CONTINENTAL CONTROLS CORPORATION

ISO 9001 CERTIFIED
US PATENT # 6,978,774 B2 OTHER PATENTS PENDING

NATURAL GAS/LPG FUEL

ELECTRONIC GAS CARBURETORS EGC2/EGC4

Air-Fuel Ratio Control and Improved Gas Mixing for Rich or Lean Burn Operation

FEATURES

- CANbus J1939
- NOx SENSOR COMPAITBILITY
- FULLY AUTOMATIC CONTROL
- CONTROLS A VARIETY OF GASEOUS FUELS
- SIMPLE-TO-USE AND INSTALL
- ON-BOARD DIAGNOSTICS
- DIRECT SUPPORT FOR WIDEBAND OXYGEN SENSORS
- CAN BE USED FOR RICH OR LEAN BURN

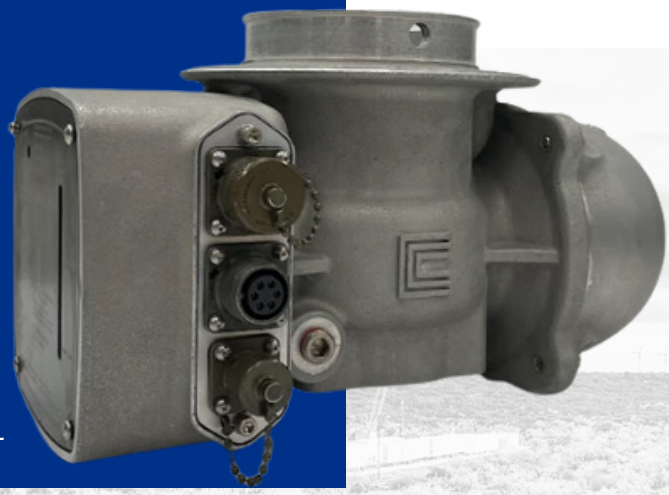
THE CONTINENTAL CONTROLS SOLUTION

CCC offers an innovative and state-of-the-art approach to Gaseous Fuel Carburetion for most gas engines in the range of 10 to 500 horsepower. The Electronic Gas Carburetor (EGC) precisely controls the air/fuel ratio using variable pressure control combined with an advanced and improved mixing venturi. The EGC provides built-in control for a wide band Oxygen sensor that is located in the exhaust stream. This improved control technique combined with enhanced fuel mixing results in the ultimate reduced emissions along with optimum engine fuel efficiency.

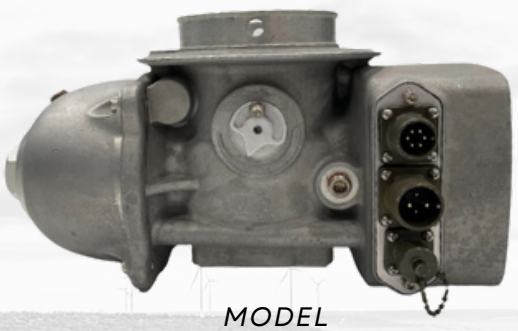
APPLICATION

The CCC Electronic Carburetors can be used in conjunction with a 3-way catalytic converter and run in a Rich Burn (Stoichiometric) Mode to meet the most stringent emission requirements. The EGC2 will work for Rich or Lean Burn applications with the use of wide band oxygen sensor (greater than 4% O2 in the exhaust). Lean Burn can offer many advantages over Rich Burn control such as improved fuel economy, lower exhaust temperatures, and reduced CO2. In both Rich Burn and Lean Burn Mode, EGC products will react rapidly to load changes and other application-specific issues such as changing heating values (BTU) in the gas supply.

Whether you are trying to meet a new emission requirement, run your engine more efficiently, or just reduce engine maintenance and extend engine life, EGC products can help achieve it all. It will improve overall engine operation and efficiency for any application.



