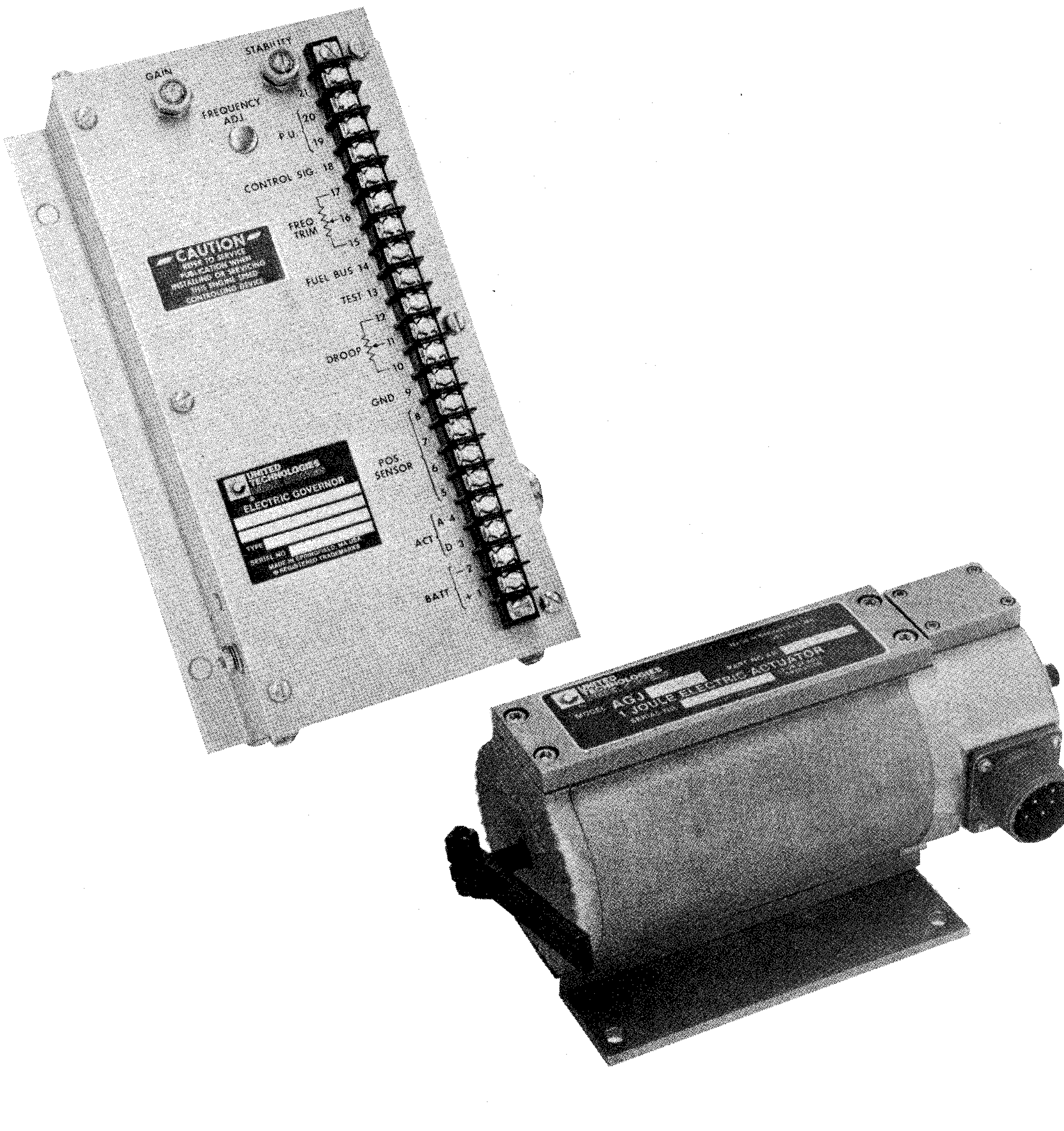
EGJ-1000 ENGINE GOVERNING SYSTEM



AMBAC INTERNATIONAL

ENGINE GOVERNING SYSTEMS

EGJ-1000

Section EG 80-4

SYSTEM INTRODUCTION

The EGJ-1000 governing system is a new generation of engine control systems which expands the United Technologies® Engine Governing Systems to a wider variety of applications (See Figure 1). The speed control unit and all-electric actuator are designed for compatible operation with each other to govern diesel, gasoline, or natural gas engines. The system permits isochronous or droop control of engines found in generator sets, marine propulsion engines, off-highway equipment and various industrial engine applications.

This new system employs a rotary design electric actuator and a position feedback system. With a feedback system, effects of friction in the fuel control or linkage are eliminated, resulting in faster response of the actuator.

The AGJ-1000 electric actuator has a work output of 1 Joule (.74ft-lb), 50° CW/CCW rotation, and contains a position feedback transducer. It permits the control of engines by adjusting the engine fuel system's control within its work output capability.

The ECJ-1000 speed control unit receives pulses from the magnetic speed sensor and actuator position feedback. any change in engine speed is processed along with the feedback, causing a corrective change in the control current going to the actuator.

The EGJ-1000 governing system has many standard features including:

- Electromagnetic transducer in the actuator position feedback system providing high reliability without sacrificing accuracy.
- Actuator output shaft automatically returns to minimum fuel position if power or magnetic speed sensor signal is lost.
- Patented phase lock loop circuit in speed control unit permits fast, accurate response to changes in engine speed over a 30:1 ratio.
- Isochronous or droop (0-5%) operation for maximum application flexibility.

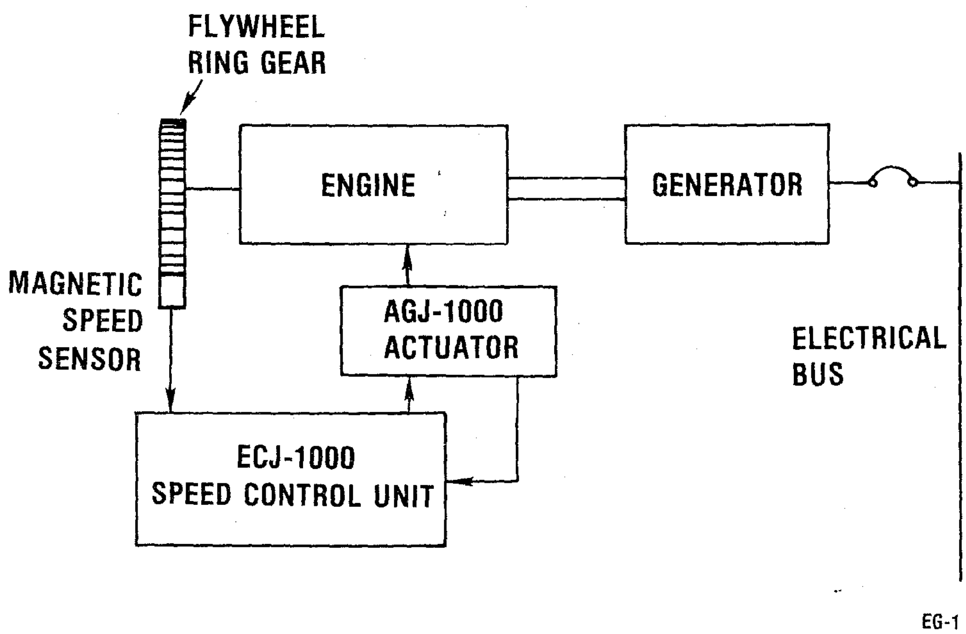


Figure 1. Block diagram of EGJ-1000 governing system on engine generator

SPECIFICATIONS

AGJ-1000 ACTUATOR PERFORMANCE

- Work	1 Joule (.74 ft - lb)
- Available Torque	1.14 Nm (0.84 lbF - ft)
- Maximum Operating Shaft Angular Travel	50° CW or CCW

POWER INPUT

- Operating Voltage	12, 24, or 32 VDC
- Normal Operating Current	8A at 12 VDC 4A at 24 or 32 VDC
- Maximum Current (Instantaneous)	12A at 12 VDC 6A at 24 or 32 VDC

ENVIRONMENTAL

- Temperature Range	–40° to +95° C (–40° to +200° F)
- Relative Humidity	up to 100%
- Case	Fungus proof and corrosion resistant

PHYSICAL

- Dimensions	See Figure 2
- Weight	6.6 kgs (14.5 lbs)
- Mounting	Any position (See Installation Page 7)

