

ENGINE GOVERNING SYSTEMS

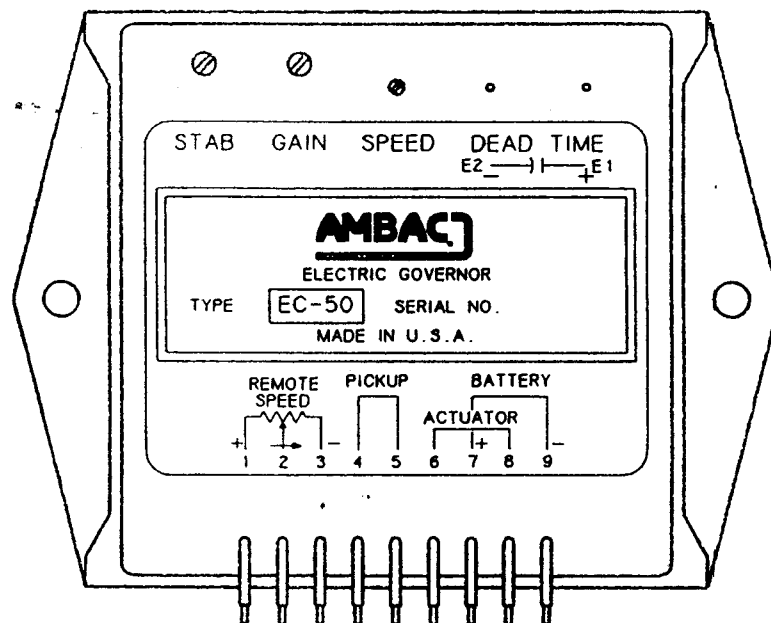
AMBAC

INTERNATIONAL

EC 50

Supersedes Issue
Dated December 1993

SPEED CONTROL UNIT



ACTUAL SIZE

FEATURES

- . Low cost
- . Compact size
- . Isochronous operation
- . Remote variable speed capability
- . Transient voltage protected
- . Vibration and moisture protected
- . Fail safe speed signal
- . Compatible with AGB, AGD, AGS and AGK 500 actuators

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INTRODUCTION

The EC 50 speed control unit contains all solid state electronic circuits which sense speed from a magnetic speed sensor or other suitable signal source and, in turn, provides a controlled output current to a proportional electric actuator for throttle control.

The performance of the speed control unit is isochronous. The speed is adjustable via a 22-turn speed adjust control. The gain control adjusts the speed of response. The stability control and dead time

compensation capacitor are used to match the time constant of the engine governing system to the engine. A speed anticipation circuit is provided to minimize over-shooting of speed on engine start-up. A wide range of magnetic speed sensor and DC supply voltage amplitudes can be accepted. If the input signal from the magnetic speed sensor is lost, the speed control unit will sense this and shut down the system.

SPECIFICATIONS

OPERATION

- Governing Mode Isochronous
- Steady State Stability $\pm 0.25\%$ or better
- Frequency Range 1K to 6K Hz continuous
- Speed Drift with Temperature $\pm 1\%$ maximum
- Remote Speed Potentiometer Range Full Frequency Range

POWER INPUT

- Magnetic Speed Sensor Signal 1.0-30 volts rms
- Supply 7-37 VDC (transient voltage protection)
- Polarity Negative ground
- Power Consumption 60mA (continuous) plus actuator current
- Maximum Actuator Controllable Current 4 Amperes continuous

ENVIRONMENTAL

- Temperature Range -40° to $+65^{\circ}$ C (-40° to $+150^{\circ}$ F)
- Relative Humidity up to 100%
- Case Fungus proof and corrosion resistant

PHYSICAL

- Dimensions See Figure 1
- Weight 0.2 kgs. (0.5 lbs.)
- Mounting Any position

RELIABILITY

- Tested 100%
- Vibration Printed circuit board is encapsulated

VARIATIONS

- EC 50A3 For 12 volt systems
- EC 50A4 For 32 volt systems
- * - EC 50A5 For 24 volt systems

