

## Natural Gas Conversion for Stationary Diesel Engines

The EVO-SP™ System allows operators of electric power generators to substantially reduce costs, extend emergency run-time and improve sustainability by substituting diesel fuel with lower cost, cleaner burning natural gas (NG). The EVO-SP System is comprised of proprietary and patent-pending technologies that allow the safe use of natural gas in place of diesel fuel, with substitution rates ranging from 50% to 70% of the generator's total fuel requirement. Generators converted with the System exhibit diesel-like performance in such critical areas as load acceptance, power output, stability and efficiency.



### Installation

The EVO-SP System allows for the on-site conversion of stationary engines to natural gas and diesel (NG+D) operation. The conversion process utilizes components that are installed externally of the engine/generator and no changes or modifications to the cylinders, pistons, fuel injectors or cylinder heads are required. By retaining the OEM diesel fuel system in its entirety, the EVO-SP System maintains the engine's capability to operate solely on diesel fuel when needed. The System utilizes pipeline-supplied natural gas at pressures of 3-7 PSI and supplies low pressure fuel gas to the engine using an electronically controlled throttle-body integrated with a fixed-geometry, low restriction air-gas mixer. Installation is performed using conventional tools and equipment and requires about 6-8 hours to complete.

### Electronic Control Unit

The EVO-SP System includes a powerful Electronic Control Unit (ECU) that monitors critical engine and generator data to dynamically control the operating fuel ratio of the engine. The ECU is J-1939 compatible and monitors mass airflow, generator power output, diesel fuel flow and other engine parameters in order to continually optimize gas substitution rate based on operating conditions. Fuel mapping changes are performed on a real-time basis using sophisticated control algorithms that are updated fifty times per second. The ECU provides engine protection and monitoring functionality with pre-alarm, alarm and shut-down control logic that allows the engine to be switched from NG+D mode to diesel-only operation seamlessly and automatically. The ECU has been designed for easy installation using pre-configured wiring harnesses and mil-spec quick connectors.

### Control Panel

The EVO-SP System allows for quick and simple access to both real-time and logged system data using a proprietary graphical user interface (GUI) displayed on a state-of-the-art touchscreen panel. The touch screen panel is mounted in a NEMA 4X stainless steel enclosure and includes an external emergency stop (E-stop) switch. Primary power is controlled via a switch located inside the control panel and

a master system enable switch is provided to allow the EVO-SP System to be powered-up for testing and diagnostics in 100% diesel mode.

### Engine Protection

The EVO-SP System ensures continued engine and generator reliability when operating in NG+D mode. The EVO-SP ECU monitors critical parameters including fuel rates, exhaust gas temperatures, vibration levels, manifold air temperatures, mass airflow, gas pressures, engine coolant temperature, engine RPM, compressor inlet pressures and manifold air pressures. Each ECU data channel is sampled up to 50 times per second ensuring rapid detection and correction of anomalies. Unlike competitive technologies that utilize a single safety setpoint at maximum load conditions, the EVO-SP System includes Dynamic Setpoint Protection™ (DSP). DSP monitors engine performance across the generator load range and provides discrete safety and control setpoint values that are referenced to baseline performance curves in 100% diesel mode. In the event that the System deactivates NG+D mode, transition to 100% diesel mode is performed without interruption in generator output or stability.

### Safety

The EVO-SP System ensures operator safety using integrated controls, sensors and remote emergency stops. The EVO-SP System gas train includes dual redundant, normally closed, DC-powered gas shut-off valves as well as a manual gas shut-off valve. The EVO-SP gas train meets the most stringent requirements and is approved for worldwide use by UL, UR, CSA, FM, CE, AGA and GOST. The EVO-SP System also includes a combustible gas detector and a flame detector providing additional safety and security for operators and facility personnel. In the event that an open flame and/or combustible gas is detected in the generator area, the System automatically reverts the generator to 100% diesel operation and de-energizes the dual gas solenoid valves. In addition, the EVO-SP System can be electronically linked to third party control systems allowing for additional alerting and remote gas shut-off capabilities in the event of fire and/or gas leaks.