RELIABILITY

- Tested	100%

MATING CONNECTOR

- Use	EC1248-3/MS3106R20-7S

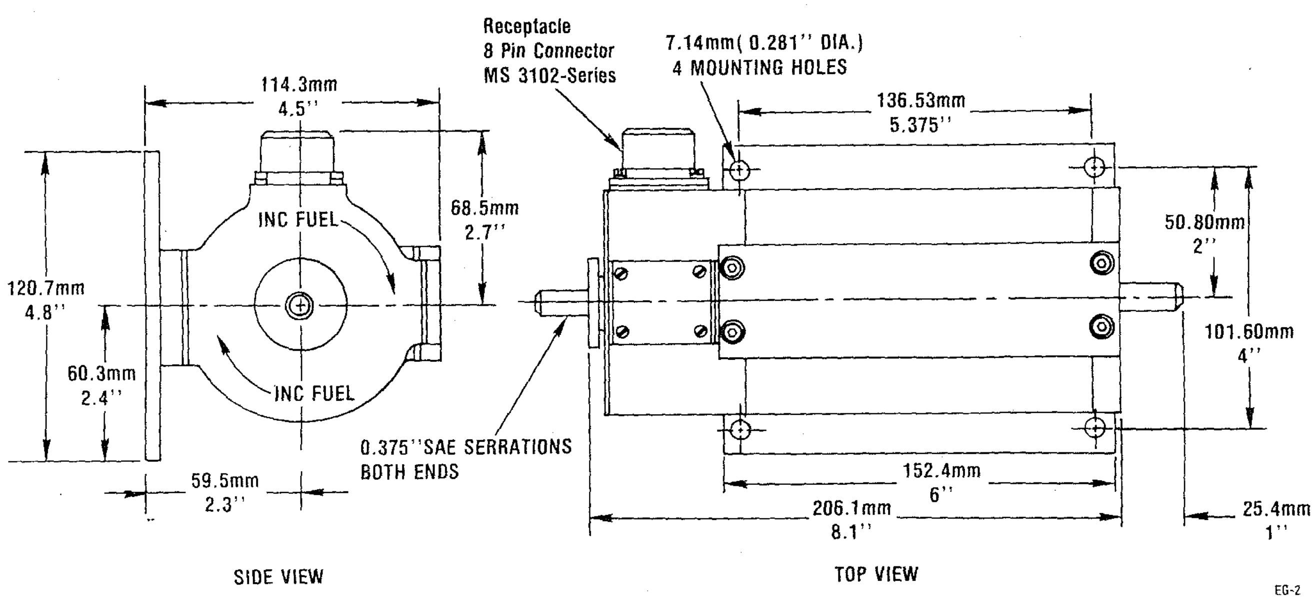


Figure 2. AGJ-1000 actuator dimensions

SPECIFICATIONS

ECJ-1000 SPEED CONTROL UNIT PERFORMANCE CHARACTERISTICS

- Isochronous .... ±0.25% regulation or better
- Droop .... 0-5% regulation
- Steady-state Stability .... ± 0.25% or better
- Frequency Range .... 300-10kHz continuous
- Speed Drift With Temperature .... ± 1% maximum
- Speed Trim Range .... ±200 Hz.

POWER INPUT

- Magnetic Speed Sensor Signal .... 0.25-30 volts rms
- Supply .... 8 - 40 VDC (transient and reverse voltage protected)
- Polarity .... Case isolated to 50 VDC
- Power Consumption .... 25mA (continuous) plus actuator current

ENVIRONMENTAL

- Temperature Range .... −40° to +85° C (−40° to +180° F)
- Relative Humidity .... up to 100%
- Case .... Fungus proof and corrosion resistant

PHYSICAL

- Dimensions .... See Figure 3
- Weight .... 1.3 kgs (2.9 lbs)
- Mounting .... Any position (See Installation Page 10)

RELIABILITY

- Tested 100%
- Vibration .... All printed circuit boards are conformally coated on both sides

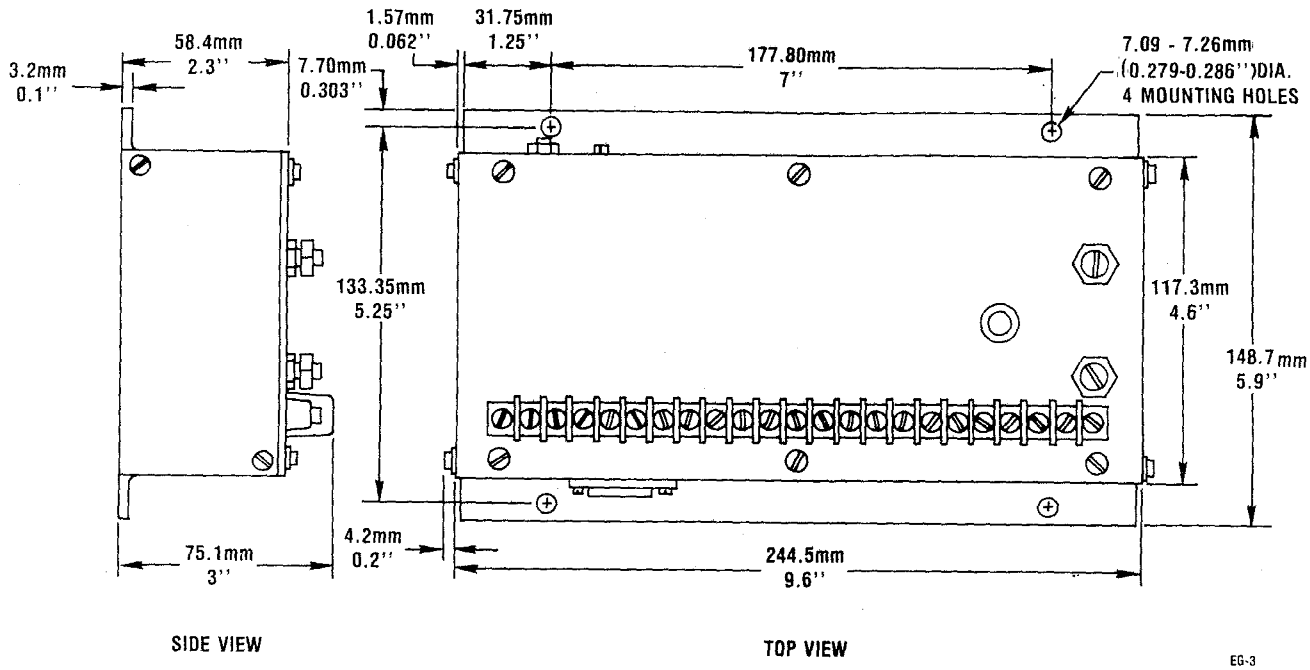


Figure 3. ECJ-1000 speed control unit dimensions

DESCRIPTIONS

AGJ-1000 ACTUATOR

The electric actuator is of a linearized rotary design with a position feedback transducer to eliminate the effects of friction and increase the actuator speed of response (See Figure 4). The electromagnetic portion provides the power to move the fuel control toward increasing the fuel. An internal spring provides the return force.

Chart ratings are for transient or steady-state. The internal spring force may be modified to increase or decrease the return force based on the fuel control's characteristics. Consult the Engine Governing Systems Applications Engineering Department of United Technologies Diesel Systems at (413) 785-6600, or Telex 955419.

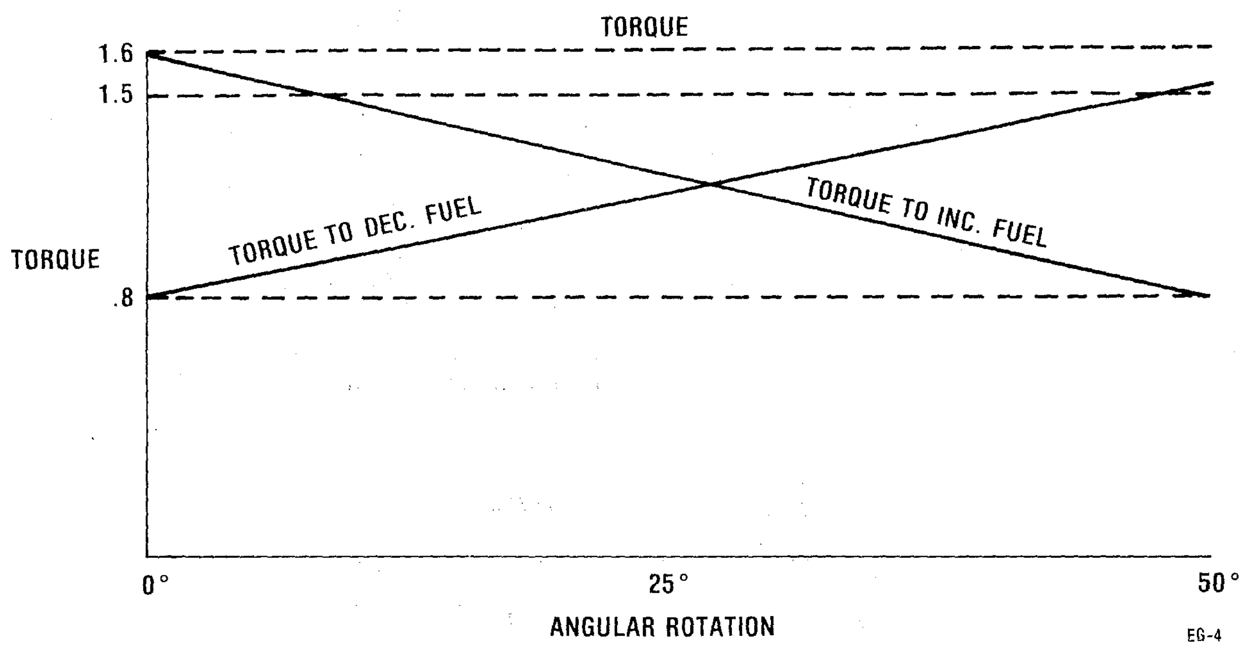


Figure 4. Actuator · torque vs. angular rotation

ECJ-1000 SPEED CONTROL UNIT

The speed control unit contains all solid state electronic circuits which sense speed from a magnetic speed sensor or other suitable signal source. The actuator provides a position signal that is fed back into the speed control unit. The speed control unit then provides a controlled output current to the proportional electromagnetic actuator which positions the engine fuel throttle according to the amount of current flowing through it (See Figure 5).