ACCESSORIES

- FU 411369 Holder w/electronic fuse for 12 volt systems
- FU 411368 Holder w/electronic fuse for 24 volt systems
- FU 411367 Electronic fuse for 12 volt systems
- FU 411366 Electronic fuse for 24 volt systems

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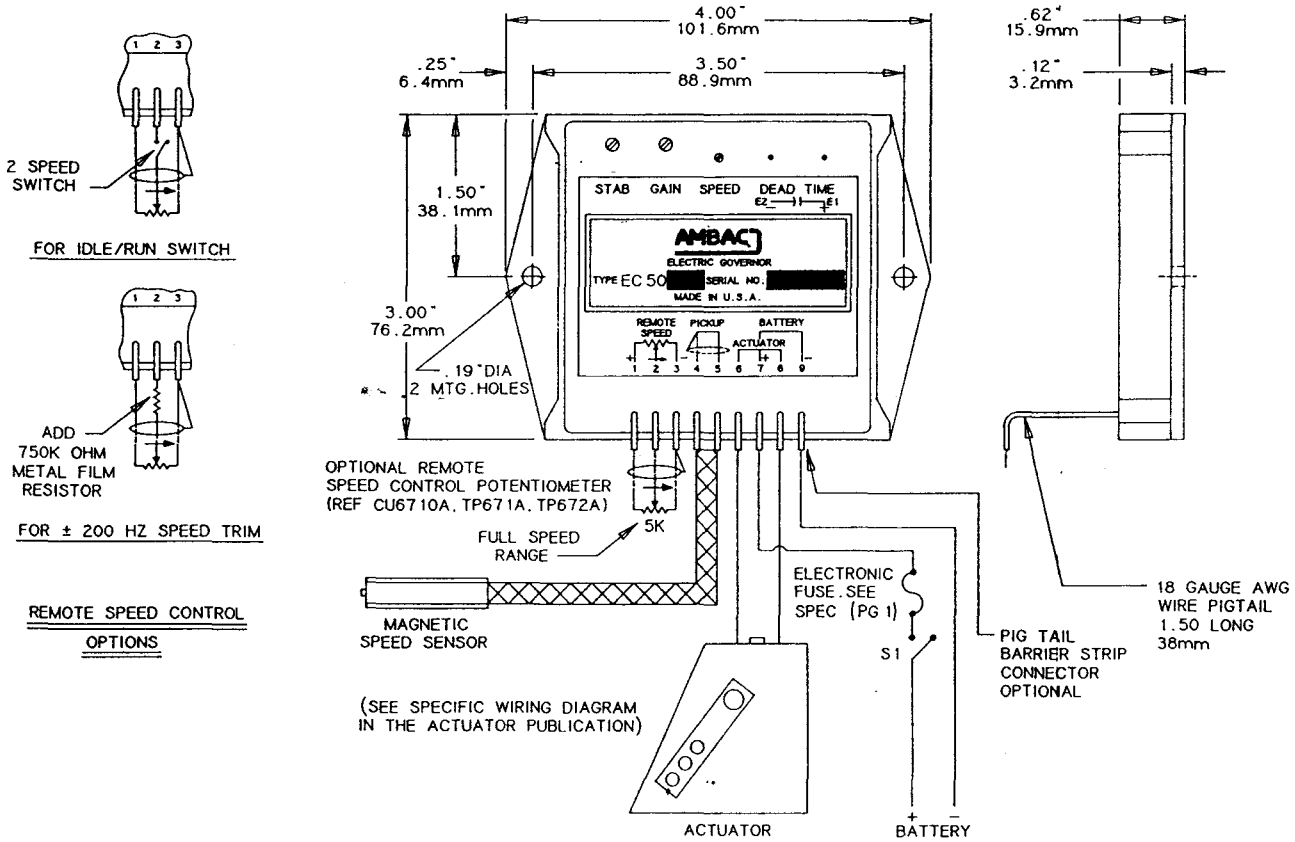
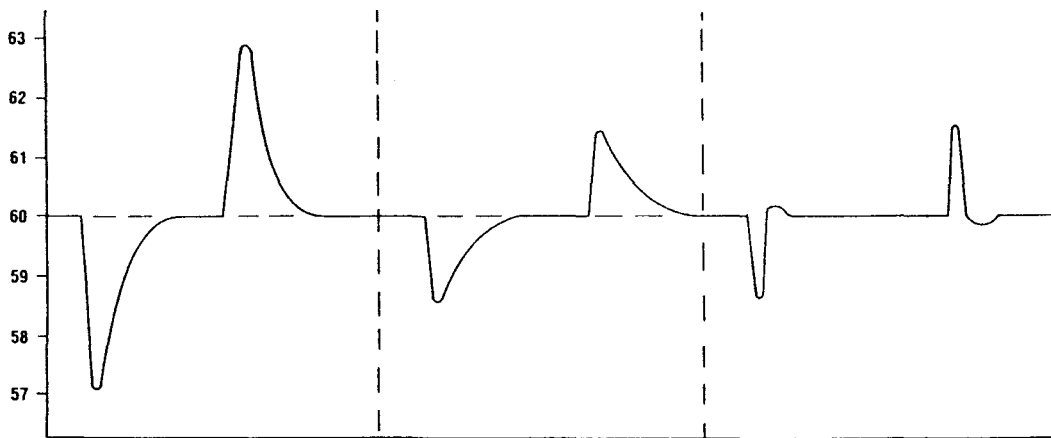


