

- Adjustable Droop and Idle Speed
- Reverse Voltage Protection
- Overspeed Shutdown Circuit

- Crank Termination Circuit
- Starting Fuel Ramp Control
- Inputs for Accessories

### INTRODUCTION

The ESD5550/5570 series speed control unit is an all electronic device designed to control engine speed with fast and precise response to transient load changes. This closed loop control, when connected to a proportional electric actuator and supplied with a magnetic speed sensor signal, will control a wide variety of engines in an isochronous or droop mode. It is designed for high reliability and built ruggedly to withstand the engine environment.

Simplify of installation and adjustment was foremost in the design. Non-interacting performance controls allow near optimum response to be easily obtained.

The primary features of the ESD5550/5570 Series speed control unit are the engine STARTING Fuel and SPEED RAMPING adjustments. The use of these features will minimize engine exhaust smoke experienced prior to attaining engine operating speed.

Other features include adjustable droop and idle operation, inputs for accessories used in multi-engine or special applications, protection against reverse battery voltage, transient voltages, accidental short circuit of the actuator and fail safe design in the event of loss of speed sensor signal or battery supply.

The ESD5550/5570 Series speed control unit is compatible with all GAC proportional actuators except the ACB2001 electric actuator. When the ESD5550/5570 Series speed control unit is used with an ADC100 Series electric actuator, the DROOP adjustment range will be less due to this actuator's low current demand.

### 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 the generated frequency is proportional to engine speed and meets the voltage input and frequency range specification. The speed sensor is typically mounted in close proximity to an engine driven ferrous gear, usually the engine ring gear. As the teeth of the gear pass the magnetic sensor, a signal is generated which is proportional to engine speed.

Signal strength must be within the range of the input amplified. Amplitude of 0.5 to 120 volts RMS is required to allow the unit to function within its design specification. The speed signal is applied to Terminals C and D of the speed control unit. Between these terminals there is an input impedance

of over 33,000 ohms. Terminal D is internally connected to Terminal E, battery negative. Only one end of the shielded cable 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 speed sensor signal, the output circuit of the speed control unit will turn off all current to the actuator. A summing circuit receives the speed sensor signal along with the speed adjust set point input. The speed range has a ratio of 8:1 and is adjusted with a 25 turn potentiometer. The output from the summing circuit is the input to the dynamic control section of the speed control unit. The dynamic control circuit, of which the gain and stability adjustments are part, has a control function that will provide isochronous and stable performance for most engine types and fuel systems.

The speed control unit circuit is influenced by the gain and stability performance adjustments. The governor system sensitivity is increased with clockwise rotation of the gain adjustment. The gain adjustment has a range of 33:1. The stability adjustment, when advanced clockwise, increases the time rate of response of the governor system to match the various time constants of a wide variety of engines. The speed control unit is a PID device, the "D"; derivative portion can be varied when required.

During the engine cranking cycle, STARTING FUEL can be adjusted from an almost closed, to a nearly full fuel position. Once the engine has started, the speed control point is determined, first by the IDLE speed set point and the SPEED RAMPING circuit. After engine speed ramping has



been completed, the engine will be at its governed operating speed. At the desired governed engine speed, the actuator will be energized with sufficient current to maintain the desired engine speed, independent of load (isochronous operation).

The output circuit provides switching current at a frequency of about 500 Hz. to drive the actuator. Since the switching frequency is well beyond the natural frequency of the actuator, there is no visible motion of the actuator output shaft. Switching the output transistors reduces its internal power dissipation for efficient power control. The output circuit can provide current up to 10 amps continuous at 25°C for 12 and 24 VDC battery systems. The actuator responds to the average current to position the engine fuel control lever. In standard operation, the speed control unit performance is isochronous. Droop governing can be selected by connecting Terminals K and L and the percent of droop governing can be varied with the droop adjustment control. The droop range can be decreased by connecting Terminals G and H. The speed control unit has several performance and protection features, which enhance the governor system. A speed anticipation circuit minimizes speed overshoot on engine

startup or when large increments of load are applied to the engine. Engine idle speed can be remotely selected and is adjustable. Accessory inputs to achieve variable speed operation and multi-engine control can be accepted by the ESD5500/5570 Series speed control unit from GAC load sharing module, automatic synchronizers, ramp generators and other accessory engine control modules. Protection against reverse battery voltage and transient voltages is provided. The design is fail-safe in the event of loss of speed sensor signal or battery supply.