Speed Sensor Signal and Amplifier

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 engine speed. The flywheel ring gear is normally used because of the ease of speed sensor installation and because of the high frequency speed sensor signal.

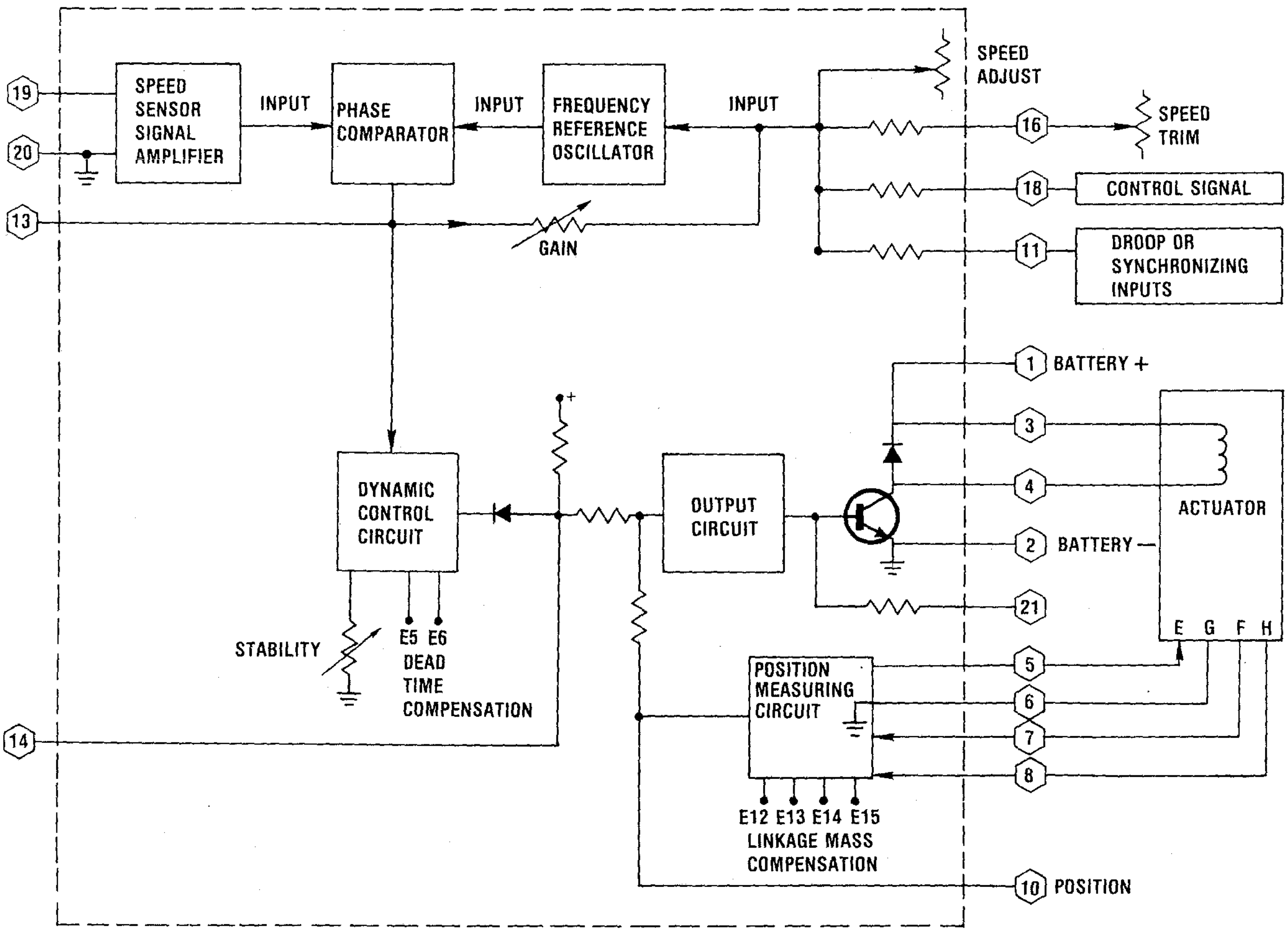


Figure 5. Functional schematic

Other sources of signals may be used for the speed signal instead of the output of the magnetic speed sensor and the flywheel ring gear. The governor will accept any signal if the frequency is proportional to engine speed, and in the frequency range of the governor (300 to 10,000 Hz). The signal strength must also be within the range of the input amplifier (.25 volts rms to 30 volts rms for approximately sinusoidal signals). The input amplifiers are very tolerant to signal wave form. It is required only that a non-sinusoidal signal have a minimum of .3 volts peak-to-peak and a maximum of 30 volts rms at all engine speeds from cranking to maximum. The speed control unit has an input impedence of 5000 ohms between terminal "19" and terminal "20". Terminal "20" is connected internally to the battery negative.

The input amplifier protects the system if the input signal is not strong enough. In the absence of any signal from the magnetic speed sensor, the speed sensor amplifier goes into a local oscillation of about 12 kHz. Since this frequency is above the maximum reference frequency, the phase detector considers the engine in "overspeed" and the actuator is moved to the minimum fuel position. This provides inherent fail safe protection against loss of speed sensor signal.

Since there is no speed sensor signal with the engine stopped, the oscillation of the speed sensor amplifier keeps the actuator in the fuel shutoff position until the engine is cranked. After a few teeth have passed the magnetic speed sensor, enough signal is provided to block the input amplifier oscillation. At this time, the actuator moves to the full fuel position and remains there during starting and acceleration of the engine.

Frequency Reference Oscillator

A wide range, temperature compensated, voltage controlled oscillator is used as the speed reference for the control system. The frequency setting is adjusted by applying zero to 10 volts at the frequency reference oscillator input. Zero volts represents a frequency of 10,000 Hz. while 10 volts represents a frequency of 300 Hz. The internal speed adjust provides this voltage setting.

Three other external inputs are available to adjust the frequency reference oscillator. Terminal "16" is the input from the external speed trim control which provides minor trimming of engine speed. Terminal "11 and 18" input are from accessories such as load sharing, droop or automatic synchronizing units. When the speed control unit is controlling the governing system the reference oscillator does not maintain a constant frequency but deviates from its nominal value as the engine speed deviates from its nominal RPM which occurs during load changes. The reference oscillator is forced by the phase comparator to track the engine speed sensor input, described below. Thus, the voltage representing speed error is the amount of voltage required to drive the reference oscillator off frequency as far as the engine is off speed at that moment.

Phase Comparator Circuit

This circuit is used to force the frequency reference oscillator to track the engine speed sensor signal. The phase comparator circuit detects the phase difference between the speed sensor signal input through the speed sensor signal input amplifier and the signal from the reference oscillator. When the engine changes speed, the signal from the speed sensor input amplifier changes frequency. The phase comparator circuit measures whether the engine signal is ahead or behind the reference oscillator signal. Its voltage output is used to force the reference oscillator to the same frequency as the speed sensor signal from the engine. In this way, the phase comparator output is proportional to the speed error. (The phase comparator and the reference oscillator make up a "Phase Lock Loop"). The gain control couples the phase comparator output to the reference oscillator. By increasing the coupling, for example, a small voltage deviation from the phase comparator corresponds to a large speed deviation, and vice versa (See Figure 6).

The phase comparator output is measured at terminal "13". This is an important terminal used to monitor governor performance and function. A reading of 3.1 volts indicates the engine is on governed speed. A reading in excess of 3.1 volts indicates an under-speed condition while readings of less than 3.1 volts indicate overspeed conditions.

