

# EEG6500 Series Enhanced Electronic Governor

With Quikset Display

## 1 INTRODUCTION

GAC's EEG6500 digital governor is designed to regulate engine speed on diesel and gaseous-fueled engines. The EEG system is a suitable replacement for any mechanical governor system that needs flexibility, precision, or accurate control of governed speed. The EEG is designed for industrial engine applications from generator sets, and mechanical drives, to pumps or compressors.



Computer



Internet Connection

With the use of GAC's Quikset Display, the EEG requires no computer or Internet connection.

- Improved & Simplified LCD User Interface
- Fast Setup with 5 Push Buttons, No Potentiometers
- Rated, Idle Speed, and Variable Speed
- Selectable Isochronous, Droop, & Variable Governing
- Built-In Fault Protection With Overcurrent Sensing
- Adjustable Starting Fuel Strategy (Black Smoke Reduction)
- Extended Speed Range to 12KHz or 4000 RPM with Frequency Display
- Speed Ramping (Idle to Rated or any Speed Setting)
- Includes Standard GAC AUX Input for Synchronizing and Load Sharing
- J1939 Engine Data and Speed Output
- Overspeed Sensing & Protection

## 2 SPECIFICATIONS

### PERFORMANCE

Isochronous Operation	± 0.25%
Speed Range / Governor	100Hz - 12 KHz (200-4000 RPM w/120 tooth flywheel) cont.
Idle Adjust	1500 RPM
Droop Range	1 - 25% regulation
Speed Trim	Programmable ±120 Hz

### INPUT / OUTPUT

Supply	12-24 VDC Battery Systems (7.0 to 32 VDC)
Polarity	Negative Ground
Power Consumption	70mA max. continuous plus actuator current
Speed Sensor Signal	1.0-120 VRMS
Actuator Output	8-10 Amps Continuous Max, Momentary >10A; works with all GAC ATB's & ACB2001
Load Share/Synchronizer Input	0-10 VDC ( 5V nominal, reversed polarity, 145Hz / V )
Reverse Power Protection	Yes
Transient Voltage Protection	60V

### ENVIRONMENTAL

Ambient Temperature	-40° to 85°C (-40 to 180°F)
Relative Humidity	up to 95%
All Surface Finishes	Fungus Proof and Corrosion Resistant
CE Rated	EN55011, EN50081-2, EN50082-2

### PHYSICAL

Dimension	See Section 3 "Installation"
Weight	1.8 lbs. (820 grams)
Mounting	Any position, Vertical Preferred

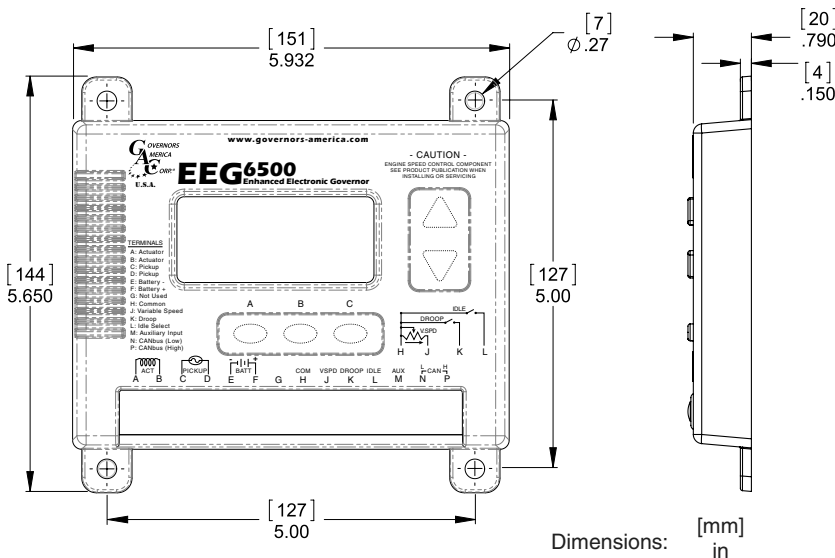
### RELIABILITY

Vibration	7G, 20-100 Hz
Shock	20G Peak
Testing	Functional Tested

### COMPLIANCE / STANDARDS

Agency	CE and RoHS Requirements
Communications	SAE J1939 (Optional)

## 3 INSTALLATION



Vertical orientation allows for the draining of fluids in moist environments.