The ESD5550/5570 Series speed control unit includes a single element speed switch. It provides a convenient means of sensing an overspeed condition and activating an internal relay. This relay may be used to shut off the fuel or ignition to provide safe engine shut down. The speed switch feature includes a wide adjustment range, test and reset functions, and an LED indicator.

The ESD5550/5570 Series speed control unit is compatible with GOVERNORS AMERICA CORP. proportional electric actuators (except ACB2001) as well as those from other manufacturers.

### SELECTION CHART

MODEL	CHARACTERISTICS					
	Starting Fuel Control	Speed Ramping	Single Element Speed Switch (Overspeed)	2 Element Speed Switch (Overspeed & Crank Termination)	Use with a Light Force Actuator	Integrator Wind-up Protection
ESD5550	•	•	•			
ESD5556	•	•		•		•
ESD5570	•	•	•		•	

### SPECIFICATIONS

#### PERFORMANCE

Isochronous Operation..... ±0.250% or better  
 Speed Range /Governor.....1K-7.5K HZ Continuous  
 Speed Drift with Temperature..... ±1% Maximum  
 Idle Adjust CW.....60% of set speed  
 Idle Adjust CCW.....Less than 1200 Hz  
 Droop Range.....1 - 5 % regulation  
 Droop Adj. Max. (K-L Jumpered).....400Hz., ±75Hz. Per 1.0A change  
 Droop Adj. Min. (K-L Jumpered).....15 Hz., ±75 Hz. Per 1.0A change  
 Speed Trim Range..... +/- 200 Hz  
 Remote Variable Speed Range..... 500 – 7.5 Hz or any part thereof  
 Terminal Sensitivity  
 J.....100Hz., ±15 Hz/Volt @ 5.0 K Impedance  
 L.....735Hz., ±60Hz/Volt @ 65 K Impedance  
 N.....148Hz., ±10 Hz/Volt 1 Meg Impedance  
 P.....10 VDC Supply @ 20 ma Max  
 Speed Switch Adjustment Range..... 1000 – 10000 Hz

#### RELIABILITY

Vibration.....1G, 20-100 Hz  
 Shock.....20G's  
 Testing.....100% Functionally Tested

#### ENVIRONMENTAL

Ambient Temperature.....-40° to +180°F (-40° to +80°C)  
 Relative Humidity.....up to 95%  
 All Surface Finishes.....Fungus proof and corrosion resistance  
 RoHS Regulation.....Compliant

#### INPUT POWER

DC Supply.....12V or 24 VDC Battery Systems (Transient and Reverse Voltage Protected)  
 Polarity.....Negative Ground (case isolated)  
 Power Consumption.....<50 mA continuous plus actuator current  
 Actuator Current Range @ 77°F (25°C) – (Inductive Load)...Min. 2.5 Amps  
 Max. 10 Amps continuous  
 Speed Sensor Signal.....0.5 – 120 Volts RMS  
 Speed Switch Relay Contacts (N.O. and N.C.).....10 Amps