Figure 6 indicates voltage at terminal "13" with different gain settings. As indicated by the curve, the gain should be turned CW as far as possible without causing instability.

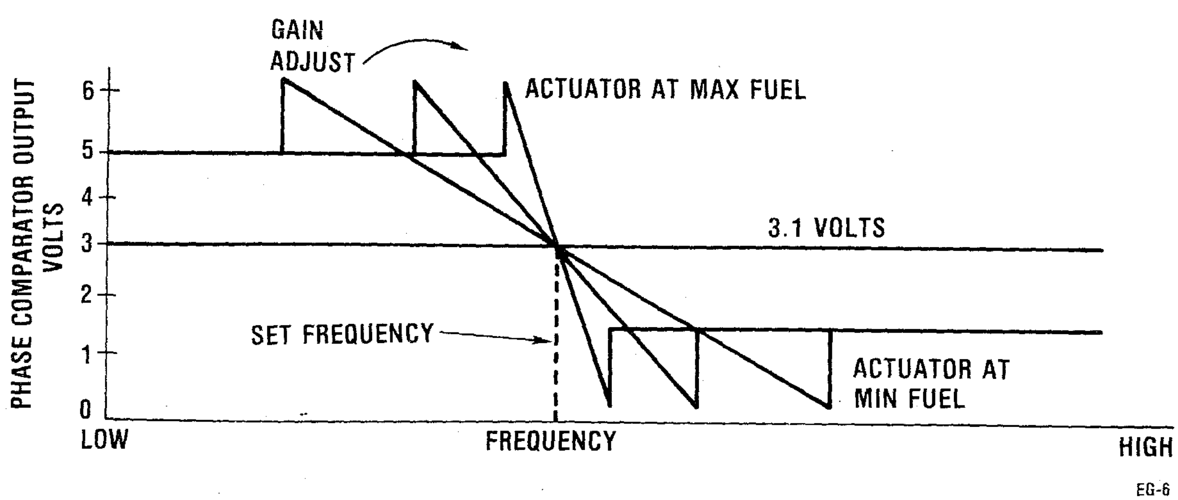


Figure 6. Phase comparator output versus frequency

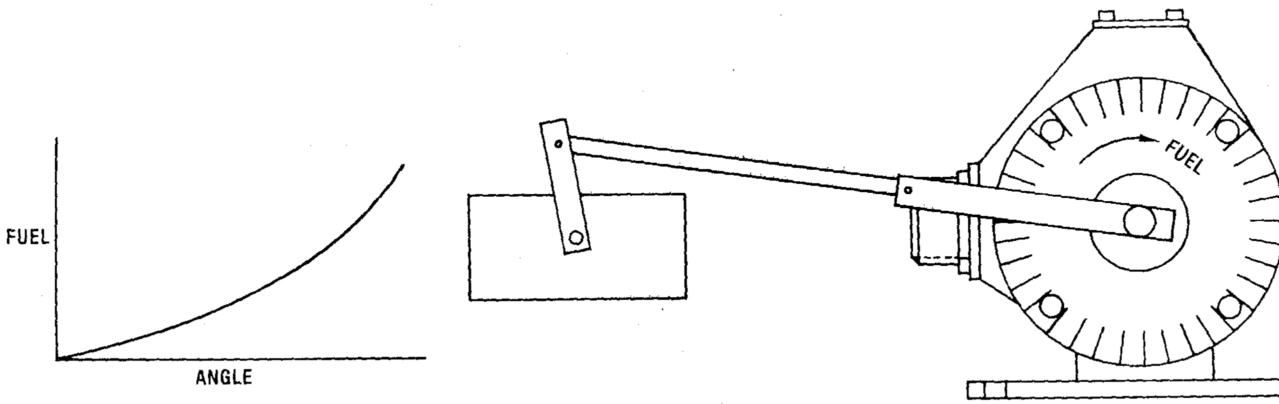


Figure 8a. Non-linear actuator linkage

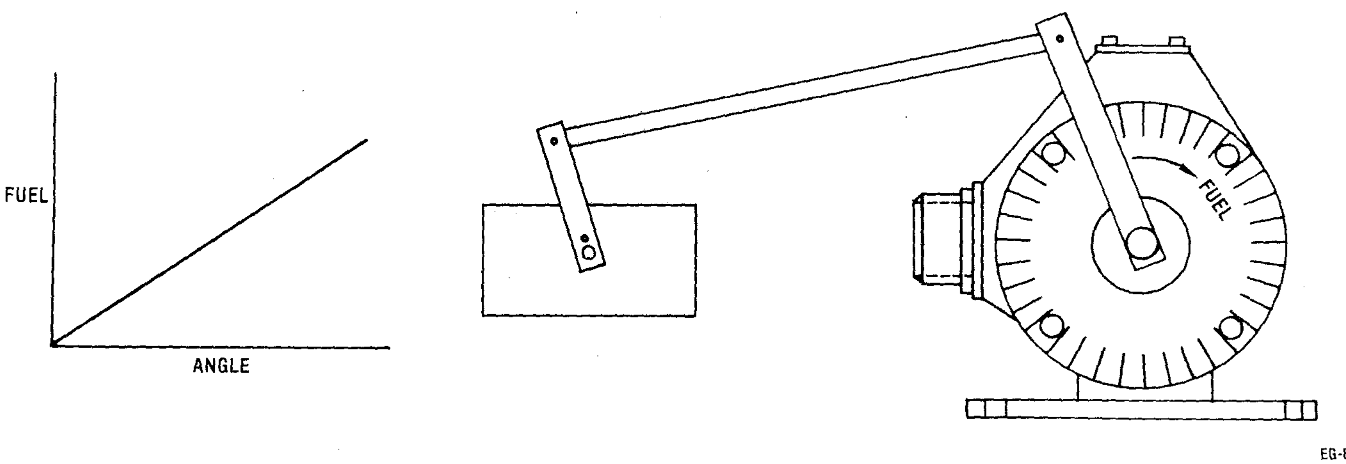


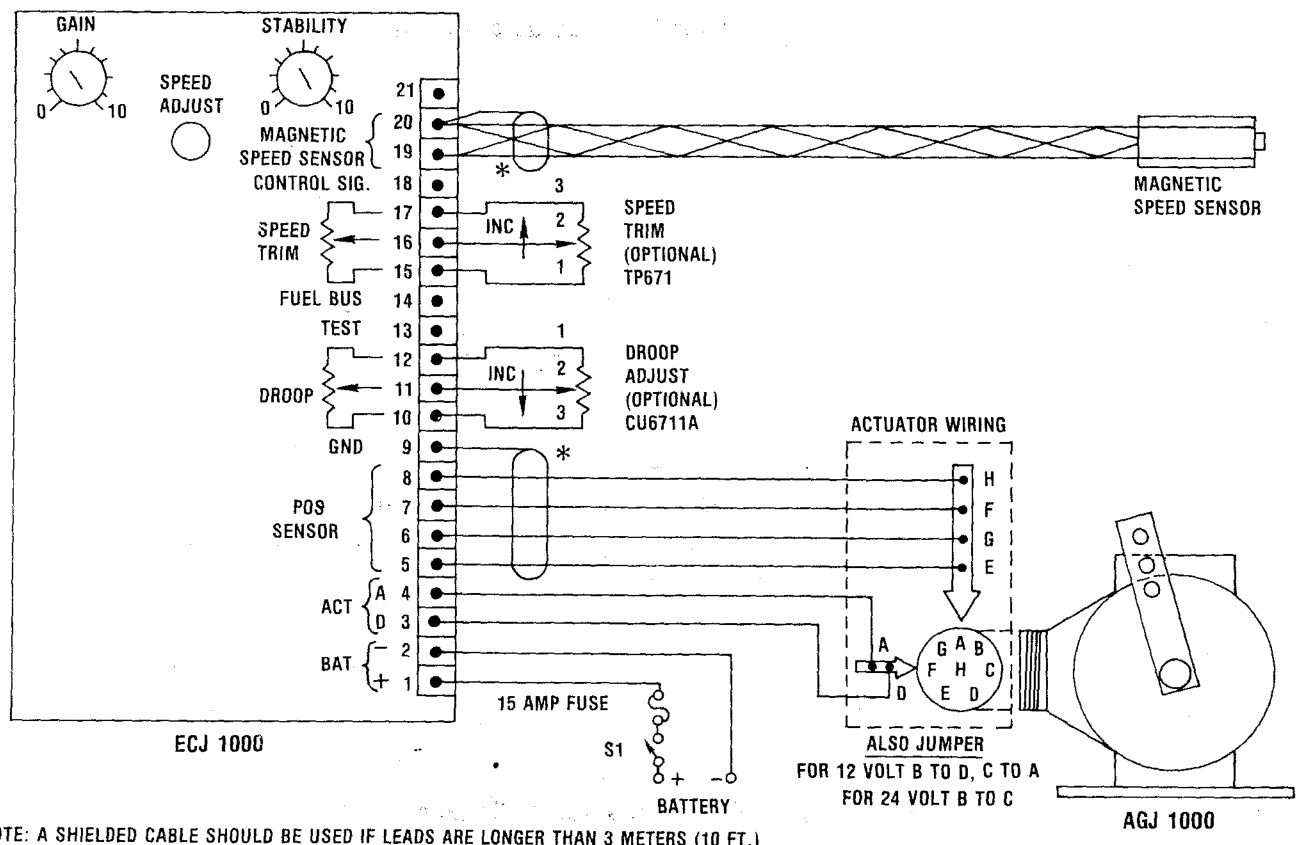
Figure 8b. Linear actuator linkage

SPEED CONTROL UNIT (ECJ-1000)