Figure 1 - EC 50 Speed Controller Dimensions and Wiring Connections



INITIAL GAIN AND STABILITY CONTROL ADJUSTMENTS GIVE A TRACE INDICATING, FROM THE EXCURSION OF THE TRANSIENT, THE GAIN SHOULD BE INCREASED BY TURNING THE GAIN CONTROL CW. NOTE: TIME IS CONSTANT FOR ALL CONDITIONS.

INCREASED GAIN RESULTED IN A NEW TRANSIENT WITH REDUCED EXCURSION. IT IS APPARENT FROM THE LONG TAIL ON THE TRANSIENT THAT THE STABILITY CONTROL MUST BE TURNED CW.

READJUSTING BOTH GAIN AND STABILITY CONTROLS GIVE A TRACE INDICATING GOOD TRANSIENT AT FULL LOAD AND GOOD STABILITY. THE SPEED CONTROL UNIT IS NOW PROPERLY ADJUSTED.

Figure 2 - Typical Performance Chart

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DESCRIPTION

The control circuits are designed to operate directly from a 12, 24, or 32 VDC battery system. The engine speed signal is usually obtained from a magnetic speed sensor mounted in close proximity to the teeth of a ferrous gear that is driven by the engine. The frequency of the speed sensor signal is proportional to the engine speed. The flywheel ring gear is normally used because of the high frequency pickup signal. The speed control unit will accept any signal if the frequency is proportional to engine speed and in the frequency range of the speed control unit (1K to 6K Hz). The signal strength must also be within the range of the input amplifier (1.0 volts rms to 30 volts rms for approximately sinusoidal signals). The magnetic speed sensor is connected to terminals "4" and "5". Terminal "4" is connected internally to the battery negative.

The speed sensor signal is amplified and shaped by the circuit to form constant width pulses. The average voltage of these pulses from the speed sensor amplifier section of the speed control unit is then fed into a summing circuit. A speed sensor monitor

circuit detects the pulses and, if the pulses disappear for longer than 0.1 second, the speed control unit will turn off the output circuit (current to actuator). During cranking, the actuator will move to the full fuel position and remain there during starting and acceleration of the engine. The summing point of the speed sensor and the speed adjust control is the input to the dynamic control section of the speed control unit. A gain control is provided to adjust the speed control unit's sensitivity.

The output actuator current switching circuit provides a pulse width modulated current to drive the actuator. The actuator responds to the average current to position the engine throttle. The output of the circuit provides up to 4 amps of continuous current at voltages up to 37 VDC. The output is suitable to drive AMBAC's AGB, AGD, AGS and AGK500 actuators, as well as those from other manufacturers.

