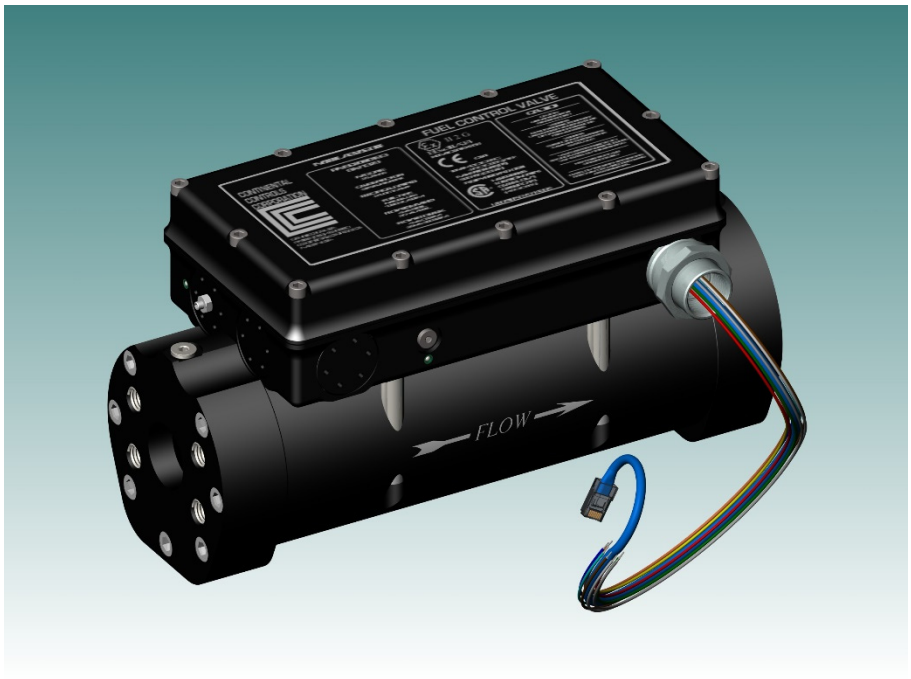
CONTINENTAL CONTROLS CORPORATION

Installation and Operating Manual

Fuel Control Valve, Model AGV10, AGV50 and AGV50 Pilot



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DEKRA 03ATEX2551X

0344, 0036

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

Introduction

This manual provides instruction and maintenance information for the AGV10, AGV50 and AGV50 Pilot Fuel Control Valve.

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 AGV10, AGV50 and AGV50 Pilot Fuel Control Valve 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, maintain, or repair 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 AGV10, AGV50 AND AGV50 PILOT Fuel Control Valve.

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 Fuel Control Valves are normally used with natural gas. Natural Gas 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 Fuel Control Valve plays an important part in the safety of the whole system. The AGV10, AGV50 AND AGV50 PILOT is not the primary control to shut down the engine.

The AGV10, AGV50 AND AGV50 PILOT Fuel Control Valve is **NOT** a shutoff valve. Shutoff valves should be used in addition to the Fuel Control 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 shut down.**
2. **No single failure can result in grossly over-fueling the engine when attempting to start.**

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

A separate fuel shutoff valve must be installed UPSTREAM of the AGV10, AGV50 AND AGV50 PILOT. The fuel shutoff valve should provide for the venting of pressure from the upstream side of the AGV10, AGV50 AND AGV50 PILOT before an engine start sequence is initiated. If no venting is provided, the fuel system must be such that no gas is trapped downstream of the AGV10, AGV50 AND AGV50 PILOT. It is the customer's responsibility to ensure that purge times are completed and the igniter of the turbine is turned on before fuel pressure is allowed to reach the AGV10, AGV50 AND AGV50 PILOT.

Before installing the AGV10, AGV50 AND AGV50 PILOT Fuel Control Valve, check as to whether or not the valve contains an embedded acceleration schedule. The AGV10, AGV50 AND AGV50 PILOT-XXX-A is the designation that the valve that does have an embedded acceleration schedule. This valve will only allow an appropriate level of gas to the turbine based upon the compressor discharge pressure (PCD or CDP). A non-acceleration schedule valve will allow a level of gas proportional to level of the fuel demand signal supplied to the valve.

When the acceleration schedule is to be turned off, one of the enclosed warning tags shall be affixed to the valve in such a way as to cover the part number on the valve. The technician disabling the acceleration schedule will need to call Continental Controls with the number on the tag he has affixed to the valve in order to get the equation code for the valve before the schedule may be turned off.

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 AGV10 FUEL CONTROL VALVE IN THE FIELD. THE AGV10, AGV50 and AGV50 Pilot FUEL CONTROL VALVE MUST BE RETURNED TO CONTINENTAL CONTROLS CORPORATION FOR REPAIR AND SERVICES.

When installing the AGV10, AGV50 and AGV50 Pilot 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 AGV10, AGV50 and AGV50 Pilot.

WARNING:
THIS VALVE ACCELERATION SCHEDULE HASS BEEN DISABLED!

This valve is only compatible with PLC's and with acceleration schedule

WARNING:
This Valve does not include an acceleration schedule

This Valve has been configured for external pilot! External Pilot must be connected for valve to work or the Pg plug must be removed

Use fasteners with yield stress greater than 3.45MPa.

Contact the Original Manufacturer for information on dimensions of flameproof joints.

ATEX - The following instructions apply to equipment covered by certificate number 03ATEX2551X:

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.*

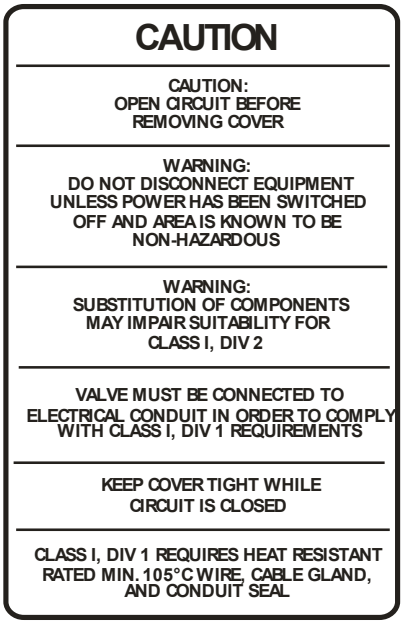
7 *Components to be incorporated into or used as replacement parts of the equipment shall be fitted by suitably trained personnel in accordance with the manufacturer's documentation.*

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

AGV10 Specifications

Flow Capacity:	Up to 1100 scfm (3081 lbs/hr)
Fuel Type:	Natural Gas, Methane (Wellhead and Biogas)
Engine Applications:	Up to 5,820 horsepower
Maximum Operating Pressure:	500 psig
Internal Filtration:	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) 0-200 mA (Optional)
Fuel Feedback Signal [from Fuel Control Valve]:	4-20 mA (Standard)
Power Input:	19-30 Vdc (1.0 Amp Maximum)
Electrical Interface:	26pin Canon Connector (Class I Div 2) 3/4" Ridged Conduit, 84" Pigtail Wires
Communication Interface:	RS485 Serial Port
Housing Materials:	- 6061-T6 Anodized Aluminum - Stainless Steel - Seals: Viton®, Alfas (Sour Gas Service)
Wetted Materials:	Stainless Steel, Carbon Steel, Anodized Aluminum, Viton® Seals, Nitrile Seals
Flanges:	1-1/2" SAE Series 61, 4-Bolt Flange 2" SAE Series 61, 4-Bolt Flange 2” Pipe 8-bolt Class 300 Flange
Dimensions:	13.9”L x 7.6”H x 5.8”W
Approximate Weights:	31.8 pounds (2” or 1-1/2” Pipe 4-bolt SAE 61 Series Flange) 33.6 pounds (2” Pipe 8-bolt Class 300 Flange)
Certifications:	ATEX, PED and CSA Approved

AGV50 Specifications

Flow Capacity:	Up to 6880 scfm (19267 lbs/hr)
Fuel Type:	Natural Gas, Methane (Wellhead and Biogas)
Engine Applications:	Up to 38,000 horsepower
Maximum Operating Pressure:	500 psig
Internal Filtration:	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)
Fuel Feedback Signal [from Fuel Control Valve]:	4-20 mA (Standard)
Power Input:	19-30 Vdc (1.0 Amp Maximum)
Electrical Interface:	26pin Canon Connector (Class I Division 2) 3/4" Ridged Conduit, 84" Pigtail Wires
Communication Interface:	RS485 Serial Port
Housing Materials:	- 6061-T6 Anodized Aluminum - Stainless Steel - Seals: Viton®, Alfas (Sour Gas Service)
Wetted Materials:	Stainless Steel, Carbon Steel, Anodized Aluminum, Viton® Seals, Nitrile Seals
Flanges:	2" SAE Series 61, 4-Bolt Flange
Dimensions:	13.8”L x 8.7”H x 5.5”W
Approximate Weights:	44.2 pounds
Certifications:	ATEX, PED and CSA Approved

AGV50 Pilot

Flow Capacity:	Application Pilot Flow Dependend
Fuel Type:	Natural Gas, Methane (Wellhead and Biogas)
Engine Applications:	Up to 38,000 horsepower
Maximum Operating Pressure:	500 psig
Internal Filtration:	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)
Fuel Feedback Signal [from Fuel Control Valve]:	4-20 mA (Standard)
Power Input:	19-30 Vdc (1.0 Amp Maximum)
Electrical Interface:	26pin Canon Connector (Class I Division 2) 3/4" Ridged Conduit, 84" Pigtail Wires
Communication Interface:	RS485 Serial Port
Housing Materials:	- 6061-T6 Anodized Aluminum - Stainless Steel - Seals: Viton®, Alfas (Sour Gas Service)
Wetted Materials:	Stainless Steel, Carbon Steel, Anodized Aluminum, Viton® Seals, Nitrile Seals
Flanges:	2" SAE Series 61, 4-Bolt Flange
Dimensions:	15.8”L x 8.7”H x 5.8”W
Approximate Weights:	48.3 pounds
Certifications:	ATEX, PED and CSA Approved

Theory of Operation (Why it works so well)

The fuel control for a gas turbine engine must include a method of safely starting the engine. The gas producer compresses the inlet air and causes the air to flow through the combustor to the turbine section. The fuel must be metered in the correct proportions to maintain a certain fuel to air ratio. This ratio determines the temperature of the gases of combustion entering the turbine section. If the temperature of these combustion gases is too high, the backpressure may cause the engine to stall or surge. If the temperature is even higher, it may cause heat damage to the turbine exhaust section of the engine.

Overview

The AGV10 is designed to be used with natural gas industrial gas turbines from 500 to 6000 horsepower (250Kw to 4.47 Mw).

The AGV50 is designed to be used with natural gas industrial gas turbines from 500 to 38,000 horsepower (250Kw to 28.34 Mw).

The AGV10, AGV50 and AGV50 Pilot uses fuel gas supply (muscle) pressure Pg of at least 42 PSIG above that which is required to run the turbine. This excess muscle pressure is used to actuate the Poppet valve assembly. A small amount of fuel gas is ported through a differential pressure regulator to the pilot stage. The pilot stage converts the electrical signal from the internal computer to a proportional pressure value. This pressure is applied to the piston in the center section to stroke the valve to an open position. A large spring in the center section is used to spring load the valve into a closed position or state when no command signal is present.

The valve uses a PID closed control loop, with fuel gas flow being the feedback signal used to close the loop. Fuel supply pressure, Pg, is used for muscle; thus, the AGV10, AGV50 and AGV50 Pilot 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 ensure the adjustment made is correct.

The AGV10, AGV50 and AGV50 Pilot with the optional embedded Acceleration Schedule (control) generally receives a governor signal from the user's PLC engine Control System (or from the Black Boxes supplied with Solar relay Mark II Control Systems). The governor signal from the PLC turbine Control System is a 4 - 20 mA current loop.

The Mark II Control System utilizes a governor signal from the MFAC Main Fuel Actuator Control (one of the Black Boxes) and is a 0 - 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 25 mA), causing the amount of fuel to the engine to decrease. The governor control signal resides within the MFAC Black Box or PLC, not from within the AGV10, AGV50 and AGV50 Pilot valve computer.

Mechanical Valve Design

Unlike many of the valves used in competing control systems, the AGV10 is specifically designed for gas turbine engines using gas fuel. It is not a modified pressure regulator, a biasing restrictor, or a valve borrowed from a different market sector or manufacturer. The valve is completely designed by Continental Controls Corporation for specific turbine applications. 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 AGV10, AGV50 and AGV50 Pilot Fuel Control Valve.

Full Fuel Authority

The AGV10 a built-in computer that 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 AGV10, AGV50 and AGV50 Pilot is a high-speed, electromechanical, linear actuator that is used to drive the poppet. 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 flapper in the open direction. The actuator gives the valve unprecedented response to the ever-changing demands of the engine.

Pressure Sensors

Integrated pressure transducers constantly monitor the gas inlet (Pg), Orifice Inlet (Po), Control Pressure (Pc) and differential pressure Dp across the orifice. These pressure sensor signals are used by the valve's internal computer for flow measurement calculations and for diagnostic purpose.

Proportional Control Logic

The AGV10, AGV50 and AGV50 Pilot 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 AGV10, AGV50 and AGV50 Pilot uses control pressure (Pc) feedback. Pc is the pressure for force on the poppet actuator, which opens the valve for flow. 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 (1000 Hz).

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 (Position) control loop. This Outer Flow control loop is performed every ten (10) millisecond (100 Hz)

Control Demand Offset

The Control Demand Offset is the minimum output to the actuator coil while the valve is flowing. Actuator current is zero (0) when the valve is closed.

These current to the actuator produces enough force just to open the valve. The value of Control Demand Offset is in counts to the Digital-to-Analog converter (DAC).

Flow Adjustment Offset

The "Flow offset" is in standard cubic feet per minute (SCFM). Flow offset is used to calibrate the measured flow calculation. The measured flow is added to the flow offset. If the valve was to flow 10 SCFM low throughout the range of the valve, this error could be calibrated out by subtracting 10 from the flow offset. The calculation for correcting measured fuel flow is:

$$\omega f * \text{flow gain} / 100 + \text{flow offset}$$

Altitude Adjustment

The Altitude Adjustment is used to change the PO measurement from gauge pressure to an absolute pressure measurement. For best flow measurement accuracy, the altitude adjustment should be set to the altitude of the installation site. The factory default setting is sea level. The flow measurement alone is affected by this number, valve performance will otherwise remain unchanged.

Demand Gain

The Demand Gain is used to change the span of the flow demand signal. The same value can be used with any engine within the same horsepower class, i.e. A Solar Saturn calibrated valve would be changed to an ASE 8 valve by changing the demand gain. The demand gain is an inverse function, therefore higher gains result in smaller spans.

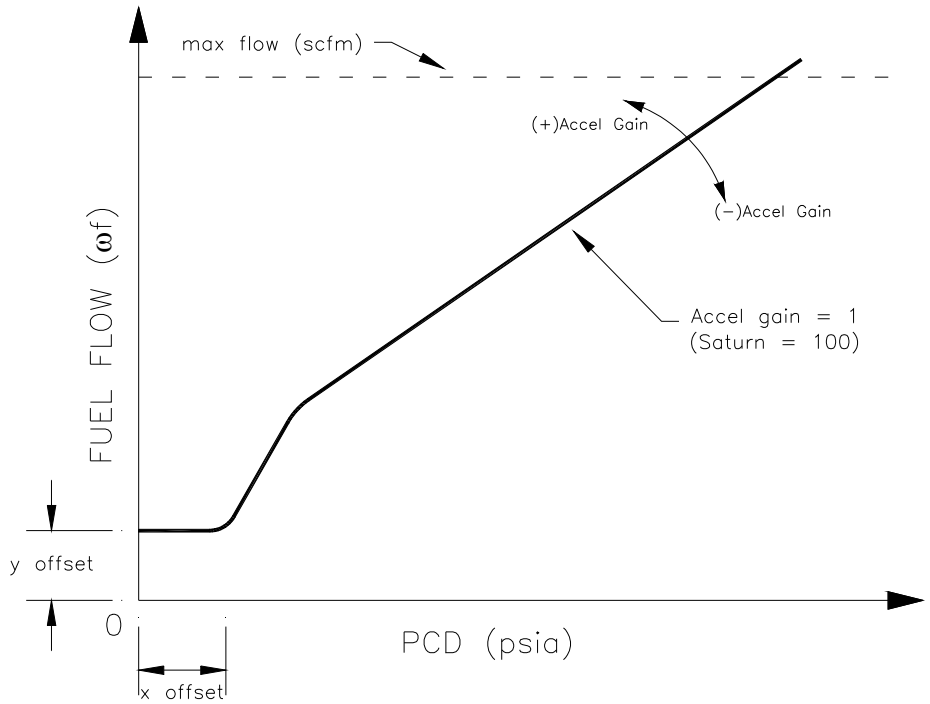
Transducer Offsets Pc, Pg, Po and Dp

Each of the transducer offsets equals what the transducer-offset equivalent was during factory testing.

This is the maximum value that the strain gauges can drift from the factory setting. If the gauge drifts beyond the gauge range, the valve computer assumes that the gauge is not functioning correctly and will not allow the valve to operate.

Acceleration Gain

The acceleration gain settings of the AGV10, AGV50 and AGV50 Pilot 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 [Y] Offset

By adjusting the Y 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 Y offset may cause the turbine to not start at all.

Acceleration [X] Offset

By adjusting the X offset of the acceleration schedule will have the effect of starting the acceleration schedule sooner / later based upon the PCD of the turbine.

Typical Calibration Values

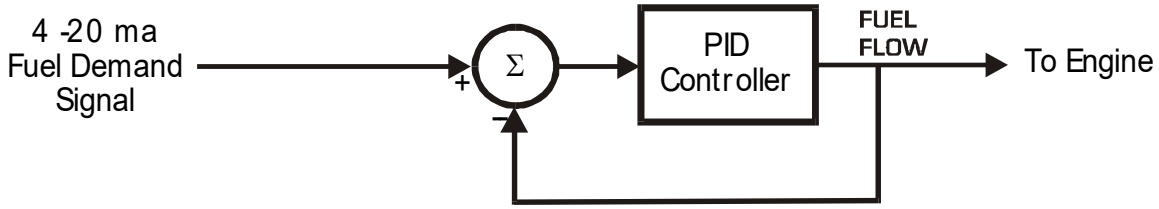
Below are the typical calibration values. These values can vary from engine to engine.