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

Wiring to the speed control unit should be as shown in Figure 9. Wiring to the on/off switch and terminals 1, 2, 3, and 4 should be sufficient gauge to carry peak currents and minimize voltage drops for 6 amps with 24 volt systems or 12 amps with 12 volt systems. All other wires carry very small currents so the size of the wire is not critical. The magnetic speed sensor terminals 19 and 20 and actuator wire terminals 5, 6, 7, and 8 should be shielded, if the system is a spark ignited engine or the distance from the speed control unit to the actuator or magnetic speed sensor exceeds 3 meters (10 ft). DO NOT combine the magnetic speed sensor signals with the actuator signals in the same shield (See Figure 9). A separate pair of shielded wires for the magnetic speed sensor must be used. The connections to terminals 11, 16, and 18 will also require shielding if longer than 3 meters (10 ft) or combined with cables of unknown signal levels. For other wiring diagrams see Figures 13 and 14.

CAUTION:
DO NOT CONNECT THE SPEED CONTROL UNIT TO A BATTERY CHARGER.



*NOTE: A SHIELDED CABLE SHOULD BE USED IF LEADS ARE LONGER THAN 3 METERS (10 FT.)
GROUND SHIELD AT ONE END ONLY.

Figure 9. ECJ-1000 governing system wiring

EG-9

ADJUSTMENTS

CAUTION:
THE ENGINE SHOULD BE EQUIPPED WITH AN INDEPENDENT OVERSPEED SHUTDOWN MECHANISM TO PREVENT RUNAWAY WHICH CAN CAUSE EQUIPMENT DAMAGE OR PERSONNEL INJURY.

STARTING THE ENGINE INITIALLY

The speed control unit has been adjusted at the factory for starting conditions and will control the engine at approximately idle speed (1000 Hz. speed sensor signal). The following adjustments or checks should be made prior to starting the engine.

A. Pre-set the gain, stability, and if used, the external speed trim controls to their mid-points.

B. Apply DC power to the engine governing system thru the wiring system by closing the switch S1. The actuator may momentarily move and should remain in the no fuel position.

C. MOMENTARILY connect terminal 2 to terminal 3. This should cause the actuator to snap into the maximum fuel position. If not, check for wiring defects or consult the "Trouble-shooting" Section (Page 14).

Crank the engine. During cranking, the actuator will move the fuel control to the maximum fuel position. Once started, the engine will be controlled at a low idle by the engine governing system.

GOVERNOR SPEED ADJUSTMENTS

Increase the engine speed to the desired governed speed by turning the "speed adjust" control in a CW direction. If used, final precise speed adjustment may be made with the external Speed Trim control. If at any time the engine governing system becomes unstable, turn the gain and stability controls CCW until the engine is stable.

PERFORMANCE ADJUSTMENTS

Once the engine is at governed speed, the two performance adjustments, gain and stability can be made as follows:

A. At no load, turn the gain control CW until instability results. Then back-off slightly CCW (one major division) beyond the point where stability returns.

B. Turn the stability control CW until instability results. Then back-off slightly CCW (one major division) beyond the point where stability returns. Excellent performance should result from these adjustments.

C. Load may now be applied to the engine. If necessary, repeat A. and B. above until optimum performance is obtained. Normally, the critical condition for gain and stability adjustment is at no load.

If the control system is not stable and not fast in response, turn to page 15 and follow the procedure to modify the extra dead time compensation.

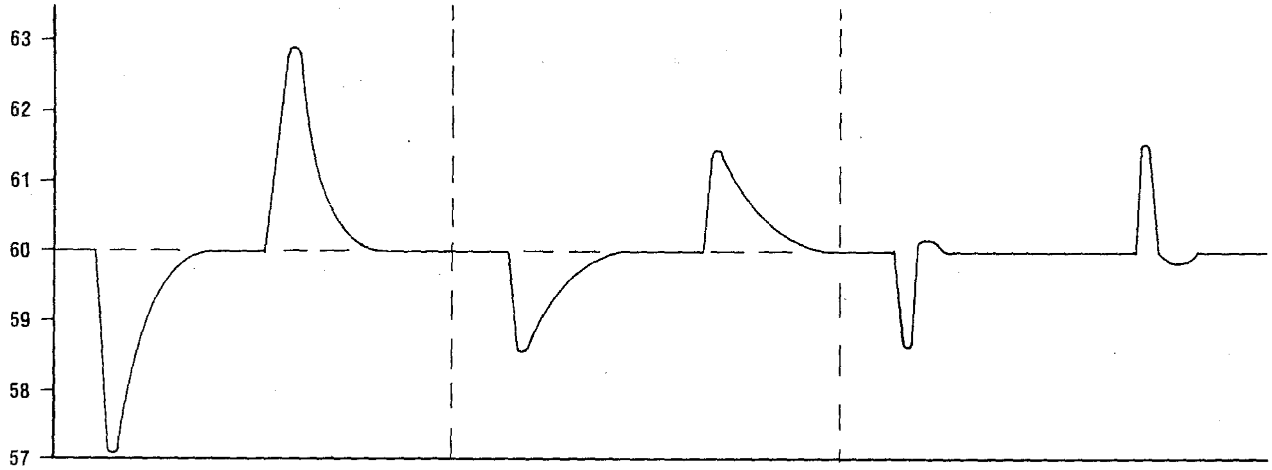
NOTE: Optimum adjustment of both controls is in the furthest CW position, without causing instability and will result in the best response and stability under all operating conditions. Backing off slightly from this position will allow for changing conditions that may affect the dynamic response of the engine. If a load bank and a recorder are available, use them to verify the performance using Figure 10 as a guide. If a stable system cannot be obtained, refer to the "Trouble-shooting Section Page 14".

The previous procedures should result in a high performance isochronous governed speed control system. However, the capability of the EGJ-1000 governing system is barely tapped.

SYSTEM OPTIONS

SPEED TRIM

The external speed trim control is typically mounted on the engine control panel and is used to make small adjustments in the engine speed, which gives proportional adjustments in the generator output frequency (See Figure 11). The external speed trim control has a range of ± 200 Hz.



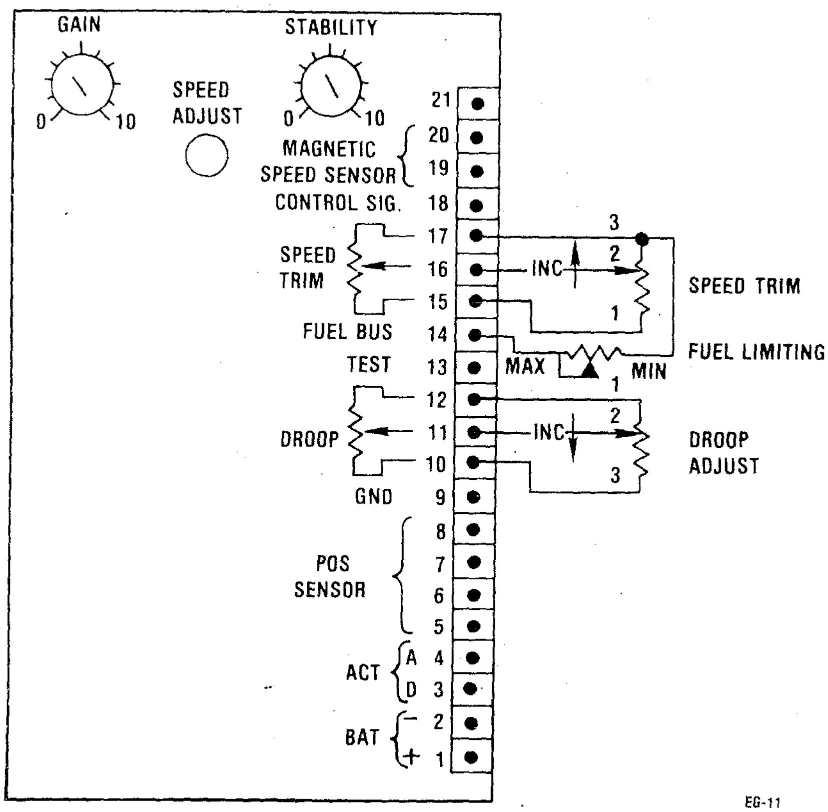
INITIAL GAIN AND STABILITY CONTROL ADJUSTMENTS GIVE A TRACE INDICATING, FROM THE EXCURSION OF THE TRANSIENT, THE GAIN SHOULD BE INCREASED BY TURNING THE GAIN CONTROL CW. NOTE: TIME IS CONSTANT FOR ALL CONDITIONS.