Mount in a cabinet, engine enclosure, or sealed metal box.



Avoid Extreme Heat

# 4 WIRING

TERM	DEFINITION	GAUGE	NOTES
A	Actuator (+)	#16 AWG	
B	Actuator (-)	#16 AWG	
C	Magnetic Pickup (+)	#20 AWG	* Twisted wires 14 turns per foot. 0.02in (.51mm) gap between sensor and gear teeth.
D	Magnetic Pickup (-)	#20 AWG	
E	Battery (-)	#16 AWG	
F	Battery (+)	#16 AWG	A 15 amp fuse must be installed in the positive battery lead to protect against any overload or short circuit
H	Ground Signal	#16 AWG	Reference for variable speed/trim input & switches
J	Variable Speed Input	#20 AWG	5K $\Omega$ Resistive or 0-2.5 VDC Potentiometer, Increasing Voltage or Resistance Increases Speed
K	Droop Select	#16 AWG	Active when connected to Terminal. H
L	Idle Select	#16 AWG	Active when connected to Terminal. H
M	Aux Input	#20 AWG	Load sharing / synchronizing, 5V nominal (0-10V), reverse ramp
N	CAN L	#20 AWG	
P	CAN H	#20 AWG	Twist wires 14 turns per foot.

### RECOMMENDATIONS

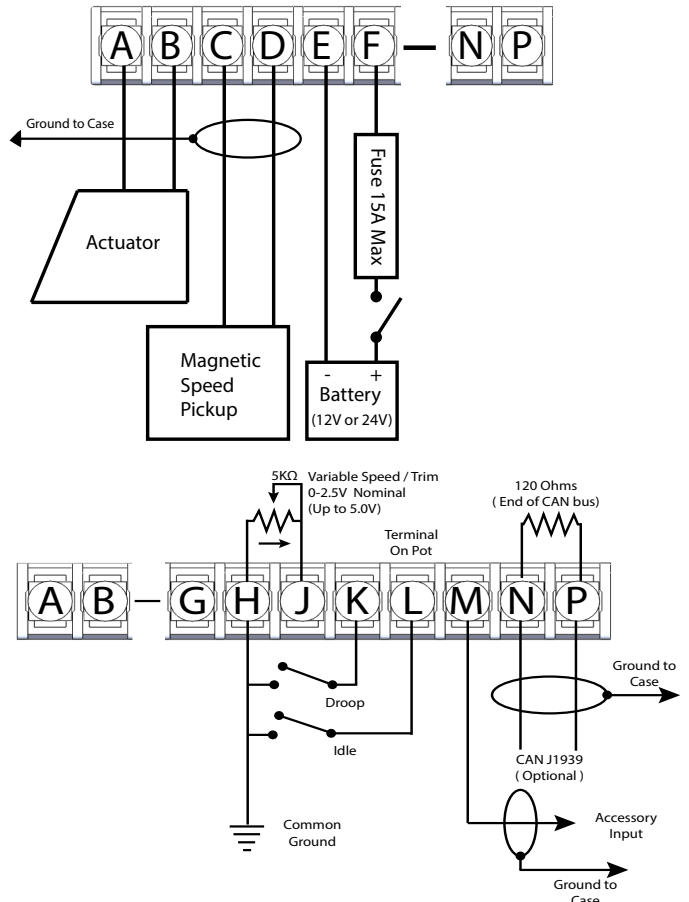
- Shielded cable should be used for all external connections to the EEG control. One end of each shield, including the speed sensor shield, should be grounded to a single point on the EEG case.
- Case should be grounded

### WARNING

#### Loss of Magnetic Pickup Sensing



If EEG detects no input from the magnetic pickup, the EEG will set the actuator to 0V and set the speed to 0 RPM. The display will flash the RPM along with the Warning Indicator. Parameters will be unchangeable.



