ALTRONIC

ECV5
Emissions Control Valve
Advanced Air/Fuel Ratio Control for Gas Engines

- **Universal line of air/fuel ratio controls for stoichiometric and lean-burn engines**
- **The ECV5 is an electronic pressure regulator**
- **Accurate closed-loop air/fuel ratio for the lowest engine emissions**
- **Fast response: Voice Coil actuated valve travels full stroke in <50 ms**
- **Maintains emissions compliance even with changes in speed and load**
- **Full authority fuel control**
- **Fully automatic**
- **Modbus, RS-232/385, CAN-Bus, and Ethernet Communications**
- **Catalyst temperature monitoring**
- **Handles changes in gas BTU**

EMISSIONS REQUIREMENTS

The ECV5 valve offers full authority fuel control for almost any size of gas engine. The variable pressure control technique allows for fast acting control that can include single setpoint steady state control, or—where emissions requirements are extremely low—mapped load versus fuel input, or even dithering around a dynamic setpoint to optimize the performance of the three-way catalyst.

THE SOLUTION

Altronic offers a complete system that maintains the emissions levels of all gas engines in compliance with the most astringent local, state, and federal emissions regulations, while maintaining peak operating efficiency.

The ECV5 is used to control fuel pressure to an Altronic mixing venturi to achieve the lowest possible emissions under all load conditions. The ECV5 can also be used as the primary fuel valve controlling fuel to the carburetor on an aftermarket AFR installation. The ECV5 is basically an electronic variable pressure regulator that will vary the fuel pressure to the engine based on a load input and/or an input from a Wide Band Oxygen Sensor (UEGO). The ECV5 also can accept an input from the Catalyst Monitor via Can Bus to dynamically adjust the O2 Sensor setpoint based on changing sensor or catalyst conditions. The carburetor venturi insert will automatically accommodate the change by allowing the precise amount of fuel required to meet the desired air to fuel ratio. No mechanical action is required to make this fuel adjustment.

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FORM ECV5 8-22

MAXIMIZE CONTROL

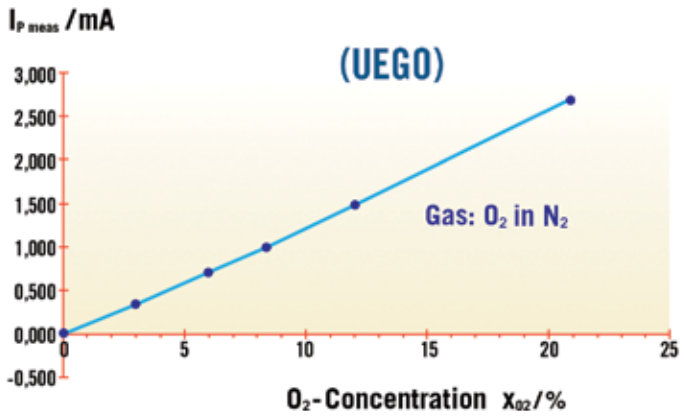
CLOSED LOOP PRESSURE CONTROL

The discharge pressure is compared to the pressure set point as shown in the diagram. The proportional and integral control provides a fast responding, no-droop pressure regulator. The pressure set point is the default pressure and is selected to run the engine when the O2 sensor is not operating. This set point is occasionally adjusted by the dynamic input from the optional catalyst monitor or other outside controller or load input.

SUPPORT FOR WIDE BAND OXYGEN SENSOR (UEGO)

The second control loop the Altronic ECV5 incorporates is closed loop control via a wide band oxygen sensor (UEGO). The ECV5 operates as a variable pressure controller where the O2 sensor constantly readjusts the control pressure set-point as required to meet the required O2 set-point. This technique helps to stabilize the engine by controlling the moving set-point and reducing droop in the regulator. This integrated pressure control concept is patented and is unlike any other controller. By reducing or increasing the pressure gain settings in the ECV5, the valve will react as quickly or can be dampened as much as is required by the application.