DESCRIPTION	TYPICAL	MINIMUM	MAXIMUM
Control Prop Gain	12	9	15
Control Intg. Gain	0	0	0
Control Intg is	OFF	Not Used	
Control Derv. Gain	0	0	0
Control Derv. is	OFF	Not Used	
Flow Prop Gain	17	10	40
Flow Intg. Gain	100	50	550
Flow Intg. is	ON	Not Used	
Flow Derv. Gain	0	0	0
Flow Derv. is	OFF	Not Used	
Cntrl Demand Offset	1100	800	1600
Flow Adjust	71	0	100
Flow Offset	-20	-70	50
Altitude Adjustment	300	100	500
Demand Gain	980	200	1225
PG Offset	270	150	300
PO Offset	270	150	300
DP Offset	250	150	300
PC Offset	270	150	300
Gauge Range	200	150	260

NOTE: "-" and "+" are always calibrated to the same value, i.e.
iProportional Gain - = 20
Proportional Gain + = 20

AGV10 <u>without</u> Acceleration Schedule

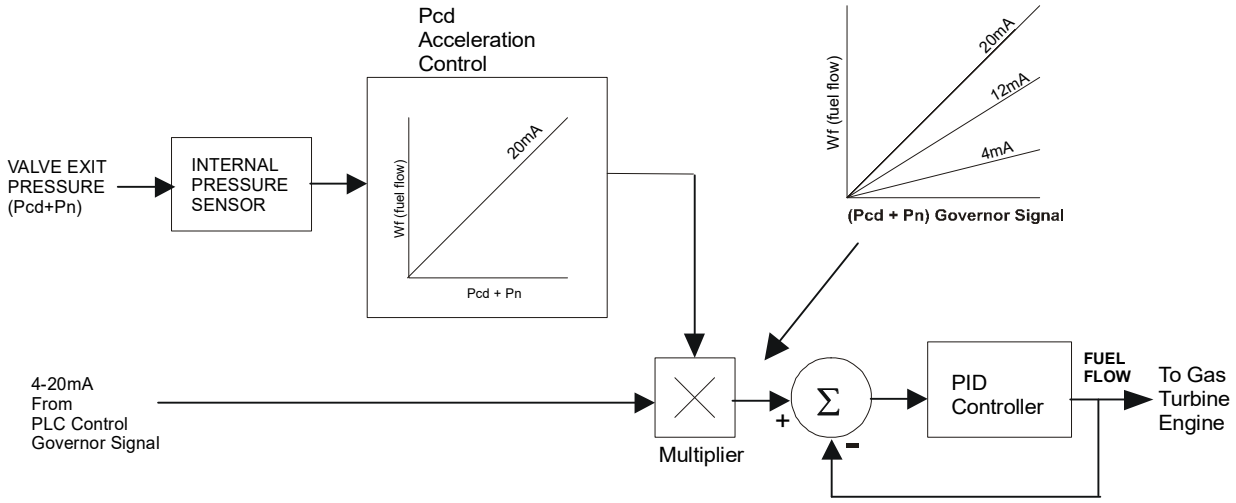
The AGV10, AGV50 and AGV50 Pilot Fuel Control Valve contains a computer that measures the analog input signals from the internal pressure sensors and the associated PLC. The function of the software configuration without the acceleration control is shown in the simplified diagram below.



The 4 to 20 mA signal from the PLC is a fuel demand signal. The AGV10, AGV50 and AGV50 Pilot 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.

AGV10 with Acceleration Schedule

The AGV10 and AGV50 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 with the Acceleration Control (Schedule) 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 (Governor signal) from the PLC.

The 4 - 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 (max). 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 AGV10's PID circuit in the "Temperature Control" loop. When the speed of the gas producer or the power turbine reaches 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. For example, 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 combustion flame will not blow out when the governor cuts the fuel back all the way.

The advantages of having the Acceleration Schedule built into the AGV10 and AGV50 fuel valve software are:

- **SAFETY** – The Control System cannot over-fuel the engine at any speed because the valve computer 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.
- **COMPRESSOR DEGRADATION COMPESATION** – 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 remains constant to maintain proper emissions.

Features of the AGV10 , AGV50 and AGV50 Pilot (What makes it better?)

Simplicity is the key of the AGV Fuel Control Valve. We recognize that if a system is too difficult to setup, install or use, all of the features in the world won't help.

The AGV10 is designed to be extremely easy to setup and use. At its simplest, the user will merely install the valve and they should be able to start and control their engine.

Range

If simplicity is the main feature of the AGV10, AGV50 and AGV50 Pilot a close second is operational **Range**. Because the AGV10, AGV50 and AGV50 Pilot is a true full authority smart fuel valve, the flow range of the AGV10, AGV50 and AGV50 Pilot is much greater than systems relying on a pressure regulator with a bypass valve or a restrictor stepper motor for fuel control.

Fully Automatic Control

The AGV10, AGV50 and AGV50 Pilot is fully automatic smart valve. This means that no matter what the operational changes are in the turbine engine, the AGV10, AGV50 and AGV50 Pilot will maintain accurate engine operation. There is no requirement to have an operator called out to reset the AGV10, AGV50 and AGV50 Pilot controller; these will be taken care of automatically.

Variable Dynamic Gain Logic

The AGV10, AGV50 and AGV50 Pilot 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 AGV10, AGV50 and AGV50 Pilot to control effectively at start, light loads or fully loaded.

Digital Communications

The Valve is RS485 Modbus compatible. Monitoring of sensors and fuel measurement is allowed from an external PLC Control System via Modbus communications. Laptop communication is also available through the use of our proprietary Valve Viewer software (also compatible with Solar's Valve Wizard software) for diagnostic and trouble shooting.

Installation Instructions

When installing the AGV10, AGV50 and AGV50 Pilot Fuel Control Valve, the possibility exists that welding slag or tubing cuttings, or other debris may foul the Poppet assembly if allowed to enter the AGV10, AGV50 and AGV50 Pilot. If this occurs, the AGV10, AGV50 and AGV50 Pilot may not function properly, due to the Poppet assembly being improperly seated. To this effect Continental Controls recommends that one (1) of two (2) types of safeties be installed to monitor the amount of fuel present in the engine during light off. The installation of these items provides a redundant safety measure, ensuring that there is no single point failure of the fuel system.

1. An installed pressure switch on the fuel manifold to detect over-fueling during ignition. The switch would be electrically connected in series with the Shut-off Valve solenoids. If the switch detects an unsafe condition, the fuel supply would be "cut-off" by the Shut-off valves (and the AGV10, AGV50 and AGV50 Pilot would cease operating).

2. Monitoring of the flow feedback signal (4 - 20mA) from the AGV10, AGV50 and AGV50 Pilot. When an unsafe condition during ignition is detected, the monitoring device (i.e. PLC) would abort the start in progress, close the fuel Shut-off solenoids and disable the igniter.

The Fuel Control Valve Dos and Don'ts

The AGV10, AGV50 and AGV50 Pilot 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. Do Not install the valve in such a manner that will trap gas pressure within the downstream side of the valve.

2. Always provide an adequate supply pressure for the application.

3. Where the gas is extremely sour, dirty, or has liquid suspension, install a separate pilot gas supply with an external filter. An air purge option is also available for the AGV10, AGV50 and AGV50 Pilot.

4. Always provide good filtration to the AGV10, AGV50 and AGV50 Pilot. Dirty fuel would cause the valve not to work properly and could damage the internal components.
5. Supply the valve with 24Vdc with 1 amp at the valve. Using small gauge wire may cause a large voltage drop resulting in an inadequate power at the valve.
6. Avoid ground loops when connecting the AGV10, AGV50 and AGV50 Pilot.
7. The flow demand signal on the AGV10, AGV50 and AGV50 Pilot is **NOT** loop powered**.**
8. Never install valve wires within the same conduit as items such as igniter wires or large solenoid wires.
9. 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.
10. Never paint the valve.
11. Do not install the valve in such a manner where condensate may build up inside the electronics housing.

Safety Warning

The AGV10, AGV50 and AGV50 Pilot Fuel Control Valve is to meter gas fuel only and should not be used as a main fuel system Shut-off valve. A separate fuel Shut-off valve must be installed UPSTREAM of the AGV10, AGV50 and AGV50 Pilot.

Pre-Installation Inspections

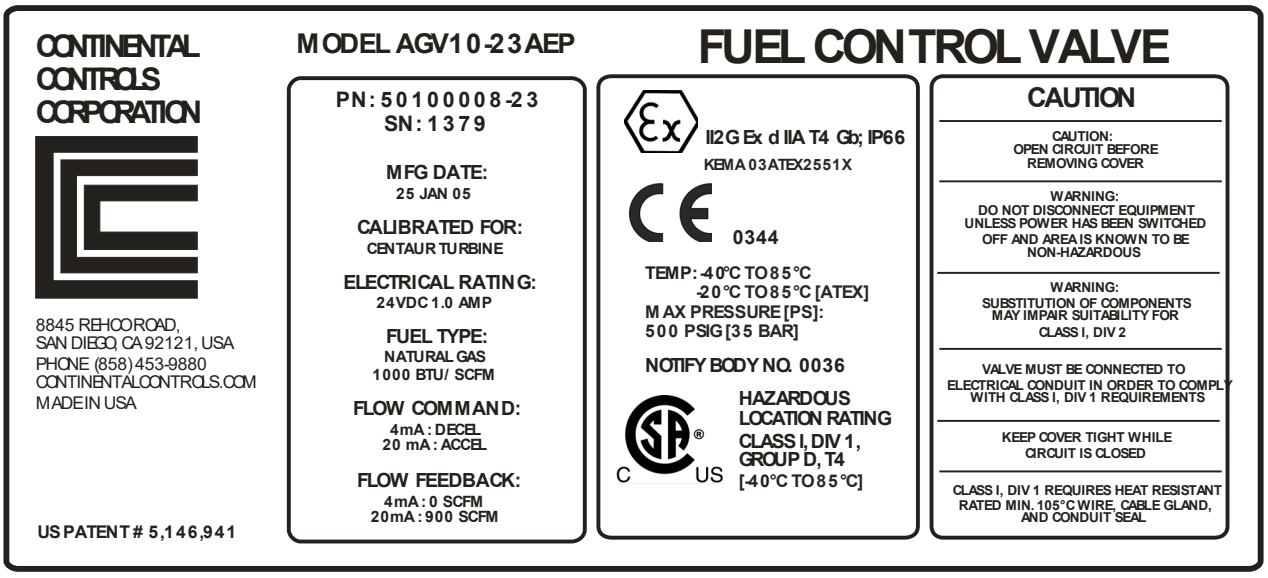
The AGV10, AGV50 and AGV50 Pilot Fuel Control Valve should be inspected immediately after unpacking. Check for any damage that may have occurred during shipping. If there are any questions regarding the physical integrity of the valve, call Continental Controls immediately.

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.

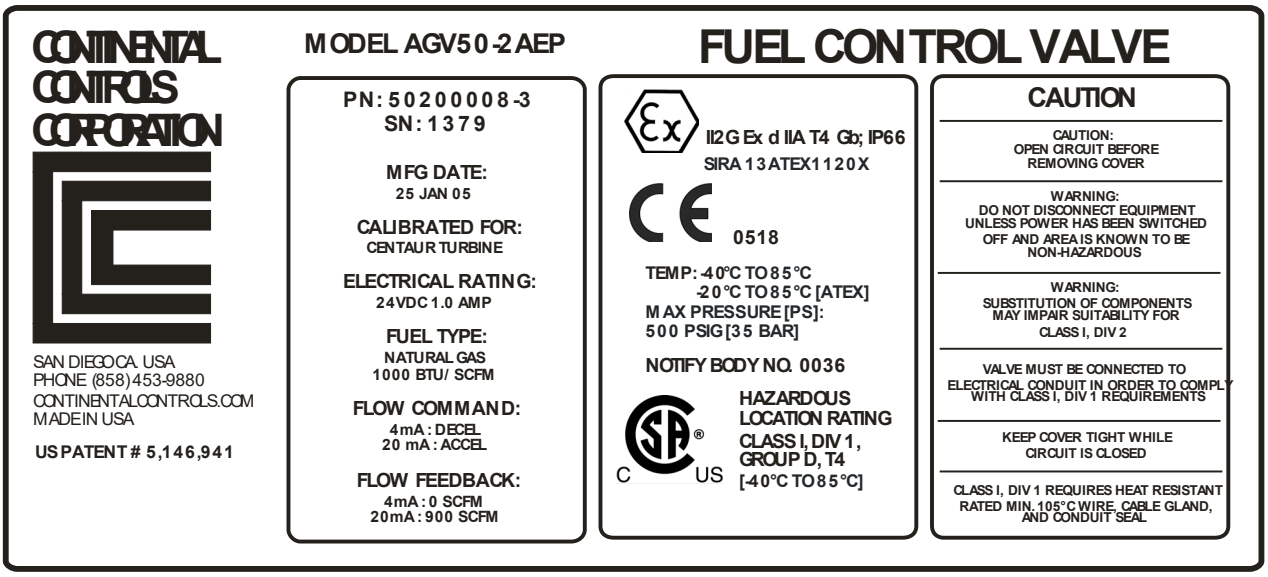
Ensure that the AGV10, AGV50 and AGV50 Pilot received matches the model number and configuration of the fuel valve to the packing list and if possible, to the purchase order. The top plate of the AGV10, AGV50 and AGV50 Pilot contains information pertinent to that particular valve, i.e. embedded acceleration schedule.

The AGV10 is the designation of all small, configured valves from Continental Controls. The dash number (i.e. AGV10-1) denotes the engine that the valve has been configured and calibrated for. Some examples are shown below:

-1	Saturn Engine	Solar Turbines Inc
-3	Centaur Engine	Solar Turbines Inc
-6	Centaur H Engine	Solar Turbines Inc



AGV50 and AGV50 Pilot:



Different configurations for the valve are available for other engine types manufactured by most other engine manufacturers.

The optional features included in the valve are denoted by a single letter designation. A list of optional features is shown below:

A Embedded Acceleration Schedule

C Control signal is 0 - 50 mA. (Control Input is 4 - 20 mA unless denoted otherwise.)

D Control Signal is 0 - 200 mA

E The valve's electrical connections are by conduit entry (with seal) and therefore the valve is explosion-proof and approved for use within Class I, Div I hazardous areas as defined by the appropriate electrical code.

F 2" ANSI 300lbs, 8-bolt flange

M RS-485 serial communications

N The valve is NACE compliant for use in sour gas service

P The valve is configured for use with an external filter on the pilot gas inlet

S 2' SAE 4-bolt (Series 61) flange

T Extended temperature service

If the valve information matches correctly, then it is the appropriate fuel-metering valve for your engine application.

General Considerations

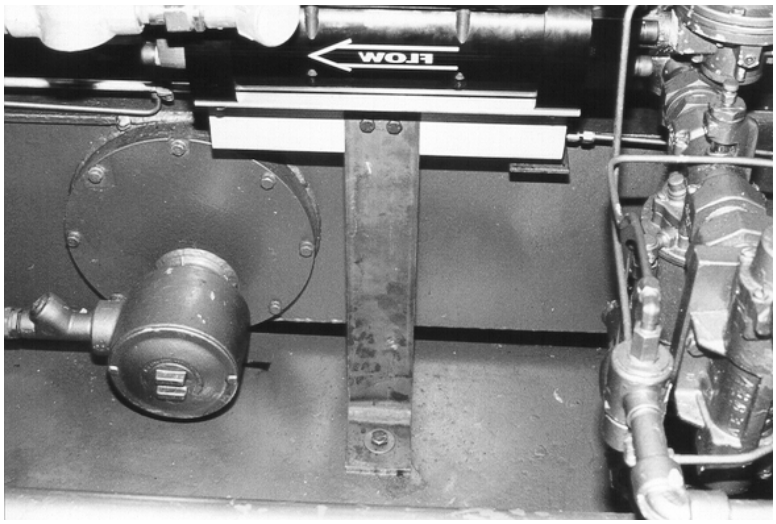
When considering where to place the AGV10, AGV50 and AGV50 Pilot Fuel Control Valve it is recommended that several issues be kept in mind.

- The valve should be located away from any extreme sources of heat. Operating ambient temperature is –40°C to +85°C [–20°C to +85°C for ATEX]. Temperatures higher than this will require special precautions from the manufacturer. However, if the temperature of the fuel gas is < 85°C, this will act as a heat sink and the valve may then be mounted in extreme temperature environments.

- Supply gas temperature will not have an effect on the flow of fuel through the acceptable operating temperature range of the valve (see above). If the fuel gas temperature is anticipated to exceed 85°C, the fuel valve will need to be modified by the manufacturer.

- Pressure variation in the fuel supply does not affect the gas flow through the valve, providing that the pressure does not drop below the minimum required for that fuel flow.

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 debris(?)(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.

Installation Locations

Typically, the AGV10, AGV50 and AGV50 Pilot Fuel Control Valve is mounted in a horizontal position, below the turbine engine. Ideally, the installation will allow for at least 10 pipe diameters of straight pipe (15" for 1.5" piping) on the downstream side of the valve. This helps to ensure a consistent and smooth airflow through the metering orifice, providing a more accurate fuel flow measurement.

However, straight runs of piping to and from the valve are not necessary, though some performance degradation in flow meter accuracy will result. Re-calibrations can be done to increase the accuracy of the flow meter once the valve has been installed. Note the procedure (from Dave)

Mounting the AGV10, AGV50 and AGV50 Pilot Fuel Control Valve

The AGV10, AGV50 and AGV50 Pilot may also be mounted in a vertical position with no loss of performance.

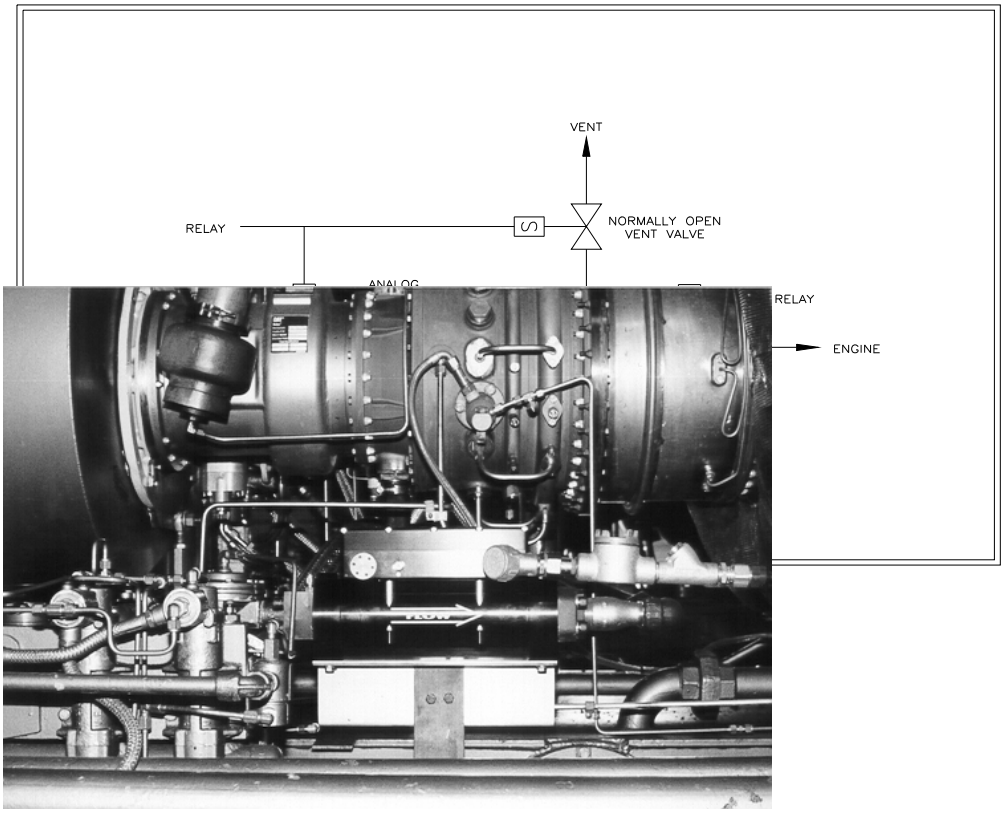
The valve is normally mounted and supported via the 4 or 8 bolt flanges, or the optional mounting plate (P/N XXXXX). Threaded holes (5/16”-18) are provided on the bottom of the valve that can be used for securing the unit to a flat surface.

The AGV10 is normally supplied with SAE 61 Series 4-bolt flange faces for 1 1/2” piping. The AGV50 and AGV50 Pilot is normally supplied with SAE 61 Series 4-bolt Flanges face seal for 2” piping. As an option, ANSI 8-bolt, class 300 flanges for 2” pipe (Option F) or SAE 61 series 4-bolt flanges also for 2” pipe (Option S) are available for the AGV10.

Before installing the gas lines to the AGV10, AGV50 and AGV50 Pilot, ensure that all electrical components are OFF and that the main fuel line is “shut in” and blocked.

