

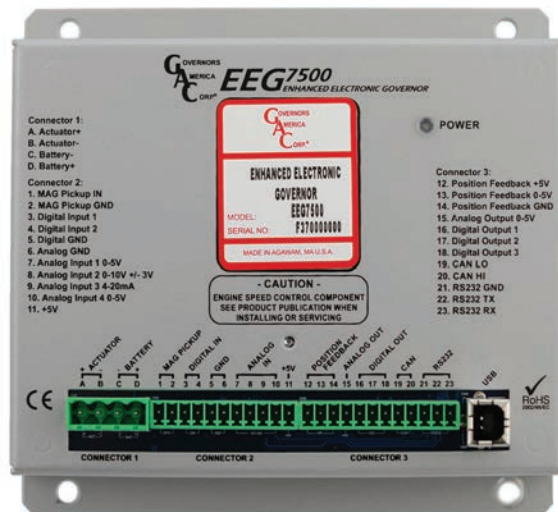
## 1 INTRODUCTION

GAC's EEG7500 enhanced electronic governor is designed to regulate engine speed on diesel and gaseous fueled engines. When paired with a GAC actuator the EEG7500 is a suitable upgrade for any mechanical governor system that needs flexibility, precision, or accurate control of governed speed. The EEG7500 is designed for industrial engine applications from generator sets, mechanical drives, pumps, and compressors to off-road mobile equipment. Configuring is easy with GAC's free [GAConfig Tool software](#). The EEG7500 supports:

- Flexible actuator compatibility including bi-directional actuators with or without actuator position feedback signal, bi-directional torque motors, and Bosch-style throttle bodies.
- Fully configurable digital and analog inputs and outputs
  - Inputs: 5 analog, 2 digital
  - Outputs: 1 analog, 3 digital
- 0 - 5 V DC, 4 - 20 mA, 0 - 10 V DC, or  $\pm 3$  V DC input ranges
- Speed Sync using CAN bus
- Virtual Input/Output Routing
- Feedback Speed Control Mode
- Variable Speed Capability
- Fuel Curve Shaping

EEG7500 supports three operating modes:

- Non-Feedback Speed Control (NFSC)** provides standard **PID** governing function for use with proportional actuators. No position feedback sensor is required. PID (Proportional, Integral, Derivative) governor functions are optimized for best response and control of the requested engine revolutions per minute (rpm).
- Feedback Speed Control (FSC)** combines NFSC and PM modes for use with proportional or bi-directional (torque motor) actuators. A position feedback sensor is required. The Speed PID position request is the input to the Positioner loop, the Position PID optimizes response and control of the requested actuator position.
- Position Control (PC)** (uncommon) provides actuator positioning control and is used with proportional actuators or bi-directional (torque motor) actuators with a feedback sensor (required).



## 2 EEG7500 SPECIFICATIONS

### PERFORMANCE

Isochronous Operation	$\pm 0.25$ %
Governed Speed / Sensor Frequency Range	100 Hz - 12 kHz
Droop Range	Up to 25 % regulation

### COMPLIANCE / STANDARDS

Agency	CE and RoHS Requirements
Communications	USB, RS-232-C, SAE J1939

### PHYSICAL

Dimension	See <a href="#">Section 4, Controller Installation</a>
Weight	18.4 oz [0.52 kgf]
Mounting	Any position, vertical preferred

### RELIABILITY

Vibration	10 - 2000 Hz @ 7 g, per SAE J1455
Shock	20 g, 11 ms per SAE J1455
Testing	100 % Functional Testing

### LED

Solid Green	Ready. Controller is powered on.
Blinking Green	Warning. Engine service due, or other. Displayed in GAConfig Tool System Status.
Unlit	No power.

### INPUT / OUTPUT

Supply	12 - 24 V DC Battery systems (6.5 to 32 V DC)
Polarity	Negative Ground (Case Isolated)
Power Consumption	200 mA continuous plus actuator current 400 mA with excitation at MAX load current
Speed Sensor Signal Input	1.0 - 60.0 V RMS
Actuator Output	10 A Continuous
Load Share / Synchronizer Input	0 - 10 V DC (5 V Nominal, Selectable Polarity, 145 Hz / V Sensitivity) or 0 V $\pm$ 3 V DC
Reverse Power Protection	Protected to -40 V DC
Transient Voltage Protection	60 V DC
Digital Switch Output(s)	Rated to 2 A DC

### ENVIRONMENTAL

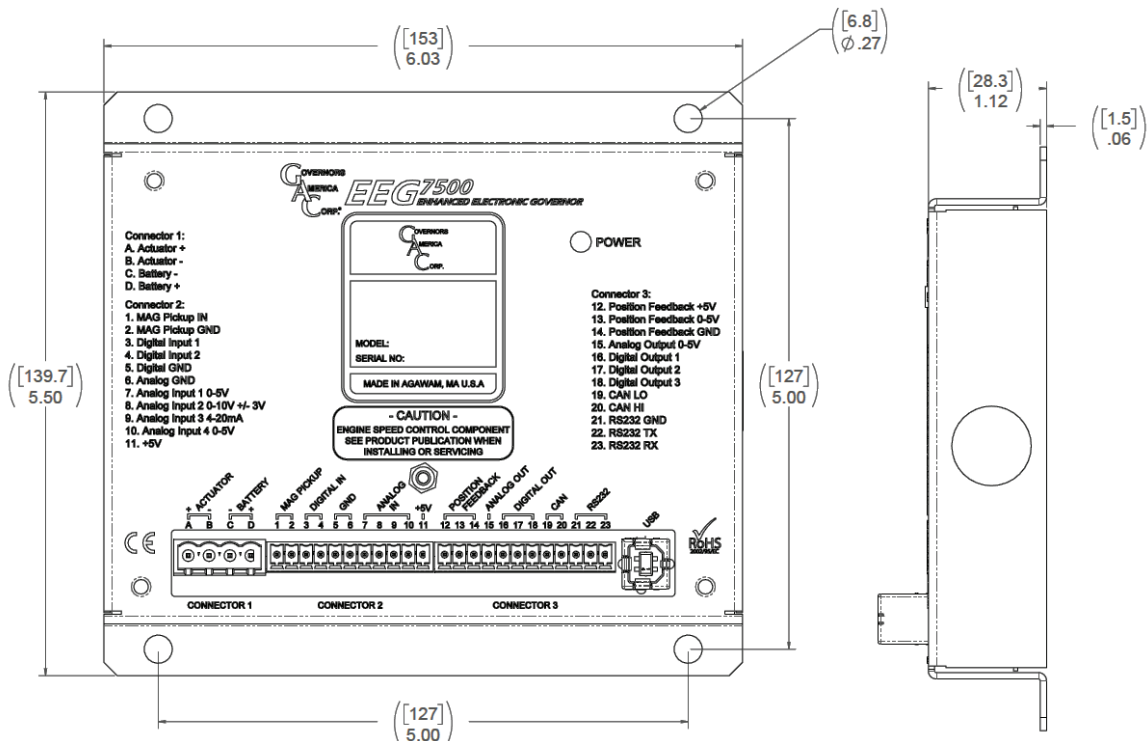
Ambient Temperature	-40 to 180 °F [-40 to 85 °C]
Relative Humidity	up to 90 % Non-Condensing at 38 °C [100 °F] (per SAE J1455)
Salt Spray	ASTM B117
All Surface Finishes	Fungus Proof and Corrosion Resistant

### 3 BEFORE YOU BEGIN

This manual provides installation and use instructions for the EEG7500 enhanced electronic governor (EEG7500 controller) with [hardware installation](#), [controller wiring](#), [software tool installation](#), [system configuration](#), and [system troubleshooting](#) instructions. Read the entire document before starting your installation. Determine what hardware devices, including an actuator, are involved in the installation and ensure you know where each device is connected on the speed controller so it can be set up in the GAC configuration tool software (GACConfig Tool).