WIDE BAND OXYGEN SENSOR (UEGO)

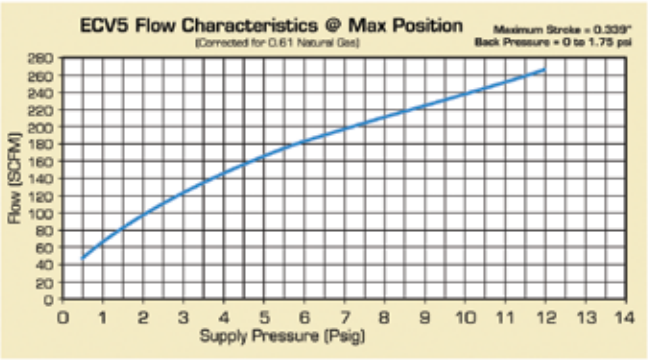


GAS SUPPLY PRESSURE

The required minimum gas supply pressure is the sum of the gas injection pressure and the pressure drop across the valve. The valve pressure drop is a function of the flow through the valve and is shown in the diagram in the next column. The supply pressure should be regulated to ideally allow the ECV5 to operate in the 50% to 75% range when the engine is at full load.

TURBOCHARGED ENGINES

The fuel system of engines turbocharged after the carburetor (draw-through) is connected like naturally-aspirated engines. When the turbocharger is before the carburetor, a reference line must be connected from the air inlet of the carburetor to the reference port on the ECV5.



If the injection pressure is zero and the gas flow is 60 scfm, 1 psi of gas pressure is required.

DUAL BANK ENGINES

Engines with a single point of fuel injection and a single turbocharger require one ECV5 and one O2 sensor. A dual bank engine with a turbocharger for each bank requires an ECV5 primary on one side of the engine and an EVC 5 secondary on the other, each controlled by its own O2 sensor.

LOAD TRANSIENTS RESPONSE

The valve transitions from open to closed in less than 50ms. This results in a very fast responding pressure regulator. If a load transient occurs, the fuel flow changes and the valve adjusts its position almost instantly to minimize the effect of the load transient. The engine runs through the transient without falling out of compliance or loss of efficiency.

REDUCED EMISSIONS

Since the ECV5 eliminates much of the lag in the response of the fuel system allowing the control loop gain to be set higher, which controls the O2 sensor voltage very close to its set point. The ECV5 maintains the oxygen content in the exhaust within the NSCR compliance window for 3-way catalysts, or at the desired control point for all other applications. This provides the lowest possible emissions control or the maximum achievable efficiency depending on the control point of the ECV5.

DESCRIPTION OF THE ECV5

The ECV5 is an electronically controlled servo valve. The electronic assembly is located inside the cover and includes an embedded microcomputer. The main components of the valve include: the poppet valve, the voice coil actuator, the LVDT for position feedback, and the pressure transducer. The valve has two control loops that are closed with feedback. The inner loop is the position control with the LVDT providing the position feedback signal. This inner loop gives the valve unusually fast response.

The outer loop is the pressure control with the pressure transducer providing the feedback signal. The pressure control amplifier is proportional and integral, which is required to operate the valve without droop, resulting in fuel pressure that does not change when the gas flow changes.

The valve is nearly all aluminum, except for the magnetic steel parts and the stainless steel shaft.

MINIMIZE EMISSIONS

USER INTERFACE (DISPLAY & CONTROL)

The ECVI (Emissions Control Valve Interface is a color touch screen display that allows the user to monitor system operation and change set-points for the air/fuel ratio controllers. The ECVI (Emission Control Valve Interface) is the user interface with the system. It also monitors the operation of the system and displays all data available. The ECVI also provides the means for changing the set points and selected parameters. Set-points can be protected via optional password protection. The ECVI has a color touch screen display that allows you to monitor both engine banks simultaneously. Parameters displayed include:

- Gas injection pressure and its set point
- Oxygen sensor voltage and its set point
- Valve position
- Default pressure
- Pre- and post-catalyst temperature

