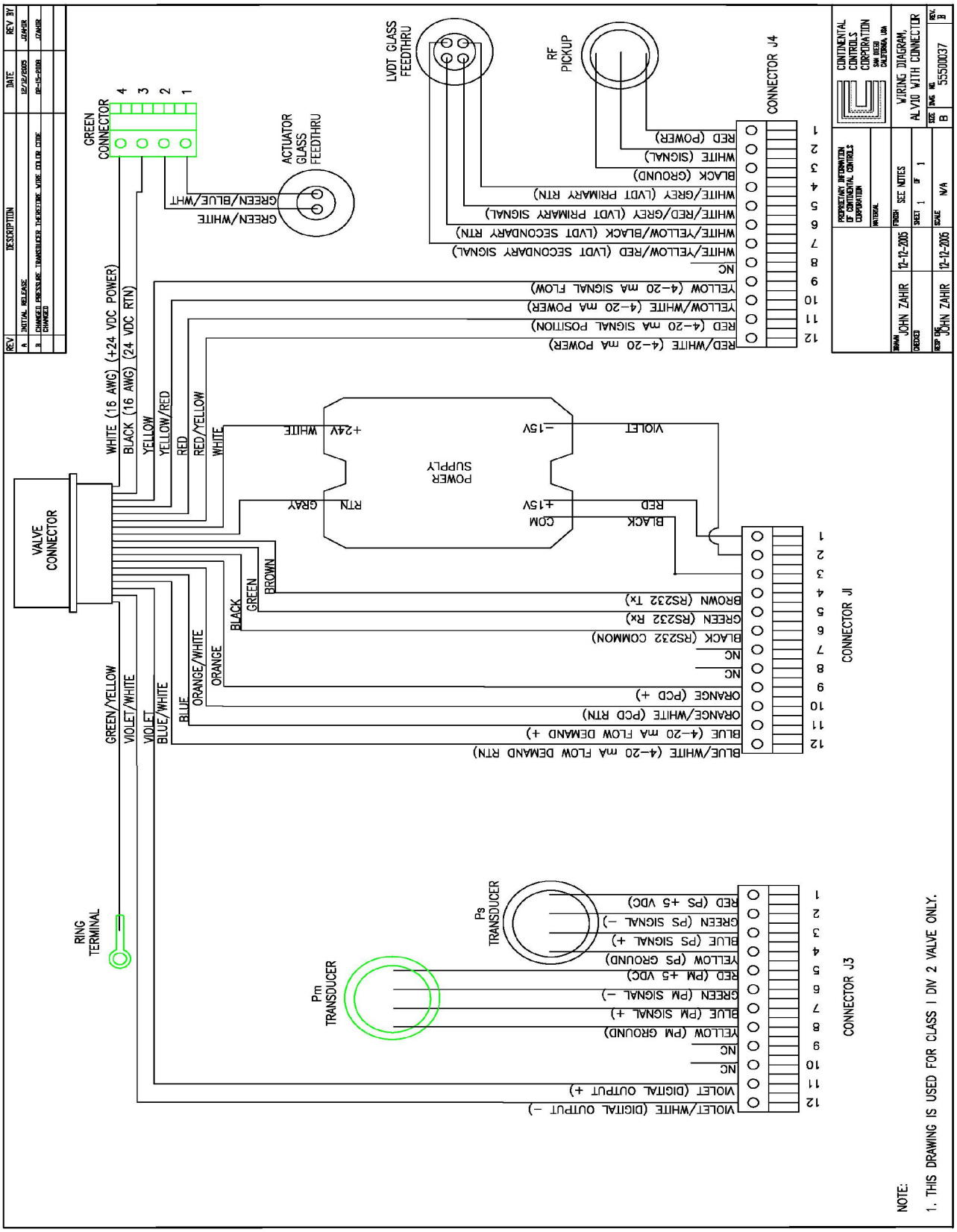

GAS NOZZLE
VENT
SHUTOFF VALVE
SHUTOFF VALVE
Metered
Supply
PILOT
FILTER
5 MICRON PARKER
VALVE AGV10/50
TORCH
GAUGE
CHECK VALVE
GAUGE
REGULATOR
SHUTOFF VALVE
SHUTOFF VALVE
REGULATOR
FILTER
& SCRUBBER
GAS SUPPLY
NOZZLE
CHECK VALVE
PRESSUREIZING VALVE
GAUGE
THREEWAY VALVE
Metered
Supply
Return
VALVE ALV10
GAUGE
NOZZLE
CHECK VALVE
SHUTOFF VALVE
SHUTOFF VALVE
GAUGE
FILTER
1 MICRON HIGH PRESSURE
CHECK VALVE
THREEWAY VALVE
RELIEF VALVE
PUMP
HIGH PRESSUE
FILTER
3 MICRON HIGH PRESSURE
PUMP
LOW PRESSRE
FILTER
10 MICRON LOW PRESSRE
RETURN TO TANK
OILY WASTE
TANK
Title TYPICAL DUAL FUEL SYSTEM
Size B
Number 55500057
Rev A
Date JAN 11,2008
Drawn by D. FISHER
Filename TYPICAL FUEL SYSTEM.SCR
Sheet 1 of 1