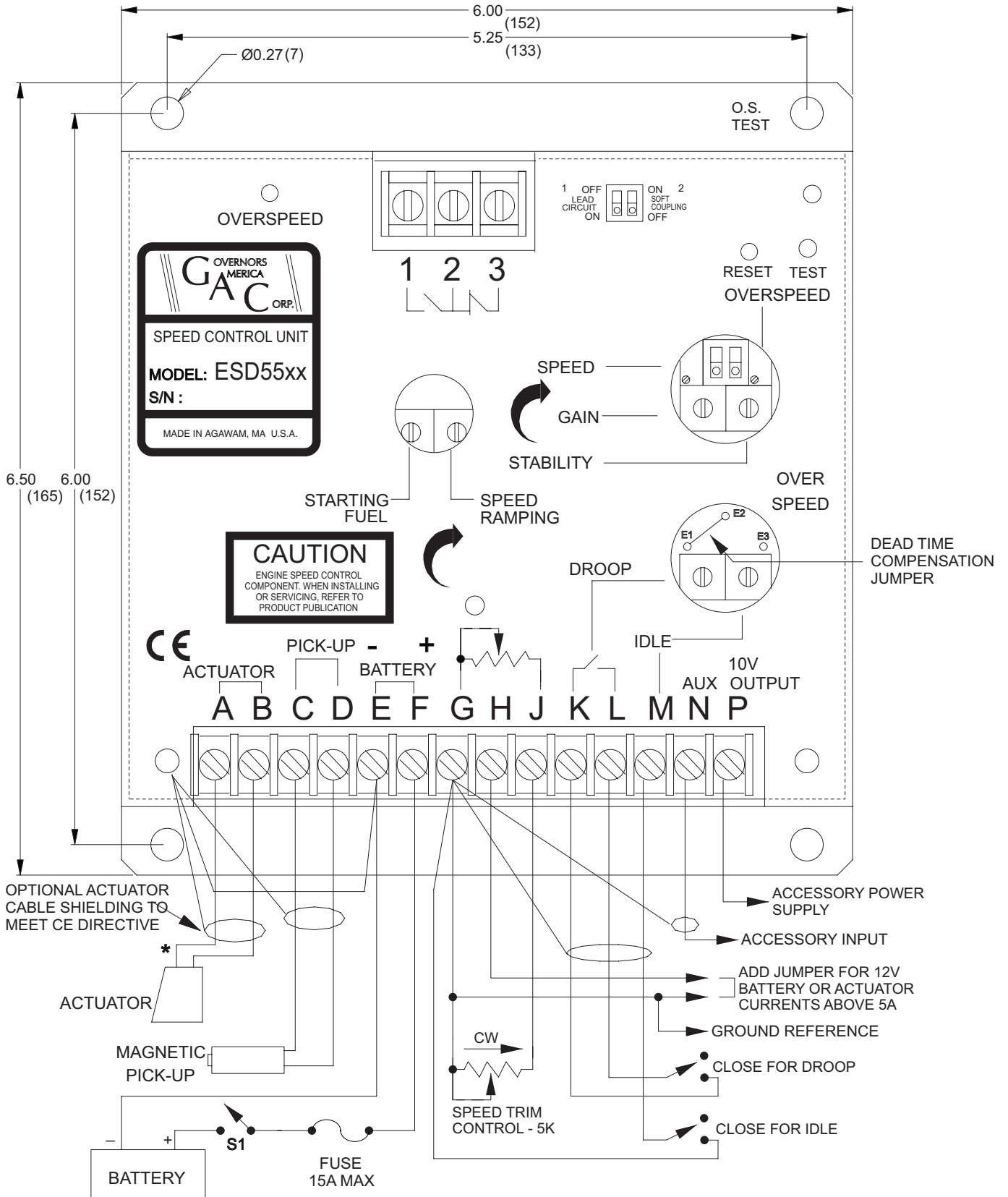
#### PHYSICAL

Dimensions.....See DIAGRAM 1 and DIAGRAM 2  
 Weight.....1.8 lb (0.82 kg)  
 Mounting.....Any Position, Vertical Recommended