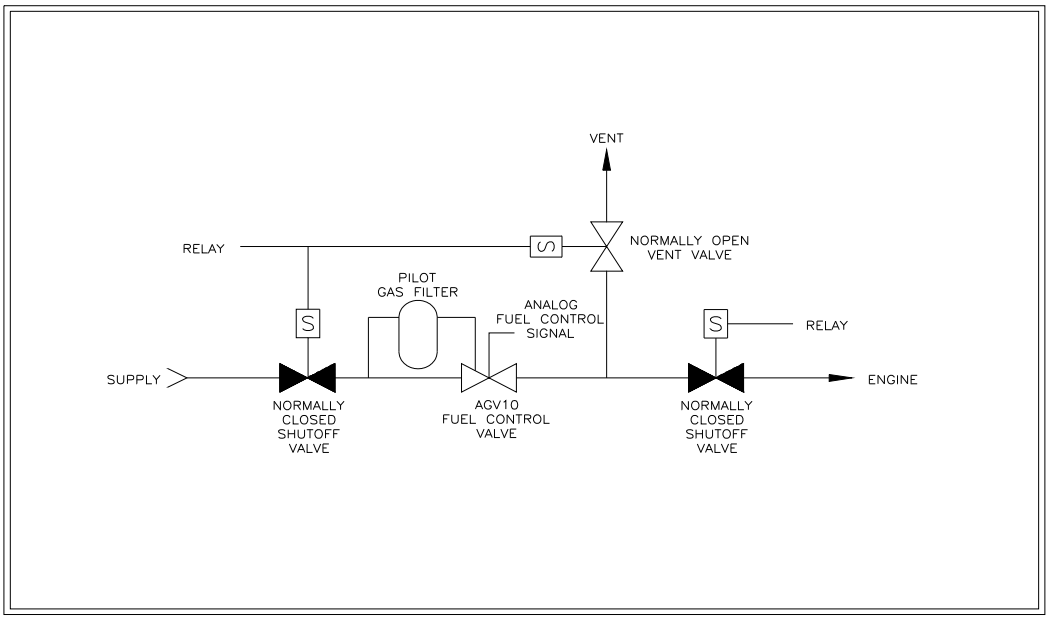
Standard Installation:

This type of installation is preferred and is good for dual-fuel applications.



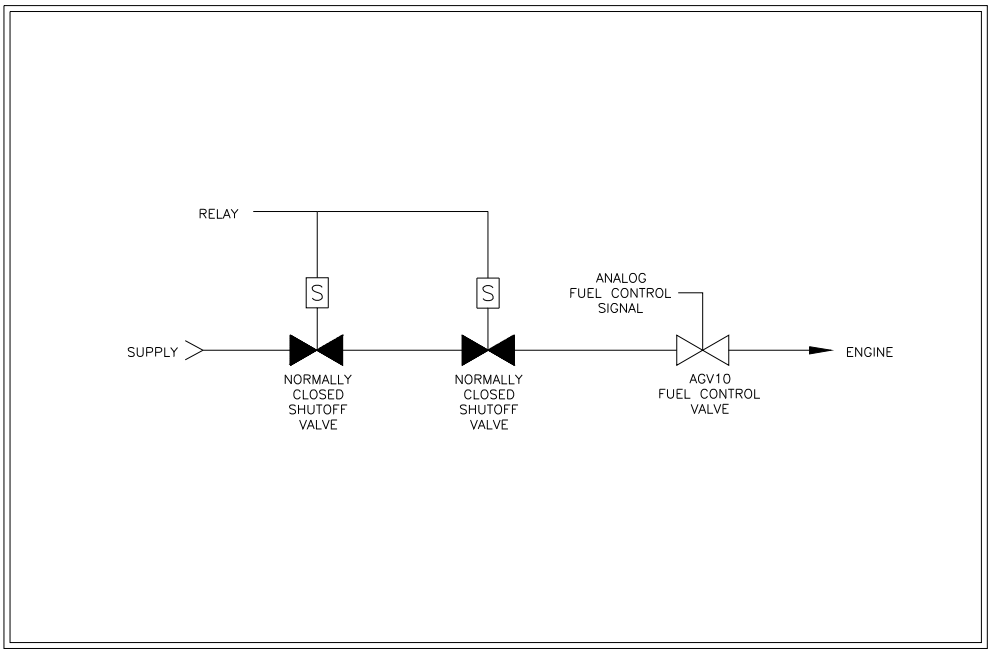
Standard Installation with Filter:

This type of installation is preferred and is good for dual-fuel applications.



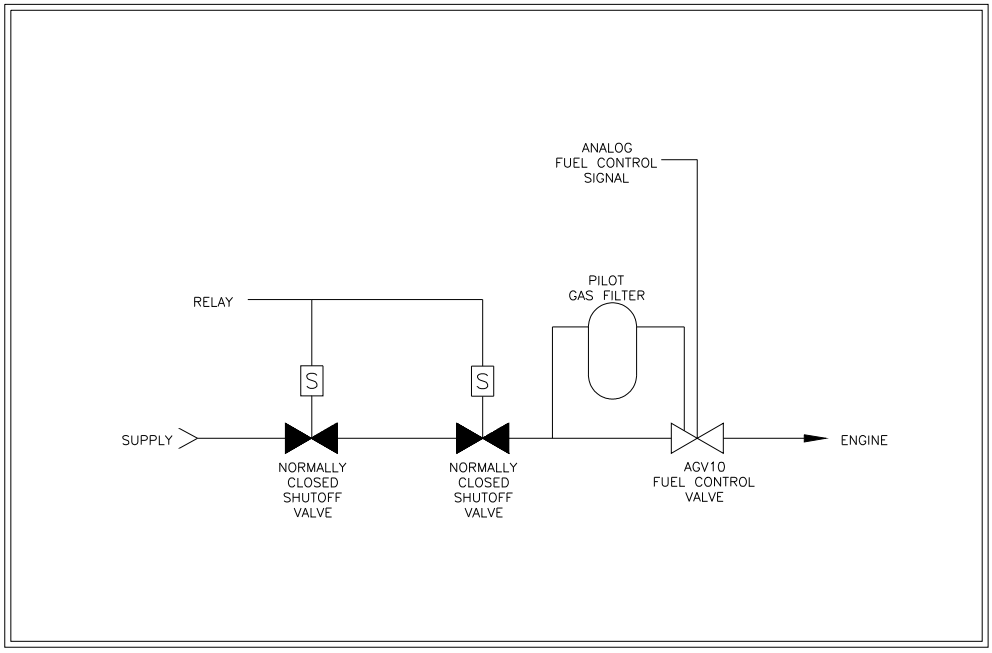
Standard Non-Vent Installation:

The non-vent installation is not capable of dual-fuel operation.



Standard Non-Vent Installation with Filter:

The non-vent installation is not capable of dual-fuel operations.



Electrical Connections

The following section applies to the electrical requirements of the installation of the AGV10 Fuel Control Valve. All efforts should be made to conform to the applicable electrical code concerning hazardous environment installations.

When installing the AGV10, AGV50 and AGv50 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 AGV10, AGV50 and AGV50 Pilot 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 AGV10, AGV50 and AGV50 Pilot.

Power Supply

To power the AGV10, AGV50 and AGV50 Pilot Fuel Control Valve, +19 - 32Vdc is required from the station instrumentation power (+24VDC typical). The AGV10 electronics are electrically isolated, but if excessive voltage noise (AC ripple) is found, it may be filtered out using a

Capacitor (300mF – 1000mF at 50 vdc is suggested). The capacitor should be placed at the source of the noise (i.e. igniter) the power wires from the AGV10, AGV50 and AGV50 Pilot valve are:

- White - +24VDC
- Grey - 24VDC common

THESE WIRES ARE THE ONLY CONNECTIONS TO ANY VOLTAGE SOURCE.

Connecting the Control Signal to / from the AGV10, AGV50 and AGV50 Pilot

The AGV10, AGV50 and AGV50 Pilot may be ordered with any of several fuel demand input signals (4-20mA and 0-50mA are the most common). **Current to the AGV10, AGV50 and AGV50 Pilot fuel demand input must never exceed the maximum of the calibrated range.**

The fuel demand signal and the flow feedback signal from the AGV10, AGV50 and AGV50 Pilot Fuel Control Valve are non-isolated signals. If both of these signals are being connected to a source with the same ground (i.e. the same PLC), no problem is usually encountered using direct connections.

However, if any other devices are connected in the demand or feedback circuits, or if demand and feedback are connected to different devices, care must be exercised not to create potential ground loops. An example of one such installation that is common is using an external electronic governor on generator sets. Even if the external devices are powered from the same source, the internal circuitry of the external devices may cause a ground potential difference. Different ground voltage potentials in the demand or feedback circuits will cause ground loops to the AGV10, AGV50 and AGV50 Pilot. Ground loops will “zero shift” the AGV10’s, AGV50’s and AGV50’ Pilot electrical components and may cause the valve to start erratic behavior and possibly damage the valve circuitry.

To avoid ground loops when the demand and feedback signals are wired to different devices, or when external devices are too be added to either circuit, it is recommended that signal isolators be installed in the feedback wiring.

Most, if not all, signal isolators have significant time delays between their input and output. These delays can cause problems if the isolators are wired into the fuel demand signal. Please contact Continental Controls before installing any device that may add signal delays in the fuel demand signal.

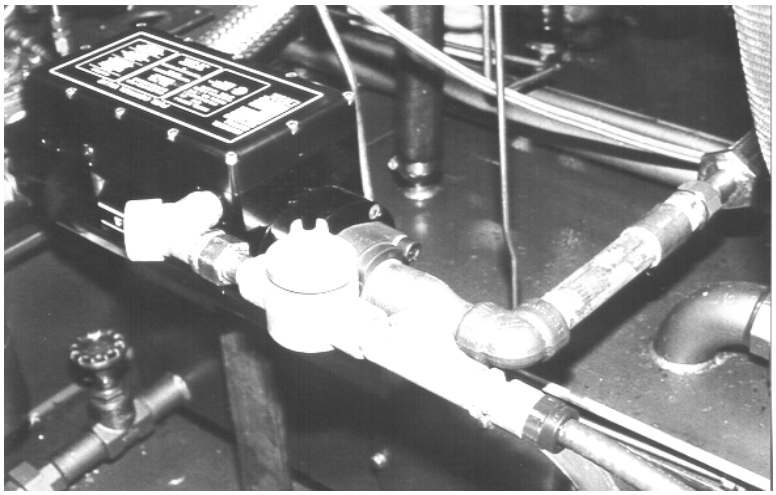
Connecting to Non-Isolated 4-20 mA Valve Input (Demand Signal)

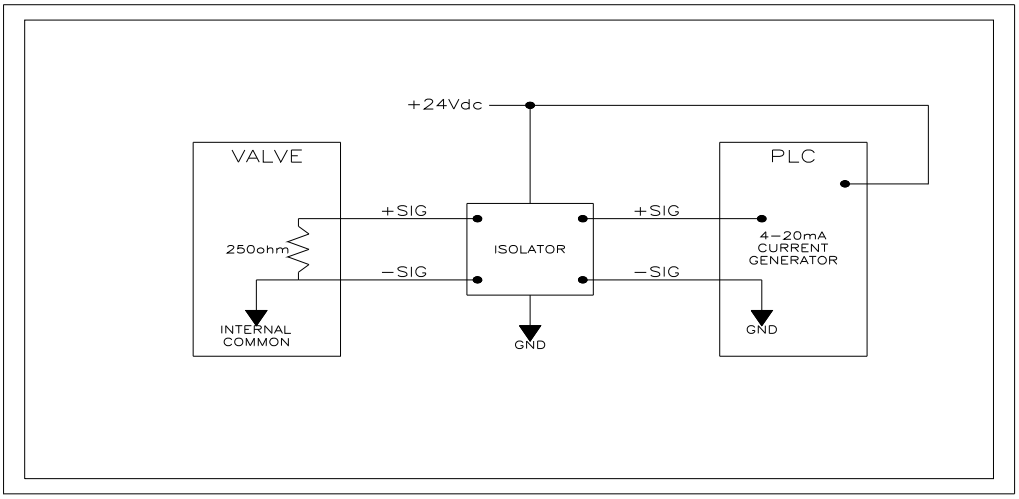
Within the valve, the return side of the 4-20mA signal is connected to the ground plane of the circuit board. Therefore, it is important to understand the common of the original signal.

If the 4 -20 mA source is isolated, the valve inputs may be connected directly. If the source is not isolated, an additional isolator should be used to protect the valve circuit board from ground loops. Shown below is the recommended setup.

The wires for the demand signal as they leave the valve are:

- Blue – 4 to 20mA signal
- Blue/White – 4 to 20mA signal return





Connecting to Non-Isolated 4-20 mA Valve output (Flow FDBK)

The non-isolated 4-20 mA output from the valve is self-powered. If power is applied to these pins, the valve circuit board components will be damaged.

The AGV10, AGV50 and AGV50 Pilot is capable of driving 5Vdc (20mA, 250ohm) to a non-isolated analog input of a control device (i.e. PLC) through the conduit connection mentioned above. Otherwise, it is recommended that isolators be bused to avoid potential ground loop problems. Shown below is the recommended setup.

Installation with MFAC Boxes (Solar Mark II Control Systems)

This option is for Solar Turbine customers only with Saturn and Centaur engine installations dating pre-1985.

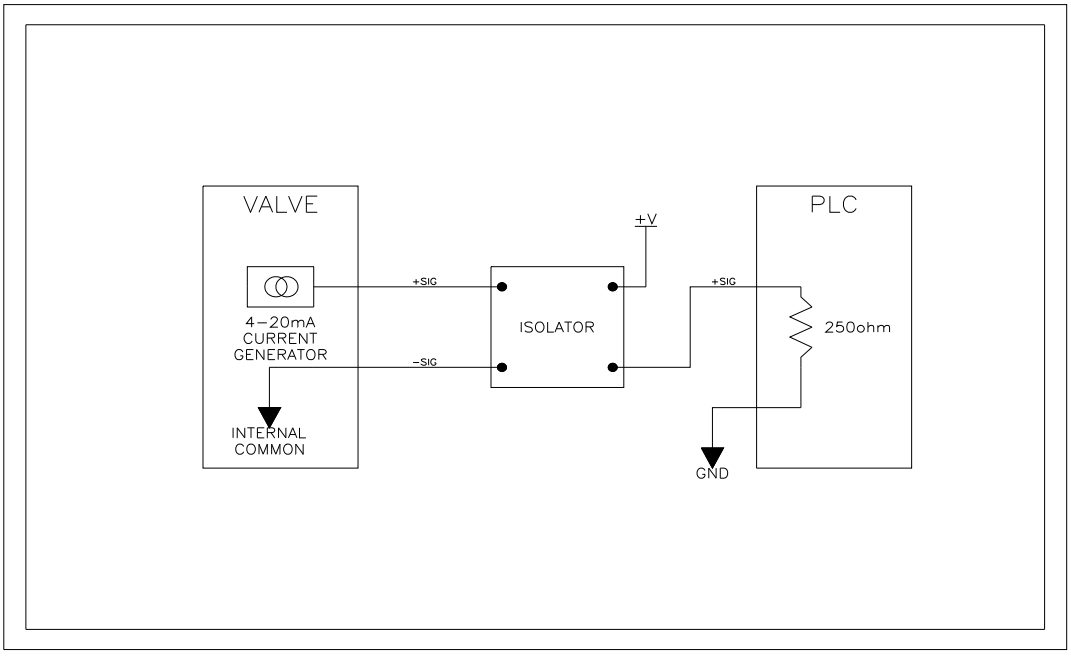
A schematic showing the wiring connection between the black boxes and the AGV10, AGV50 and AGV50 Pilot Fuel Control Valve is shown below.

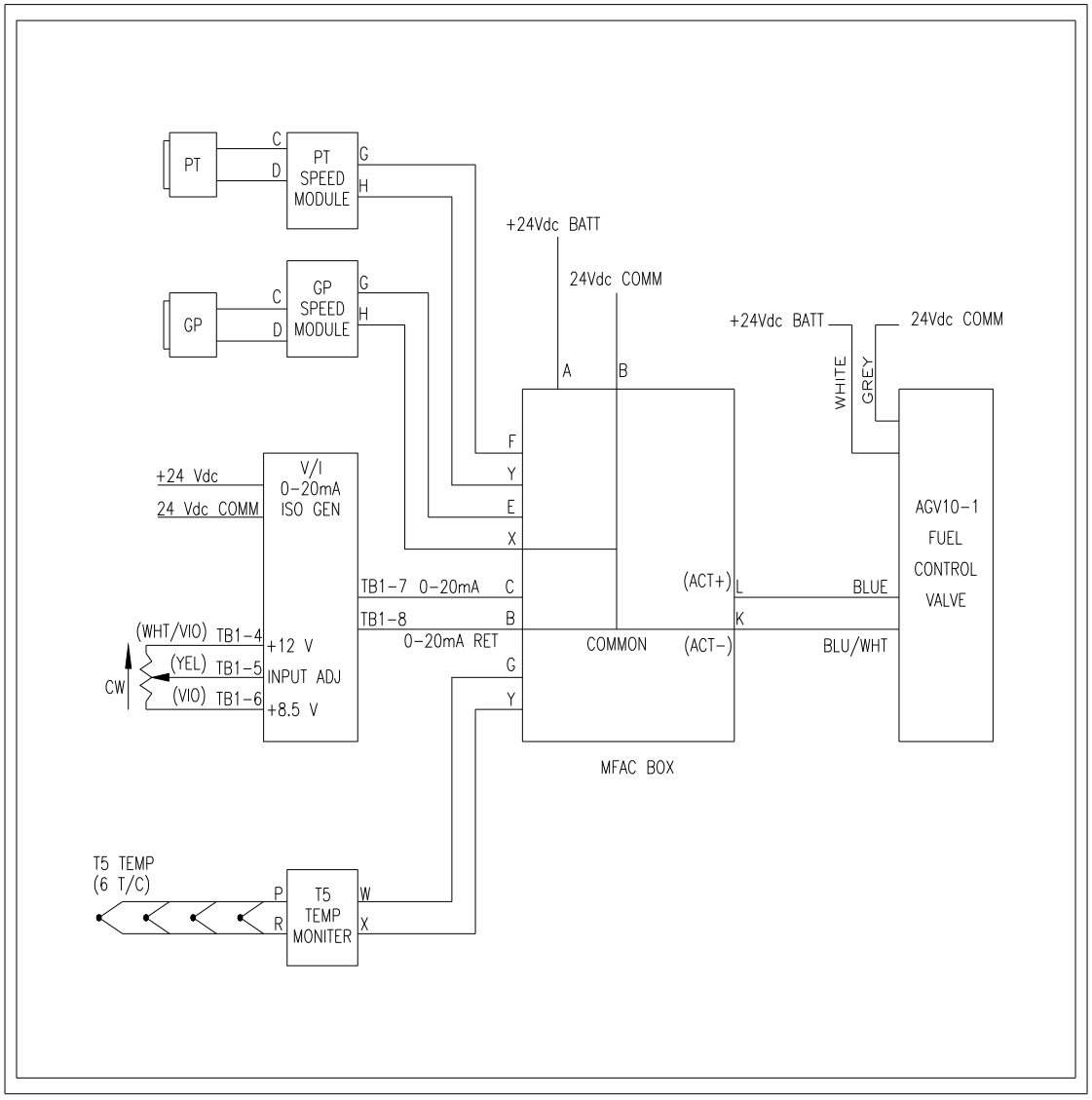
The only wiring changes that are necessary are:The two (2) wires that connected to the HR Textron (Ladeen) actuator would be removed and connected to the AGV10, AGV50 and AGV50 Pilot Fuel Control Valve. The battery +24Vdc and its return wire (24Vdc common) would be connected to the AGV10, AGV50 and AGV50 Pilot.

Speed Monitors - the analog output signals from the GP and the PT speed monitors should be 4.167Vdc when the input frequency from the magnetic pickup is correct for 100% speed. These signals connect to the MFAC box as shown.