An overshoot limiter circuit minimizes the overshoot of speed on start-up (typically less than 1.5%).

INSTALLATION

The speed control unit is rugged enough for mounting in the control cabinet or engine mounted enclosure. Care should be taken to ensure that the speed control unit is not subjected to extreme heat. If it is expected that water or mist will come in contact with the speed control unit, mount it vertically so that condensation will not accumulate on the speed control unit.

Leads to the battery and the actuator from the speed control unit should be #16, or #14 if over 10 feet long. These are the leads that are connected to terminals 6, 7, 8, and 9 of the speed control unit. A fast acting external fuse (see ACCESSORIES column on page 1) must be in series with terminal 7, the positive (+) battery input terminal. The magnetic speed

sensor leads are twisted and/or shielded for their entire length and are connected to terminals 4 and 5. Connect the shield to terminal 4 only. Do not connect the shield at the magnetic speed sensor end. If a speed trim control is used, connect it using shielded wire. Connect the shield to terminal 3. Actuator connections should be made according to the actuator publications.

Note: For applications requiring a fine adjust remote speed trim, the range of the remote speed adjustment potentiometer can be restricted to ± 200 Hz by adding a 750K OHM metal film resistor in series with the pot wiper arm, i.e., wire lead number 2. (Ref: Options on Figure 1.)

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NOTE: Optimum adjustment of both controls is in the furthest CW position that will result in the best response and stability under all operating conditions. Backing off slightly from the best position achieved during adjustment will allow for changing conditions that may affect the dynamic response of the engine. If a load bank and a recorder are available, use them to

verify the performance using Figure 2 as a guide. If a stable system cannot be obtained, refer to the Troubleshooting Section.

The previous procedures should result in a high performance isochronous governed speed control system.

TROUBLESHOOTING

Symptom: Governor is inoperative or throttle does not move. (Measurements to be made with standard VOM.)

<u>STEP</u>	<u>TERMINALS</u>	<u>NORMAL MEASUREMENT</u>	<u>POSSIBLE CAUSES OF ABNORMAL MEASUREMENTS</u>
1	4, 5	1.0 volt rms minimum while cranking engine (AC measurement)	<ol style="list-style-type: none"> 1. Gap too large between magnetic speed sensor and gear teeth. 2. Shorted or improper wiring to magnetic speed sensor. 3. Defective magnetic speed sensor.
2	7, 9	Battery voltage (DC measurement 7+ and 9-)	<ol style="list-style-type: none"> 1. Improper wiring of battery circuit or fuse blown.
3	1, 3	5 volts \pm 0.5V from the internal supply (DC measurement 1+ and 3-)	<ol style="list-style-type: none"> 1. Inadequate battery voltage. 2. Short across trim control circuit. 3. Defective speed control unit.
* 4	8, 9	Less than 0.5V when cranking. Battery voltage when not cranking.	<ol style="list-style-type: none"> 1. Speed setting lower than cranking speed. 2. Output transistor defective. 3. Error in actuator wiring. 4. Actuator defective. 5. Defective speed sensor.

Erratic or Unstable Governing or Unwanted Droop
If noisy electrical devices are present, such as magnets, solid state ignition systems, battery chargers or regulators which emit radio frequency interference (RFI), unstable governing or droop may be noticed. The speed control unit has internal filters which provide some protection from radio frequency interference. Excessive levels of RFI must be treated separately. A metal shield placed around the emitting source will help and/or placing the governor harness and speed control unit as far away as possible from the emitting source. Always twist the leads from the magnetic speed sensor all the way back to the speed

control unit. Shield the speed sensor leads with the shielding connected to terminal "4" of the speed control unit **only**. Raise the magnetic speed sensor voltage by reducing the gap between the speed sensor and the ring gear. A gap of 0.020" will provide a strong signal. If noise is still present, a 1000 micro-Fd (12V) capacitor may be connected across the speed trim control, terminal 1+ to terminal 3-. This will reduce external interference coming from the power supply. When extreme RFI is encountered, it may be necessary to shield battery leads to the speed control unit. The shield should be grounded at terminal "9" of the speed control unit.