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 GIVES A TRACE, INDICATING GOOD TRANSIENT AT FULL LOAD AND GOOD STABILITY. THE SPEED CONTROL UNIT IS NOW PROPERLY ADJUSTED AND THE LOCKNUTS CAN BE TIGHTENED.

Figure 10. Typical performance chart

EG-10



EG-11

Figure 11. Speed trim, fuel limiting, and droop

DROOP OPERATION

The EGJ-1000 governing system can be operated in droop by wiring the Droop Control (CU 6711A) to the speed control unit as shown in Figure 11. A full CW adjustment will increase droop to approximately 5%. A minimum of 25 degrees travel of the actuator must be used for 5% droop to be obtained. Since speed droop is based on actuator position, droop will have the same linearity as the rotation of the actuator. The linearity will vary in accordance with the actuator linkage and throttle linearity. To double the droop range connect a jumper wire between terminals 11 and 18 on the speed control unit.

FUEL LIMITING

If it is desired to limit fuel or throttle movement, install a 10k ohm variable resistor from terminal 14 to terminal 17. Adjust to the desired limit, minimum fuel is with the lowest resistance. See Figure 11.

VOIDING LOSS OF PICKUP SIGNAL PROTECTION

The speed control unit has a built in loss of pickup signal protection. The actuator current will turn off if the signal level from the magnetic speed sensor falls below the minimum 0.25 volts rms. To void this feature for applications such as a torque converter where drive shaft speed sensing is required instead of engine speed sensing, follow the procedure below:

1. Remove the end plate next to the gain and stability controls.
2. Locate posts E3 and E4 (See Figure 12).
3. Solder a jumper wire between E3 and E4.
4. Replace end plate.

WIDE RANGE VARIABLE SPEED OPERATION

If wide range governor operation is desired such as a ramp generator, multivariable speed, idle/run kits, etc., follow the procedure below:

1. Remove end plate next to the gain and stability controls.
2. Locate posts E1 and E2 (See Figure 12).
3. Solder a jumper wire between E1 and E2.
4. Replace end plate.

Note: Speed trim terminal 16 is now a wide range variable speed control terminal.

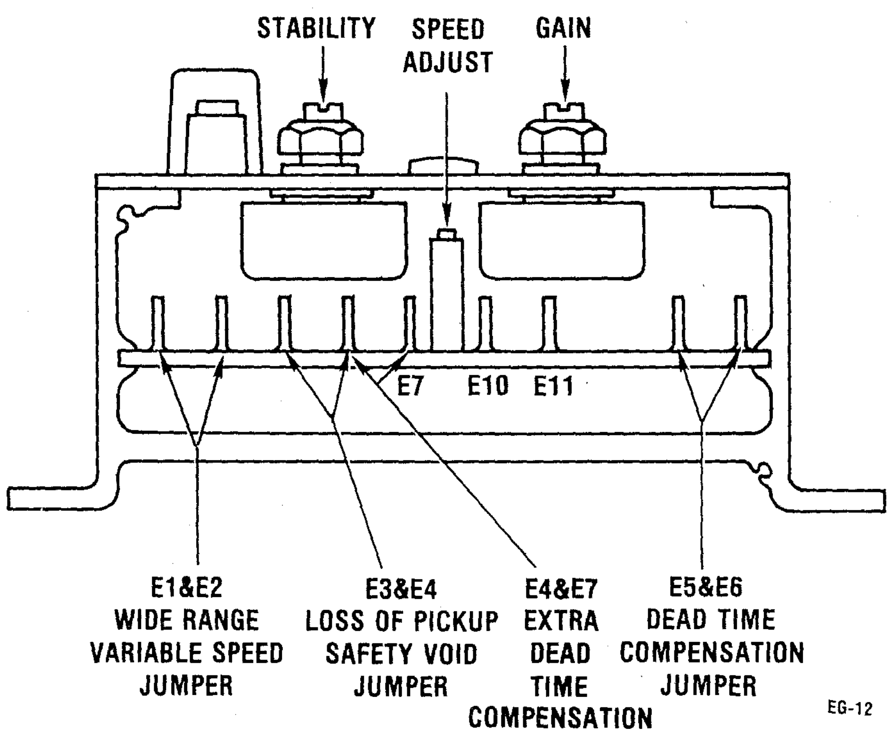


Figure 12. Wide range variable speed, voiding loss of signal protection, and extra dead time compensation.

TROUBLE-SHOOTING

Disconnect all accessories before trouble-shooting.

SYSTEM INOPERATIVE

Measure the following voltages in order with battery supply on. Step 1 is an AC measurement. Steps 2-5 are DC measurements. Terminals 2 and 17 are DC negative.

	TERMINALS	NORMAL READING	Probable Cause of NON-NORMAL READING
1.	Magnetic speed sensors signal 19 to 20	Minimum 1 VAC while cranking. Maximum 30 volts VAC at running speed.	- Magnetic speed sensor improperly installed. - Wiring defective - Defective magnetic speed sensor
2.	Regulated DC voltage 15 to 17	6.2 VDC ± .62 VDC constant all the time.	- Battery circuit open or reversed polarity. - Short circuit on terminal 15. - Defective speed control unit.
3.	Speed Signal 13 to 17 (While in governing mode)	Above 3.1 VDC when engine speed is below speed setting. Below 3.1 VDC when engine speed is above speed setting. 3.1 VDC when engine speed is at speed setting.	- Speed setting too low, turn 4 turns CW. - Linkage binding - Defective speed control unit.
4.	Actuator position signal 10 to 17	(With Actuator Linkage disconnected) Below 1.5 VDC at minimum actuator position. Above 3.2 VDC maximum actuator position (move manually or electrically).	- Wiring to actuator incorrect. - Defective actuator - see Actuator Resistance Test (Page 15) - Defective speed control unit.
5.	Output Transistor 3 to 2	2.5 VDC while cranking. Battery voltage while power switch SI on and not cranking.	- Wiring to actuator incorrect. - Defective actuator - see Actuator Resistance Test (Page 15). - Defective speed control unit.

Disconnect all accessories before trouble-shooting.

ENGINE GOES TO OVERSPEED

> CAUTION:
> ENGINE OVERSPEED IS A DANGEROUS CONDITION, MAKE ALL CHECKS BELOW WITHOUT RUNNING THE ENGINE.

Make the following checks in order with battery supply on:

	ABNORMAL CONDITION	PROBABLE CAUSE OF NON-NORMAL READING
1.	Actuator at maximum fuel position.	- Is the failsafe pickup protection void jumper E3 to E4 in place? If so, remove that jumper. See Figure 12 for location - Actuator linkage is binding - Wiring incorrect - Noise on speed sensor line - Defective speed control unit.
2.	Actuator in minimum fuel position then goes to overspeed at start-up.	- Speed adjust set too high. Turn speed adjust to full CCW position then 4 turns CW

PERIODIC INSTABILITY (EXTRA DEAD TIME COMPENSATION)

If rythmic instability cannot be removed by the gain and stability controls (both controls at near maximum CCW position), adjustment of the speed control units derivative function (extra dead time compensation) can be made. If the frequency of the instability is 5 Hz. or more, remove the end plate near the gain and stability controls, and cut the jumper from E5 to E6 (See Figure 12). Readjust the gain and stability.

If instability is less than 5 Hz. add a 10 μF 6 VDC capacitor across E4 to E7 with positive (+) lead to terminal E7. (See Figure 12).

PERIODIC INSTABILITY (Linkage Mass Compensation)

Inspect the actuator for binding or excessive friction. If it appears that the linkage is too massive (i.e. actuator cannot respond to the shift in speed fast enough) adjust the linkage. The linkage can be adjusted by moving the actuator closer to the throttle control, or by using lighter weight linkage. If the system is a carburetor type, refer to Figure 8A & 8B on Non-Linear vs. Linear Fuel Control Characteristics. If adjusting the position of or linkage to the actuator does not help, linkage mass compensation can be added electronically. Remove the end plate near terminal 1, and cut the jumper across E12 to E13. Readjust the gain and stability controls. If this is still not satisfactory, cut the jumper from E14 to E15.