# 5 DISPLAY & CONTROLS

### Parameter Value

Displays the value of a selected parameter or live running parameter. This area will blink if a system shutdown and restart is required.



### Parameter Units

Displays the units for the parameter (e.g. RPM)



### Secondary Parameter

Toggle between the 4 views:



### Loss of Magnetic Speed Pickup / Overcurrent

After the EEG has detected loss of magnetic pickup, the display will flash the RPM along with the Warning Indicator. Parameters will be unchangeable.



### Over Speed

"Over Speed" will blink when the unit is in overspeed. (Cycle power to restart)

**OVER SPEED**

### Lock Feature

Once the LOCK parameter on the main menu is enabled ("ON"), the display can be manually locked.

SPEED RAMP V.SPEED LOCKED

← Row 2 Column 3

### Locking/Unlocking the Display



### Quikset Menu

OVER SPEED	#TEETH	CRANK
SPEED RAMP	V.SPEED	LOCKED
START FUEL	DROOP %	FUEL RAMP
SPEED	IDLE	FUEL LIM
GAIN	STABILITY	DEADTIME

One row of parameters is displayed at a time.

### Parameter Adjust

Parameter Adjust Up

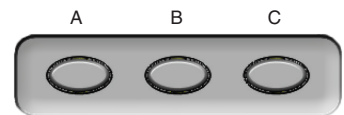
Increment a Parameter Value:  
HOLD and TAP or



Rapidly Increment a Value:  
HOLD and HOLD or

Parameter Adjust Down

### Column Select Buttons

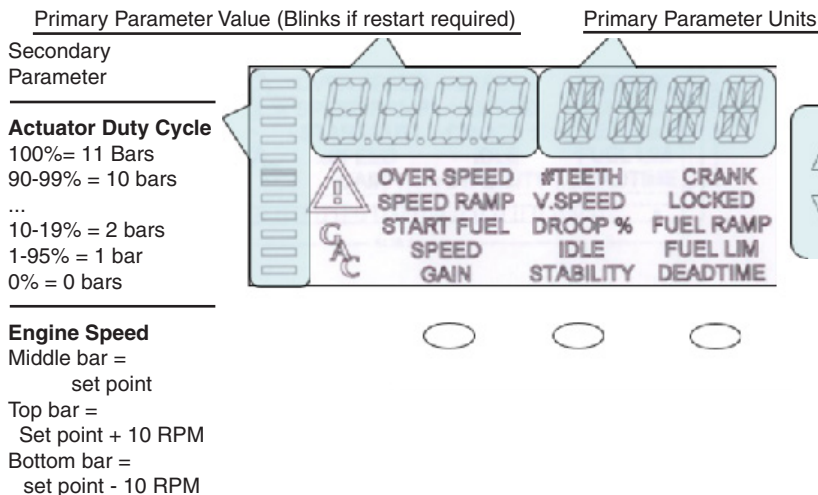


To change the displayed row of parameters:  
Tap any

To view a parameter value in a selected row:  
Hold

For: SPEED Hold: Button A  
For: IDLE Hold: Button B  
For: FUEL LIM Hold: Button C

## End User Interface



Pressing either UP or DOWN arrow moves the primary and secondary parameters to the next parameter set. The list is always traversed in one direction.