The GACConfig Tool software allows you to setup preliminary configuration settings prior to connecting to the engine and supporting hardware devices. The GACConfig Tool is downloaded from GAC's website. A PC with at least Windows 7, one USB port, and an internet connection is required. A 14 pin connector (GAC EC1502) or cable harness assembly (CH1520) is also required. Additional hardware, including the actuator, is not included. For help with a complete solution to your application please [contact your GAC representative](#).

### 4 EEG7500 INSTALLATION



Vertical orientation allows for draining of fluids in moist environments.



Mount in a cabinet, engine enclosure, or sealed metal box. Ensure adequate ventilation for cooling.

Do not mount directly on engine.



Avoid extreme heat. Do not mount next to turbocharger, exhaust manifold, or other high temperature equipment.

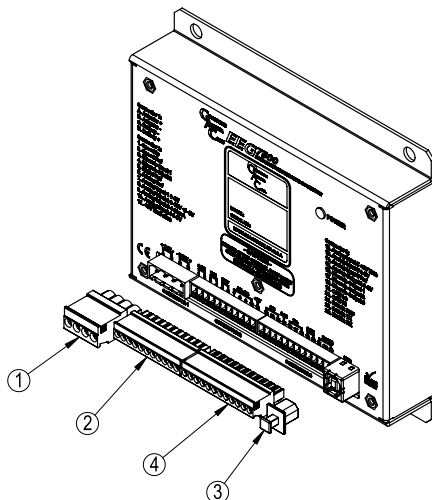
Dimensions [mm] in



Use an overspeed shutdown device, independent of the governor system, to prevent loss of engine control.

Do not rely exclusively on the governor system electronic actuator to prevent overspeed. A secondary shutoff device, such as a fuel solenoid must be used. Pressing STOP on the GACConfig Tool sets fuel to the actuator to 0, it does not directly shut down the engine.

### EEG7500 CONTROLLER CONNECTORS



The following connectors are required when using the EEG7500.

ITEM NO.	PART NUMBER	DESCRIPTION	NOTE
1	EC02-01-0097	PLUG, 4 POS	Included
2	EC02-01-0094	PLUG, 11 POS,	Included
3	EC12-04-0016	USB COVER	Included
4	EC02-01-0098	PLUG, 12 POS	Included

## 5 EEG7500 WIRING DIAGRAMS

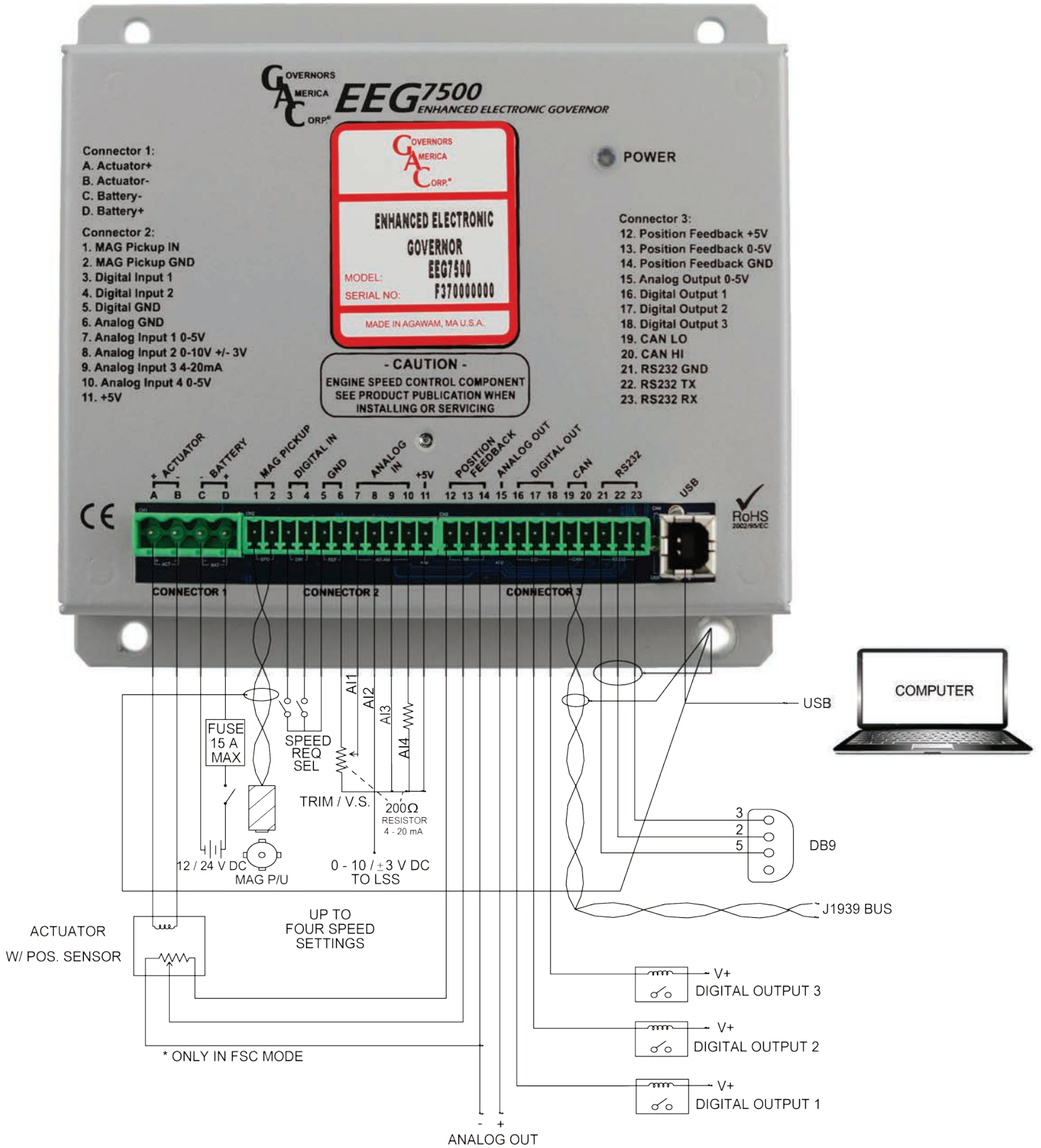
Wire the EEG7500 for either [speed control](#) or [position control](#), as detailed in sections 5 and 6. Items highlighted in the following table are the minimum connections required before starting. Read this entire manual before starting. Determine what hardware devices will be involved in the installation and ensure you know where they are being mapped to on this speed controller. Note your wiring setup to make setup easier to configure in the GAConfig Tool.

