EDG5500
Electronic Digital Governor
With Quikset Display

1 INTRODUCTION

GAC's EDG5500 digital governor is designed to regulate engine speed on diesel and gaseous-fueled engines. The EDG system is a suitable replacement for any mechanical governor system that needs flexibility, precision, or accurate control of governed speed. The EDG 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 EDG5500 requires no computer or internet connection.

2 SPECIFICATIONS

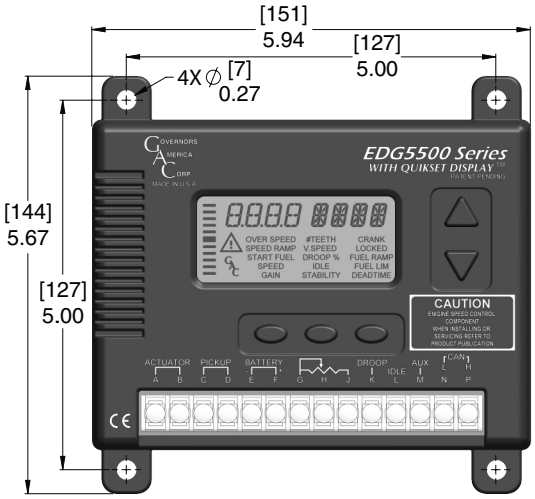
PERFORMANCE	
Isochronous Operation	± 0.25%
Speed Range / Governor	400Hz - 10 KHz
	(200-5000 RPM w/120 tooth flywheel) cont.
Idle Adjust	Full Range
Droop Range	1 - 5% regulation
Speed Trim	Programmable 0-100%, (default = 5%)
INPUT / OUTPUT	
Supply	12-24 VDC Battery Systems (7.0 to 33 VDC)
Polarity	Negative Ground
Power Consumption	70mA max. continuous plus actuator current
Speed Sensor Signal	1.0-120 VRMS
Actuator	8-10 Amps Continuous
Load Share/Synchronizer Input	0-10 VDC (5V nominal, reversed, 100Hz / 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	100% Functional Testing
COMPLIANCE / STANDARDS	
Agency	CE and RoHS Requirements
Communications	SAE J1939 (Option)

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



Dimensions: [mm] in

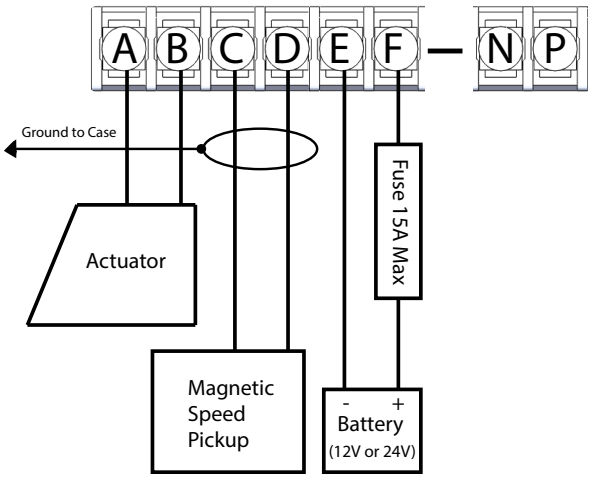
4 WIRING

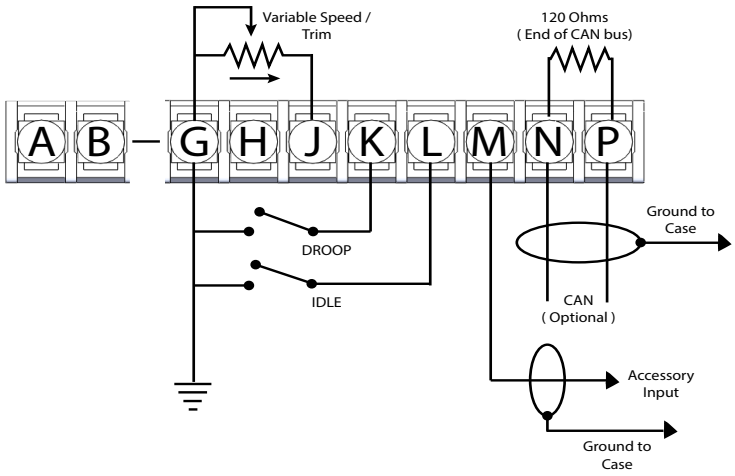
* Keep reading for diagrams and/or additional notes