POOR PERFORMANCE, WANDER, ERRATIC OPERATION

Poor performance and wander, less than 5 Hz. instability, is usually a result of lack of sensitivity (low gain), raising the gain control may induce instability. When these conditions are experienced, proceed as follows:

A. Diagnose fault by adding droop (via a droop control). If the gain can be advanced CW then the addition of a 15k ohm resistor between terminals 12 and 13 will allow for further advancement of the gain control, when the governor system is reset to isochronous operation.

B. If poor performance is still experienced when droop has been applied the fault may lie with the engine or the fuel system.

ACTUATOR RESISTANCE TEST

Disconnect the actuator mating half electrical connector when making the following checks. Measurements are made at the actuator.

ACTUATOR COIL RESISTANCE	NORMAL READING
A to B	1.5 ohms
C to D	1.5 ohms

ACTUATOR FEED BACK TRANSDUCER RESISTANCE	NORMAL READING
E to G	70 ohms
F to G	105 ohms
H to G	105 ohms

TYPICAL VOLTAGE MEASUREMENTS WITH NO ACCESSORIES ATTACHED (USING AT LEAST 10 MEGOHM/VOLT METER)

TERMINALS	SWITCH S1 "ON" ENGINE NOT CRANKING	SWITCH S1 "ON" ENGINE IN GOVERNING MODE	"C" SERIES CROSS REF.
1.	Battery voltage	Battery voltage	C
2.	Battery ground	Battery ground	F,G,H
3.	Battery voltage	2.0 VDC to battery voltage	B
4.	Battery voltage	Battery voltage	D
5.	1.4 VDC	1.4 VDC	—
6.	Signal ground	Signal ground	—
7.	AC	AC	—
8.	AC	AC	—
9.	Signal ground	Signal ground	—
10.	(Actuator Position) 1.5-3.5 VDC	(Actuator Position) 1.5-3.5 VDC	N
11.	3.1 V.	*3.1 V.	R
12.	3.1 VDC	3.1 VDC	P
13.	Speed approx. 1.0 VDC (Without Voiding Loss of Signal Protection	3.1 VDC (Without Voiding Loss of Signal Protection	L
14.	1.4 VDC	1.0 to 5.0 VDC	—
15.	6.2 VDC	6.2 VDC	K
16.	3.1 V.	*3.1 V.	J
17.	Signal ground	Signal ground	F
18.	3.1 V.	*3.1V.	R
19.	Speed Sensor input: 0	Speed Sensor input: 1.0-30.0 volts rms	S
20.	Ground side of speed sensor	Ground side of speed sensor	T
21.	0 VDC	1.0-5.0 VDC	—

*Note: Engine speed shift may occur when some of these measurements are taken.

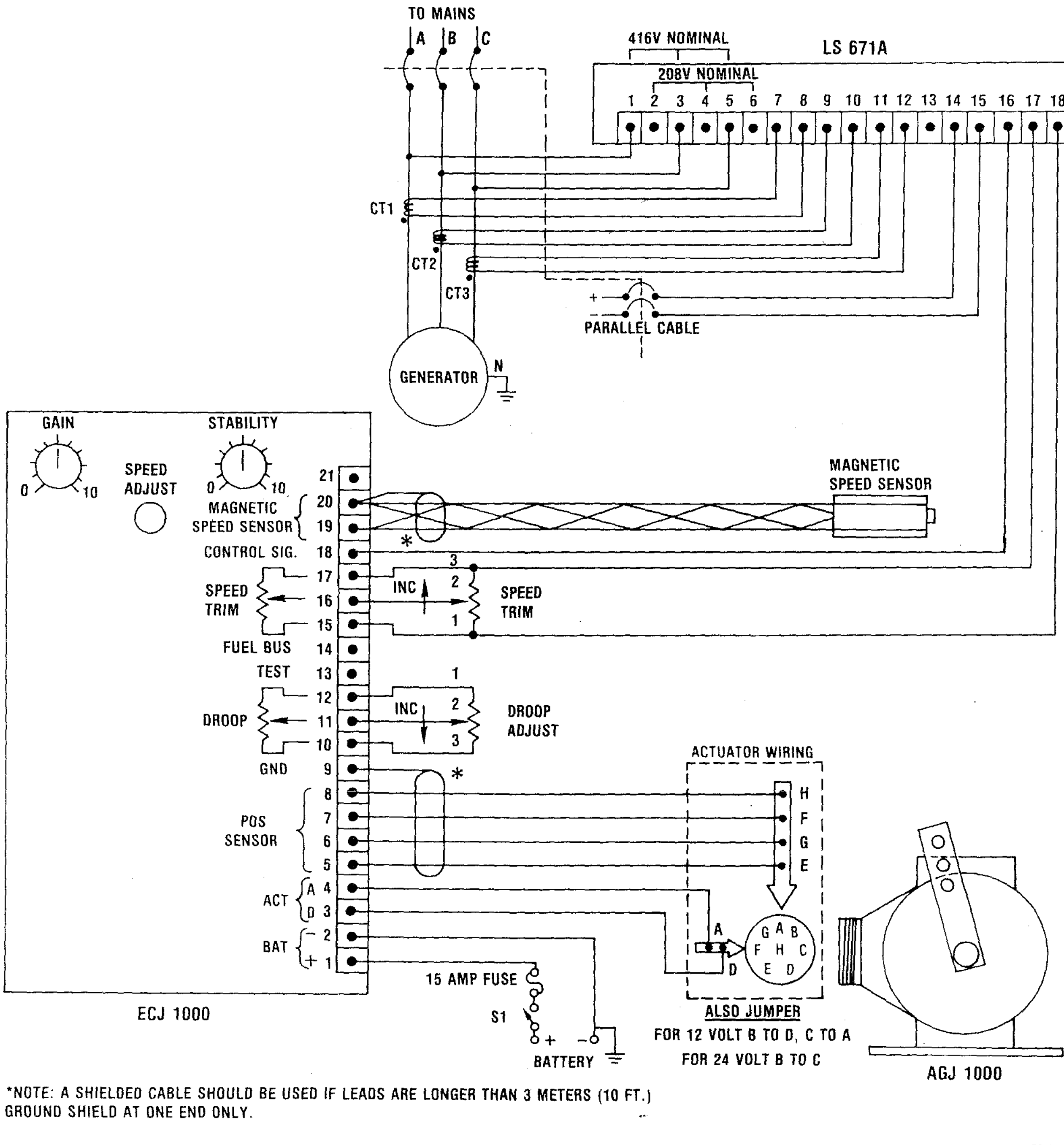
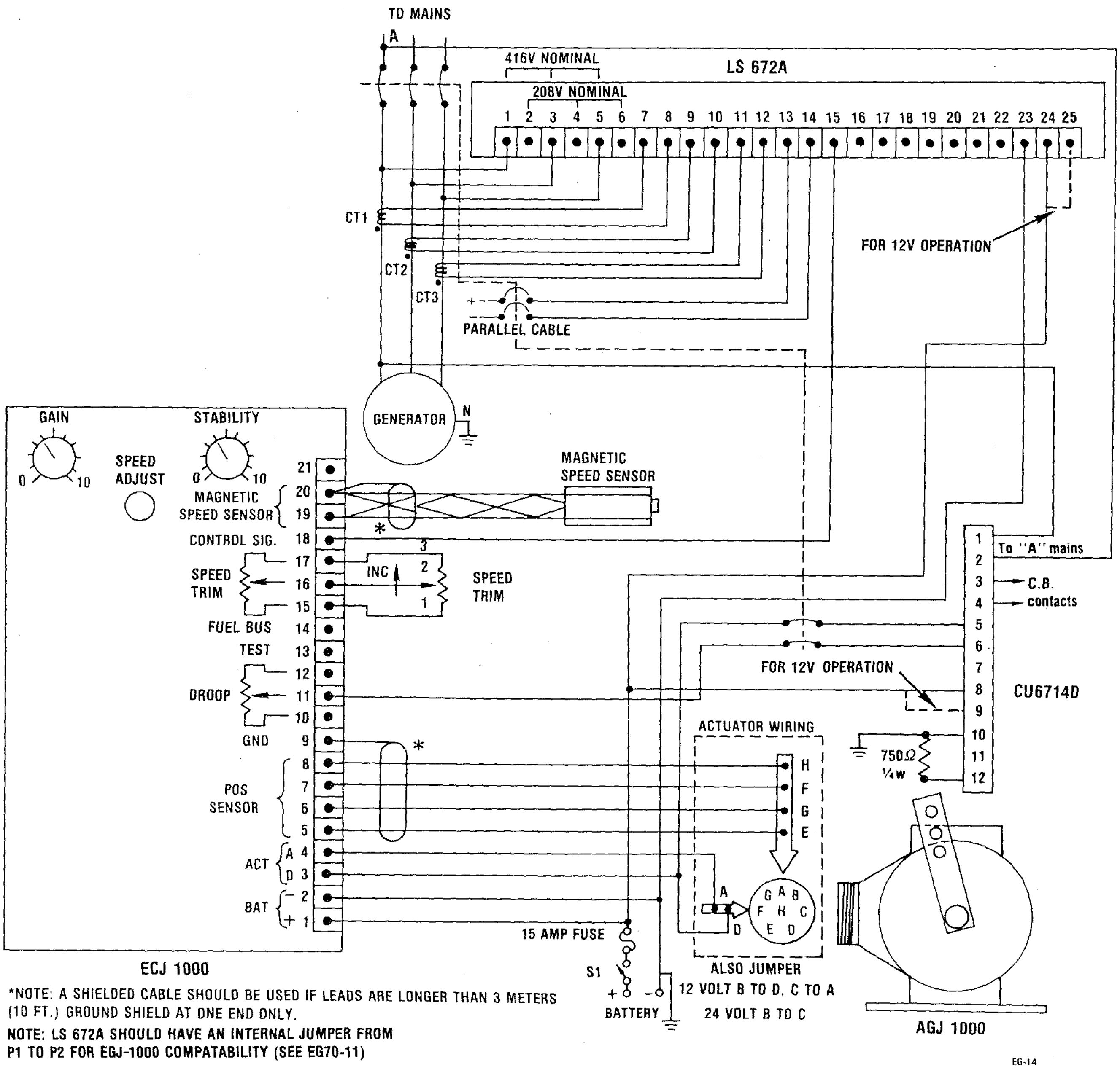