TERMINAL <sup>(1)</sup>	DEFINITION	CONNECTION	GAUGE	FIXED SPEED	VARIABLE SPEED	POSITION CONTROL
A	Actuator (+)	Actuator	16	REQUIRED	REQUIRED	REQUIRED
B	Actuator (-)		16	REQUIRED	REQUIRED	REQUIRED
C <sup>2</sup>	Battery Ground (-)	12 or 24 V DC Battery	16	REQUIRED	REQUIRED	REQUIRED
D <sup>2</sup>	Battery Power (+)		16	REQUIRED	REQUIRED	REQUIRED
1	Magnetic Pick-up (+)	Mag Pick-up speed sensor input is not polarity sensitive <sup>3</sup>	20	REQUIRED	REQUIRED	
2	Magnetic Pick-up (-)		20	REQUIRED	REQUIRED	
3	Digital Input 1	Switch or jumper wire to Terminal 5	20	REQUIRED with more than 2 speed settings	REQUIRED with Idle speed setting used	REQUIRED with position select
4	Digital Input 2	Switch or jumper wire to Terminal 5	20	REQUIRED with 3 speed settings	REQUIRED when using additional fixed settings	REQUIRED when using additional positions
5	Digital Ground (GND)		20	REQUIRED with Terminals 3 and 4	REQUIRED with Terminals 3 and 4	REQUIRED with Terminals 3 and 4
6	Analog Ground (GND)		20		REQUIRED	REQUIRED
7	Analog Input 1	0 - 5 V DC, potentiometer or 4 - 20 mA (200 Ω resistor required)	20		REQUIRED	REQUIRED IF using Position Control (Position 4)
8	Analog Input 2	AUX 0 - 10 V DC (5 V Nominal) OR ±3 V DC (0 V Nominal). Selectable polarity.	20			
9	Analog Input 3	4 - 20 mA	20			
10	Analog Input 4	0 - 5 V DC (4 - 20 mA with 200 Ω external resistor)	20			
11	+ 5 V Excitation		20		REQUIRED with potentiometer on Terminal 7	REQUIRED with potentiometer on Terminal 7
12	+ 5 V Excitation	Actuator Position Feedback Sensor	20	REQUIRED with Position Control	REQUIRED with Position Control	REQUIRED
13	Analog Input 5					REQUIRED
14	Analog Reference Ground					REQUIRED
15	Analog Output	0 - 5 V DC (25 mA MAX)	20			
16	Digital Output 1	Switch output 2 A MAX	20			
17	Digital Output 2	Switch output 2 A MAX	20			
18	Digital Output 3	Switch output 2 A MAX	20			
19	CAN Low	J1939 BUS, Non Terminated <sup>3</sup>	20			
20	CAN High		20			
21	RS232 <sup>2)</sup> Ground Reference		20			
22	RS232 TX		20			
23	RS232 RX		20			

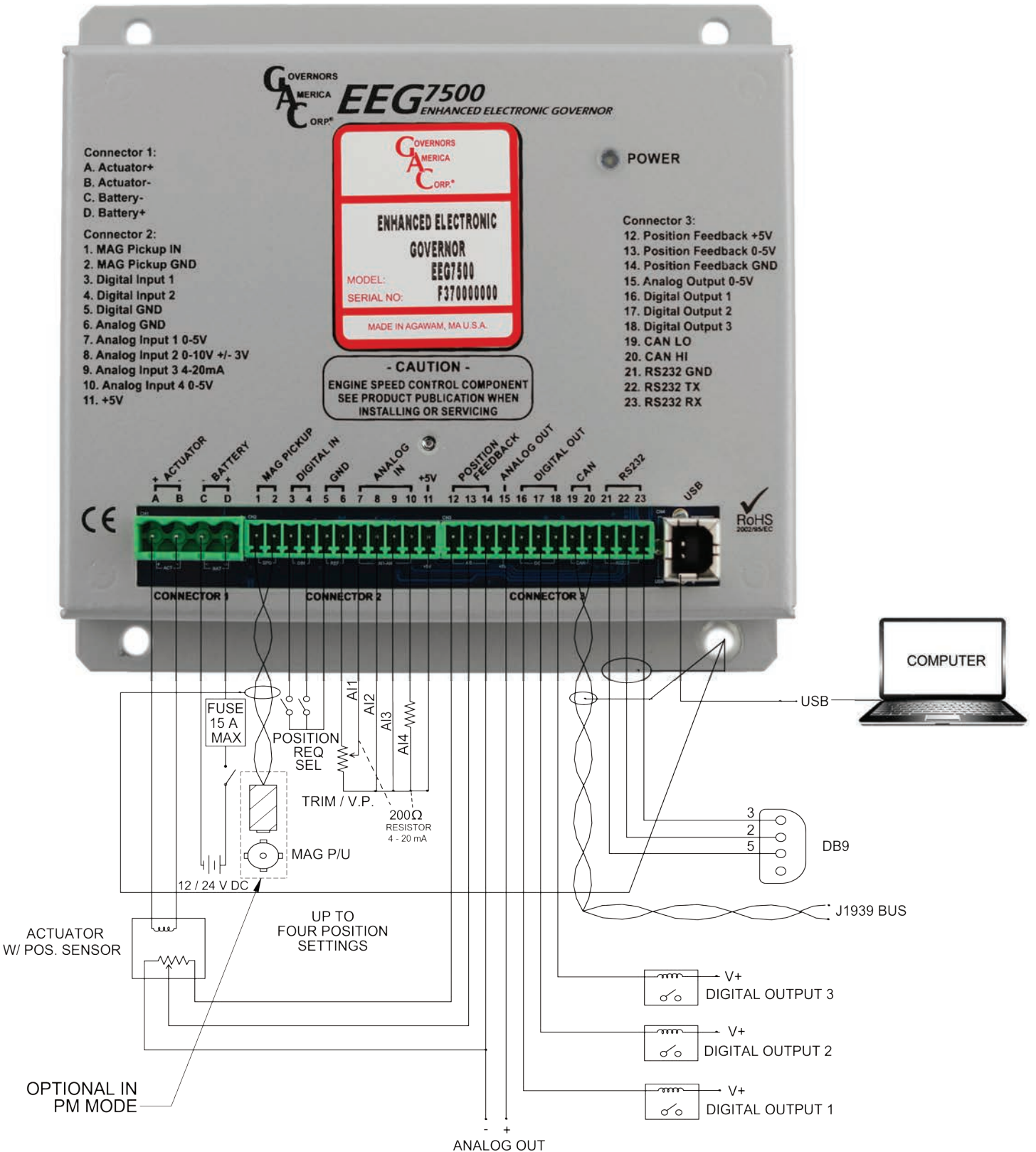
### RECOMMENDATION NOTES

- Use shielded cable on all external connections. Ground one end of each shield, including speed sensor shield, to a single point on the EEG7500 case.
- Ground controller case to battery (-)
- For magnetic pickups and CAN bus, use twisted wires at 14 turns per foot in wire length.

