Engine Governing System

ESC61C Series Speed Control Unit

Governors America Corp.®

- Accepts Various Standard Battery Voltages
- Adjustable Speed Range 33:1
- Simple Installation
- Actuator Current to 20 Amps
- MIL Connector
- Speed Anticipation Circuit

INTRODUCTION

The ESC61C Series speed control unit is a high performance, solid-state 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.

Simplicity of installation and adjustment was foremost in the design. The low profile of the control is convenient to install with all adjustments and wiring connections accessible from the top cover. Two performance controls, GAIN and STABILITY, are non-interacting and will allow near optimum response from the governor system.

Other features include; direct acceptance of various standard battery supplies, wide adjustable speed range of 33:1, inputs for accessories used in multi-engine or special applications, protection against reverse battery voltage and transient voltages, and fail-safe design in the event of loss of speed sensor signal or battery supply.

DESCRIPTION

The ESC61C speed control is designed using a phase locked loop principle. This design provides very fast response with high accuracy.

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 input voltage 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 and frequency must be within the range of the input amplifier. An amplitude of 0.50 to30 VRMS with a frequency range of 300 - 10,000 Hz is required to allow the unit to function within its design specification. The speed signal is applied to Terminals S and T of the speed control unit. Between these terminals there is an input impedance of 5,000 ohms.

The speed sensor signal is amplified and shaped by the speed sensor input amplifier circuit. In the event the speed sensor signal is lost, the speed control unit's fail-safe feature will turn off the output circuit.

The output of the phase lock loop will provide a signal, which is approximately 5 volts (Terminal L) when the engine is "On-speed." A signal above 5 Volts means the engine speed is lower than the set point and the output is changing toward full fuel. Voltages less than 5 Volts means the engine speed is above the desired speed setting and the output is going toward no fuel.

As part of the phase locked loop, the GAIN control will adjust the sensitivity of the detected speed signal.

The speed range has a ratio of 33:1 and is adjusted with a 25-turn potentiometer. The output from the phase detector 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 a part, has a control function that will provide isochronous and stable performance for most engine types and fuel systems.

The output circuit provides switching current to drive the actuator at frequencies between 200 - 300 Hz. The switching frequency is well beyond the natural frequency of the actuator, thus there is no visible motion of the actuator output shaft. Switching of the output transistor reduces its internal power dissipation for efficient power control. The output circuit can provide current of up to 20 amps at battery voltages up to 40 VDC to drive an actuator. The output circuit is transient protected for voltages above 47 Volts and reverse voltage protected. The actuator responds to the average current to position the engine fuel control lever.

During engine cranking, the actuator is fully energized and moves 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.

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. The GAIN adjustment has a nonlinear range of 33:1. The STABILITY adjustment, when advanced clockwise, increases the time rate of response of the governor system in order to match

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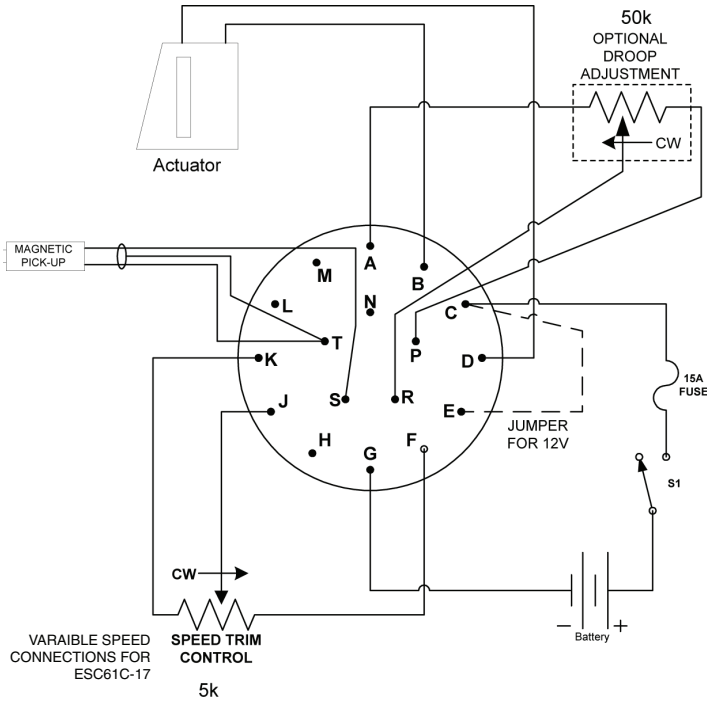
the various time constants of a wide variety of engines. Since the speed control unit is a P I D device, the “D”, derivative portion can be varied when required.