MODEL EGC2



MODEL EGC2 side view

INTEGRATED UNIT

The EGC is a single unit made to mount on the butterfly valve and will directly replace several popular carburetors. The installation is greatly simplified by combining the fuel pressure regulator, mixing venturi and the fuel control valve. The overall design and performance of each component is optimized for this application. It is a cost-effective solution for replacing a multiple component system.

EGC OPERATION

The EGC is an Air-Fuel Ratio (AFR) system designed specifically for small gas engines. It consists of two main components: the venturi mixer and the electronic pressure regulator working together to provide precise control of the air-fuel mixture in response to changing oxygen content in the exhaust. This patented technique provides superior control for gas engines.

VENTURI MIXER

The venturi shape of the mixer is designed to produce the low pressure at the throat of the venturi. This throat pressure is used to draw the fuel through the injection ports into the air stream. The injection ports and the venturi are designed to work together to provide the chemically correct air-fuel mixture at all load and speed conditions.

ELECTRONIC PRESSURE REGULATOR

The highly accurate pressure transducer is provided in the annulus surrounding the gas injection holes in the mixer. It provides the gas injection pressure measurement used by the electronic system to adjust the fuel pressure to match the setpoint. The fuel gas supply pressure should be large enough so that at maximum load the actuator in the EGC carburetor is open about 60%-70%.

As a result, a lower pressure is being developed in the throat of the mixer which draws the correct amount of fuel into the air stream to provide the correct air-fuel ratio for stoichiometric operation. The air-fuel mixture is then trimmed by adjusting the set point of the electronic pressure regulator based on the oxygen content in the exhaust.

WHY EGC IS THE BEST SYSTEM

Competing air-fuel ratio control systems generally work one of two ways:

The first method is to control the pressure of the fuel gas injected into an existing carburetor. The characteristics of the existing carburetor require the pressure from the regulator to change when the load or speed of the engine changes to maintain a constant mixture. The oxygen content in the exhaust is the only indication that the injection pressure must change for the new load or speed. A transit period is required for the exhaust gas to travel through the engine, and the exhaust system to get to the oxygen sensor. This causes a dead time or delay in the O2 feedback control signal. Due to this lag, the closed loop control system must operate with very low gains to maintain stable operation. This makes the system too slow to respond to changes in load, speed or heating value of the gas. During a transient condition, the engine will likely run out of compliance for a substantial time (15 minutes or more) following the event.

The second method is to control a small bypass valve that is used to add a limited amount of fuel to supplement the main fuel flow. In this type of system, the pressure regulator is fixed at a constant pressure and the electronic control system adds fuel to the carburetor air inlet to make the mixture richer. The valve is modulated to maintain the correct mixture. This system has the same problem as the first method. In addition, it has a potential issue of running out of adjustment range. The transient and load conditions cause the engine to run out of compliance.

The Continental Controls EGC (Electronic Gas Carburetor) maintains the gas injection pressure near zero for all conditions eliminating the need to reset the pressure control during load changes. Therefore, the engine will stay within compliance during any load transient. It will react instantly to any oxygen content change in the exhaust by adjusting the system's fuel pressure set point.

FUEL TYPES

The EGC can be used with hydrocarbon fuel in a gaseous state, including:

- Natural gas
- Propane
- Digester biogas
- Flare gas from oil wells

HEATING VALUE OF THE FUEL

If the heating value (BTU) of the fuel changes while the engine is running in AFR mode utilizing oxygen sensor feedback, the EGC will automatically adjust the injection pressure to maintain the correct fuel mixture and low emissions.

POWER REQUIREMENTS

10 VDC to 14 VDC

12 VOLT BATTERY

3.0 amp at 10 volts with 6 amp peak

DESIRED FUEL SUPPLY PRESSURE

4-8 inches of water column (WC)
EGC4 will require greater supply of pressure based on specific application.

FULL AUTHORITY VALVE

The EGC controls all the fuel to the engine which allows greater range of load and BTU changes in contrast to limited function of smaller bypass type valves.

FULLY AUTOMATIC

Starts the engine using default pressure setting. Upon getting valid oxygen sensor feedback it automatically determines the correct fuel pressure setpoint for emissions minimization.