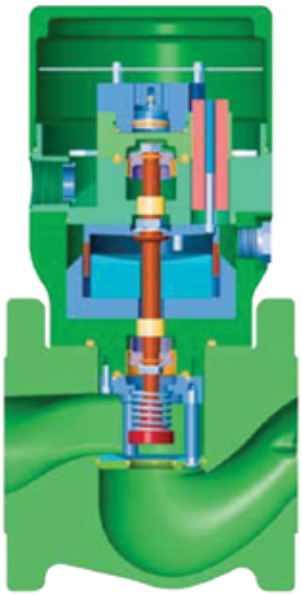
The ECVI is programmed to provide an over-temperature alarm or shutdown to prevent damage to the catalytic converter. The ECVI can be used to monitor the temperature rise in the catalyst due to the exothermic reaction. The differential temperature can be displayed, logged and exported via the serial port. The ECVI also is provided with a serial port for ModBus communications with other control and data logging systems.

INSTALLATION

The ECV5 system is simple to install and commission. The figure above illustrates the wiring necessary to fully implement the system. Further installation documentation can be found on our website.

HOW THE SYSTEM WORKS

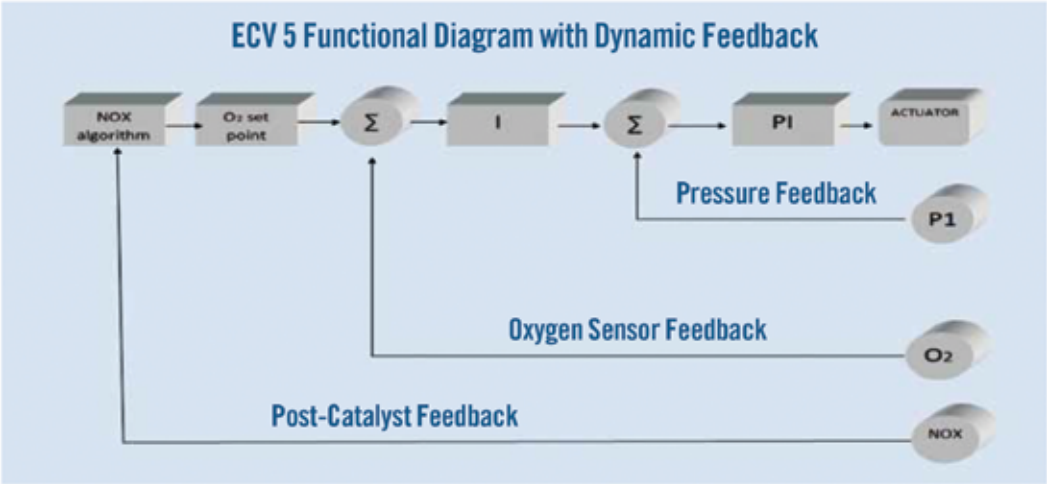
The functional diagram below is used to explain the operation of the ECV5 and the system. The ECV5 is an electronically controlled valve that functions as a zero pressure regulator with no droop. A precise low pressure transducer is embedded in the valve and is used to sense the discharge pressure, which is the gas injection pressure to the carburetor or mixing venturi device. **CATALYTIC**