Figure 13. Wiring diagram for parallel operation



*NOTE: A SHIELDED CABLE SHOULD BE USED IF LEADS ARE LONGER THAN 3 METERS (10 FT.) GROUND SHIELD AT ONE END ONLY.

NOTE: LS 672A SHOULD HAVE AN INTERNAL JUMPER FROM P1 TO P2 FOR EGJ-1000 COMPATABILITY (SEE EG70-11)

Figure 14. Wiring diagram for parallel operation

Dynamic Control and Output Circuit

This circuit allows isochronous governing by introducing temporary droop during a load change for stability purposes. It provides an adjustable means to control the magnitude and time constant of the temporary droop to match the dynamic characteristics of the engine.

The output current switching portion of the circuit provides current to drive the actuator. The output transistor is alternately switched off and on at a frequency of 500 Hz. which is well beyond the natural frequency of the actuator.

The actuator responds to the average current from the transsistor and moves in proportion to this average current to position the engine throttle. The output transistor is switched to reduce power dissipation. The output of the circuit provides up to 20 amps at voltages up to 40 VDC.

Position Measuring Circuit

This circuit energizes the actuator position feedback transducer through terminals 5 and 6. As the actuator rotates, the actuator position is continually fed back to the position measuring circuit through terminals 7 and 8.

The use of this circuit increases the system response time and maximizes the capabilities of the governor system.

Applications which require higher mass in linkage arrangements generally, result in slower actuator speed. The ECJ-1000 has internal jumpers which may be removed to compensate for the extra weights (mass), resulting in increased speed of response. The method to employ the linkage mass compensation is referred to in the Trouble-shooting section, page 14.

Three integral adjustments are provided to achieve the desired performance. A "Speed Adjust" control which can adjust the speed control range by 30:1 and a "Gain" control to increase or decrease governor response sensitivity and a "Stability" control to match the time constant of the governor to that of the engine.

All adjustments are accessible from the top of the speed control unit (See Figure 7).

As an additional feature an external Speed Trim control can be added for fine adjustment of the engine's speed (See Page 11).

Another feature which can be added is Droop. This is used to change the speed mode of the engine from isochronous (constant speed regardless of load change) to speed droop (decrease in engine speed with increase in load, See Page 13).

Along with the optional features the ECJ-1000 speed control unit is compatible with accessories for isochronous load sharing, auto synchronizers, ramp generators, and variable speed control devices. For specific application, consult the Engine Governing Systems Applications Engineering Department, of United Technologies Diesel Systems at (413) 785-6600 or Telex 955419.

INSTALLATION

AGJ-1000 ACTUATOR

The electric actuator must be mounted rigidly and in any attitude and within a close proximity to the engine fuel system. Due to the wide angle of operation the linkage can be made non-linear or linear as shown in Figures 8A and 8B respectively. Generally, carbureted engines require non-linear linkage to offset carburetor throttle non-linearities. Some diesel systems such as the Cummins PT pump are also non-linear and require a similar linkage arrangement. The governor system will overcome the modest amounts of friction in the linkage and fuel control, but it is always desirable to minimize friction for minimum wear and long life.

Proper actuator linkage ratio's should yield at least 25 degrees travel. Always leave about 5 degrees of extra travel at the actuator ends so that the fuel control is against its stops at no load and full load. This will insure that positive engine shutdown and maximum fuel will be achieved.

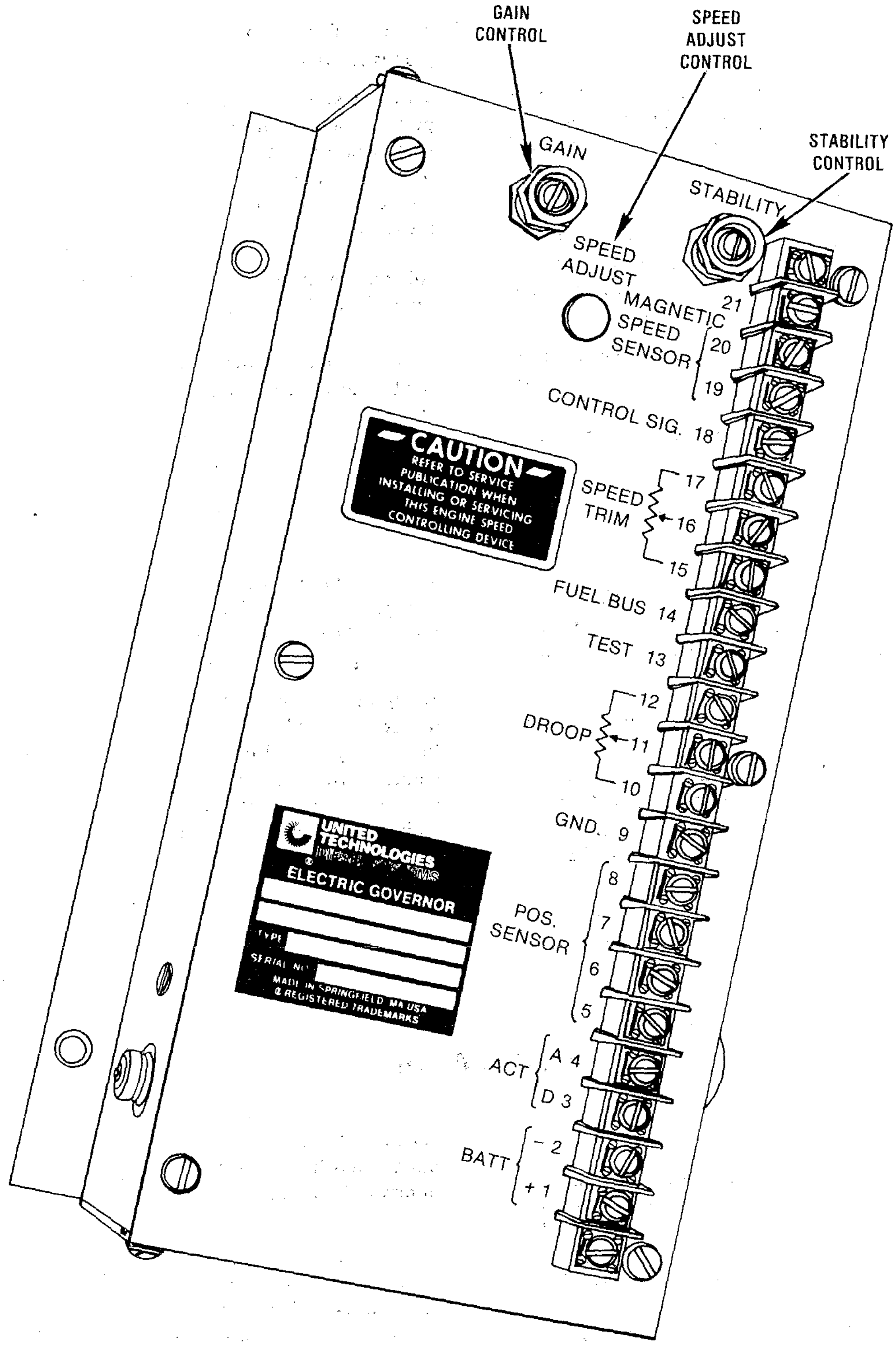


Figure 7. ECJ-1000 speed control unit adjustments