# EVO-SP 4600 System | Specifications



## Electronic Control Unit (ECU)

32-bit Microcontroller with USB and CAN Communications  
 J1939 Compatible  
 Programmable Fuel Mapping  
 Remote Graphic User Interface  
 Monitors >25 Sensors 50X per Second  
 Six Channel Throttle-Body Control Output  
 24V Input Power  
 Load Dump Overvoltage >1w00V  
 Under-Voltage Lockout <18V  
 Reverse and Double Battery Voltage Protected  
*Ambient Operating Temperature:*  
 -40°C to +105°C  
*Storage Temperature:*  
 -40°C to +125°C  
*EMC / EMI:*  
 EN61000-6-2/-4  
 ISO 10605  
 ISO 11452-2,4  
 CISPR 25  
*Humidity:* MIL-STD-810D, 507.2  
*Chemical Resistance:* SAE J1455, 4.4.3  
*Shock:* 40 Gs  
*Vibration:*  
 Random: 0.3G<sup>2</sup>/Hz, 10-2000 Hz  
*Thermal Shock:* SAE J1455, 4.1.3.2  
*Ingress Protection:* IP56 Per IEC 60529  
 SAE J1455

## Integrated Mixer Throttle-Body

*Mixer Diameter:* 6" O.D. Nominal  
*Number of Mixers:* 4  
*Material:* 6061-T6 Aluminum  
*Fuel Supply Connection:* 1.5" JIC  
*Ambient Operating Temperature:*  
 -40 to +105 °C (-40 to +221 °F)  
*Storage Temperature:* -40 to +125 °C  
 (-40 to +257 °F)  
*Humidity:* US MIL-STD 810E,  
 Method 507.3, Procedure III  
*Salt Spray:* US MIL-STD 810E, Method 509.3,  
 Procedure I  
*Shock:* MS1-40G 11ms Sawtooth  
*Vibration Random:* 0.3 G<sub>C</sub>/Hz , 10–2000 Hz  
 (22.1Grms) 3 h/axis  
*Sine:* 5 G 2.5 mm peak-to-peak, 5–2000 Hz,  
 3 h/axis, 90 min dwells, 1 octave/min  
*Drop:* SAE J1211, Paragraph 4.8.3 (modified)  
*Thermal Shock:* SAE J1455,  
 Paragraph 4.1.3.2  
*Ingress Protection:* IP56 per EN60529  
*Inlet Pressure Sealed Shaft Bearings:*  
 2 bar (29 psi) gage  
*Standard Shaft Bearings:*  
 0.068 bar (1 psi) gage

## Touch Screen Display

12.1" TFT XGA LCD  
 Ingress Protection IP65 per EN60529  
 Power: 24V  
*Viewing Angle:* -80~80 (H); -70~70 (V)

*Active Display Area:* 245.76 (H) x 184.32 (V)  
*Resolution:* 1024x768  
*Ambient Operating Temperature:* -20 to 60 °C  
 (-4 to 140 °F)  
*Humidity:* 10% to 95% non-condensing  
*Shock:* 15G, 11 ms duration  
*Vibration:* 5 Hz ~ 500 Hz / 1 Grms

## Dual Modular Gas Valve

Size: DN65  
*Ambient Operating Temperature:*  
 -15 to +60 °C (5 to 140 °F)  
 Power: 24 – 28 VDC  
 Rating: Class A Group 2, EN 161  
*Ingress Protection:* IP54, IEC 529  
 Open Time: <1 Sec  
 Close Time: <1 Sec

## Safety Features

- Flame Detection
- Combustible Gas Detection
- Air-Gas Mixture Inflammable Outside Combustion Chamber
- High Exhaust / Turbo Temperature
- High Boost Pressure / Temperature
- Over-Speed Protection
- High Vibration (Knock Detection)
- Excess Diesel & Gas Flow
- Gas Throttle Position Feedback Loop