WIRING FOR FEEDBACK SPEED CONTROL AND NON-FEEDBACK SPEED CONTROL MODE



WIRING FOR POSITION CONTROL



## 6 EEG7500 WIRING DETAILS

The EEG7500 controller provides a broad range of configuration options. Wiring is dependent on your application and the [actuator type](#).

The controller provides dedicated actuator and magnetic pickup input and configurable analog and digital inputs to support direct communications to SAE J1939 (CAN) using the GAConfig Tool software.

Controller outputs are created using output terminals and mapped using the software; for example if a specific speed is achieved the controller can be set to output a warning, shut down, or engage a particular piece of hardware.

[Three connectors](#) with multiple terminals on each are used to wire to the engine and other hardware. The following details the connector and terminal labels and their uses.

### Actuator Connection: Connector 1 - Terminals A and B

Terminals A and B are dedicated to actuator usage. They provide input for bidirectional devices such as torque motors which require specific polarity settings.

Proportional actuators are not polarity sensitive. See your specific actuator manual for details.

### Battery Connection: Connector 1 - Terminals C and D

Connect the engine battery to the Terminals C and D.



A 15 A fuse and power switch must be installed on the positive battery lead going to Terminal D.

### Magnetic Speed Pickup Signal: Connector 2 - Terminals 1 and 2: Speed In / Speed Ref

- Wires must be twisted and/or shielded for their entire length (14 turns per foot).
- Gap between speed sensor and gear teeth should be > 0.02 in [0.51 mm].
- Speed sensor voltage should be at least 1 V AC RMS during crank.



If the EEG7500 detects no input from the magnetic pickup, the EEG7500 will set the actuator to 0 V DC and set the speed to 0 rpm.

### Digital Input 1 and 2 - Speed Input Routing: Connector 2 - Terminals 3 and 4

Terminals 3 and 4 are digital inputs used to support incoming digital, analog, or virtual (J1939) signals. An external switch can also be used between Terminals 3 and 4 (Ground to Terminal 5) to select assigned fixed speed settings.

From the GAConfig Tool → I/O Configuration → Physical Input Mapping set Run/Stop Input to Digital Input 1 or 2 to match the external switch wiring.

### Digital and Analog Ground Reference: Connector 2 - Terminals 5 and 6:

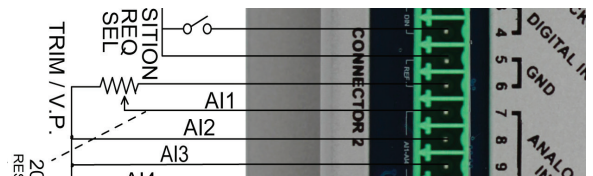
Terminal 5 provides a digital ground. Terminal 6 provides the internal ground for use with external trim or variable speed potentiometers.

An external switch can be added between Terminals 3 and 4 with ground to Terminal 5 to select assigned fixed speed settings using the GAConfig Tool.

### Analog Input: Connector 2 - Terminal 7

Terminal 7 is the analog input from external trim or variable speed potentiometer. Speed trim uses a [potentiometer](#) to vary the engine speed remotely.

The GAConfig Tool [Speed Trim](#) parameter lets you adjust speed trim  $\pm 10\%$  based on the minimum and maximum voltage configured for the variable speed input. Trim speed logic is used with fixed speed settings.



**Auxiliary Input - Analog Input 2: Connector 2 - Terminal 8**

The auxiliary (Aux) input (Terminal 8) accepts input signals from load sharing units, auto synchronizers, and other governor system accessories. The Aux input enables or disables the load sync input. GAC accessories connect directly to this terminal.

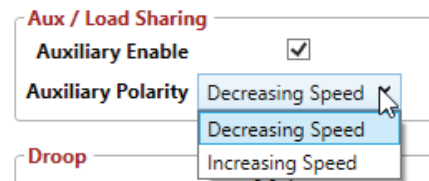
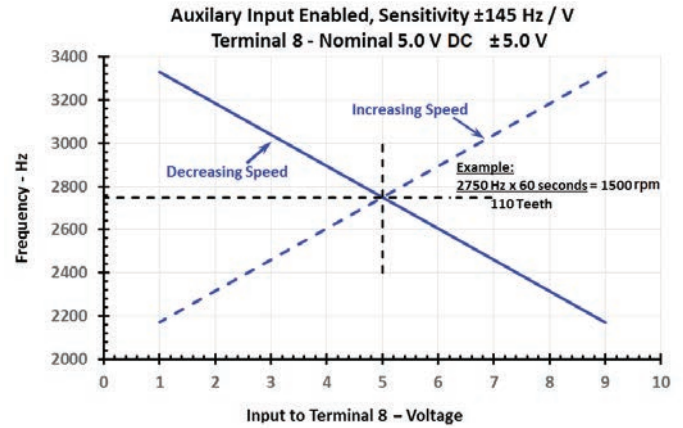
The Aux function decreases engine speed in response to increased input voltage. Use the Auxiliary Polarity shift function to choose to increase engine speed as input voltage increases:

- To decrease speed set above 5 V DC.
- To increase speed set below 5 V DC. The Aux input is a 0 - 10 V DC reverse polarity signal used to parallel to the mains, or load share multiple generators.

The AUX input also enables or disables the load sync input.

To use the Aux input at AI4, using the GAConfig Tool select Advanced Configuration → Aux / Load Sharing → and check the Auxiliary Enable box.

Select the desired Auxiliary Polarity (Decreasing Speed or Increasing Speed) from the drop down box. Polarity must be matched for all auxiliary products used with the EEG7500.



**4 - 20 mA Input and 0 - 5 V DC Input: Connector 2 - Terminals 9 and 10**

Terminal 9, Analog Input 3, provides dedicated 4 - 20 mA input signal.

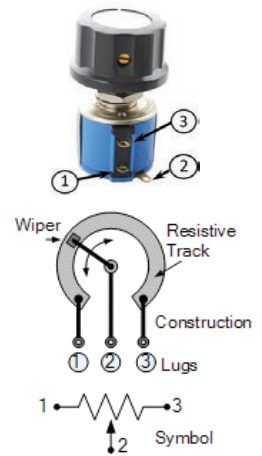
Terminal 10, Analog Input 4, provides dedicated 0 - 5 V DC input signal, or 4 - 20 mA with an external 200 Ω resistor.

**+5 Volt Power Supply: Connector 2 - Terminals 6, 7, and 11**

- Terminal 11 provides +5 V DC excitation, power to potentiometers or other equipment requiring power.
- Terminal 6 is ground.
- Terminal 7 provides Analog Input. Terminal 7 input must be equated to the GAConfig Tool → Physical Input Mapping → Variable Speed Input Analog Input setting

Section 8 offers details on using the potentiometer with the EEG7500. For information on available potentiometers see the [GAC Potentiometers](#) list on the GAC website.

