ENGINE GOVERNING SYSTEMS

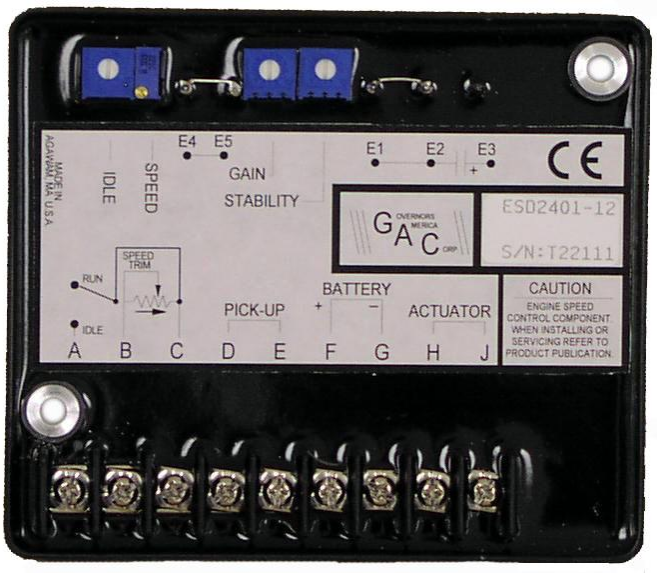
ESD2400 Series

Speed Control Unit

- Designed for non-feedback GAC actuators
- Idle speed adjustment
- Extremely rugged hard potted
- Single engine isochronous operation
- High performance design
- Adjustable PID functions

INTRODUCTION

The **ESD2400** electronic speed control is 100 % solid-state electronic device designed to control engine speed with fast and precise response to transient load changes. The specific application of this controller is as an alternative, cost effective controller to be used with GAC's extensive line of electric actuators and throttle bodies. This speed control unit, when used in conjunction with an electric actuator and supplied with signal from the magnetic speed sensor, will control a wide variety of gaseous fueled or diesel engines in an isochronous mode. It is designed for high reliability and is hard potted to withstand the harsh environments. Simplicity of installation and adjustment was foremost in the design. Two non-interacting performance controls allow near optimum response to be readily obtained.



DESCRIPTION

Engine speed information for the speed control unit is usually received from a magnetic speed sensor. Any other signal-generating device may be used provided that the generated frequency is proportional to engine speed and meets the voltage input and frequency range specifications. The speed sensor is typically mounted in the close proximity to an engine driven ferrous gear, usually the ring gear. As the teeth of the gear pass the magnetic sensor, a signal is generated which is directly proportional to engine speed.

Signal strength must be within the range of the input amplifier. An amplitude of 0.5 to 50 Volts RMS is required to allow the unit to function within its design specifications. The speed signal is applied to Terminal D and E of the speed control unit. Between these terminals there is an input impedance of over 5k Ohms. Terminal E is internally connected to Terminal G, battery negative. Only one end of the cable shield should be connected.

When a speed sensor signal is received by the controller, the signal is amplified and shaped by an internal circuit to provide an analog speed signal. If the speed sensor monitor does not detect a signal from the speed sensor, the output circuit of the speed control unit will turn off all current to the actuator.

A summing circuit, internal to the ESD2400 series, receives the speed sensor signal along with the speed adjust set point input. The speed range has a ratio of 7:1 and is adjusted with a 25-turn potentiometer. The output from this summing circuit is the input to the dynamic control circuit. The dynamic control circuit, of which the gain and stability adjustments are a part, has a control function that will provide isochronous and stable performance for most engine fuel systems.

The speed control unit's output circuit is influenced by the integral gain and stability performance adjustments. The governor system sensitivity is increased with clockwise rotation of the gain adjustment. This gain adjustment has a non-linear range of 33:1. The stability adjustment, when turned clockwise, increases the rate-of-response time of the governor system in order to match the various time constants of a wide variety of engines. Since the ESD2400 series is a PID device, the "D" derivative portion can be varied when required (see PIB1023).

During engine cranking, the actuator is fully energized and will move to the maximum fuel position. The actuator will remain in this state during engine cranking and acceleration. While the engine is at steady load, the actuator will be energized with sufficient current to maintain the governor speed set point.

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The output circuit provides switching current at a frequency of about 400Hz to drive the actuator. This switching frequency is well beyond the natural frequency of the actuator, thus there is no visible motion of the actuator output shaft. Switching the output transistor reduces its internal power dissipation for more efficient power control. The output circuit can provide a current of up to 10 amps continuous at 25°C at battery voltages up to 32VDC to drive the actuator. The actuator responds to the average current to position the engine's fuel control lever.

The ESD2400 Series has several performance and protection features, which enhance the governor system. A speed anticipation circuit will minimize speed overshoot on engine start-up or when large increments of load are applied to the engine.

ESD2400 SERIES SPEED CONTROL UNITS

ESD2401-12 ..... Standard unit, 12V	ESD2401-24 ..... Standard unit, 24V
ESD2402-12 ..Lower Gain Range for Low Inertia Actuators .	ESD2402-24 ..Lower Gain Range for Low Inertia Actuators

SPECIFICATIONS

Performance

Isochronous Operation/Steady State Stability ..... ± 0.25% or Better
Speed Range/Governor ..... 1kHz - 7.5KHz
Continuous Speed Drift with Temperature ..... ±1% Maximum
Speed Trim Range ..... ±250Hz Typical
Idle Range ..... < ±0-3% Typical

Environmental

Ambient Operating Temperature Range ..... -40°F to +180°F (-40°C to +85°C)
Relative Humidity (Non-condensing) ..... Up to 100%
All Surface Finishes ..... Fungus Proof & Corrosion Resistant

Input Power

Supply ..... -12; 8-20Vdc, -24; 16-32Vdc (Transient and Reverse Voltage Protected)*
Polarity ..... Negative Ground (Case Isolated)
Power Consumption ..... 60mA Continuous plus actuator current
Maximum Actuator Current at 77°F (25°C) ..... 10 Amps Continuous
Speed Sensor Signal ..... 0.50 VAC - 50 VAC RMS

Reliability

Vibration ..... 5G @ 20-500Hz
Testing ..... Functionally Tested

Physical

Dimensions ..... See Outline (Diagram 1)
Weight 12oz (347g)
Mounting ..... Any Position (Vertical Preferred)

DIAGRAM 1. SYSTEM WIRING/OUTLINE