Primary Parameter (Units)	Secondary Parameter
Engine Speed (RPM)	Actuator Duty Cycle
Duty Cycle (%)	Engine Speed relative to set point
ACTuator Current (A)	Engine Speed relative to set point
Engine Speed (Hz)	Actuator Duty Cycles

## 6 FEATURES

### TRIM or VARIABLE SPEED OPERATION

**Trim Function** - Performs finer adjustments (e.g. generator frequency)

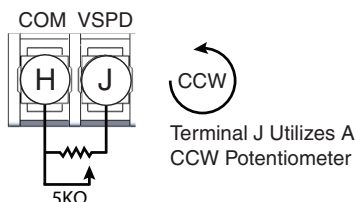
**Variable Speed Function** - Operates over a larger RPM range

MODE	Special Menu Parameter	Quikset Menu Parameters	
	VSPD	SPEED	V. SPEED
Trim (Default)	OFF	Application Rated Speed (e.g., 1500 RPM)	Speed Trim Percentage (10 = ±10Hz)
Variable Speed	ON	Minimum speed when potentiometer is at lowest resistance (e.g., 1000 RPM)	Maximum Speed when potentiometer is at the highest resistance (e.g., 2000 RPM)

**IMPORTANT** Increasing voltage or resistance increases speed.

### RESISTIVE POTENTIOMETER OR VOLTAGE

Voltage  
0 - 2.5V, into J



### SPEED DROOP OPERATION

Droop will replicate a mechanical governor's response to a load change. In Droop Operation, the engine speed will decrease as engine load increases. **DROOP%** (Quikset Menu) is based on the change in current in the actuator (**DRNG** see Section 6 Special Menu Parameters) from no load to full load.

**IMPORTANT** Before adjusting DROOP%, the optional external selector switch must be in DROOP position. DROOP icon will blink.

### IDLE SPEED

**IMPORTANT** The optional external switch must be tied to terminal "H". Pressure switch may also be used as a method of enabling. When enabled, IDLE has independent Gain adjustment.

### ACCESSORY INPUT

The Aux terminal accepts signals from auto synchronizers, load sharing units, and other GAC accessories.

## 7 PRE-START SETUP & QUIKSET PARAMETERS

Set the parameters below before starting the engine:

<b>#TEETH</b>	Input the Number of Teeth on the Flywheel. This can not be changed while engine is running.
<b>CRANK</b>	Input the Crank Termination (RPM)
<b>SPEED</b>	Input the Fixed Speed of the Engine (RPM)

OVER SPEED	#TEETH	CRANK
SPEED RAMP	V.SPEED	LOCKED
START FUEL	DROOP %	FUEL RAMP
SPEED	IDLE	FUEL LIM
GAIN	STABILITY	DEADTIME

### ADJUSTABLE QUIKSET PARAMETERS

<b>OVER SPEED *</b> Range: 400 - 4000 RPM Default: 2220 RPM	<b>#TEETH</b> Range: 60 - 250 Default: 120	<b>CRANK *</b> Range: 250 - 1000 RPM Default: 400 RPM
RPM to automatically shutoff the actuator	Number of teeth on flywheel	RPM which EEG switches from starting fuel limit to fuel limit
<b>SPEED RAMP</b> Range: 25 - 1000 Default: 300	<b>V.SPEED *</b> Range: 0-4000 RPM (vspd) 0-120 Hz (trim) Default: 2000 RPM (vspd) : 0 RPM (trim)	<b>LOCKED</b> Range: OFF, ON Default: OFF
Rate at which speed changes from idle to speed and back	Maximum speed change allowed from trim input	Enables the ability for Manual/Auto locking of display
<b>START FUEL</b> Range: 0 - 100% Default: 90%	<b>DROOP%</b> Range: 0 - 25.0% Default: 5.0%	<b>FUEL RAMP</b> Range: 10 - 100% Default: 10%
Percent of fuel to apply to actuator first upon cranking	Droop to apply under maximum load (based on current of actuator)	Percent per second to apply fuel as cranks.
<b>SPEED *</b> Range: 0-4000 RPM(fixed) 0-4000 RPM(droop) Default: 1800 RPM(fixed) 50 RPM(droop)	<b>IDLE *</b> Range: 300 - 1500 RPM Default: 1000 RPM	<b>FUEL LIM</b> Range: 0 - 100% Default: 100%
Operating speed of engine	Speed of engine when IDLE input is closed	Maximum actuator percentage allowed
<b>GAIN</b> Range: 1 - 100, 100 = Max Gain Default: 50 (rated) : 30 (idle)	<b>STABILITY</b> Range: 1 - 100, 100 = fastest response Default: 50	<b>DEADTIME</b> Range: LOW, HI Default: HI
Proportional (P) set point of the PID control at operating SPEED and IDLE	Integral (I) set point of the PID control	Derivative (D) set point of the PID control