Temperature Monitors - the Temperature Monitor input is from the T5 or T7 thermocouple harness. The analog signal output from the Temperature Monitor is set for 0-5.0Vdc and is adjustable based upon Solar specifications of individual engine types. The Temperature Monitor is based upon a 300° per volt output and will not require adjustment.

Main Fuel Actuator Control (MFAC) – the MFAC Box may require adjustment. It should be calibrated in accordance with Solar Service P/N108649-__ for that specific engine type/application.

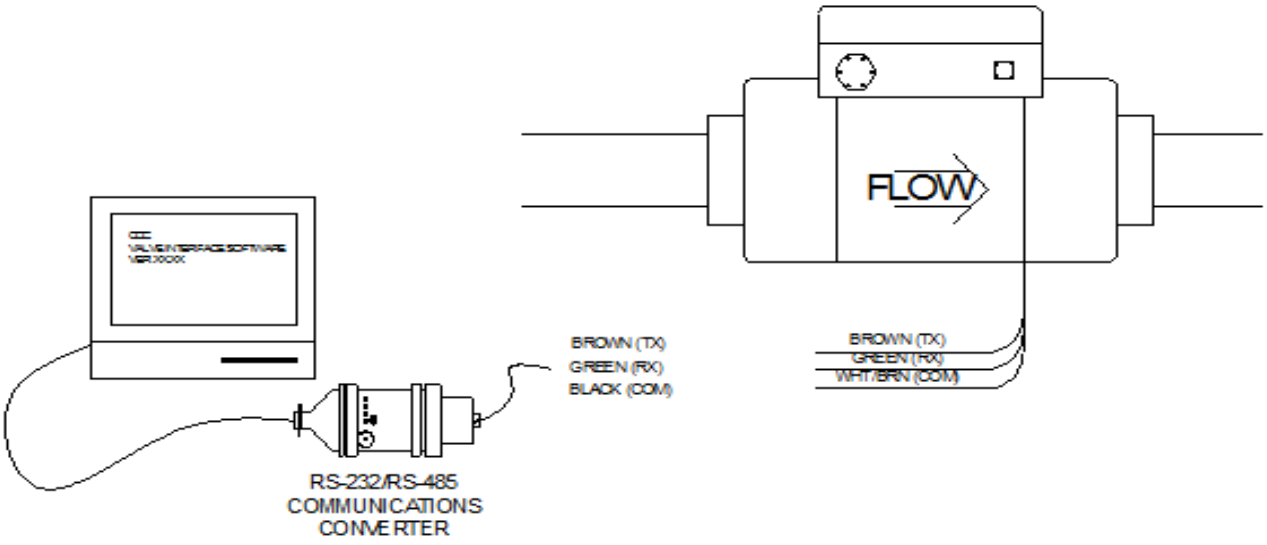




CAUTION: There are several models of the solar turbines with different T5, T7 operating temperature ranges. It is the user's responsibility to be sure the MFAC is adjusted properly to limit the temperature to a safe value for that respective engine.

Communication Setup Instructions

The following instruction is for assistance on setting up the communication link between customer's PC/laptop and the AGV10. The AGV10, AGV50 and AGV50 Pilot Fuel Control Valve uses RS-485 communications protocol. Most laptop computers use an RS-232 serial protocol from their respective communications ports. An RS-232/RS-485 protocol converter must be used to communicate with the AGV10, AGV50 and AGV50 Pilot. A converter and cable is available from Continental Controls (part no. 50109059).

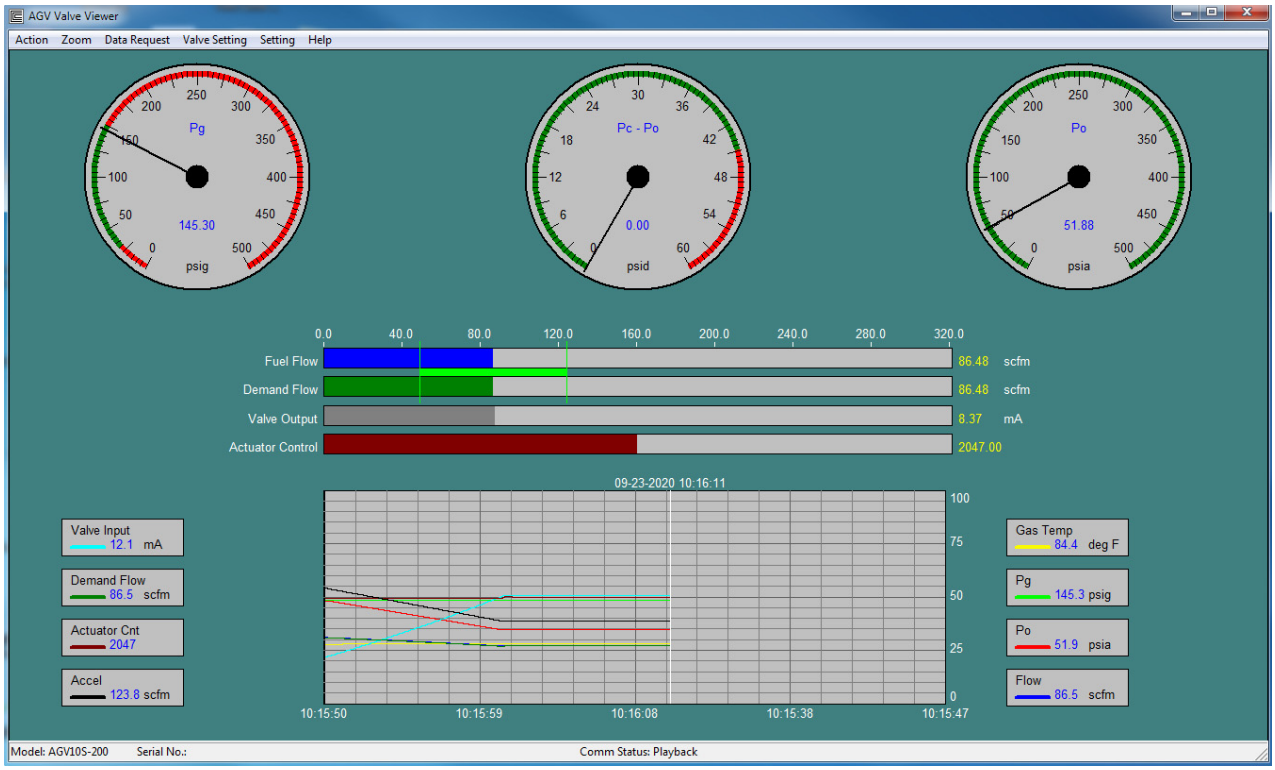


Valve Interface Software – "Valve Viewer"

AGV Valve Viewer is a Microsoft Windows OS (Operating System) based application used to interface the AGV Fuel Control Valve.

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

AGV Valve Viewer is an intuitive software tool which offers an array of features like setup of all user-definable set-points in AGV, monitoring key data points, optional data logging, playback of history files, exporting data to Excel, and other.



Establishing Communications with Valve

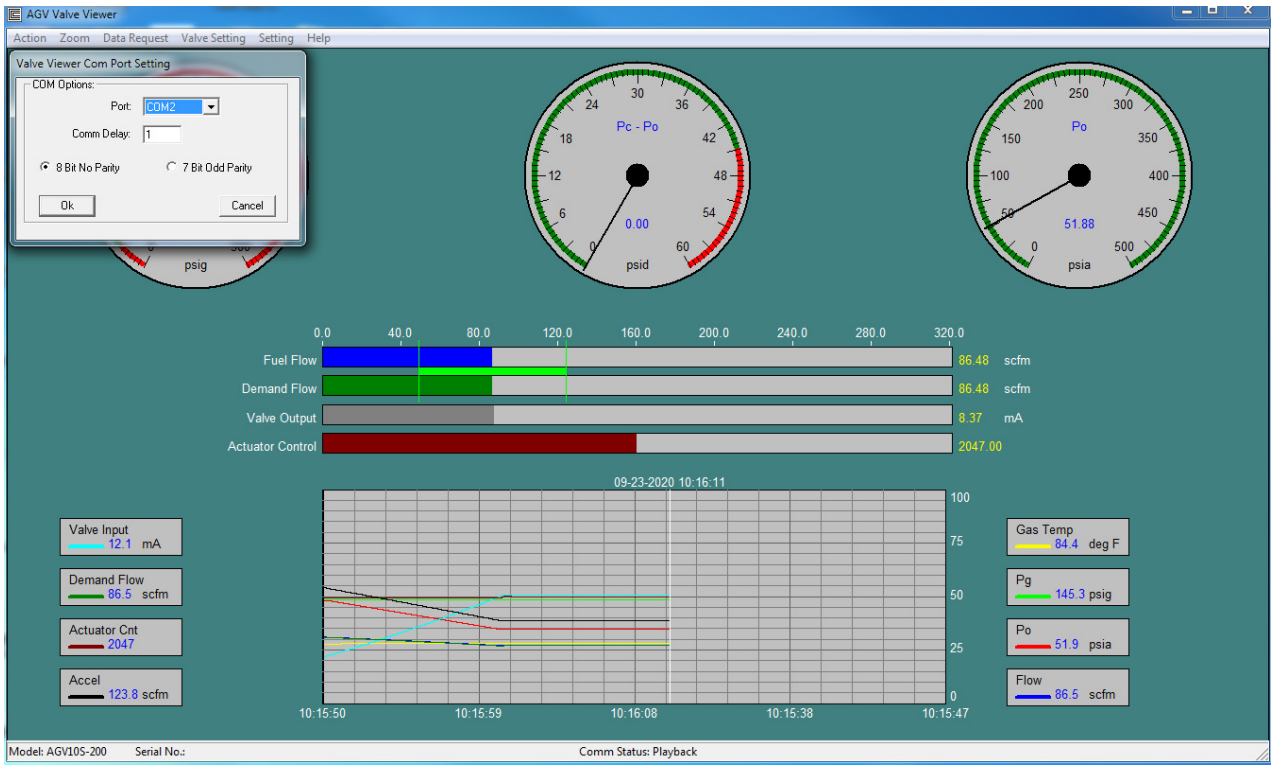
Main Menu -> Setting -> Comm Port Setting

AGV Valve Viewer automatically establishes communications with AGV fuel control valve using default communication port **COM 1**. If needed, a different communication port could be specified.

Communication setup guide:

1. Go to Setting -> Comm Port Setting.
2. Communication Port dialog box should open up.
3. Enter communication port.
   Note: Ports COM1 through COM4 are supported.
4. Press OK to apply changes and close dialog box.

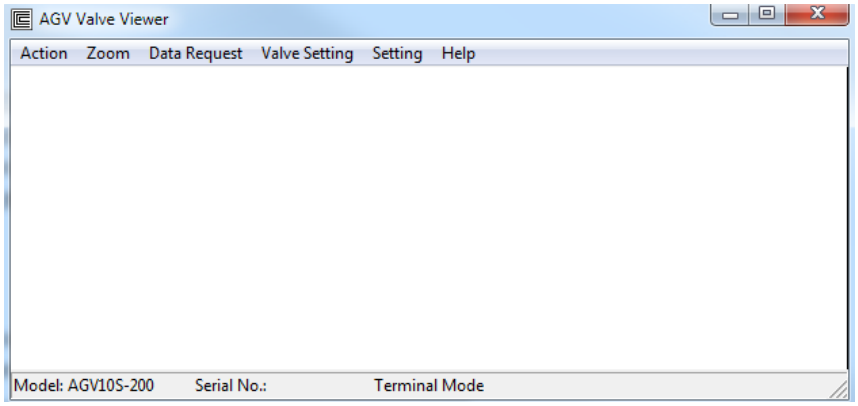
AGV Valve Viewer will apply new settings to establish communications with AGV valve.



Note:
If valve communication does not immediately start, power to the valve may have to be cycled (on/off). Before doing this, start the AGV Valve Viewer program and have the appropriate connections made.

Main Menu -> Data Request -> Valve Comm

This menu option allows to establish terminal mode link with AGV valve via serial connection. Upon selection the white terminal window should be displayed.



The following is the list of available valve commands:

AGV Terms and Functions
WORD

These will give you a list of all words and symbols associated with the operation, testing, and programming code functions. Most of these are for programming use only and are not usable at the customer level.

REPORT

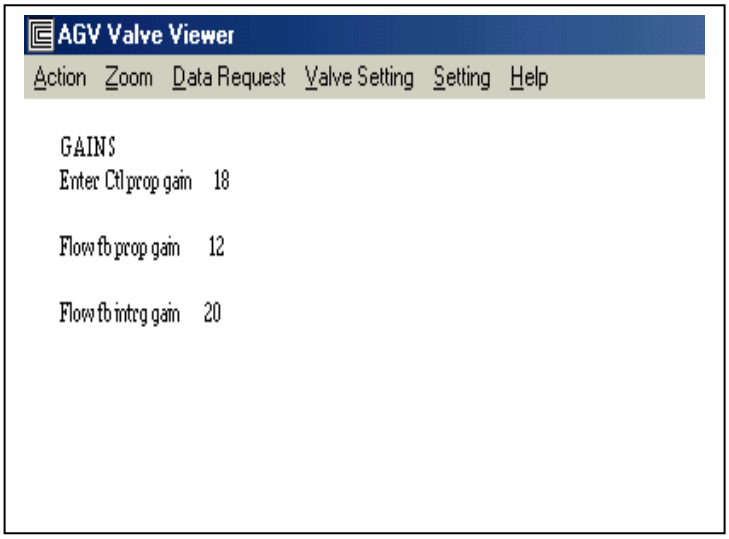
Provides a REPORT of Gains, Offsets and Adjustments accessible for the calibration of the valve. This information can be printed out directly from the screen by pressing the "Print Screen" button on your computer keyboard. ***This should be done first before valve operation or engine tuning***.

GAINS

This menu is used for setting the GAINS during the valve calibration process and is available to the customer for fine-tuning of the valve to match the installation.

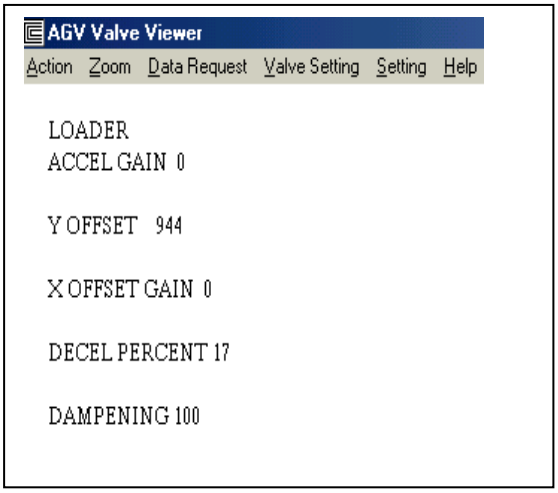
LOADER

The LOADER command works as the ACCEL command with the exception that it affects the embedded acceleration schedule specific to the engine type.



CHANGE-CALS

Normally used during the calibration process, this menu allows for setting the Acceleration parameters for the engine flow calculation adjustments, altitude, and original transducer settings.

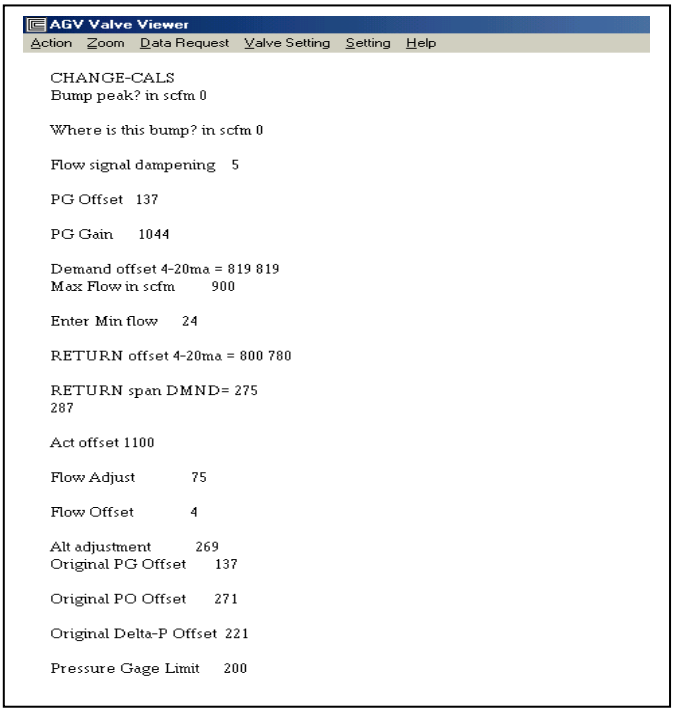


SET-ORG

This command sets the original transducer counts as the “zero” point after calibration and is used as the reference point for the program and to identify that the transducers are operating within tolerance. Tolerance being +/-200 computer counts from the “original” set point. Performing a SET-ORG function after a transducer malfunction will change the accuracy of the flow calibration across the entire range of the valve. **This should not be performed in the field unless the transducer counts are first verified to be approximately the same as the original counts through the READINGS command.**

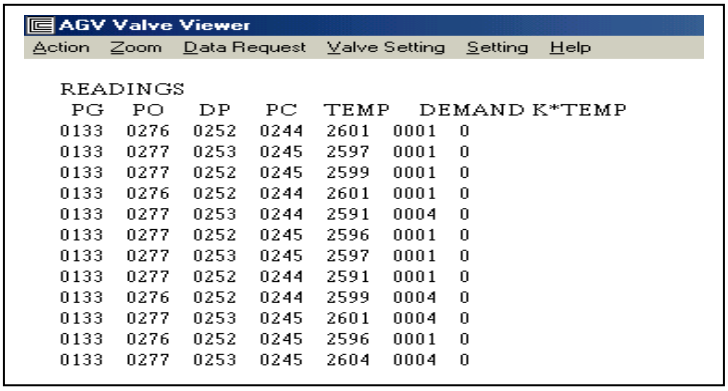
READING

This shows transducer computer counts in real time and can be done during valve operation to determine if transducers are reporting within allowable ranges. Maximum count values are 4095 and all readings should be less than 4095.



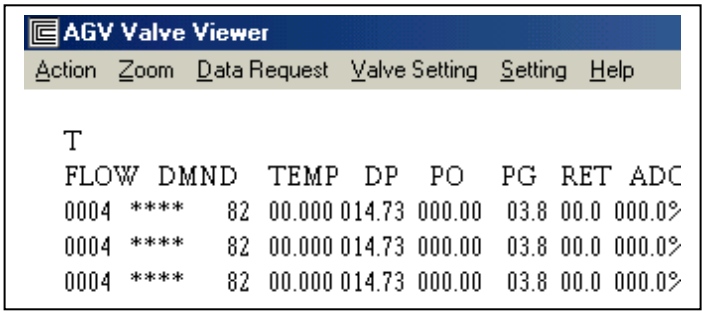
T Command

Allows for an extended report during the FLOW! Function. The more "T's" entered the longer the valve will flow at the requested rate.



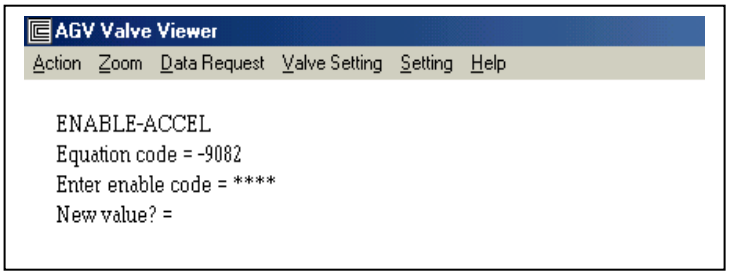
ENABLE-ACCEL Command

Allows operator to enable the embedded acceleration control but only if the have the proper equation code.



DISABLE-ACCEL Command

Allows operator to disable the embedded Acceleration Schedule (control) but only if they have the proper equation code (obtainable only from Continental Controls Corporation.)