#### COMPLIANCE / STANDARDS

Agency.....CE Requirements

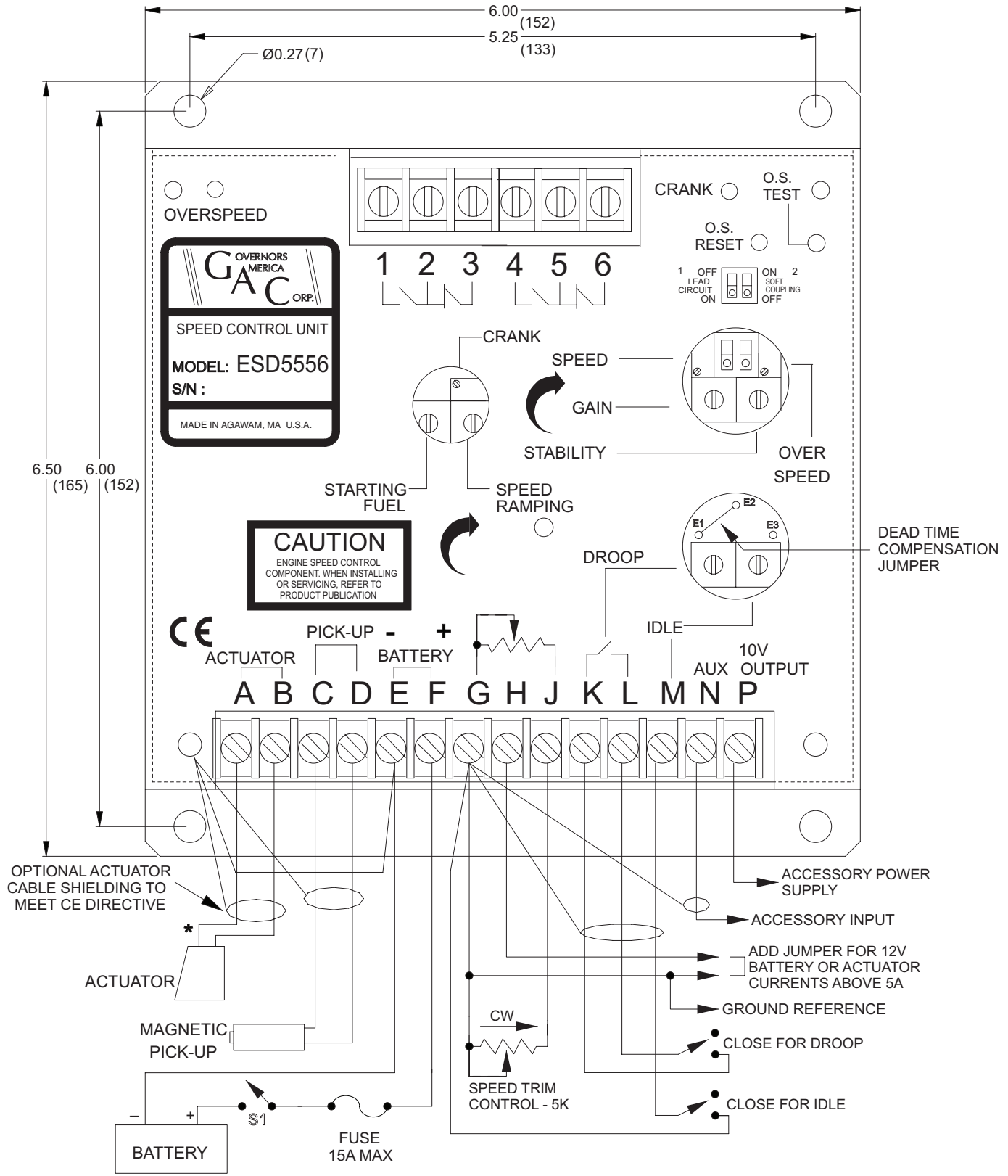
**DIAGRAM 2 SYSTEM WIRING AND OUTLINE (FOR ESD5550 AND ESD5570 ONLY)**



\* SEE SPECIFIC ACTUATOR PUBLICATION FOR PROPER WIRING OF ACTUATOR BASED ON BATTERY VOLTAGE

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 Caution: None of GAC products are flight certified controls including this item.

**DIAGRAM 3 SYSTEM WIRING AND OUTLINE (FOR ESD5556 ONLY)**



\*SEE SPECIFIC ACTUATOR PUBLICATION FOR PROPER WIRING OF ACTUATOR BASED ON BATTERY VOLTAGE

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