Potentiometer Terminal	EEG7500 Terminal	Location
1	11	+5 V (power)
2	7	Analog Input
3	6	Ground



The potentiometers outer legs are used for power and ground while the middle is used for analog input. This means that the value coming out of the third leg will change depending on how far the knob is turned.

**Position Feedback Sensor: Connector 3 - Terminals 12, 13 and 14**

An actuator position feedback sensor is required for the Control Mode Feedback Speed Control and Position Control, but not for Non-Feedback Speed Control mode.

- Terminal 12: 5 V Supply to Position Feedback Sensor
- Terminal 13: 0 - 5 V DC Actuator Position Signal
- Terminal 14: Position Sensor Ground Ref

Position control is not intended for use in gaseous fuel control. [Contact your GAC representative for more details.](#)



## 6 EEG7500 WIRING DETAILS (CONTINUED)

### 0 - 5 V Analog Output: Connector 3 - Terminal 15

Terminal 15 supports one 0 - 5 V DC analog output and can be assigned to any analog output source including engine speed, load, actuator position, switches, alarms, or J1939 inputs.

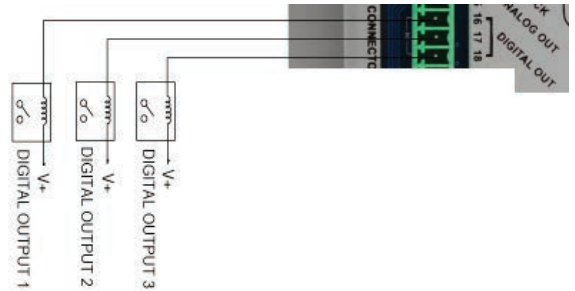
Use the GAConfig Tool → I/O Configuration → Physical Output Configuration to set the output destination.

### Digital Output 1, 2, and 3: Connector 3 - Terminals 16, 17 and 18

Terminals 16 - 18 support 3 digital output sources including engine speed, load, actuator position, switches, alarms, or J1939 inputs.

Using the GAConfig Tool → I/O Configuration → Output Configuration or Physical Output Configuration:

- Map input sources to output actions
- Set speed or position switch limits, with and without latch
- Assign an output to be normally open (NO) or normally closed (NC)



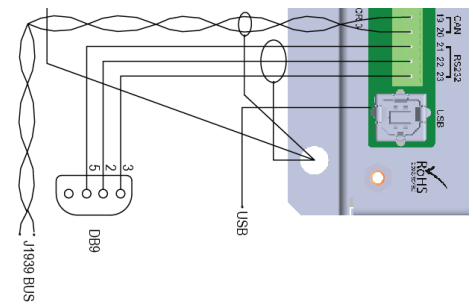
### CAN and RS232: Connector 3 - Terminals 19 - 20 and Terminals 21 - 23

The controller supports RS232 and a subset of [SAE J1939](#) protocols.

The CAN bus must be terminated at both ends by a 120 k  $\Omega$  resistor.

Termination resistance should be set in parallel (60  $\Omega$ ), 2 X 120 k  $\Omega$ .

- Terminal 19 = CAN Low
- Terminal 20 = CAN High
- Terminals 21 - 23 = RS232



A secondary shutoff device, such as a fuel solenoid must be used. GAConfig Tool shuts down fuel to the actuator, but does not directly shutdown the engine.

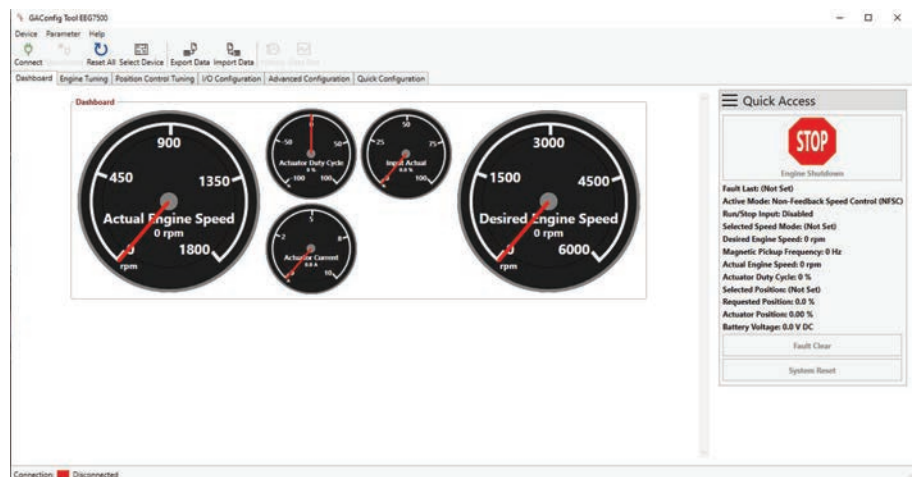
## 7 INSTALLING THE GAConfig TOOL

EEG7500 controller uses the GAConfig Tool to update parameter values, map physical connections, adjust performance settings, and view results. This PC software provides a menu-driven user-friendly interface to update settings, and speed diagnostics and troubleshooting.

The tool also allows you to set up multiple scenarios and save them for use later or for sharing with other sites-solutions using the EEG7500 controller.

The GAConfig Tool is downloaded from GAC's [website](#). The following is required to run the software:

- A PC with at least Windows 7 or higher and at least one USB port
- An internet connection
- A 14 pin connector (GAC EC1502) or cable harness assembly (CH1520)





## 7 INSTALLING THE GAConfig TOOL (CONTINUED)

### INSTALLING GAConfig TOOL AND CONNECTING TO EEG7500

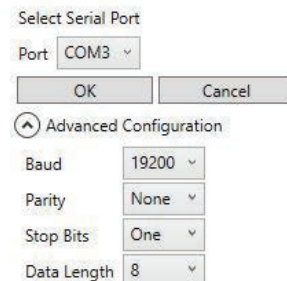
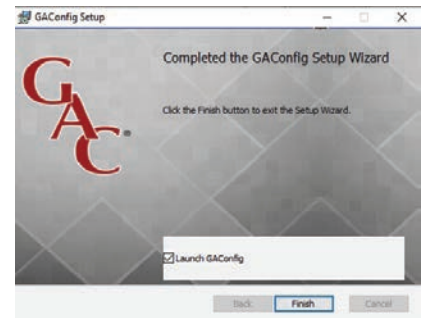
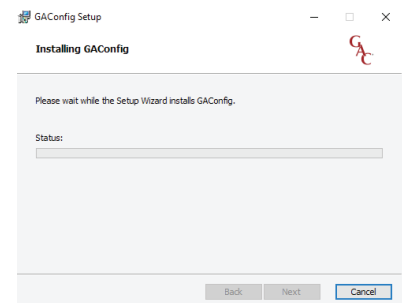
The EEG7500 speed controller uses the GAConfig Tool to update parameter values on the controller, adjust performance settings for the engine and view engine information. This free PC tool uses a menu-driven user-friendly interface for configuration, tuning, and troubleshooting. The tool also allows you to set up multiple scenarios and save them for use later or to import and export settings to share with other EEG7500 controllers.