Accessories and Options - Operation and Installation

The AGV10, AGV50 and AGV50 Pilot interface cable is a custom cable, which includes all necessary wires between the AGV10 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 Division 2 Hazardous environment applications.

Options:

The following options are available:

- **AGV10 with ¾" NPT Union Harness Assembly**: The AGV10 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 AGV10 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.
- **AGV10, AGV50 and AGV50 Pilot with 26-pin Connector**: This valve meets the CSA Requirements for Class I Division 2 applications. This valve uses a custom cable made for the AGV10, AGV50 and AGV50 Pilot. The cable is twisted paired shielded Class I Division 2 and the wires are color coded.
- **AGV10 Interface Cable**: The Interface cable will only work for AGV10, AGV50 and AGV50 Pilot 0 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 AGV10, AGV50 and AGV50 Pilot has been designed to operate reliably with a minimum amount of maintenance. To ensure optimum performance, periodic inspection and cleaning is necessary.

Preventative maintenance issues can be integrated into the current maintenance schedule of the turbine engine. Most maintenance requires little effort and no downtime of the AGV10, AGV50 and AGV50 Pilot valve.

Corrective maintenance is to be done when the AGV10, AGV50 and AGV50 Pilot Fuel Control Valve begins to behave erratically. Procedures have been generated to troubleshoot and to repair most minor issues. It is recommended that Continental Controls be informed whenever corrective maintenance is to be performed on the AGV10, AGV50 and AGV50 Pilot.

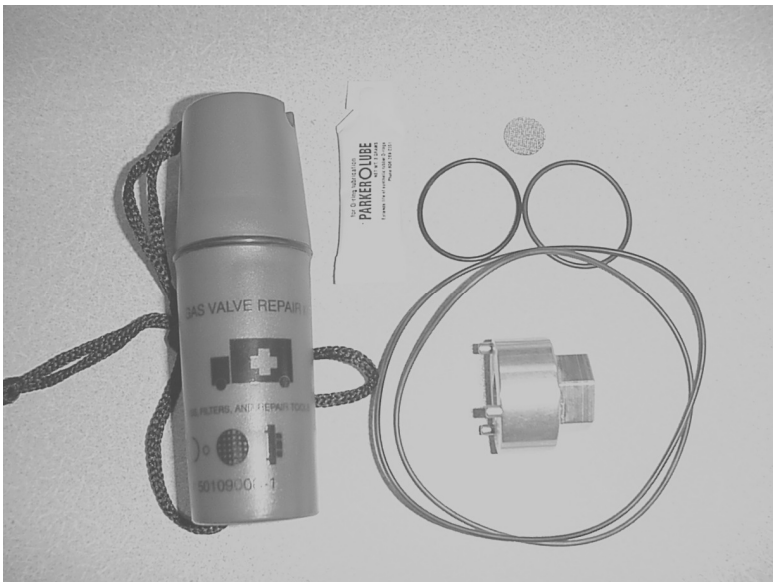
- **External Visual Inspection**
  Inspect the exterior of the valve for loose connections, frayed wires, or major structural damage.
- **Cleaning**
  Exterior cleaning will aid in the visual inspection of the external casing and ensure good connections. Ethyl alcohol or mild soapy water can be used 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, a maintenance log should be kept on the AGV10, AGV50 and AGV50 Pilot Fuel Control (metering) Valve.
- **Calibration**
  Flow calibration of the AGV10, AGV50 and AGV50 Pilot 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.
- **Pilot Gas Filter**
  The pilot gas filter, if installed should be changed every six (6) months or more frequently if operations if necessary. A replacement filter (part no. 50109169) may be ordered from Continental Controls. The filter is coalescing .01 micron filter with less than 3 psi drop at 15 scfm.

Corrective maintenance

The only corrective maintenance procedures that field personnel may be able to perform on the AGV10, AGV50 and AGV50 Pilot Fuel Control Valve are that of regulator and pilot filter cleaning/replacing and Poppet valve assembly removal. Any other actions taken on the AGV10 valve may cause physical damage or loss of calibration and would require that the valve be returned to Continental Controls for refitting or re-calibration

Regulator & Filter Cleaning or Replacement

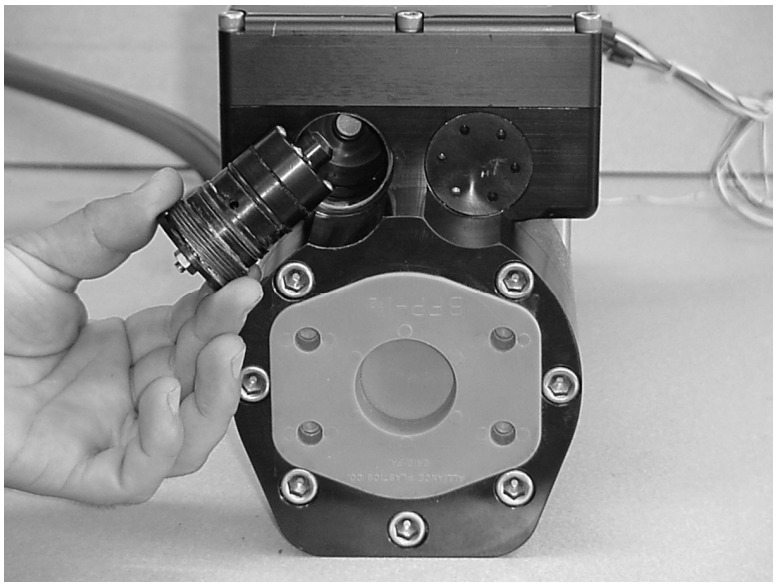
The following section will cover the replacement or cleaning of the Regulator assembly (part no. 50105008). Before starting it is recommended that a clean flat work surface be prepared and the proper tools available. It is also recommended that Valve Repair Kit (part no. 50109129) be purchased from Continental Controls. The kit contains items such as a spanner wrench, replacement O-rings, replacement filter and O-ring lube.



Procedure for the cleaning/replacing of pilot filter

1. Using the spanner wrench, apply pressure in a counter-clockwise motion and remove the regulator assembly.

2. **DO NOT** remove the regulator adjustment screw and nut. If these are removed, the correct regulator settings (42 psid) cannot be reset without returning the valve to Continental Controls for re-calibration.



3. Check to see that the regulator does not interfere with the end flanges. If there is no interference, continue to step 5. If there is interference, the inlet flanges need to be removed (step 4).
4. Remove the 7 cap screws holding the inlet flange on using a 5/16" Allen wrench. Remove the flange.
5. The filter O-ring (size 4470-200-012) and filter should now be visible.
6. Carefully remove the O-ring for later use. Inspect the O-ring for cuts and abrasions before reuse. If there is any physical damage to the O-ring, it is to be replaced.
7. If you have a replacement filter and DO NOT want to reuse the current filter, puncture the filter with a sharp object and remove it. Continue to step 11.

8. If the filter is to be reused, use a dental pick to carefully ease the filter out by its edges.
9. Backs flush the filter with Stoddard solvent or other cleaner.

10. Place the new or cleaned filter into the housing filter cavity coarse-side down.
11. Place the O-ring in front of the filter to fasten it. **When replacing or reusing an O-ring, the proper lubricant should be used at all times** (i.e. Dow Corning lubricant #55).
12. Tighten the regulator assembly using the spanner wrench in conjunction with a torque wrench (30 lb-ft of torque).
13. If the end flange had to be removed, place a small amount of O-ring grease on the flange O-ring and re-install.

AGV10 Poppet Valve Assembly Removal

The following will cover the removal of the Poppet valve assembly (center section) from the AGV10 Fuel Control Valve. Since the center section is not serviceable in the field, a replacement must be installed if on-site repairs are desired. These parts are included in the Valve Repair Kit (part no. 50109129) available from Continental Controls. In addition, replacement Poppet valve assemblies are sold separately.

Procedure for the removal of the Poppet valve assembly

1. Remove the AGV10 valve from the fuel line.

2. Remove the downstream flange, indicated by two (2) ridges, being careful not to cut the O-ring. If needed, tap the flange upward with a rubber mallet to ease removal.

3. Using a pair of snap ring pliers, remove the steel snap ring. Use eye protection as the snap ring can release out of the assembly unexpectedly.

4. Using the soft, rubber coated side of the snap ring pliers; pry out the orifice metering plate (DO NOT DAMAGE THE INNER EDGE IN ANY WAY).

5. Remove the upstream flange, being careful not to cut the O-ring. Again, tap the flange with a rubber hammer to ease removal.

6. Put a 2” diameter PVC pipe over the downstream portion of the center section. Using a rubber mallet, tap the PVC pipe until the center section is removed from the housing. Do not press or turn the Poppet itself.

7. Coat the O-rings (3) of the new center section with O-ring lubricant.

8. Insert the Poppet assembly into the valve body with the cone facing in the upstream direction.

9. Align the control pressure inlet of the Poppet assembly with the dowel insert of the control pressure transducer. NOTE: The cone of the assembly, which does not have a cap screw, is in line with the control pressure inlet of the assembly.

10. Click the center section in place by providing sufficient downward force on the center section cone. In the field, this can be done by CAREFULLY standing on the cone portion of the center section when it is oriented vertically.

11. Replace the upstream flange (it has two ridges). Tighten down the 7 cap screws (6 lb-ft torque each).

12. Apply O-ring lubricant to the orifice O-ring. Firmly press the orifice into the valve body at the downstream end. Ensure that the taper faces the downstream side of the valve.

13. Replace the snap ring.

14. Replace the downstream flange. Tighten down the 7 cap screws (6 lb-ft torque each).

15. Send the malfunction center section to Continental Controls for refitting.

Removal of Foreign Debris from Poppet Assembly

Occasionally some form of foreign debris will make its way into the metering housing and will become lodged inside. This will cause the AGV10 to malfunction in such ways as failure to shut-off (leakage) and incorrect transducer readings affecting valve accuracy. This debris may be removed by using station instrument air.

Procedure for removing foreign debris from the metering housing and Poppet assembly

1. Upon the removal of the Poppet assembly from the metering housing of the AGV10, inspect the housing for any internal damage that may have occurred.

2. Shop air can be used to blow away and clean any loose particles that may have accumulated. DO NOT use any hard-edged instrument to clean the valve housing.

3. Holding the center section in hand, apply instrument air to the Poppet assembly through the control pressure port (Pc).

4. The Poppet valve will open with 30 to 70 psi air applied. Do not exceed this range.

5. Using a soft edged device (i.e. Popsicle stick, Q-Tip, etc) hold open the Poppet valve. **Do NOT use any hard-edged instruments (i.e. screwdrivers) as this will damage the assembly** and concurrently require repairs made by Continental Controls.

6. Ensuring that the Poppet assembly is clear of debris, release the Poppet valve.

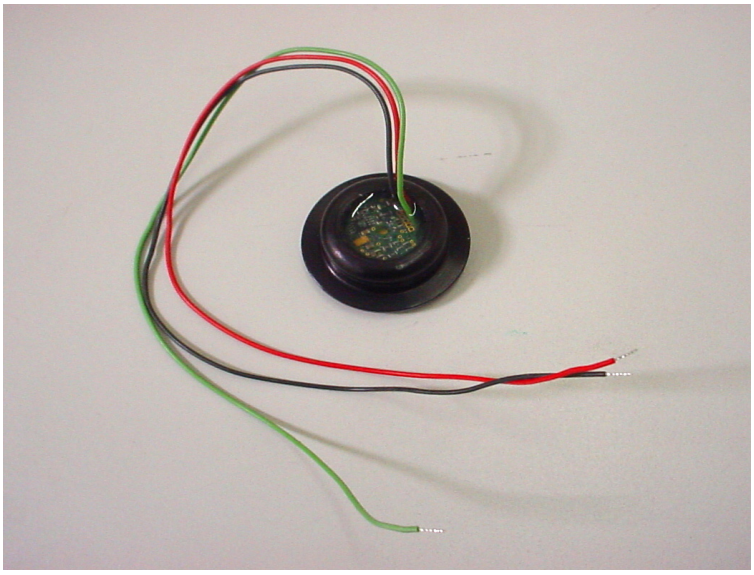
7. Re-lubricate the O-ring seals of the Poppet assembly and reinstall as instructed.

CAUTION: Due to the strong nature of the shutoff spring within the center section, DO NOT place your fingers near the Poppet valve if it is in an open position.

Replacement of Pressure Transducers Assembly

Replacement of the AGV10, AGV50 and AGV50 Pilot Fuel Gas Valve transducers can be done in the field under the direction of Continental Controls Corporation. The transducers that may be replace are the

- P(control) transducer
- P(offset) transducer
- P(supply) transducer



By replacing a transducer in the field, accuracy of the AGV10, AGV50 and AGV50 Pilot may be slightly affected due to the small variances in transducer parts.

1. Remove the electronics housing cover.
2. Examine and make notes of the AGV10, AGV50 and AGV50 Pilot electronic board assembly (i.e. wire placement and orientations).

3. Unclip the affected transducer from the electronics board and unscrew the board from the circuitry housing. **Do not remove more wires than necessary.**

4. Using snap ring pliers, remove the snap ring of the affected transducer.

5. With a small pry tool, remove the transducer from its housing.

6. **NOTE: There is an O-ring placed on the underside of the transducer. If this O-ring is damaged, it must be replaced properly.**

7. Insert the new transducer into the appropriate position, taking care to have the O-ring in place (within the cavity).

8. Re-insert the snap ring to hold the transducer in place.

9. Attach the wiring to the electronics board in the proper orientation. NOTE: The red wire of the harness is on the downstream side of the valve.

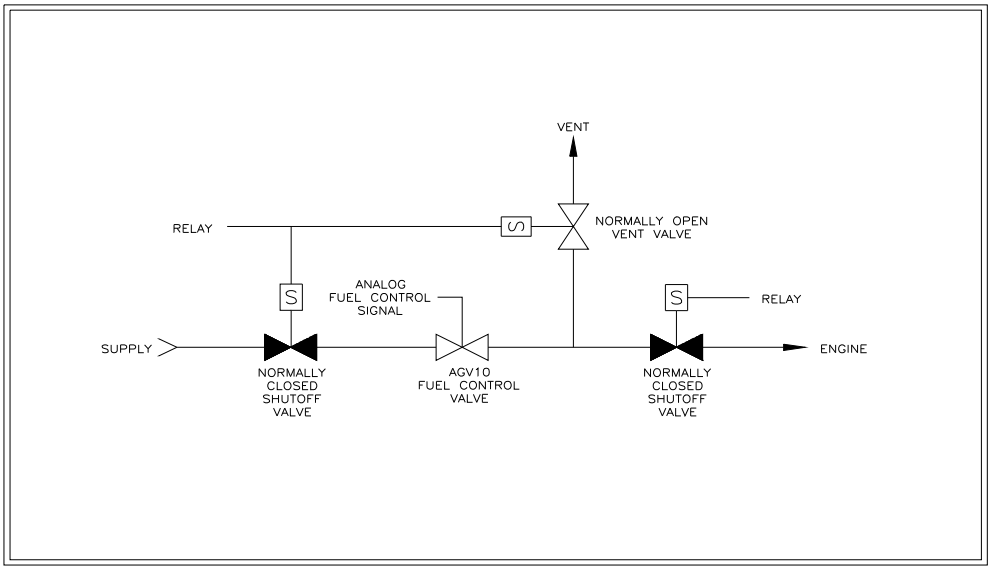
10. Re-assemble the electronics board to the electronics housing.

11. Install the electronics cover to the AGV10, AGV50 and AGV50 Pilot. Do NOT allow any wires to become pinched when placing the cover on. Re-tighten the cap screws to 40 in-lb torque. Max clearance between the cover and the housing is 0.0015”.

Fuel System Schematic

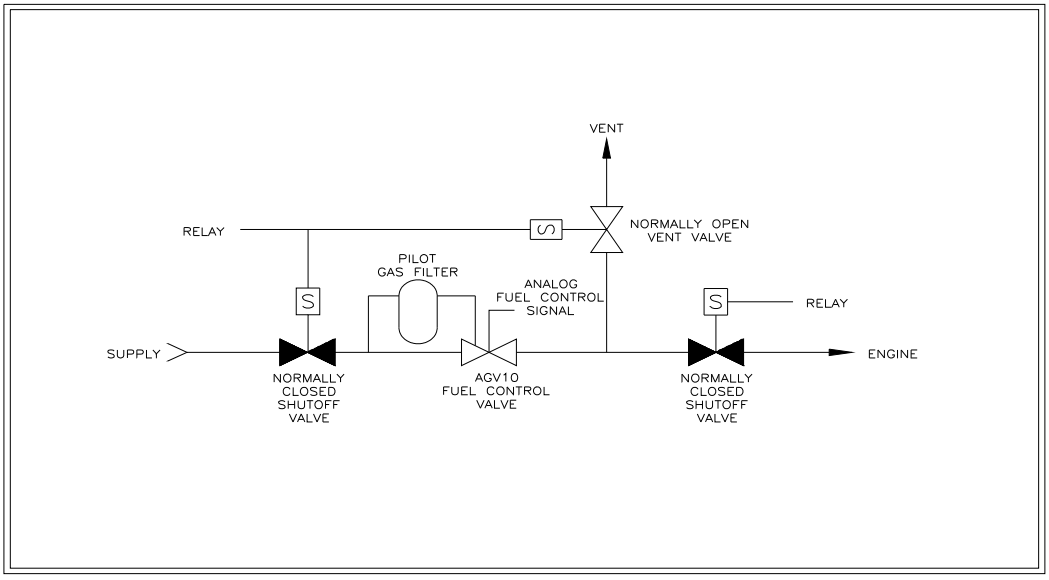
Standard Installation:

This type of installation is preferred and is good for dual-fuel applications.



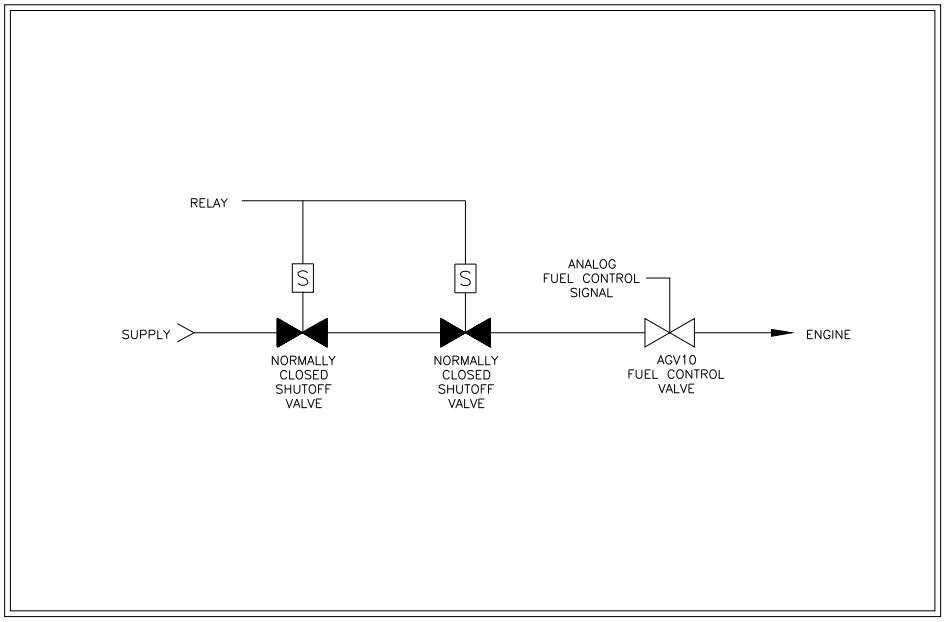
Standard Installation with Filter:

This type of installation is preferred and is good for dual-fuel applications.