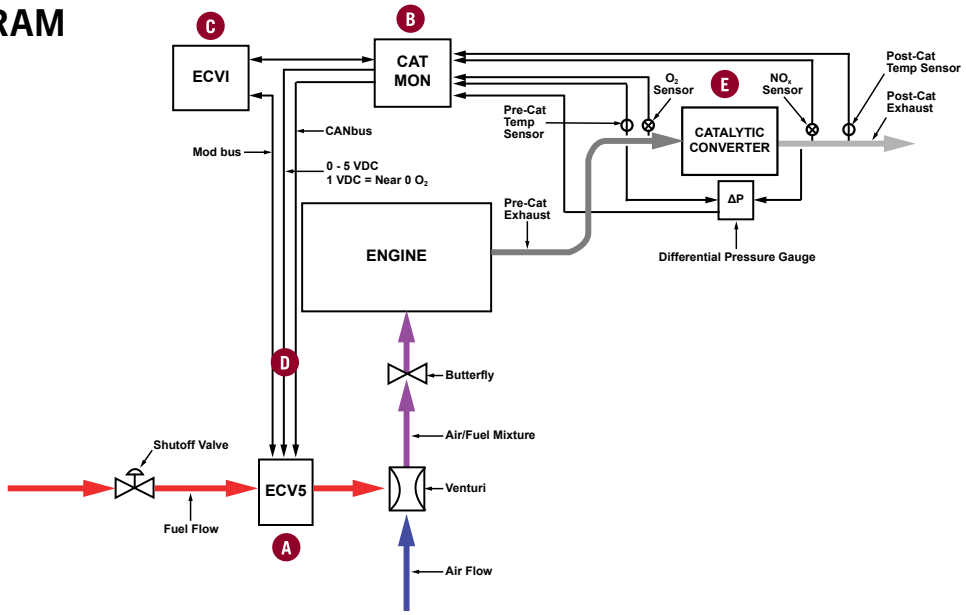
CONVERTER

To maximize reduction of NOx, CO and HC's, the ECV5 is used on a rich burn engine with a 3-way catalytic converter in the exhaust. An oxygen sensor is placed in the exhaust stream before the converter. The ECV5 valve controls the air fuel mixture to maintain very precise control of oxygen content in the exhaust at the oxygen sensor. This precise control will not only maximize the effectiveness of the catalyst which will allow the system to meet the most stringent emissions requirements, but it will also extend the life expectancy of the catalyst.

When the emission requirements are not stringent enough to currently require the use of a 3-way catalyst, the ECV5 can be used to control in a lean burn mode with or without an Oxidation Catalyst. In this mode the operator will tune the ECV5 for the mixture that provides maximum efficiency for the engine or by adding the Oxidation Catalyst improved efficiency with low CO and VOC's.



SYSTEM DIAGRAM



TO ORDER

	DESCRIPTION	PART NUMBER	CCC REFERENCE
A:	**ECV⁵ EMISSION CONTROL VALVE**		
	Emission Control Valve, ECV⁵ (Pre–Turbo)	891003	50500008_B–C¹–N–G¹
	Emission Control Valve, ECV⁵ (Post–Turbo)	891004	50500008_B–C¹–T–G²
	Emission Control Valve, ECV⁵ (Post–Turbo) Extended Range – 8" to 36"	891044	50500008_B–C¹–T–G²–Z
B:	**CATALYST MONITOR**		
	Kit, Catalyst Monitor, ECV⁵ Single Bank	893006	50507026_S–CM²
	Kit, Catalyst Monitor, ECV⁵ Dual Bank	893005	50507026_D–CM³
	Cable, Catalyst Monitor Interface, 30' long	893024	60202007_2_30
	Cable, Interface, ECV⁵, 50' long	893014	50505047_50
	Cable, Oxygen Sensor, 30' long	893015	52040177_7_30
	Sensor, Oxygen, Wideband, 5–wire	891008	52040029
	Thermocouple, Type K, 8" long	891011	50505159
	Connector, Male NPT Thread, ¼" tube x ¼" MNPT, bore–thru	504423	50505269
C:	**INTERFACE/DISPLAY**		
	Emission Control Valve, ECVI	891005	67301008
	Emission Control Valve Interface, Model: ECVI, Application: Indoor Control Option ¹: Red Lion Kadet 7" display (SCADA); Not CSA approved	891014	67301008_I–RL¹
	Display, ECVI 75, ECV⁵, Vision 120_22–UN²/UA² (display only)	891010	67300049
	Valve Viewer Software, ECV⁵		50500013
	PCB Power Board, ECVI	893051	67301014_T
D:	**COMMUNICATION**		
	Cable, Communication, RS²³² to Mini Grabbers, 30' long	893016	50505037_30
	Kit, RS²³² to Mini Grabber Cable, 30' long, plus USB to RS²³² Adapter	893023	50505038
E:	**SENSORS**		
	Cable, Extension, NOx Sensor without Connector, 30' long	893017	60202027_30
	Kit, Flange and Mount, 2" pipe	893007	50506206
	Transducer, Differential Pressure, 0–20" H²O, 4–20mA output, 24Vdc, CSA Class I Div 2	891012	60202119
	Sensor, NOx, Type NGK, 24 Volt	891013	60202039
	Bung, 20mm, NOx Sensor	810156	60202099