TERM.	DEFINITION	GAUGE	NOTES
A	Actuator (+)	#16 AWG	Not polarity dependent
B	Actuator (-)	#16 AWG	
C	Magnetic Pickup (+)	#20 AWG	* Twist wires 14 turns per foot
D	Mag Pickup Ground	#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
G	Ground Signal	#16 AWG	* Variable speed/trim input & switches
H	Not Used		
J	Variable Speed Input	#20 AWG	* 5K Ω Resistive Potentiometer
K	Droop Select	#16 AWG	* Active when connected to Term. G
L	Idle Select	#16 AWG	* Active when connected to Term. G
M	Aux Input	#20 AWG	* Load sharing / synchronizing, 5V nominal (0-10V), reverse ramp
N	CAN L	#20 AWG	* Twist Wires 14 turns per foot.
P	CAN H	#20 AWG	

RECOMMENDATIONS

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





PIN 3 **Magnetic Speed Pickup**

- Wires must be twisted and/or shielded for their entire length (14 turns per foot)
- Gap between speed sensor and gear teeth should not be smaller than 0.02 in. (.51mm)
- Speed sensor voltage should be at least 1VAC RMS during crank

WARNING — **Loss of Magnetic Pickup Sensing**

If the EDG5500 detects no input from the magnetic pickup, the EDG will set the actuator to 0V and set the speed to 0 RPM. After the EDG has detected loss of magnetic pickup, the display will flash the RPM along with the Warning Indicator. Parameters will be unchangeable.

5 DISPLAY & CONTROLS

Numerical Area

Displays the value of a selected parameter or live running parameter

Alpha-Numerical Area

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

Throttle, Delta Speed Graph, & Current

Toggle between the 3 views:

Tap △ **or** ▽

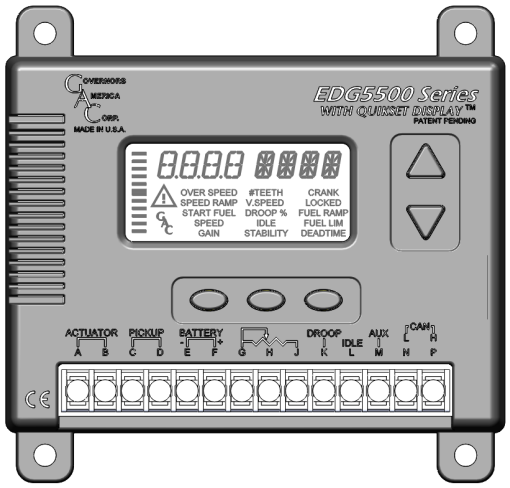
Loss of Magnetic Speed Pickup / Overcurrent

After the EDG 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



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

Parameter Adjust Down

Increment a Parameter Value:

HOLD ⬭ and TAP △ or ▽

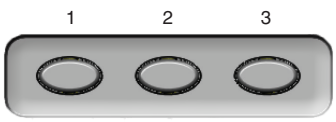
Rapidly Increment a Value:

HOLD ⬭ and HOLD △ or ▽

Locking the Displpay

HOLD △ and ▽ for 2 seconds

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 1
For: IDLE Hold: Button 2
For: FUEL LIM Hold: Button 3

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

	Special Menu Parameter	Quikset Menu Parameters	
MODE	**VSPD**	**SPEED**	**V. SPEED**
Trim (Default)	OFF	Application Rated Speed (e.g., 1500 RPM)	Speed Trim Percentage (e.g., 5% = ±90RPM)
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)

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 postition.