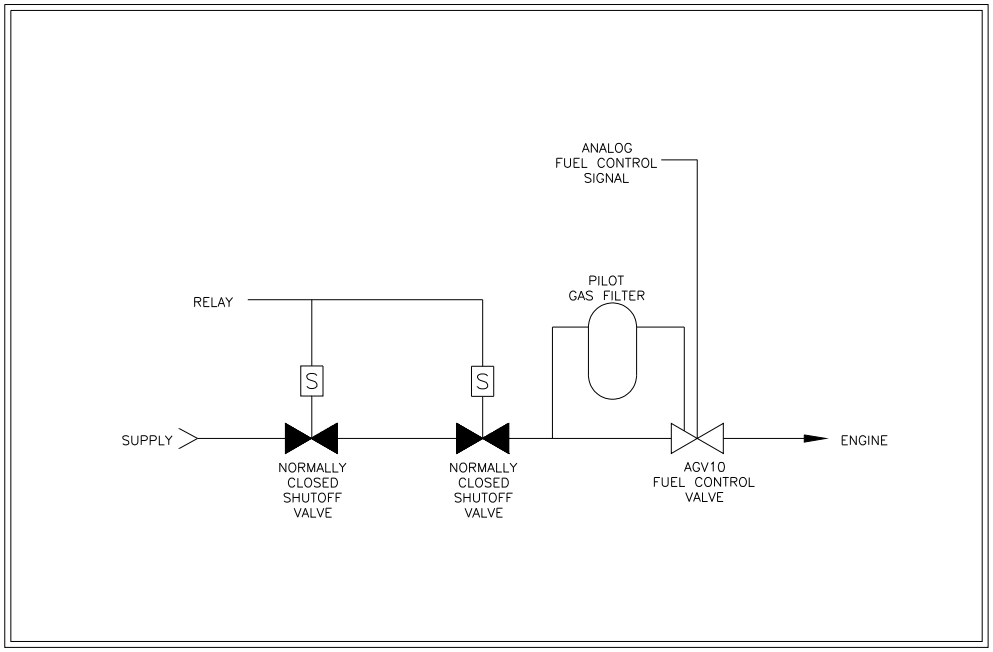
Standard Non-Vent Installation:

The non-vent installation is not capable of dual-fuel operation.



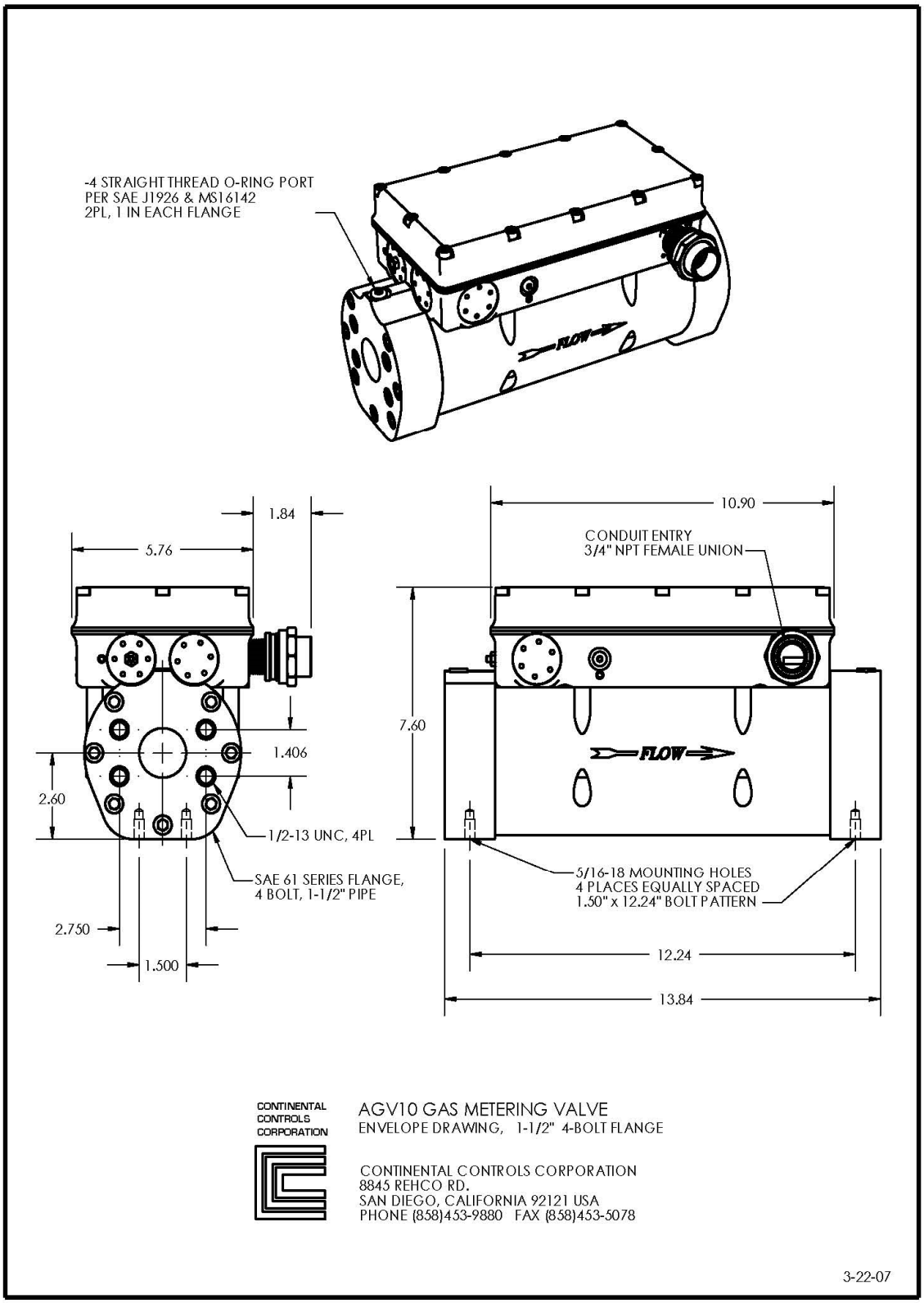
Standard Non-Vent Installation with Filter:

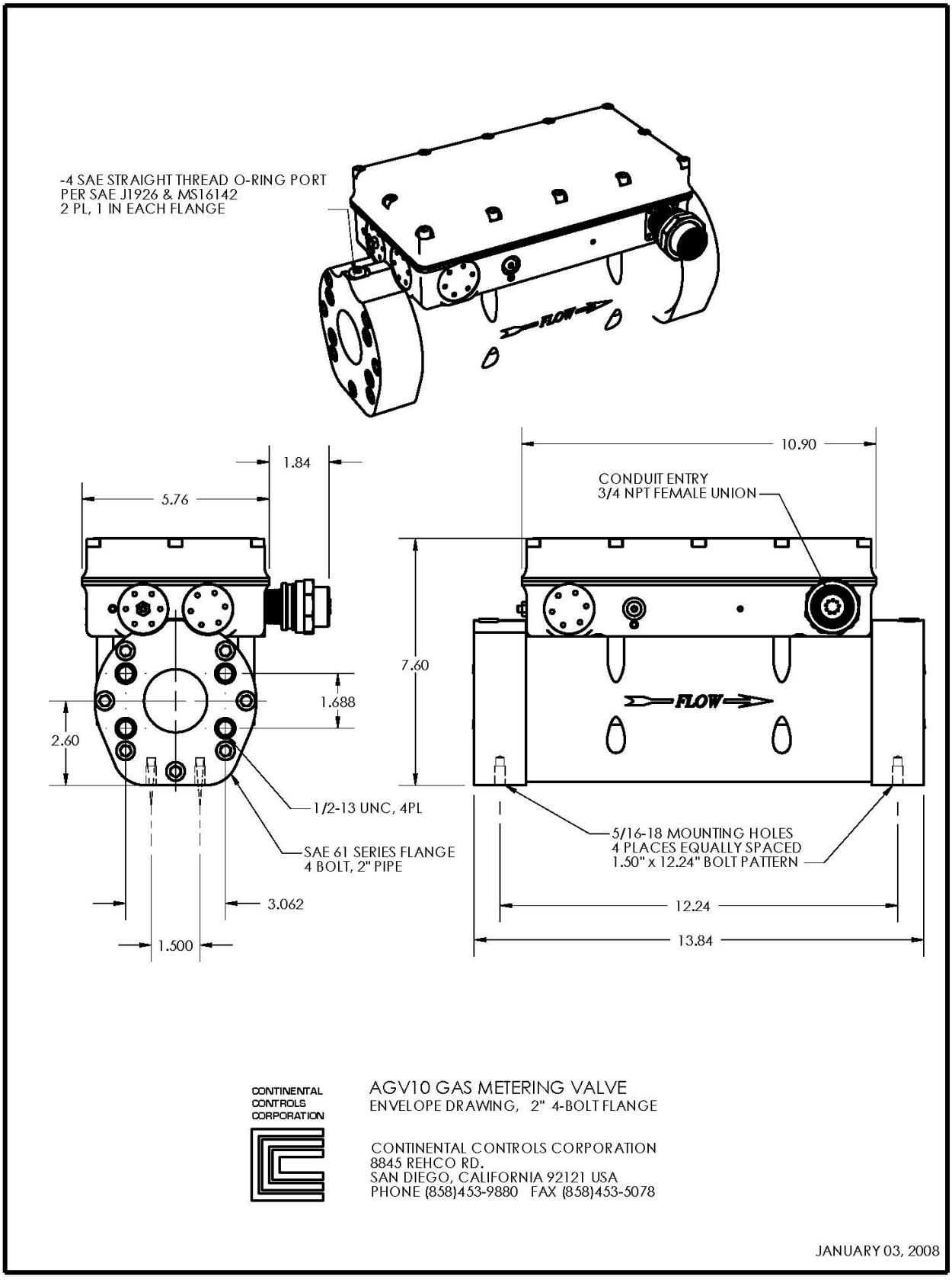
The non-vent installation is not capable of dual-fuel operations.

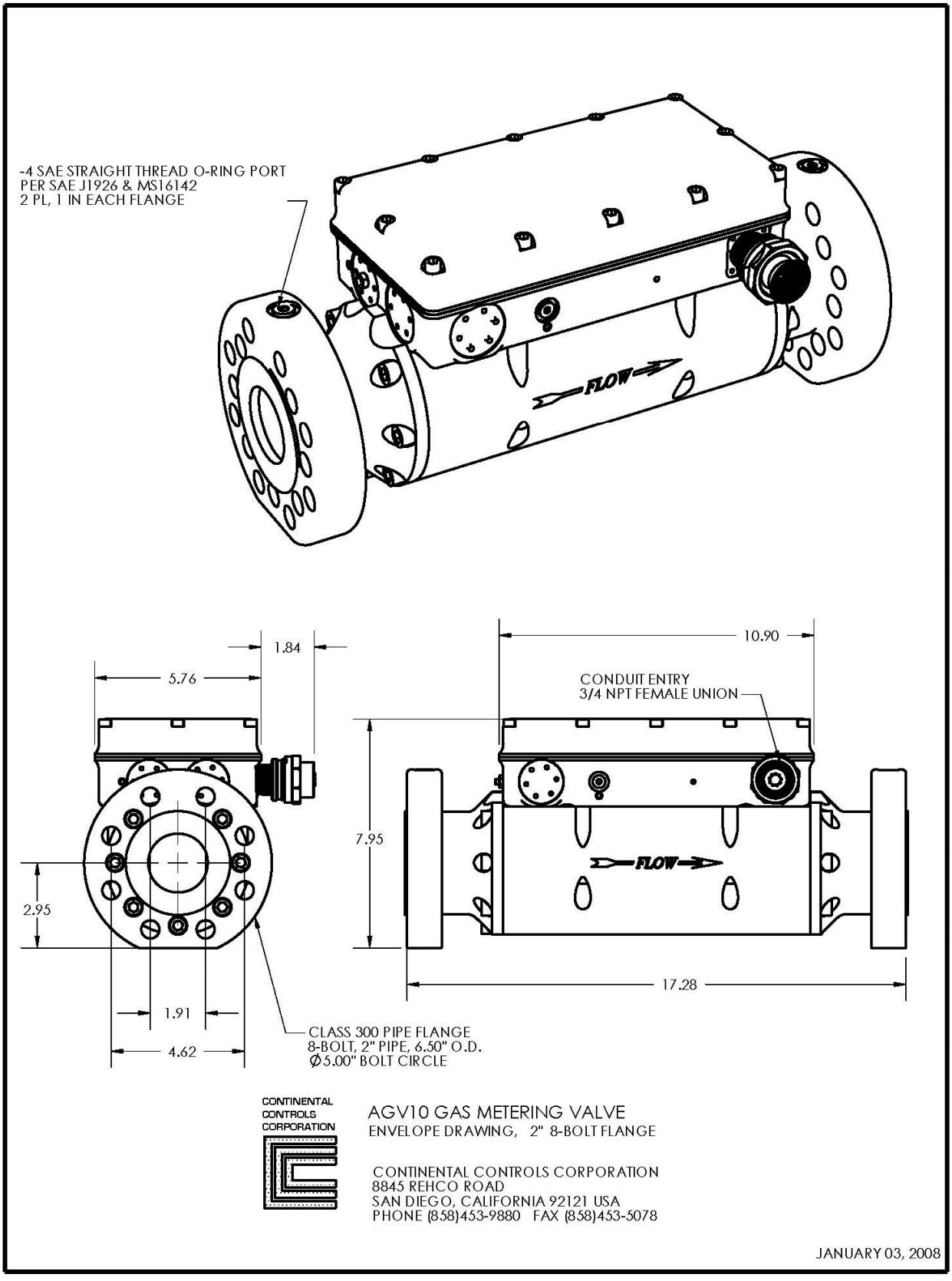


AGV10 Envelope Drawing

The envelope drawing that shows connector for electrical connection is not rated for Explosive Atmosphere.

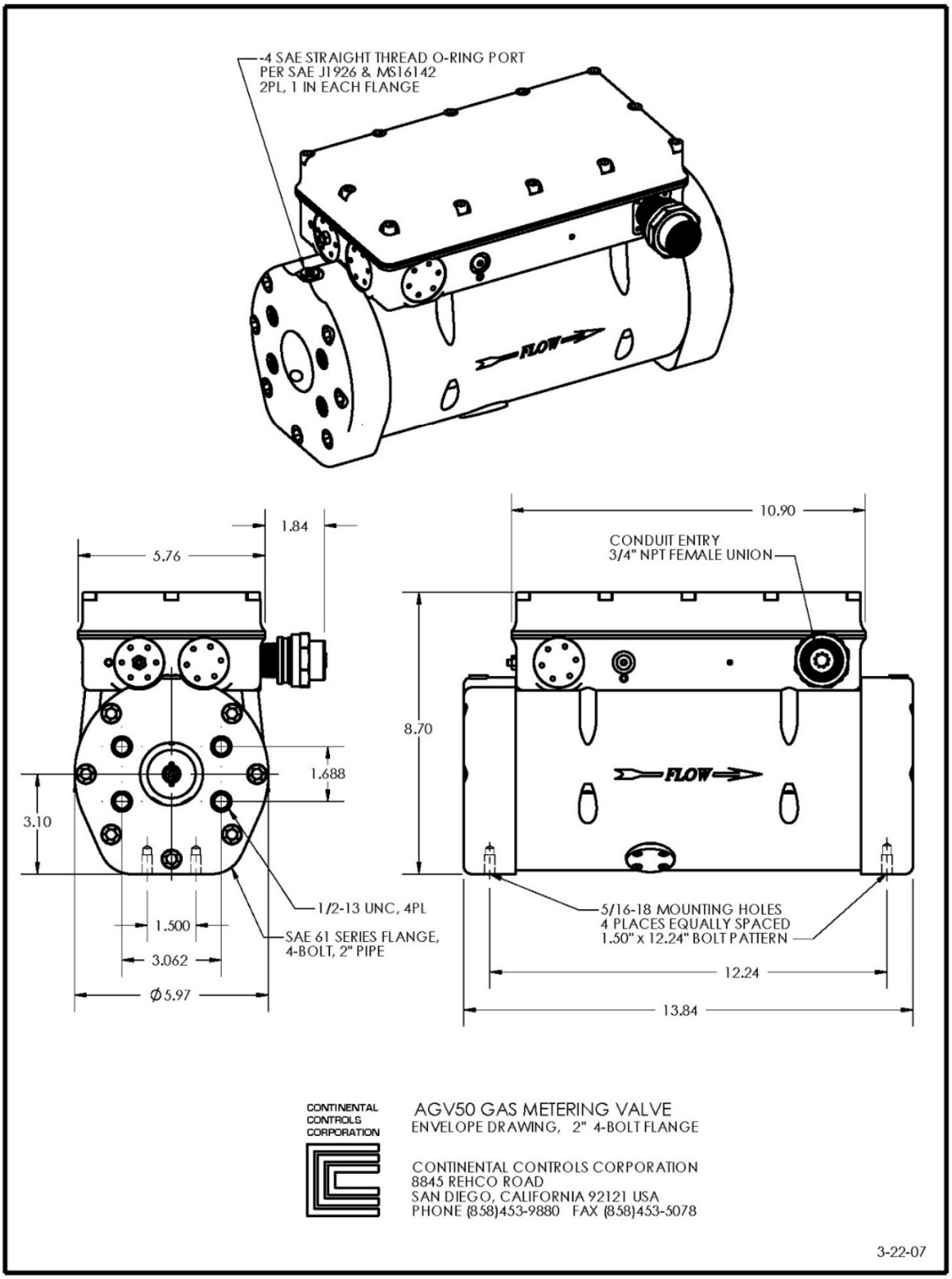

-4 STRAIGHT THREAD O-RING PORT
PER SAE J1926 & MS16142
2PL, 1 IN EACH FLANGE
FLOW
1.84
5.76
1.406
2.60
1/2-13 UNC, 4PL
SAE 61 SERIES FLANGE,
4 BOLT, 1-1/2" PIPE
2.750
1.500
10.90
CONDUIT ENTRY
3/4" NPT FEMALE UNION
7.60
FLOW
5/16-18 MOUNTING HOLES
4 PLACES EQUALLY SPACED
1.50" x 12.24" BOLT PATTERN
12.24
13.84
CONTINENTAL
CONTROLS
CORPORATION
AGV10 GAS METERING VALVE
ENVELOPE DRAWING, 1-1/2" 4-BOLT FLANGE
CONTINENTAL CONTROLS CORPORATION
8845 REHCO RD.
SAN DIEGO, CALIFORNIA 92121 USA
PHONE (858)453-9880 FAX (858)453-5078
3-22-07

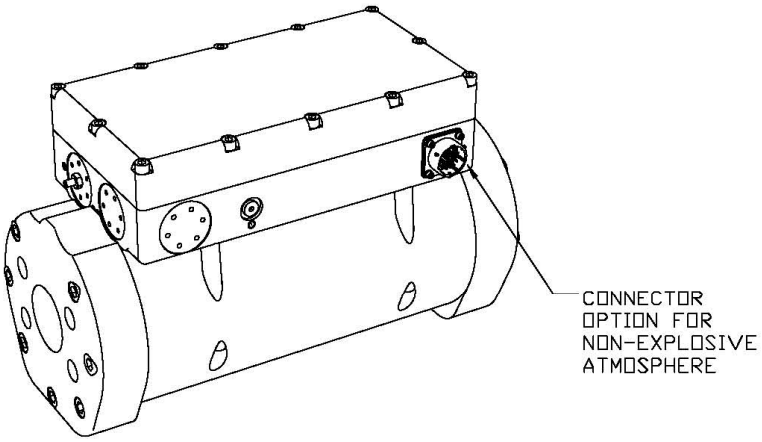

-4 SAE STRAIGHT THREAD O-RING PORT
PER SAE J1926 & MS16142
2 PL, 1 IN EACH FLANGE
FLOW
1.84
5.76
10.90
CONDUIT ENTRY
3/4 NPT FEMALE UNION
7.60
1.688
2.60
FLOW
1/2-13 UNC, 4PL
SAE 61 SERIES FLANGE
4 BOLT, 2" PIPE
5/16-18 MOUNTING HOLES
4 PLACES EQUALLY SPACED
1.50" x 12.24" BOLT PATTERN
3.062
12.24
1.500
13.84
CONTINENTAL
CONTROLS
CORPORATION
AGV10 GAS METERING VALVE
ENVELOPE DRAWING, 2" 4-BOLT FLANGE
CONTINENTAL CONTROLS CORPORATION
8845 REHCO RD.
SAN DIEGO, CALIFORNIA 92121 USA
PHONE (858)453-9880 FAX (858)453-5078
JANUARY 03, 2008