The GAConfig Tool is downloaded from [GAC's website](#). A PC with at least Windows 7, one USB port and an internet connection is required. A 14 pin connector (GAC EC1502) or cable harness assembly (CH1520) is also required.

1. Download the EEG7500 GAConfig Tool from the [GAC Software Download page](#). Depending on your workplace the download installer may request additional information. After the software is installed the PC must be restarted.
2. The download file is saved in the PC's default download folder area, unless you tell it otherwise. Once downloaded, double-click the file name to start the installation. If you have any issues installing the file please call your GAC representative. The default installation is in the Program Files (x86) /Governors America Corporation file area.
3. The GAConfig Setup screen displays. Click Install. The Installing GAConfig screen displays, showing a progress bar.
4. Click Finish when complete. The GAConfig Tool icon displays on your PC desktop. On first use, a prompt will ask you to select a device. Select EEG7500 from the drop-down list.
5. Connect the EEG7500 to the PC using a USB-A port and connect the USB-B port on the EEG7500. Power for the controller comes from the engine battery. A green LED displays on the EEG7500 when power is successful.
6. **Do not start the engine.**
7. Double-click the GAConfig Tool icon on your desktop.
8. Connect the GAConfig Tool to the EEG7500 by clicking the Connect icon on the top left of the GAConfig window.
9. A pop-up dialogue window displays a drop-down list of available serial port connections. Select the appropriate port and click OK. If you are unsure of the port, [use the Windows Device manager](#) to locate what device is plugged in to which USB port.
10. The Connection Status indicator on the lower left corner of GAConfig Tool flashes yellow then turns green as the connection is completed. The status bar displays Connected. If the connection does not complete, a red Disconnected message displays. Check your connections and note any error messages on the PC and try again.

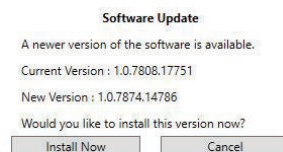


Connection: ■ Connected



### INSTALLING AN UPDATE

If you already have the GAConfig Tool software on your system, an automatic upgrade with the latest version will be offered. It is always good practice to save your settings.

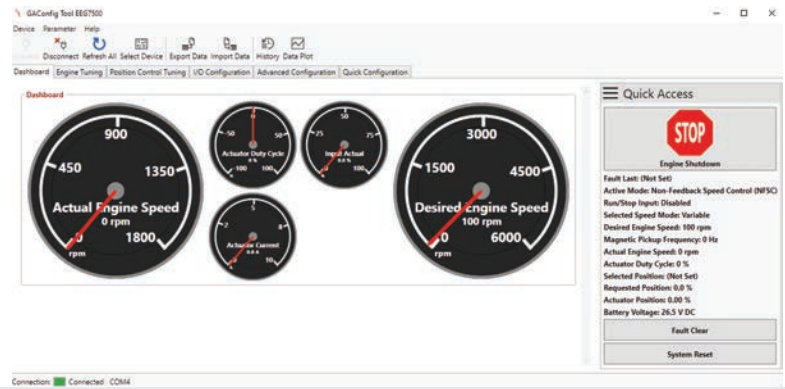


To install manually, visit the download page:  
<https://www.governors-america.com/pages/sof>

## 8 USING THE GAConfig TOOL

EEG7500 uses the GAConfig Tool software to add parameter values, adjust performance settings, and view results. Parameters are grouped by functionality at the main menu. The tool allows you to change controller parameters on the fly. The initial view shows this Dashboard.

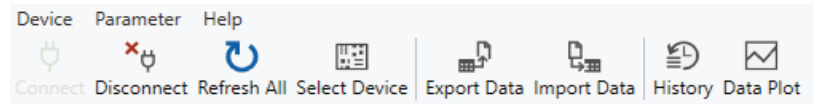
Initial setup is completed from [Engine Tuning](#) menu without the engine running, but powering the GAConfig Tool using engine voltage.



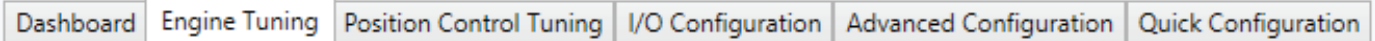
### TOOL BAR

The tool bar provides access to connect to your EEG7500, use imported and exported configuration files, create and save data plots, view setting history, view error logs, or reset your current settings. From the tool bar you can:

- Connect PC configuration software to the EEG7500
- Export and import settings
- View history of parameter settings
- Create and save data plots



### MAIN MENU




The main menu provides access to parameter settings and information. The Quick Access panel details the current engine status. The menus are:

- The Dashboard gives a quick view of the engine status.
- [Engine Tuning](#) includes basic setup of initial and system safety settings including control mode (based on actuator type) overspeed, flywheel teeth, fuel settings, and acceleration rates. Engine Tuning also includes fixed speed settings, Gain, Stability, Deadtime, and Variable Speed setup. A fuel limiting table can also be built here.
- [Position Control](#) sets fixed and variable position settings, and allows a position table to be built.
- [I/O Configuration](#) assigns analog and digital devices to the wiring.
- [Advanced Configuration](#) sets Droop, Auxiliary sharing, Trim and configures and displays diagnostic messaging for TSC1/J1939.
- [Quick Configuration](#) puts all the parameter settings on one place.

### TIPS

Some quick tips when using the GAConfig Tool:

- Use the Tab key to jump to the next parameter. Use the Enter key to save changes.
- Parameters can be set without being attached to the engine and saved. See [Off-line Setup Mode](#) for details.
- For a short description of a parameter, hover over the parameter name and a description briefly displays, or reference the item in the Quick Configuration menu where a short description is available in its associated menu tab.
- Parameter setting errors may display when you change a value. Read all **RED** warning boxes  error information, yellow cautions, and other pop-up information. Setting some parameter values impact other parameter values, often displaying a caution. One common message indicates the selected Control Mode does not support the parameter changed.
- The GAConfig Tool windows automatically re-sizes its window.
- Changing the Actuator Mode requires a restart of the GAConfig Tool to take affect.
- While using the tool, note the far right Quick Access bar, showing engine and setup status. This quick access area is very useful.
- Each physical input is mapped to one physical input device (terminal). Each output device (terminal) can be mapped to multiple output destinations.
- Quick Access **STOP** sets the engine speed to 0 rpm and shuts down the actuator. STOP does not directly shut down the engine.

**ENGINE TUNING**

Engine Tuning is the basic menu to store your engine startup and tuning information.

- System Status includes basic engine speed settings and actuator settings.
- System Setup for the actuator and engine with Control Mode (Type of actuator): non-feedback (default) feedback, or position , H-Bridge Mode and required setting Flywheel teeth, overspeed, fuel limit. Changes once started to these parameters require a es a system restart to take effect.
- Speed Configuration including:
  - Fixed speed and Variable speed settings
  - Tuning: [Gain](#), [Stability](#), [Deadtime](#), Lead circuit, [Light force Governing](#), [Speed anticipation](#)
  - Start-Up / Ramp Control for the Actuator: Start Fuel rate, Fuel ramp rate, starter cutoff, acceleration and deceleration

**POSITION CONTROL TUNING**

Actuators with feedback sensors can be fine tuned using Position control. Position Control must be set to a minimum calibration before using a feedback actuator.