\* Maximum 12KHz

## 8 ADJUSTING FOR STABILITY

Once the engine is running at operating speed and at no load, the following governor performance adjustments can be made to increase engine stability.

### GAIN - RATED SPEED & IDLE SPEED

**NOTE** The EEG6500 is equipped with two separate gains, one for rated speed, the other for idle speed. Both are set using the GAIN setting on the Quikset menu.

GAIN TYPE	ADJUSTMENT PROCEDURE
RATED SPEED	1. Selected when IDLE input is disconnected.
IDLE SPEED	1. Connect the idle input to ground. 2. Change GAIN value. 3. Disconnect Idle input from ground to switch back to Rated.


**NOTE** Idle icon will blink.


### QUIKSET MENU



PARAMETER	ADJUSTMENT PROCEDURE
A. GAIN	1. Increase this parameter until instability develops. 2. Then, gradually decrease this parameter until stability returns. 3. Finally, decrease this parameter one increment further to ensure stable performance. 4. If instability persists, adjust the next parameter.
B. STABILITY	1. Follow the same adjustment procedure as the GAIN parameter. 2. If instability persists, adjust the next parameter.
C. DEADTIME	1. If fast instability occurs, switch DEADTIME to low and repeat steps A & B.

**NOTE** Normally, adjustments made at no load achieve satisfactory performance. For further performance, refer to sections (10) & (11).

## 10 ADVANCED PARAMETERS MENU

**Display Special Menu Parameters:** Hold ALL 3  until "AUX" appears in display

**Selecting Parameters:**   
Previous Parameter      Next Parameter

**Adjust Parameters:** Increase Parameter   
Decrease Parameter 

**Return to Quikset Menu:** Hold ALL 3  for 2 seconds

**NOTE** 1. After 3 minutes of no user input, EEG switches to Quikset Menu.  
2. "Lock" is displayed when attempt to change a Read-Only parameter.

## 9 ADJUSTING FOR DROOP

After the initial set up is completed and the # of Teeth, Crank Termination Speed and Rated Speed are set, position the external switch connecting terminals 'H' and 'K' on to activate the DROOP mode following these sequence steps.

1. Go to the Advanced menu: Press and hold all three buttons simultaneously for two seconds to switch to Advanced Menu.
2. Confirm that the VSPD (Variable Speed / Fixed Speed Control) is off. Default position is off.
3. Confirm that the LEAD circuit is off. Default position is off.
4. Set the DRNG (current representing 100% load) to the normal operating current for the actuator being used, at its given system voltage (default value is 4.0 amps.)
5. Return to the Main Menu: Press and hold all three buttons simultaneously for two seconds to switch to the Main Menu.
6. Select and set DROOP to the desired percentage.
7. Change the Speed parameter, which turns into the 'DROOP OFFSET'. This sets the RPM, above operating speed, to which the system will be commanded when DROOP is enabled. This is an offset value.