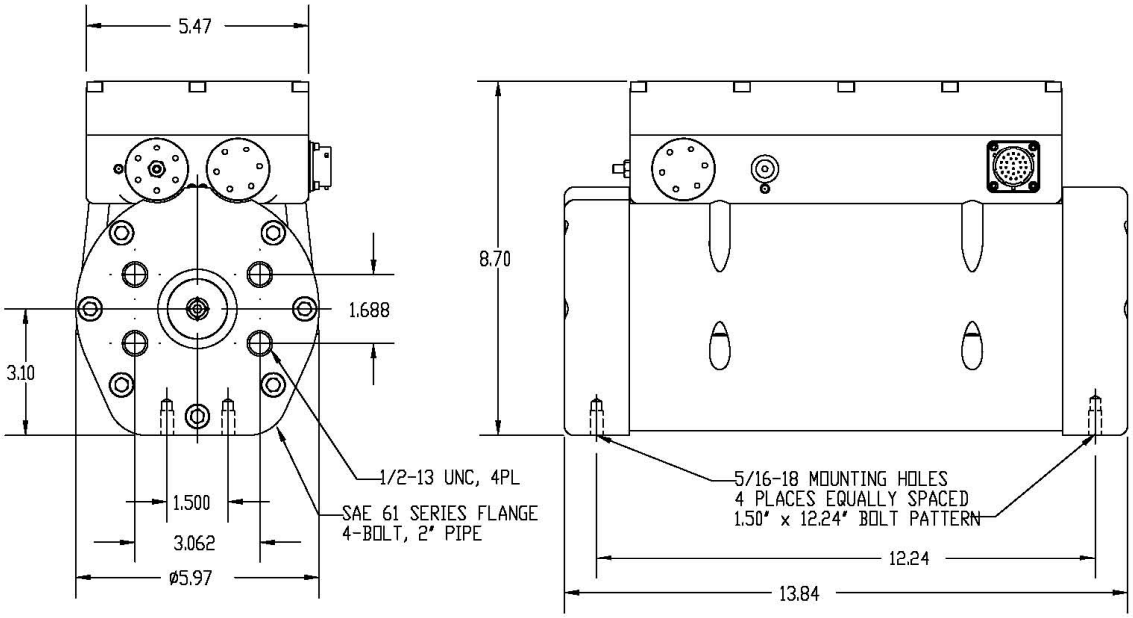

-4 SAE STRAIGHT THREAD O-RING PORT
PER SAE J1926 & MS16142
2 PL, 1 IN EACH FLANGE
FLOW
1.84
5.76
10.90
CONDUIT ENTRY
3/4 NPT FEMALE UNION
7.95
2.95
FLOW
17.28
1.91
4.62
CLASS 300 PIPE FLANGE
8-BOLT, 2" PIPE, 6.50" O.D.
Ø5.00" BOLT CIRCLE
CONTINENTAL
CONTROLS
CORPORATION
AGV10 GAS METERING VALVE
ENVELOPE DRAWING, 2" 8-BOLT FLANGE
CONTINENTAL CONTROLS CORPORATION
8845 REHCO ROAD
SAN DIEGO, CALIFORNIA 92121 USA
PHONE (858)453-9880 FAX (858)453-5078
JANUARY 03, 2008

AGV50 Envelope Drawing

The envelope drawing that shows connector for electrical connection is not rated for Explosive Atmosphere.


-4 SAE STRAIGHT THREAD O-RING PORT
PER SAE J1926 & MS16142
2PL, 1 IN EACH FLANGE
FLOW
1.84
5.76
10.90
CONDUIT ENTRY
3/4" NPT FEMALE UNION
8.70
1.688
3.10
1/2-13 UNC, 4PL
SAE 61 SERIES FLANGE,
4-BOLT, 2" PIPE
1.500
3.062
Ø5.97
5/16-18 MOUNTING HOLES
4 PLACES EQUALLY SPACED
1.50" x 12.24" BOLT PATTERN
12.24
13.84
CONTINENTAL
CONTROLS
CORPORATION
AGV50 GAS METERING VALVE
ENVELOPE DRAWING, 2" 4-BOLT FLANGE
CONTINENTAL CONTROLS CORPORATION
8845 REHCO ROAD
SAN DIEGO, CALIFORNIA 92121 USA
PHONE (858)453-9880 FAX (858)453-5078
3-22-07



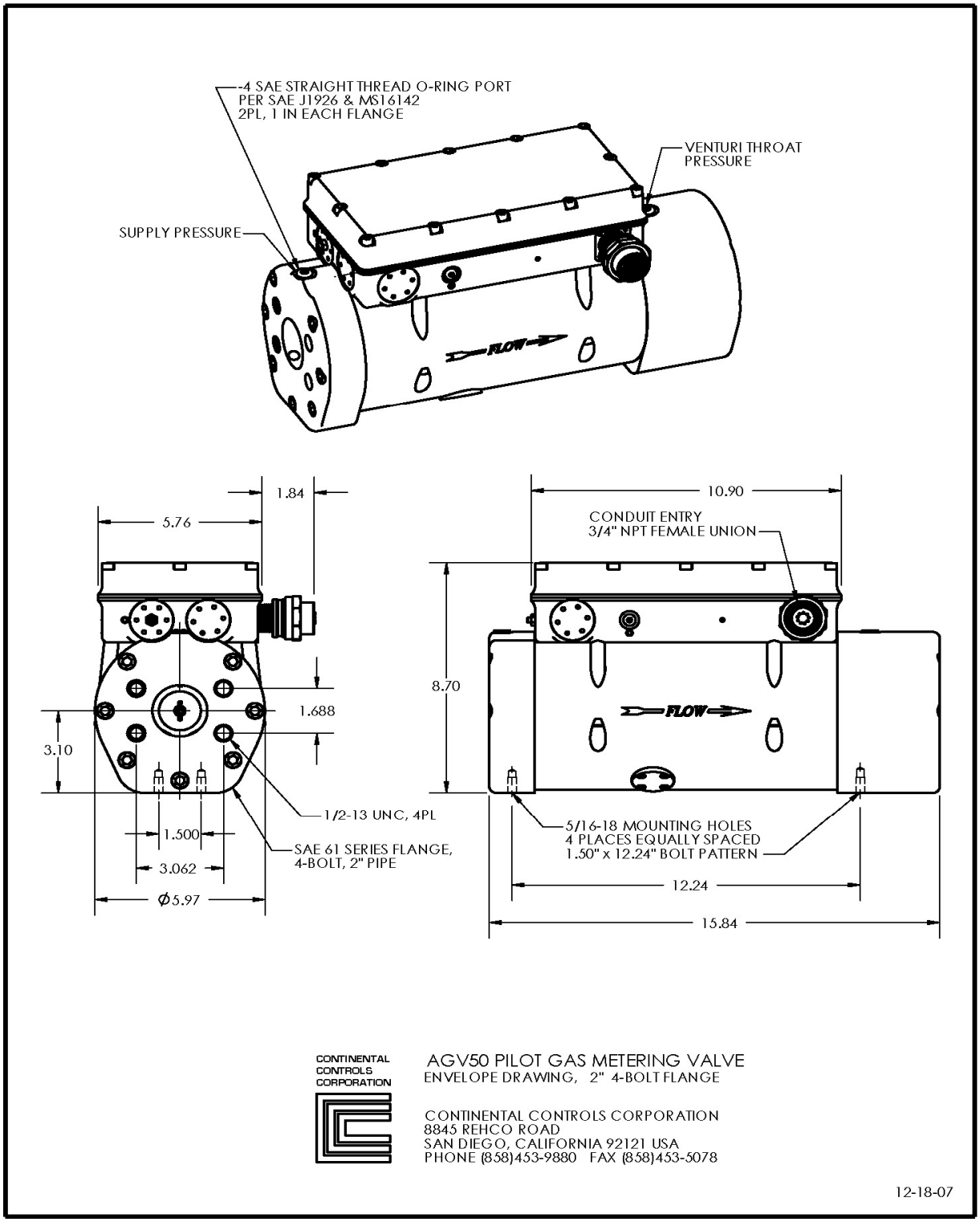


CONTINENTAL CONTROLS CORPORATION

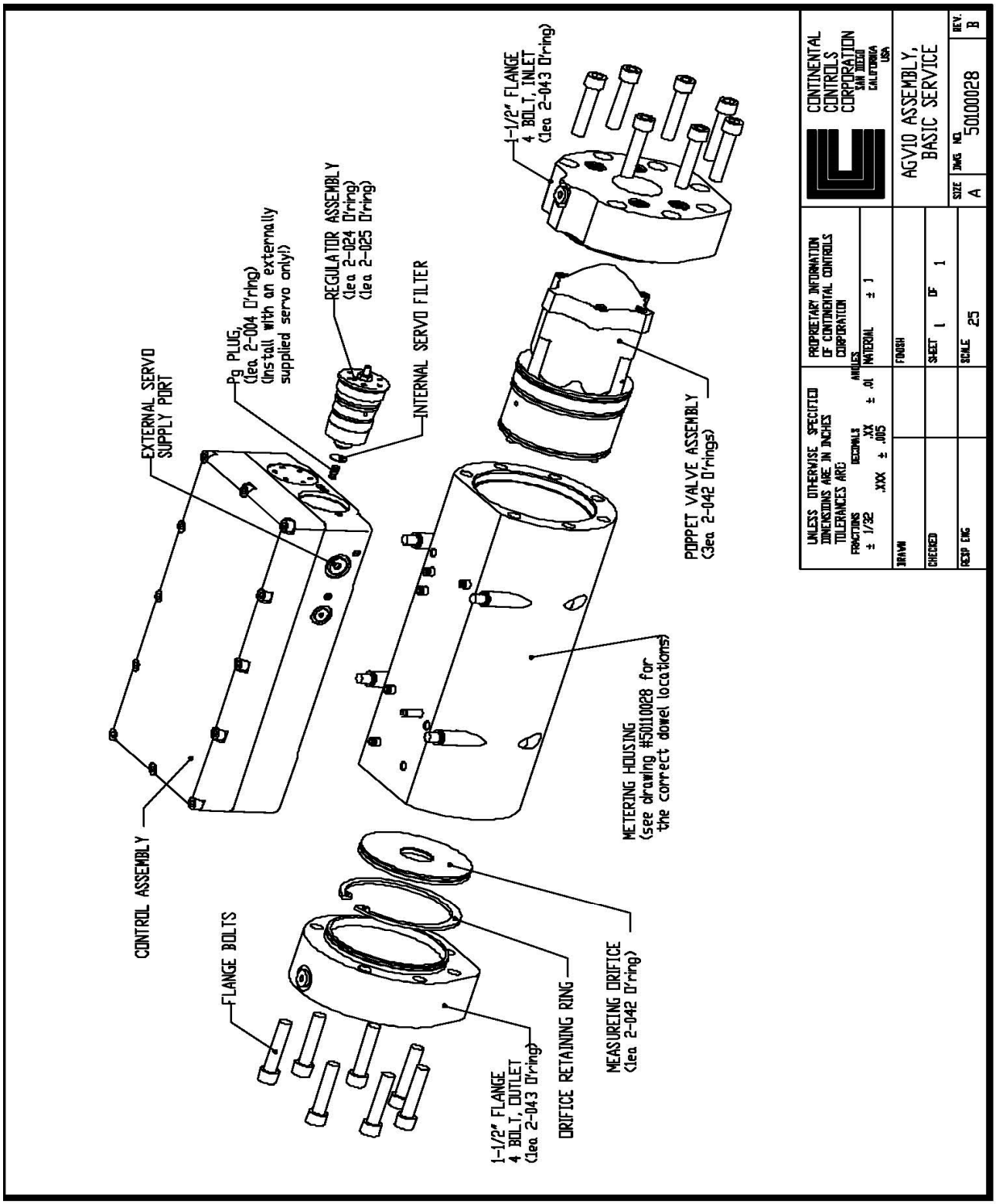
AGV50 GAS METERING VALVE
ENVELOPE DRAWING, 2" 4-BOLT FLANGE

CONTINENTAL CONTROLS CORPORATION
8845 REHCO ROAD
SAN DIEGO, CALIFORNIA 92121 USA
PHONE (858)453-9880 FAX (858)453-5078

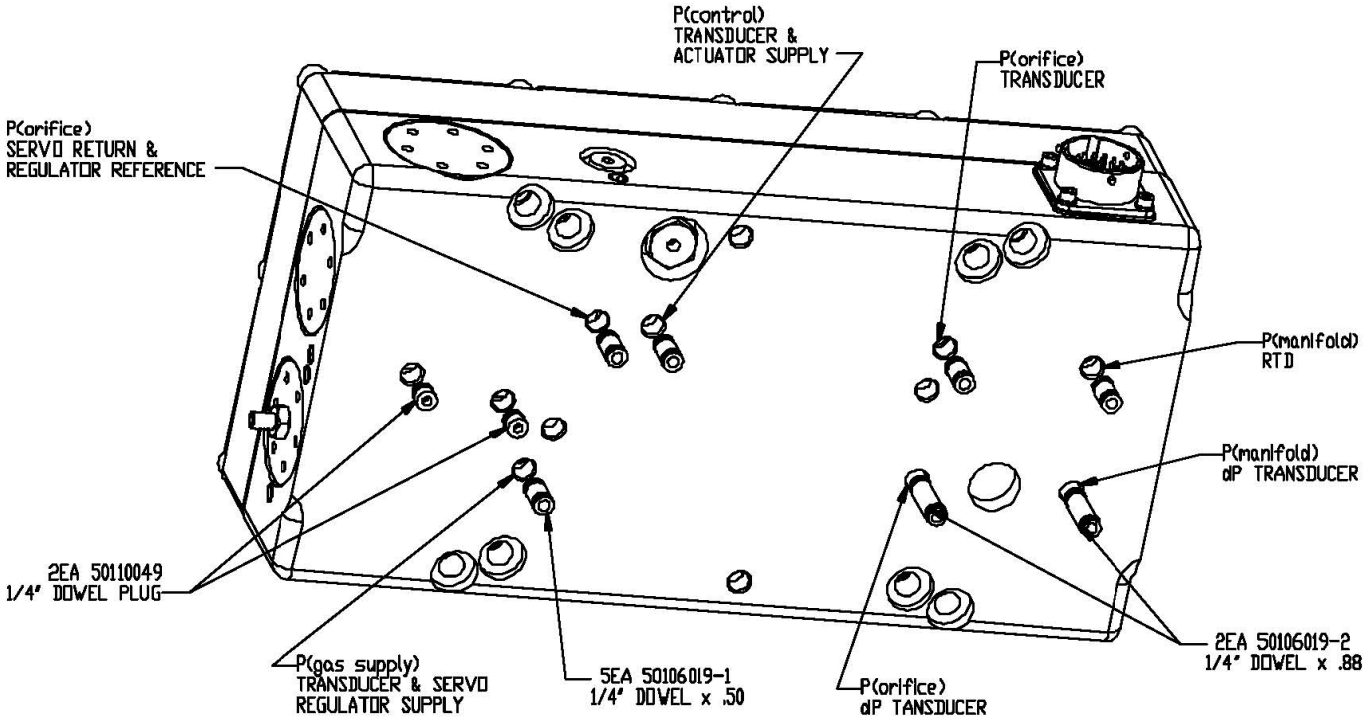
AGV50 Pilot Envelope Drawing



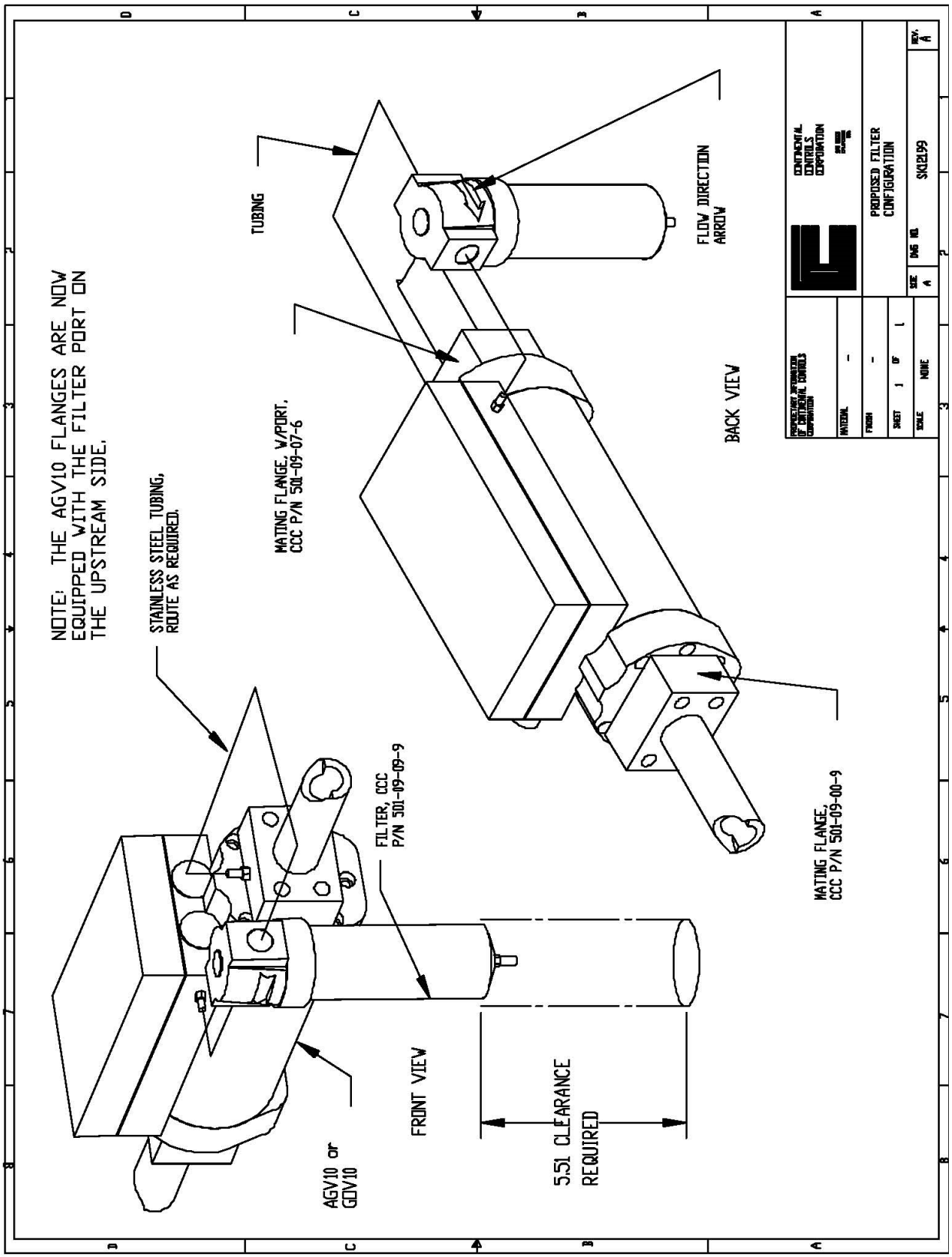
AGV10 Basic Service Drawing



REV	DESCRIPTION	DATE	APRV'D
A	INITIAL RELEASE	6-1-98	
B	DRAWING NUMBER PREVIOUSLY 50100018, ADDED	3-30-99	
	PORT LABELS, 1/4" DOWEL PART NO. 50110049		