- Fixed position
- Variable position
- Position Speed Settings
- Position Feedback Setup
- Position Control Table

## 8 USING THE GAConfig TOOL (CONTINUED)

### I/O CONFIGURATION

I/O Configuration maps physical input and output connections between the EEG7500 controller, the engine, and other hardware.

**Physical Input Mapping** allows you to choose from 15 options to relate that terminal to a hardware device. For example:

- A potentiometer is wired at Terminal 7 (Analog In) on the EEG7500 controller to support Variable Speed.
- In the GAConfig Tool:
  - Set I/O Configuration → Analog Input Mode → AI 1 to 0 - 5 V DC
  - Set Physical Input Mapping → Variable Speed Input to Analog Input 1

**Output Configuration** connects to data output locations outside the system, such as speed switches, position switches, setting a digital output mode mapping the output source to a location. Physical Output Mapping sets a specific output to a specific function, such as shutting down the actuators, changing speed.

### ADVANCED CONFIGURATION

The Advanced Configuration menu includes all the menu settings for the EEG7500 controller available in the GAConfig Tool in one menu area. Use this menu with its multiple tabs to update parameter settings directly.

- Auxiliary settings, Droop, Speed Trim
- J1939 message display, mapping, and control settings
- See overall system and software information like engine runtime and last fault time

### QUICK CONFIGURATION

The Quick Configuration menu includes all the menu settings for the EEG7500 controller available in the GAConfig Tool in one menu area.

Use this menu, with its multiple tabs, to update parameter settings directly; it is conveniently divided by the same groupings as on the PC tool view.

- Engine tuning
- Input and output configuration
- Position control
- Auxiliary settings, Droop, Speed Trim
- J1939 messaging

The EEG7500 can be set up and used straight out of the box, with an actuator attached, using default settings. This section details the initial installation and setup using the default settings. Wiring between the engine and the EEG7500 is required, and reviewing this document and default settings is advised. There are two sets of parameters to work with: basic engine wiring and engine parameter settings. This section details the initial installation and setup using the default settings. Wiring between the engine and the EEG7500 is required, and reviewing this document and default settings is advised.

**QUICK START**

1. After mounting the actuator following the actuators installation manual, mount the EEG7500 controller.
2. Determine the Control Mode of the actuator.
3. Based on the actuator control mode, complete the basic wiring between the engine, EEG7500, and actuator. The following are the minimum wiring requirements:
  - Connect actuator to EEG7500 (Terminals A and B)
  - Connect magnetic pickups to EEG7500 (Terminals 1 and 2)
  - Connect EEG7500 to battery (Terminal C and D)
  - Connect USB from EEG7500 to PC
2. Install the GAConfig Tool on the PC.
3. At the Main menu select Engine Tuning.
4. Check to make sure the default Flywheel Teeth value is correct for you engine. If not, click the value to change it.
5. Enter values for all the System Setup and Start-Up parameters.
6. At the Speed Configuration panel set the Fixed Speed values for Speed 1, Speed 2, and Speed 3.

PARAMETER	RANGE	DEFAULT	DEFINITION
Speed 1	0 - 6000	1500	Selects one of three fixed speeds (rpm).
Speed 2 and 3	150 - 6000	1500	
Gain 1, 2, and 3	1 - 100	50	Set one Gain value for each fixed speed.

**INITIAL SETUP: SELECT ACTUATOR CONTROL MODE**

The Control Mode is directly related to the actuator model. Actuators use one of three operating control modes: [non-feedback speed control](#), [feedback speed control](#), or [position control](#). These feedback modes are further divided into half and full<sup>5</sup> bridge modes. See your actuators installation guide for more information or talk to your GAC representative.



If H-Bridge Mode is set to Half Bridge, but the actuator does not support half bridge<sup>(4)</sup>, attempting to run the engine may harm the engine or actuator. The information in the Minimum Setup is based on using a Non-Feedback Speed Control actuator.

		Actuator Type	
		Proportional	Motor
Control Mode	Non-Feedback Speed Control	Control Mode Operating Mode: Non-Feedback Speed Control H-Bridge Mode: Non-Feedback Speed Control, Feedback Speed Control, Positioner	Default Mode
	Feedback Speed Control	Control Mode Operating Mode: Feedback Speed Control H-Bridge Mode: Half Bridge	Control Mode Operating Mode: Feedback Speed Control HBridge Mode: Full Bridge
	Position Control	Control Mode Operating Mode: Position Control (PC) H-Bridge Mode: Half Bridge	Control Mode Operating Mode: Position Control (PC) H-Bridge Mode: Full Bridge

1. Actuators are connected Terminals A and B as shown on the control mode wiring diagrams. An actuator with a position feedback sensor is required to use the GAConfig Tool settings feedback speed control or position control mode.
2. If control mode is changed, cycle power to the EEG7500 controller for the change to take effect. The default setting is Non-Feedback Speed Control (NFSC). No other parameter settings need to have the power cycled.
3. Position Control mode is further defined in [section 11](#) of this manual.

<sup>(4)</sup> Half-bridge connects an output pin to either VCC (voltage common collector), ground, or disconnects. Use half-bridge to turn a DC motor on or off, or apply braking. Do not use it to reverse the motor. Half bridge mode requires an actuator with a spring to return to the original setting.

<sup>(5)</sup> Full bridge control drives the actuator both ways and does not require a spring in the actuator.

## 9 SYSTEM SETUP (CONTINUED)

### MINIMUM SETTINGS

Once the control mode for your actuator is selected, the following minimum parameters must be set, or the default settings used, before starting the engine. GAC suggests using the default settings to first ensure the engine runs smoothly before adding additional devices. However, you may want to update default settings and additional parameter values depending on your application.

PARAMETER	RANGE	DEFAULT	DEFINITION
<b>Control Mode</b>			
Operating Mode	NFSC, FSC, or PC	NFSC	Operating mode of the actuator. <b>Requires restart of the EEG7500 for changes to take effect.</b>
H-Bridge Mode	Bridge	Half Bridge	
<b>SET-UP</b>			
Flywheel Teeth	60 - 250	120	Number of teeth on the engine flywheel. This should be set prior to starting the engine.
Overspeed	600 - 6000	1800	rpm set to cause automatic engine shut down. Set this value low enough to prevent mechanical damage but high enough to allow realistic load rejection speeds without stopping the engine.
Fuel Limit	0 - 100	100 %	Maximum fuel output.
<b>START-UP</b>			
Actuator Start Fuel	1 - 100 %	100 %	Initial actuator position at start of crank.
Actuator Ramp Rate	1 - 100 %	10 %	The rate of change for the actuator start from the throttle begin point to 100 %, during the start/crank cycle (% / s)
Starter Cutoff	100 - 1000	400	The rpm at which governor switches from starting to governing. Also known as crank termination.
Acceleration	25 - 2000	300	Rate of acceleration controlled by the governor when a command to increase rpm is received.
Deceleration	25 - 2000	300	Rate of deceleration controlled by the governor when a command to decrease rpm is received.