DATA COMMUNICATIONS

Supports two serial protocols: Modbus and CAN bus. The EGC is integral to the complete engine system On-Board Diagnostic (OBD) solution by providing all measured parameters and logged faults.

APPLICATIONS

- Gas Compression
- Power Generation
- Irrigation Pumps
- Refrigeration

OPTIONAL DISPLAY

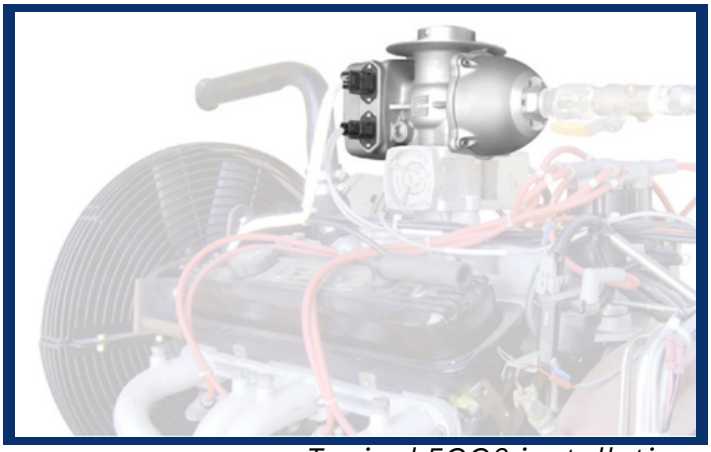
The optional display allows monitoring engine's key parameters and gives access to all user defined settings within EGC, e.g. oxygen sensor set-point/feedback, fuel pressure set-point/feedback, etc.

CONFIGURATION SOFTWARE

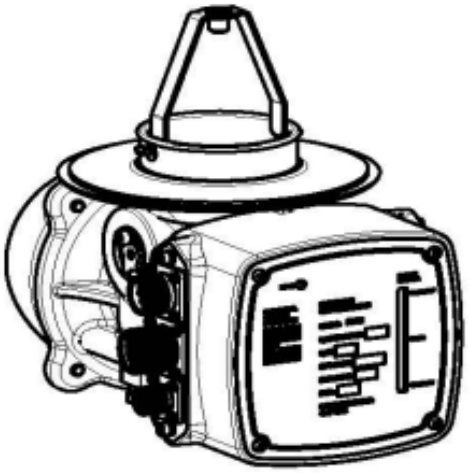
EGC Valve Viewer is a Microsoft Windows based application used for interfacing the EGC Air-Fuel Ratio Control System. EGC Valve Viewer application provides real-time monitoring of control functions in EGC, gives the user overall control over the EGC functionality, serves as diagnostic tool helping to detect, and evaluate problems related to fuel control and emissions reduction on natural gas engines. EGC Valve Viewer is an intuitive, user-friendly software tool which offers an advanced array of features like easy setup of all user-definable setpoints in the EGC, monitoring key data points, optional data logging, playback of history files, settings report, zoom feature, digital inputs control, and other.