MODE	D SW	SPEED
SPEED with Auto Offset	ON	Controller will run at SPEED (Quikset Menu) with an offset determined by the DROOP%
Droop Speed	OFF	Controller will run to DSPD (Special Menu). A manual offset is required for operation

IDLE SPEED

IMPORTANT The optional external switch must be tied to terminal "G". Pressure switch may also be used as a method of enabling.

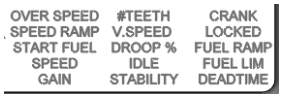
ACCESSORY INPUT

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:

#TEETH	Input the Number of Teeth on the Flywheel
CRANK	Input the Crank Termination (RPM)
SPEED	Input the Fixed Speed of the Engine (RPM)



ADJUSTABLE QUIKSET PARAMETERS		
OVER SPEED	**#TEETH**	**CRANK**
Range: 500 - 9999 RPM Default: 2220 RPM	Range: 50 - 255 Default: 120	Range: 0 - 9999 RPM Default: 400 RPM
RPM to automatically shutoff the actuator	Number of teeth on flywheel	RPM which EDG switches to starting fuel ramp
SPEED RAMP	**V.SPEED**	**LOCKED**
Range: 0 - 9999 Default: 400	Range: 0 - 9999 RPM Default: 5 RPM	Range: OFF, ON Default: OFF
Rate at which speed changes from idle to speed and back	Maximum speed change allowed from trim input	Indicates if EDG will lock after 5 minutes of non-use
START FUEL	**DROOP%**	**FUEL RAMP**
Range: 0 - 100% Default: 99%	Range: 0 - 25.0% Default: 0.0%	Range: 0 - 100% Default: 2%
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 engine starts to idle
SPEED	**IDLE**	**FUEL LIM**
Range: 0 - 9999 RPM Default: 1500 RPM	Range: 0 - 9999 RPM Default: 900 RPM	Range: 0 - 100% Default: 99%
Operating speed of engine	Speed of engine when IDLE input is closed	Maximum actuator percentage allowed
GAIN	**STABILITY**	**DEADTIME**
Range: 0 - 100, 100 = Max Gain Default: 20	Range: 0 - 100, 100 = fastest response Default: 36	Range: 0 - 100 Default: 21
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

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 EDG5500 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 by default. (Value will remain when switching between Idle and Rated Gain.
IDLE SPEED	1. Connect the idle input to ground. 2. Change GAIN value. 3. Disconnect Idle input from ground to switch back to Rated.

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. Follow the same adjustment procedure as the GAIN parameter.

NOTE Normally, adjustments made at no load achieve satisfactory performance. If further performance improvements are required, refer to Section (9) ADVANCED PARAMETERS MENU and Section (10) SYSTEM

9 SPECIAL 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 To change parameters, refer to Section 4 DISPLAY & CONTROLS.

SPECIAL MENU PARAMETERS

Parameter	Definition	Range	Default
AUX	Auxiliary Input Enable	Off, On	Off
AVE	On = Averages four pulse samples from the Mag-Pickup for more accurate response Off = Calculates speed from pulses accumulated over the last system update	Off, On	Off
VSPD	Variable Speed or Trim Select (On=Variable Speed, Off=Trim)	Off, On	Off
SOFT	Soft Coupling - Dampening of system (slow down response)	Off, On	Off
LEAD	Lead Circuit - Response increase	Off, On	Off
D SW	Sets the droop mode On=Auto Offset Off = Manual Offset	Off, On	On
DITH	Adds white noise to actuator or throttle body prevent sticking in the fuel rack.(%)	0 - 10	0
DRNG	System current to the actuator that represents full load. Units in (A)	0.0 - 10.0	3.9
DSPD	Droop offset when DSW is set to Off (RPM)	0 - 9999	1500
OVRC	Over Current - Turns off actuator if specified current value is exceeded. Units in (A)	0 - 12	11.7

10 ADVANCED PARAMETERS MENU

Advanced Menu Parameters will further adjust engine stability.