**EXAMPLE** 500 RPM operating speed x 0.05 (5.0% droop) = 25 RPM  
Input 25 RPM, this is the offset value.

### ADVANCED MENU PARAMETERS (CONFIGURABLE)

Parameter	Definition	Range	Default
AUX	Auxiliary Input Enable	Off, On	Off
VSPD	Variable Speed or Trim Select (On=Variable Speed, Off=Trim)	Off, On	Off
LEAD	Lead Circuit - Response increase	Off, On	Off
DRNG	System current to the actuator that represents full load. Units in (A)	0.0 - 10.0	4.0

### ADVANCED MENU PARAMETERS (READ ONLY)

Parameter	Definition
SREV	Software revision number
BID	Software build identifier
AREV	Assembly revision: Identifies board hardware configuration, not software.
FLTH	Highest fault code since power up. Aids in trouble shooting.
DATL	Supplemental data associated with last fault code. Aides in troubleshooting.
FLTL	Last fault code detected. Associated data is DATL and aids in trouble shooting.

# 11 FAULT CODES

## ADVANCED MENU PARAMETERS (CONFIGURABLE)

CODE	CAUSE	EFFECT	CUSTOMER ACTION
1	Actuator over current (continuous)	Actuator turned off for 30 sec.	Check actuator wiring.
2	Loss of speed signal (inc/dec in speed by more than 64Hz in 4ms, 16KHz/s)	WARNING indicator blinks then system shutdown	Check speed pickup.
3	Over speed (speed exceeds OVER SPEED setting for 12 ms)	WARNING and OVER SPEED indicators blink then system shutdown.	Check fuel system as well as OVER SPEED, SPEED, and V.SPEED
203	Variable Speed settings are reversed. V.SPEED is lower than SPEED.	WARNING indicator blinks, speed set to V.SPEED setting, variable speed input unresponsive.	Flip V.SPEED and SPEED settings.
206	No potentiometer/signal detected on variable speed input when VSPD enabled.	WARNING indicator blinks, speed set to SPEED setting.	Check potentiometer wiring.
241	New software loaded. Configuration not compatible.	Default configuration used.	Reset configuration.
251	Software loaded on incompatible hardware.	WARNING indicator blinks then System shutdown.	Return unit to GAC

**IMPORTANT** For all other codes, note the condition and contact GAC. The WARNING indicator will blink and failures will cause a system shut down.

# 12 J1939 CAN INFO

J1939 Address: 26

PGN	DEFINITION	NOTES
61444	Engine Speed	Engine speed in RPM

# 13 SYSTEM TROUBLESHOOTING

## SYSTEM INOPERATIVE

If the engine governing system does not function, the fault may be determined by performing the voltage tests described in Steps 1 through 3. Positive (+) and negative (-) refer to meter polarity. Should normal values be indicated during troubleshooting steps, then the fault may be with the actuator or the wiring to the actuator. Tests are performed with battery power on and the engine off, except where noted. See actuator publication for testing procedure on the actuator.

STEP	WIRES	NORMAL READING	PROBABLE CAUSE OF ABNORMAL READING
1	F(+) & E(-)	Battery Supply Voltage (12 or 24V DC)	<ol style="list-style-type: none"> <li>DC battery power not connected. Check for blown fuse</li> <li>Low battery voltage</li> <li>Wiring error</li> </ol>
2	C & D	1.0V AC RMS min. While Cranking	<ol style="list-style-type: none"> <li>Gap between speed sensor and gear teeth too great</li> <li>Improper or defective wiring to the speed sensor</li> <li>Resistance between D and C should be 130 to 1200 ohms.</li> <li>Defective speed sensor.</li> </ol>
3	F(+) & A(-)	1.0 - 2.0V DC While Cranking	<ol style="list-style-type: none"> <li>SPEED or IDLE parameter set incorrectly</li> <li>CRANK or START FUEL set incorrectly</li> <li>Short/open in actuator wiring</li> <li>Defective speed control</li> <li>Defective actuator, see Actuator Troubleshooting</li> </ol>