Envelope Drawing


ALV10, ADVANCED LIQUID VALVE
ENVELOPE DRAWING
CONTINENTAL CONTROLS CORPORATION
8845 RECHO RD.
SAN DIEGO, CALIFORNIA 92121 USA
PHONE (858)453-9880 FAX (858)453-5078
WWW.CONTINENTALCONTROLS.COM
CONTINENTAL CONTROLS CORPORATION
4-13-05
OPTIONAL SUPPLY FLOW FROM PUMP
-8 SAE O-RING PORT
(PER SAE J1926 & MS16142)
5.76
OPTIONAL RETURN FLOW TO TANK
-8 O-RING BOSS PORT
(PER SAE J1926 & MS16142)
3/4-14 NPT CONDUIT ENTRY OR
OPTIONAL 23 PIN CONNECTOR
(THE CONNECTOR OPTION IS NOT
EXPLOSION PROOF)
8.45
6.54
1.00
1.900
RETURN FLOW
TO TANK
3.800
1.900
SUPPLY FLOW
FROM PUMP
-12 O-RING BOSS PORT 3PL
(PER SAE J1926 & MS16142)
METERED FLOW
TO ENGINE
2.63
Ø5.95
12.08
MOUNTING OPTION #1
4X 3/8-16 UNC x.75 DP
4.00
2.00
Ø5.95
4.75
2.30
1.15
6.98
MOUNTING OPTION #2
4X 3/8-16 UNC x.75 DP
2.75
5.49
1.75
.88
2.80
5.10
4.31

Wiring Schematic




CONTINENTAL CONTROLS CORPORATION
WIRING DIAGRAM, ALV10 WITH CONNECTOR
55500037
CONNECTOR J4
LVDT GLASS FEEDTHRU
RF PICKUP
ACTUATOR GLASS FEEDTHRU
GREEN CONNECTOR
VALVE CONNECTOR
POWER SUPPLY
CONNECTOR J1
CONNECTOR J3
Ps TRANSDUCER
Pm TRANSDUCER
RING TERMINAL
WHITE (16 AWG) (+24 VDC POWER)
BLACK (16 AWG) (24 VDC RTN)
NOTE:
1. THIS DRAWING IS USED FOR CLASS I DIV 2 VALVE ONLY.

Modbus Register Map

3x Input Registers

Register	Description	Scaling	Units
40001	fuel flow	0.01	lb/hour
40002	demand flow	0.01	lb/hour
40003	stroke	0.1	%
40004	supply pressure	1	psig
40005	manifold pressure	1	psig
40006	actuator output	1	counts
40007	accel	Ignore	Ignore
40008	decel	Ignore	Ignore
40009	pcd dampened	0.1	psig
40010	pcd	0.1	psig
40011	dash	Ignore	Ignore
40012	version	Ignore	Ignore
40013	selected slope	Ignore	Ignore
40014	duty cycle	Ignore	Ignore
40015	pos proportional contribution	Ignore	Ignore
40016	pos integral contribution	Ignore	Ignore
40017	freq	Ignore	Ignore
40018	position demand	0.1	%
40019	flow proportional contribution	Ignore	Ignore
40020	flow integral contribution	Ignore	Ignore
40021	fforward_cont	Ignore	Ignore
40022	dac1_output	1	counts
40023	dac2_output	1	counts
40024	dac3_output	Ignore	Ignore
40025	dac4_output	Ignore	Ignore
40026	flow derivative contribution	Ignore	Ignore
40027	spare2	Ignore	Ignore
40028	spare3	Ignore	Ignore
40029	spare4	Ignore	Ignore
40030	spare5	Ignore	Ignore
40031	spare6	Ignore	Ignore
40032	spare7	Ignore	Ignore
40033	spare8	Ignore	Ignore
40034	spare9	Ignore	Ignore

4x Holding Registers

Register	Description
40101	stroke gain
40102	stroke offset,
40103	demand gain,
40104	demand offset,
40105	pcd gain,
40106	pcd offset,
40107	manifold_gain,
40108	manifold_offset,
40109	supply_gain,
40110	supply_offset,
40111	pos_prop,
40112	pos_intrgal,
40113	flow_prop,
40114	flow_intrgal,
40115	freq_gain,
40116	freq_offset,
40117	act_offset,
40118	max_flow,
40119	min_flow,
40120	serial_number,
40121	modbus_address,
40122	dac1_gain,
40123	dac1_offset,
40124	dac2_gain,
40125	dac2_offset,
40126	calibrated,
40127	accelslope1,
40128	offset1,
40129	accelslope2,
40130	offset2,
40131	accelslope3
40132	offset3,
40133	lightoff,
40134	decel_percent,
40135	dampening,

Fuel Valve Questionnaire

The following are questions that will help us to ensure proper configuration of the ALV10. Please answer as completely as possible and add comments as necessary:

1. Engine Manufacturer and Model _____

2. Application (Generator or Mechanical Drive) _____

3. Rated Horsepower of the Engine _____

4. Does the Engine has motor driven pump or engine driven pump? _____

5. What is your existing liquid fuel control valve? _____

6. Do you do your own acceleration schedule in the PLC?_____

7. Do you want 4-20 mA or 0-50 mA Configuration Valve? _____

8. Will the engine burn Standard Diesel #2? (If not what fuel?)_____

9. Will this be used in an area classified as hazardous? What Classification? _____

10. If you are using the ALV10 cable and connector are the run less than 10 feet. If it is greater than 10 feet, specify length. _____

11. Is there anything special or problematic about the application?

_____