The reference for the speed control unit is the internal voltage control oscillator. This circuit has several inputs to adjust the controller’s speed settings. In addition to the primary speed adjustment, Terminals J and R provide inputs for various accessories. Accessory inputs to achieve variable speed operation and multi-engine control can be accepted by the ESC61C Series speed control unit from GAC load sharing modules, automatic synchronizers, ramp generators and other accessory engine control modules.

In standard operation, the speed control unit performance is isochronous. Droop governing can be selected by connecting a droop control. Droop of 0-5% can be achieved with this external droop adjustment control.

An actuator current derived droop signal is available at Terminal A of the controller. Stable and precise droop can be obtained from the use of this signal. See the droop circuit in Diagram 1.

DIAGRAM 1 WIRING DIAGRAM



The speed control unit 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. Protection against reverse battery voltage and transient voltages is provided. The design is fail-safe in the event of loss of speed sensor signal of battery supply.

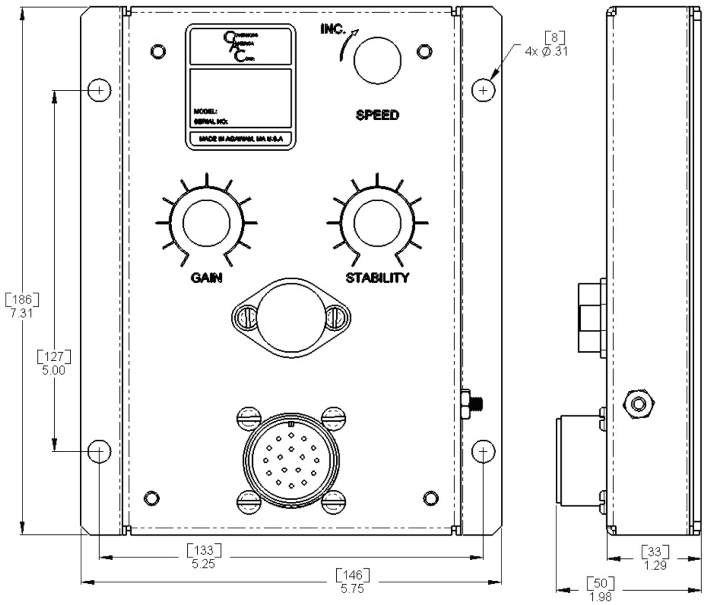
The control has two supply voltage ranges for operation. The low range is from 7.5-15 Volts, typically 12 Volts, and the high range is from 14-40 Volts for 24 and 32 Volt systems. A simple wiring change is required for this selection. Refer to Diagram 1.

The ESC61C Series speed control unit is compatible with GAC proportional electric actuators as well as those from other manufacturers.

SELECTION CHART

MODEL	CHARACTERISTICS
ESC61C-7	Standard Unit
ESC61C-17	Variable Speed Operation Version

DIAGRAM 2 SYSTEM OUTLINE



SPECIFICATIONS

PERFORMANCE

Isochronous Operating / Steady State Stability.....± 0.25% or better
Speed Range.....300 - 10K Hz continuous
Droop Range.....0 - 5 % regulation
Speed Drift with Temperature.....Less than ±1%
Speed Trim Range.....± 200 Hz
Terminal Sensitivity
R.....104 Hz./Volt
J (Without Jumper).....40 Hz./Volt
or J (With Jumper).....1100 Hz./Volt

ENVIRONMENTAL

Ambient Operating Temperature Range.....-65° to 180°F (-55° to +85° C)
Relative Humidity.....up to 95%
All Surface Finishes.....Fungus proof and corrosion resistance
RoHS Regulation.....Compliant

INPUT POWER

Supply.....11-40 VDC (transient and reverse voltage protected)
Polarity.....Negative Ground (Case Isolated)
Power Consumption.....60 ma continuous plus actuator current
Maximum Actuator Current at 25° C (77 °F).....20 Amps
Speed Sensor Signal.....0.5 to 30 Volts RMS
Speed Sensor Signal - Impedance.....5 K ohms

RELIABILITY

Vibration.....5G @ 20-500 Hz
Testing.....100% Functionally Tested

PHYSICAL

Dimensions.....See Outline, Diagram 2
Weight.....3.2 lbs. (1.45 kg)
Mounting.....Any Position, vertically preferred