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ± 1/32 DECIMALS .XX ± .01 .XXX ± .005 ANGLES ± 1	PROPRIETARY INFORMATION OF CONTINENTAL CONTROLS CORPORATION	CONTINENTAL CONTROLS CORPORATION SAN DIEGO CALIFORNIA USA	
DRAWN	MATERIAL	DOWEL LAYOUT, AGV10 & GOV10 CONTROL HOUSING	
CHECKED	FINISH SEE NOTES		
RESP ENG	SHEET 1 OF 1	SIZE A	DWG. NO. 50110018 REV. B
	SCALE .5X		


NOTE: THE AGV10 FLANGES ARE NOW EQUIPPED WITH THE FILTER PORT ON THE UPSTREAM SIDE.
STAINLESS STEEL TUBING, ROUTE AS REQUIRED.
MATING FLANGE, W/PORT, CCC P/N 501-09-07-6
TUBING
FLOW DIRECTION ARROW
BACK VIEW
FILTER, CCC P/N 501-09-09-9
MATING FLANGE, CCC P/N 501-09-00-9
AGV10 or GDV10
FRONT VIEW
5.51 CLEARANCE REQUIRED
CONTINENTAL CONTROLS CORPORATION
PROPOSED FILTER CONFIGURATION
SVA2199

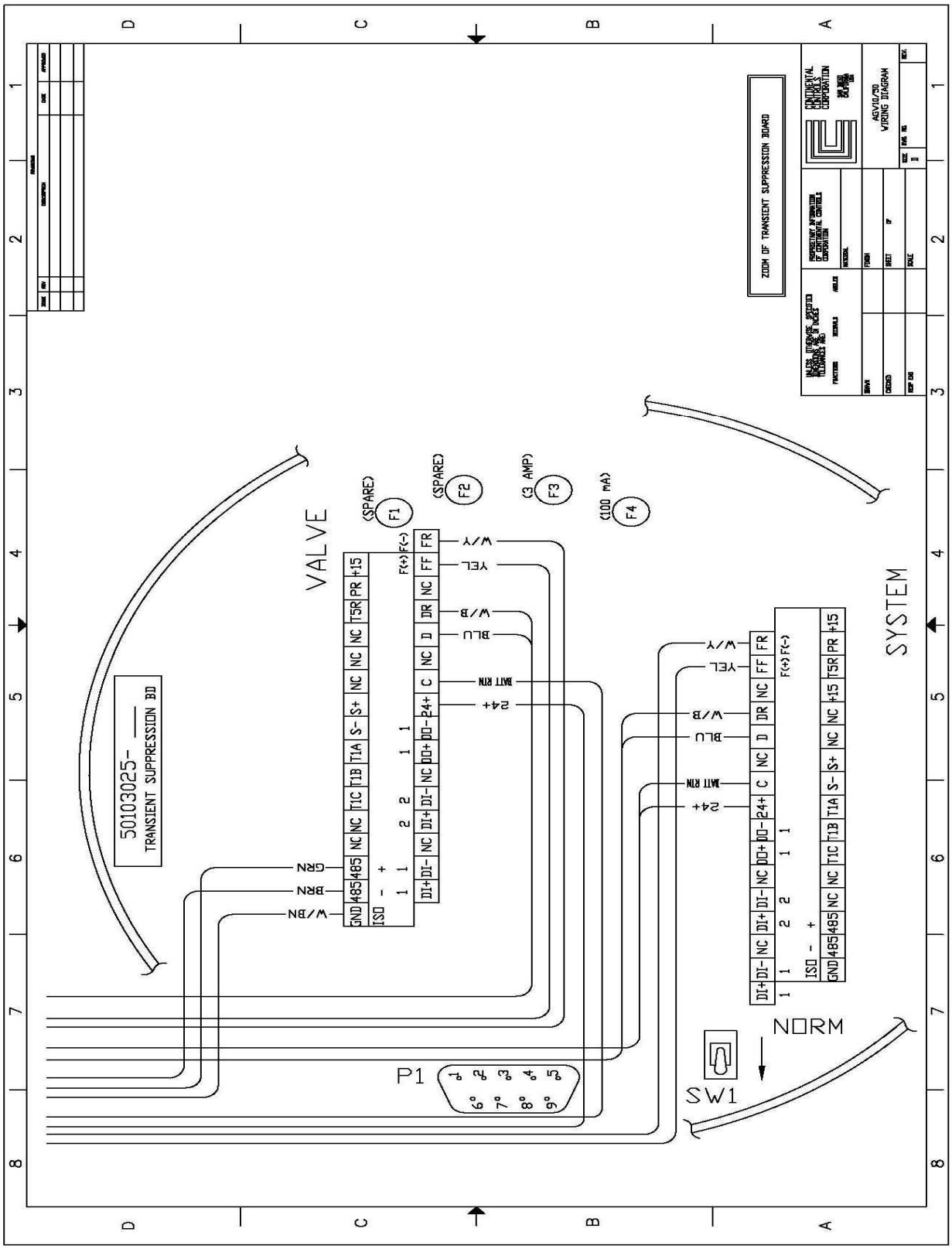
AGV10, AGV50 and AGV50 Pilot Wiring Drawings

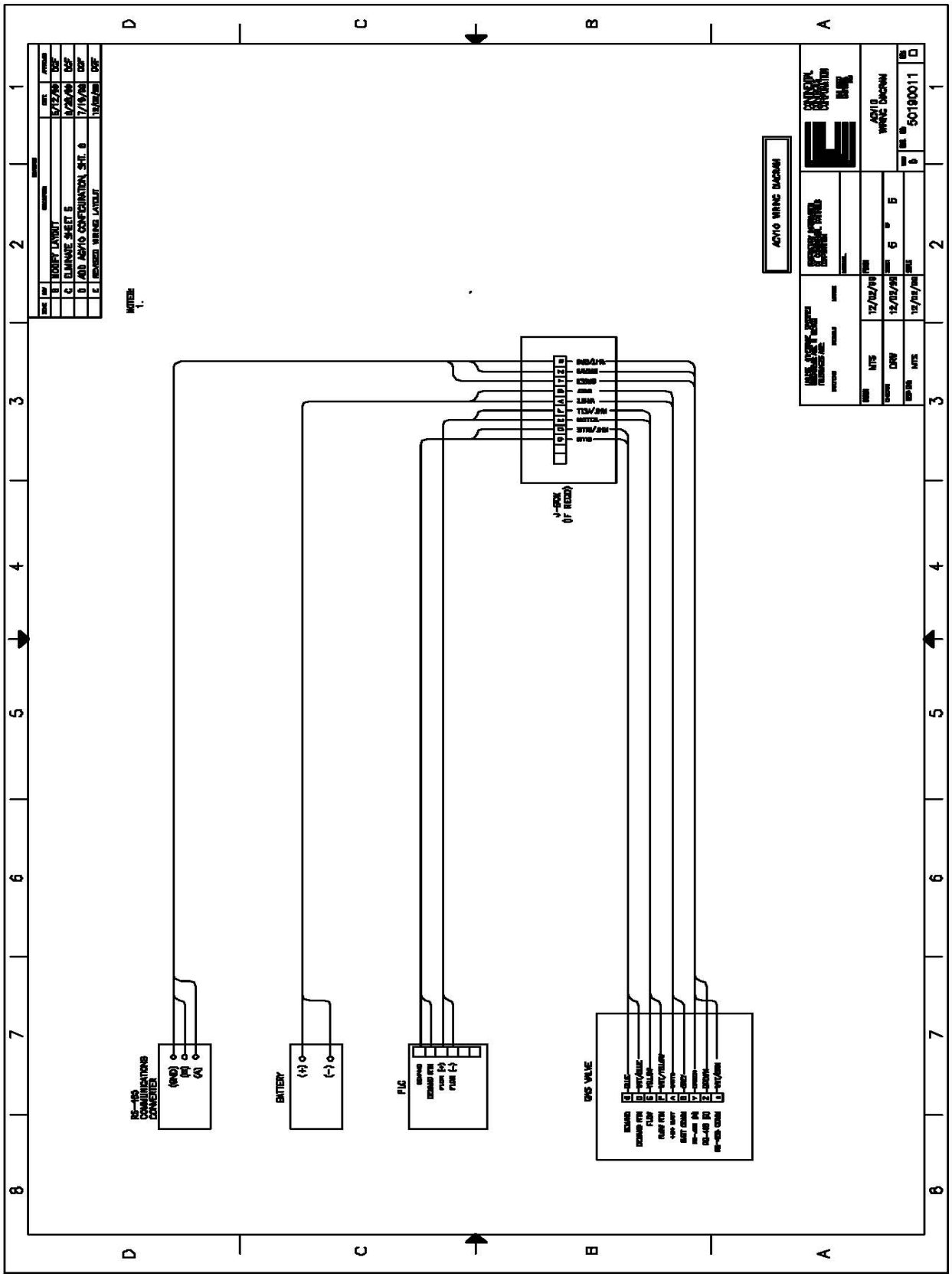
Valve Board Description

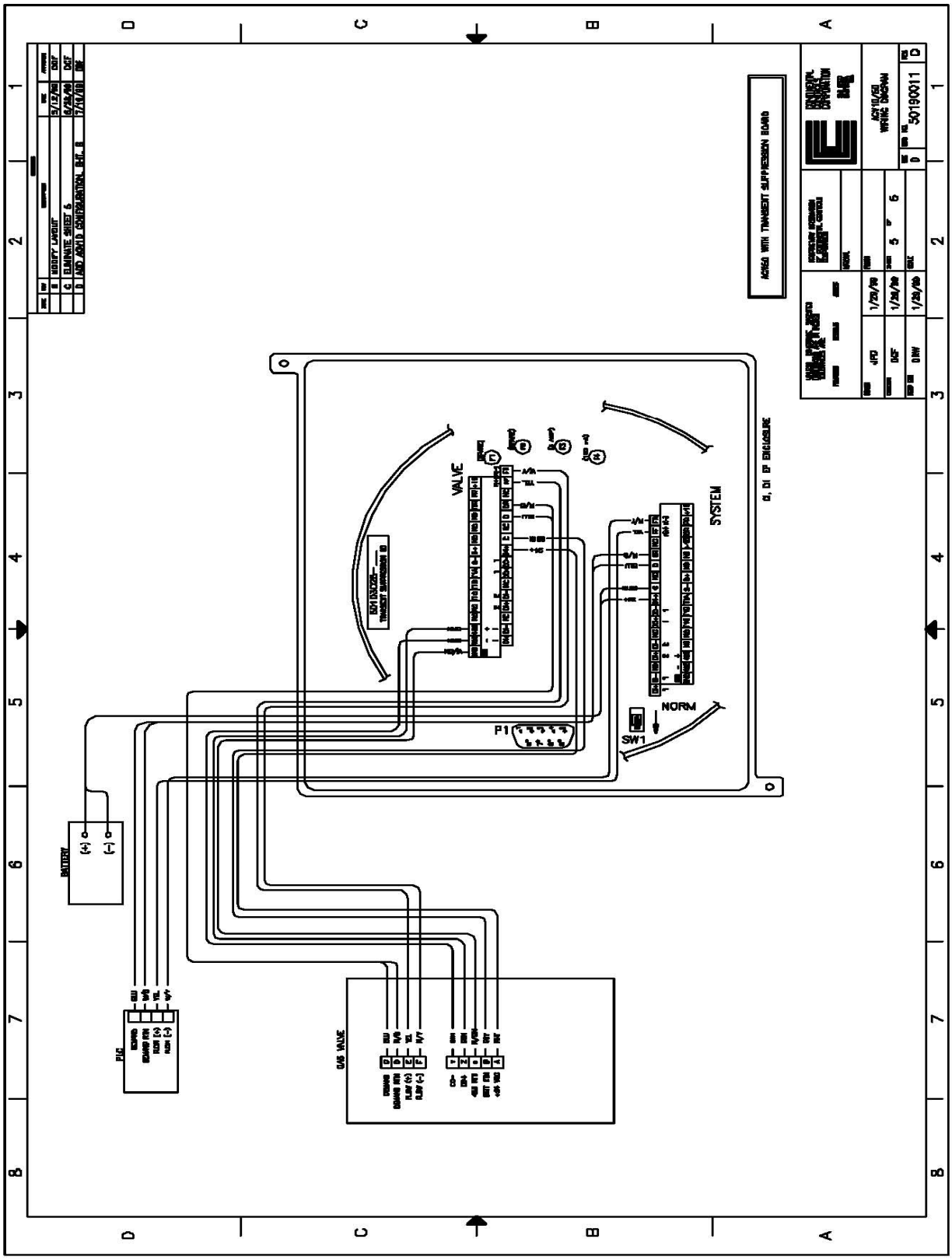
TEST POINT	DESCRIPTION	VALUE/RANGE
TP01	Upstream Orifice Pressure	0 to –5 Vdc
TP02	Differential Pressure	0 to –5 Vdc
TP03	Control Pressure	0 to –5 Vdc
TP04	Supply Pressure	0 to –5 Vdc
TP05	Not Present/Not Used	
TP06	Gas Temperature	0 to –5 Vdc
TP07	Board Voltage Common	Reference
TP08	Fuel Demand Signal	1 to 5 Vdc
TP09	Board Amplifier Negative Power	-11 Vdc +/-3%
TP10	Strain Gauge Power	7.0 Vdc +/-0.5%
TP11	Actuator DAC Voltage	0 to 10 Vdc
TP12	Strain Gauge Power	7.0 Vdc +/-0.5%
TP13	Not Present/Not Used	
TP14	Flow Feedback	1 to 5 Vdc
TP15	Board Amplifier Positive Power	11 Vdc +/-3%
TP16	Digital Power Supply	5 Vdc +/-2%
TP17	Board Voltage Common	Reference

Internal Board Wiring

DESCRIPTION	BD PIN No.	WIRE COLOR	CONNECTOR PIN	SIGNAL TYPE
+24Vdc (Nominal) 24Vdc Common	N/A N/A	WHITE GRAY	A B	Supply Power Supply Return
Flow Demand Flow Return	11 10	BLUE WHITE/BLUE	C D	Non-Isolated 4 to 20 mA Input
Flow Feedback Flow FB Return	7 8	YELLOW YELLOW/WHITE	E F	Non-Isolated 4 to 20 mA Output
RS485 (A) (B) GND	1 2 12	GREEN BROWN WHITE/BROWN	Y Z A	Non-Isolated RS485 Communication


ZOOM OF TRANSIENT SUPPRESSION BOARD
AGV10/50
WIRING DIAGRAM
VALVE
SYSTEM
50103025-
TRANSIENT SUPPRESSION BD
(SPARE) F1
(SPARE) F2
(3 AMP) F3
(100 mA) F4
P1
SW1
NORM
W/BN
BRN
GRN
W/Y
YEL
W/B
BLU
BATT RTN
24+
GND 485 485 NC NC T1C T1B T1A S- S+ NC NC NC T5R PR +15
DI+ DI- NC DI+ DI- NC DO+ DO- 24+ C NC D DR NC FF FR
F(+) F(-)
ISO - +


AGV10 WIRING DIAGRAM
50190011
BATTERY
PLC
DVS VALVE
J-BOX
(IF NEED)


AGV50 WITH TRANSIENT SUPPRESSION BOARD
VALVE
SYSTEM
P1
SW1
NORM
BATTERY
(+)
(-)
PLC
GAS VALVE
50190011

Modbus Register Map

Type	Register	Description	Scaling Factor	Units
Input Register	40001	Flow	0.1	scfm
Input Register	40002	Demand	0.1	scfm
Input Register	40003	Gas Temp	1	K
Input Register	40004	DP	0.01	psid
Input Register	40005	PO	0.01	psi
Input Register	40006	PG	0.01	psi
Input Register	40007	DAC-Flow out	1	adc
Input Register	40008	Flow - Demand In	1	adc
Input Register	40009	Actuator Output	1	adc
Input Register	40010	Status	1	adc
Input Register	40011	Accel	0.1	%
Input Register	40012	Decel	0.1	%
Input Register	40013	Not Used	Ignore	Ignore
Input Register	40014	Not Used	Ignore	Ignore
Input Register	40015	PG raw	1	adc
Input Register	40016	PO raw	1	adc
Input Register	40017	DP raw	1	adc
Input Register	40018	PC raw	1	adc
Input Register	40019	Not Used	1	adc
Holding Register	40020	PG (original setting)	1	adc
Holding Register	40021	PO (original setting)	1	adc
Holding Register	40022	DP (original setting)	1	adc
Holding Register	40023	Not Used	1	Ignore
Holding Register	40024	CONTROL PROP	1	control
Holding Register	40025	FLOW PROP	1	control
Holding Register	40026	FLOW INTRG	1	control
Holding Register	40027	PG OFFSET	1	convert
Holding Register	40028	PG GAIN	1	convert
Holding Register	40029	ACT OFFSET	1	counts
Holding Register	40030	FLOW ADJUST	1	convert
Holding Register	40031	FLOW OFFSET	1	convert
Holding Register	40032	DEMAND GAIN	1	convert
Holding Register	40033	DEMAND OFFSET	1	convert
Holding Register	40034	GAUGE LIMIT	1	convert
Holding Register	40035	BUMP CORRECTION	1	convert
Holding Register	40036	BUMP LOCATION	1	convert
Holding Register	40037	ACCELERATION GAIN	1	control

Type	Register	Description	Scaling Factor	Units
Holding Register	40038	Y OFFSET	1	convert
Holding Register	40039	X OFFSET	1	convert
Holding Register	40040	DECELERATION %	1	control
Holding Register	40041	DAMPENING	1	control
Holding Register	40042	Not Used	1	Ignore
Holding Register	40043	FLOW DAMPENING	1	control
Holding Register	40044	Not Used	Ignore	Ignore
Holding Register	40045	Not Used	Ignore	Ignore
Holding Register	40046	Not Used	Ignore	Ignore
Holding Register	40047	Not Used	Ignore	Ignore
Holding Register	40048	Not Used	Ignore	Ignore
Holding Register	40049	Not Used	Ignore	Ignore
Holding Register	40050	Not Used	Ignore	Ignore
Holding Register	40051	Not Used	Ignore	Ignore
Holding Register	40052	Slope 1	1	control
Holding Register	40053	Offset 1	1	control
Holding Register	40054	Slope 2	1	control
Holding Register	40055	Offset 2	1	control
Holding Register	40056	Slope 3	1	control
Holding Register	40057	Offset 3	1	control
Holding Register	40058	MIN FLOW	0.1	scfm
Holding Register	40059	MAX FLOW SCFM	0.1	scfm
Holding Register	40060	VERSION	0.01	Ignore
Holding Register	40061	TYPE	1	Ignore
Holding Register	40062	MFG DATE	1	Ignore
Holding Register	40063	SERVICE DATE	1	Ignore
Holding Register	40064	MAX PO	1	psi

Note:
convert - conversion counts
control - control counts
adc- analog to digital convert counts
dac- digital to analog convert counts

Fuel Valve Questionnaire

The following are questions that will help us to ensure proper configuration of the AGV10. 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. What is your existing fuel control valve? _____
5. Do you do your own acceleration schedule in the PLC?_____
6. Do you want 4-20 mA or 0-50 mA Configuration Valve? _____
7. Will the engine burn Standard Natural Gas? (If not what fuel?)_____
8. Will this be used in an area classified as hazardous? What Classification? _____
9. If you are using the AGV10 cable and connector are the run less than 10 feet. If it is greater than 10 feet, specify length. _____
10. Is there anything special or problematic about the application?

_____