DISPLAYING ADVANCED MENU PARAMETERS: Hold ALL 3 until "RATE" appears in display.

Adjust Parameters: Increase Parameter / Decrease Parameter

Return to Quikset Menu: Hold ALL 3 for 2 seconds

ADVANCED MENU PARAMETERS

Parameter	Definition	Range	Default
RATE	The time (mS) between calls to the PID control loop.	4 - 250 mS	4
FLTR	Number of speed samples in frequency calculation. Filter is active when soft coupling (**SOFT**) is set to ON. Lower numbers filter high frequency noise.	1 - 62 samples	40
GMUL	If the **GAIN** parameter is at maximum and more **GAIN** is required, increase **GMUL**. **GAIN** will be more responsive. If small changes in the **GAIN** parameter are over responsive, decrease **GMUL.**	1 - 20	17
SMUL	If the **STABILITY** parameter is at maximum and more **STABILITY** is required, increase **SMUL**. **STABILITY** will be more responsive. If small changes in **STABILITY** parameter are over responsive, decrease **SMUL.**	1 - 20	17
DMUL	If **DEADTIME** value is at maximum and more **DEADTIME** is required, increase **DMUL**. **DEADTIME** will be more responsive. If small changes in **DEADTIME** parameter are over responsive, decrease **DMUL.**	1 - 20	12

CAUTION Multiplier Changes can make drastic changes. Changing a multiplier (e.g. GMUL) will affect the corresponding Quikset parameter (e.g. GAIN) in two ways:

1. If the multiplier is decreased by 1, corresponding Quikset value will double.
2. If the multiplier is increased by 1, corresponding Quikset value will halve.

NOTE The engine will maintain current operation while adjusting parameters. (i.e. **NO CHANGES**) Since the scaling will be made to the Gain, Stability, and Derivitive parameters automatically, go back and readjust these parameters to the diesired levels.

11 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)	1. DC battery power not connected. Check for blown fuse 2. Low battery voltage 3. Wiring error
2	C & D	1.0V AC RMS min. While Cranking	1. Gap between speed sensor and gear teeth too great 2. Improper or defective wiring to the speed sensor 3. Resistance between D and C should be 130 to 1200 ohms. See specific mag pickup data for resistance. Defective speed sensor.
3	F(+) & A(-)	1.0 - 2.0V DC While Cranking	1. SPEED or IDLE parameter set imcorrectly 2. CRANK or START FUEL set incorrectly 3. Short/open in actuator wiring 4. Defective speed control 5. Defective actuator, see Actuator Troubleshooting

INSTABILITY

INSTABILITY	SYMPTOM	PROBABLE CAUSE OF ABNORMAL READING
Fast Periodic	The engine seems to jitter with a 3Hz or faster irregularity of speed. (Not as moderate)	1. Make sure LEAD Special parameter is set to “OFF”. 2. Readjust the GAIN and STABILITY for optimum control. 3. In extreme cases, decrease the DEADTIME parameter.
Slow Periodic	Speed irregularity below 3Hz. (Sometimes severe)	1. Verify the SOFT (soft coupling) Special Manu parameter is disabled. 2. Decrease the update rate of the controller by decreasing the RATE Advanced parameter. (Each time RATE is changed, GAIN, STABILITY, and DEADTIME must be re-adjusted. 3. Check fuel system linkage during engine operation for: a. binding b. high friction c. poor linkage 4. Dead Time Parameter set too high.
Non-Periodic	Erratic Engine Behavior	1. Increasing the GAIN should reduce the instability but not totaly correct it. If this is the case, there is most likely a problem with the engine itself. Check for: a. engine mis-firings b. an erratic fuel system c. load changes on the genera tor set voltage regulator.

If unsuccessful in solving instability, contact GAC for assistance.
GAC@governors-america.com or call: 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 position 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.
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 B 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

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