## INSTABILITY

INSTABILITY	SYMPTOM	PROBABLE CAUSE OF ABNORMAL READING
Fast Periodic	The engine seems to jitter with a 3Hz or faster irregularity of speed.	<ol style="list-style-type: none"> <li>Readjust the GAIN and STABILITY for optimum control.</li> <li>In extreme cases, change the DEADTIME parameter.</li> </ol>
Slow Periodic	Speed irregularity below 3Hz. (Sometimes severe)	<ol style="list-style-type: none"> <li>Check fuel system linkage during engine operation for:                             <ol style="list-style-type: none"> <li>binding</li> <li>high friction</li> <li>poor linkage</li> </ol> </li> <li>DEADTIME Parameter set too high.</li> </ol>
Non-Periodic	Erratic Engine Behavior	<ol style="list-style-type: none"> <li>Increasing the GAIN should reduce the instability but not totally correct it. If this is the case, there is most likely a problem with the engine itself. Check for:                             <ol style="list-style-type: none"> <li>engine mis-firings</li> <li>an erratic fuel system</li> <li>load changes on the generator set voltage regulator.</li> </ol> </li> </ol>

If unsuccessful in solving instability, contact GAC for assistance.  
GAC@governors-america.com or call: 1-413-233-1888



UNSATISFACTORY PERFORMANCE		
SYMPTOM	NORMAL READING	PROBABLE CAUSE OF ABNORMAL READING
Engine Over Speeds	1. Do Not Crank. Apply DC power to the governor system.	1. If the actuator is at minimum fuel position and there exists an erroneous speed signal, then check speed sensor.
	2. Manually hold the engine at the desired running speed. Measure the DC voltage between Terminals A(-) & F(+) on the speed control unit.	1. If the voltage reading is 1.0 to 2.0V DC: a. SPEED parameter set above desired speed b. Defective speed control unit 2. If voltage reading is > 2.0V DC then check for: a. actuator binding b. linkage binding 3. If the voltage reading is below 1.0V DC: a. Defective speed control unit
	3. Check #TEETH parameter.	1. Incorrect tooth count entered.
Over Speed shuts down engine after running speed is reached	1. Examine the SPEED and OVER SPEED operating parameters for the engine	1. SPEED parameter set too high. 2. OVER SPEED set too close to SPEED. 3. Check SPEED RAMP parameter. 4. Actuator or linkage binding. 5. Speed Control unit defective. 6. Gain too low.
Over Speed shuts down engine before running speed is reached	1. Check resistance between Terminals C&D. Should be 130 to 1200 ohms. See specific Magnetic Pick-up data for resistance.	1. OVER SPEED set too low 2. If the speed sensor signal is erroneous, then check the wiring.

UNSATISFACTORY PERFORMANCE		
SYMPTOM	NORMAL READING	PROBABLE CAUSE OF ABNORMAL READING
Actuator does not energize fully	1. Measure the voltage at the battery while cranking.	1. If the voltage is less than: a. 7V for a 12V system, or b. 14V for a 24V system, Then: 1. Check wiring 2. Check circuit protection/relay 3. Check charging system 4. Check battery
	2. Momentarily connect Terminals A and F. The actuator should move to the full fuel position.	1. Actuator or battery wiring in error 2. Actuator or linkage binding 3. Defective actuator 4. Fuse open. Check for short in actuator or harness. 5. Check START FUEL and CRANK
Engine remains below desired governed speed	1. Measure the actuator output, Terminals A & B, while running under governor control.	1. If voltage measurement is within 2V DC of the battery supply voltage level, then fuel control is restricted from reaching full fuel position, possibly due to mechanical governor, carburetor spring, or linkage interference. 2. Check SPEED, IDLE, GAIN, START FUEL, and CRANK



720 Silver Street,  
Agawam, MA 01001 USA  
GAC@governors-america.com  
www.governors-america.com



720 Silver Street,  
Agawam, MA 01001 USA  
GAC@governors-america.com  
www.governors-america.com