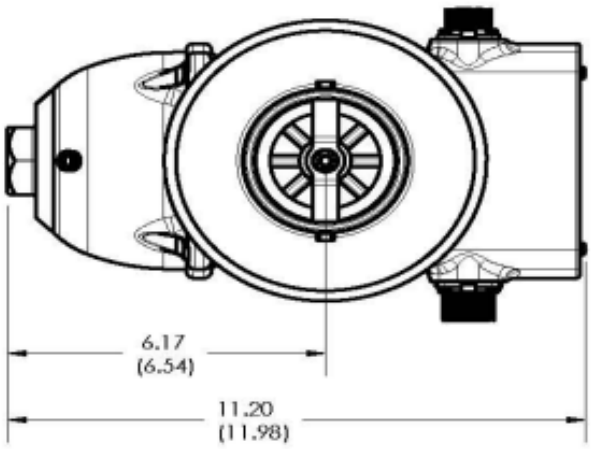
EMISSIONS REQUIREMENTS

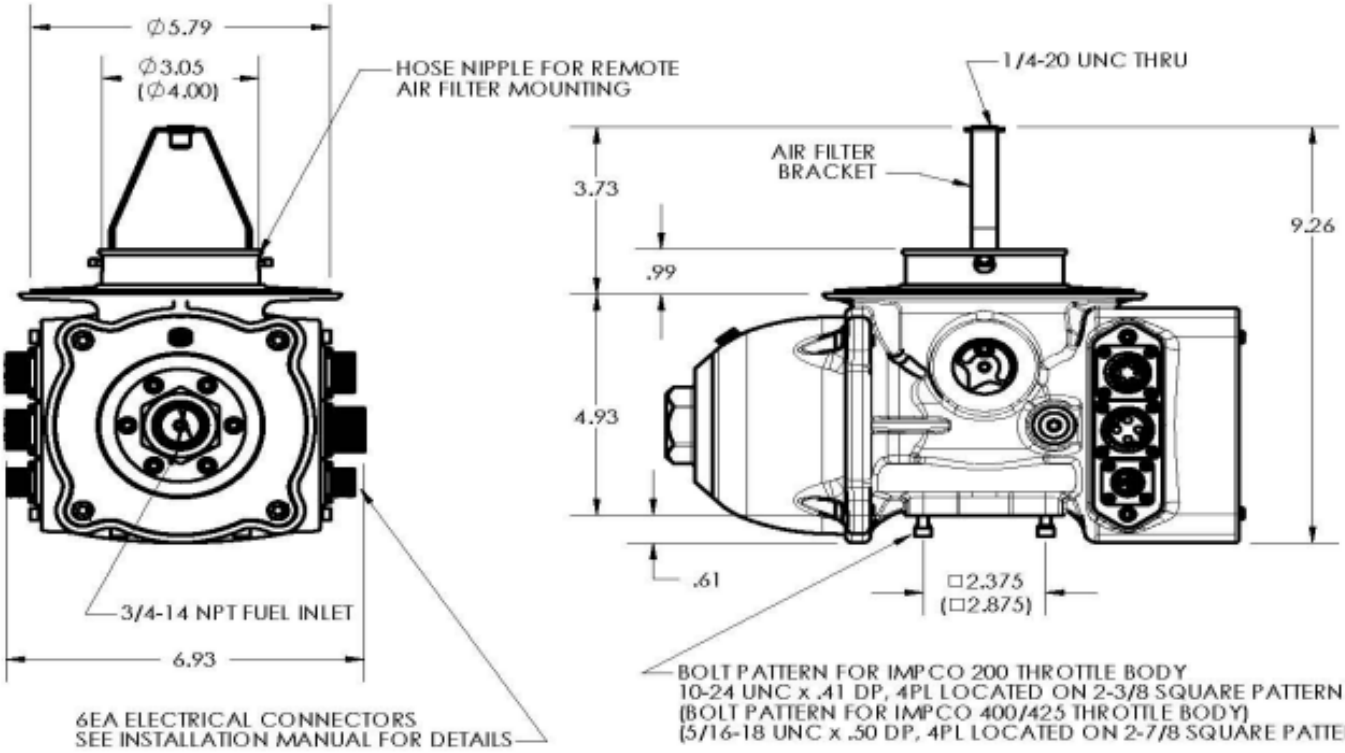
The emissions limits set by government agencies vary depending on the state and county regulations. The EGC will provide the best available control technology (BACT) when used in conjunction with a properly sized 3-way catalytic converter allowing to meet even the most stringent emissions requirements anywhere.



Typical EGC2 installation







DIMENSIONS SPECIFIC TO THE EGC4 ARE SHOWN IN PARENTHESIS (X.XXX)
ALL OTHER DIMENSIONS ARE THE SAME FOR THE EGC2 & EGC4 UNLESS OTHERWISE NOTED

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