### OTHER DEFAULT SETTINGS

PARAMETER	DEFAULT	PARAMETER	DEFAULT
Speed 1	1500	Gain 1, 2, and 3	50
Speed 2	1500	Stability	50
Speed 3	1500	Deadtime	High
Variable Speed Minimum	1500	Lead Circuit	Selected
Variable Speed	1500	Light Force Governor Enable	Deselected
Variable Speed Gain	50	Variable Speed End Gain	50
Analog Input 1	0 - 5 V DC	Input MIN	0 %
Speed Minimum	1500	Input MAX	100 %
Variable Speed Start Gain	50	Input Actual	0
Speed Maximum	1500	Actual	1500

### START YOUR ENGINE



Use an overspeed shutdown device, independent of the governor system, to prevent loss of engine control which may cause personal injury or equipment damage. Do not rely exclusively on the governor system electronic actuator to prevent overspeed. A secondary shutoff device, such as a fuel solenoid must be used.

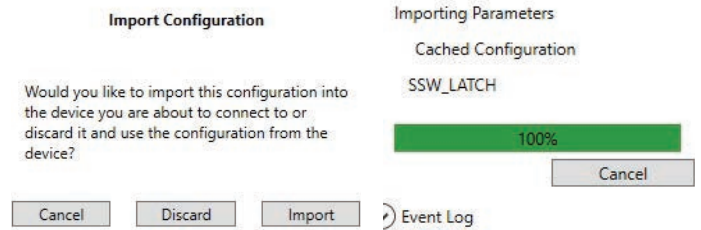
Once the parameter settings are reviewed and updated as required, start your engine.

1. Crank the engine with DC power applied to the governor system.
2. Set the engine at operating speed with no load.
3. The actuator/ fuel to the engine will be positioned to the level set by the [Actuator Start Fuel](#) parameter (default is MAX fuel). Actuator Ramp Rate controls the rate at which fuel is increased to start the engine. Set it 10 % by default.
4. If the engine is unstable after starting, open the GAConfig Tool and adjust Gain, Stability, and Deadtime in the [Engine Tuning](#) menu in the PID Tuning block, until the engine is relatively stable.
5. Once the engine is stable you can connect additional devices and further optimization.

**OFF-LINE SETUP MODE**

The GAConfig Tools settings can be added before If you set up the parameter settings connecting to the engine. These settings can be saved and uploaded once the engine to GAConfig Tool connection is made. The EEG7500 must be connected to power and the PC.

1. Click the Connect button on the Main menu. The **Import Configuration** menu displays asking if you want to import the settings you have recently created.
2. Click Import to update the EEG7500. The progress bar displays. If the controller is not ready or not connected they system displays an error message.



**DEFAULT I / O DEVICE MAPPING**

The EEG7500 controller pairs device input mapping of signals connected to the controller with various input and output parameters. It supports 5 analog and 2 digital inputs, and 1 analog and 3 digital outputs. Physical inputs are mapped to the parameter settings in the GAConfig Tool. Depending on the signals being used you will need to map each input and output to a parameter in the GAConfig Tool software. The **Controller Wiring** table shows the terminal to input/output mapping.

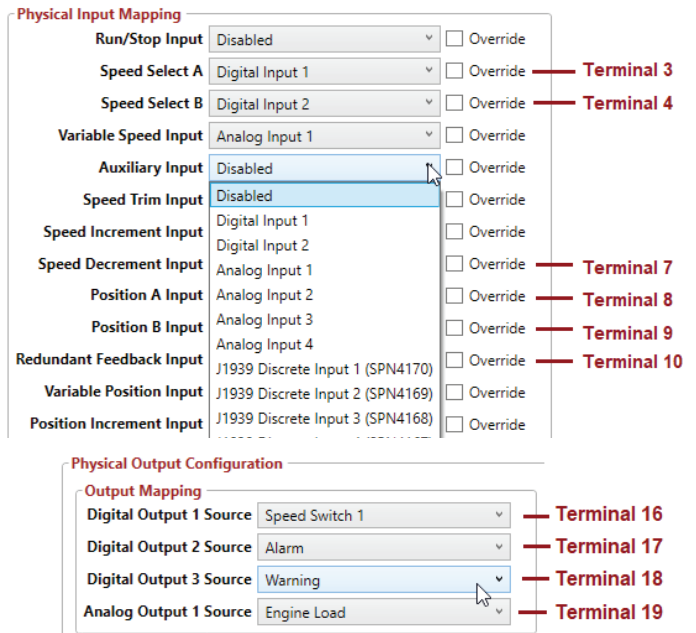
**MAPPING HARDWARE TERMINALS TO SOFTWARE SETTINGS**

The Physical Input Mapping links settings between the terminal a device is attached to and its assigned use. For example, Terminal 16 could be physically connected to a speed switch. Therefore Digital Output 1 Source should be set to Speed Switch 1 as shown in the Output Mapping.

Check the Override box to set the physical input to On or Off.

By combining settings you can map signals to specific uses. See more on **Mapping Physical Inputs** in Section 10.

Output Mapping lets you assign external signals such as J1939 to specific outbound locations. It is also useful for setting external devices to complete tasks based on overspeed or another event.



## 9 SYSTEM SETUP (CONTINUED)

### SETTING UP ENGINE OVERSPEED SHUTDOWN

The shutdown STOP button available on the GAConfig Tool shuts down fuel to the actuator, but does not directly shutdown the engine. To shut down the engine at a set speed use the GAConfig Tool and a solenoid or other relay switch and complete the following set up.

1. Wire a shutdown solenoid between the engine and the EEG7500 controller to Digital Output 1 at Terminal 16.
2. From the GAConfig Tool, open the I/O Configuration menu and set the following:
  - a. Map the solenoid switch location to the Digital Output 1 Source. In this example the switch is attached to the Speed Switch 1 (Terminal 16). In Output Mapping, set Digital Output 1 Source to Speed Switch 1.
  - b. At the Speed Switches SSW1 Limit/Threshold set the rpm. This example shows 2600 rpm. Overspeed on the Engine Tuning menu should be set above the engine shutdown switch speed.
  - c. Set the Select SSW1 Latch. This sets the latching relay to hold its position after the switch has been released.
  - d. At Digital Output Mode, set Digital Output 1 to Normally Closed.
3. When the rpm shutdown is reached, the switch engages the solenoid, shutting down the engine.

**NOTE** Default settings include setting the Digital Output Mode to Normally Open, setting the switch to stay open.

### ADDING A POTENTIOMETER

When using a potentiometer, the following wiring and GAConfig Tool settings are required. For more information see the [GAC potentiometers](#) for additional information on GAC potentiometers and see the [Wiring](#) section in this manual.

1. For basic potentiometer connection, connect the controller to the potentiometer as follows:
  - Terminal 11 to potentiometer Terminal 1
  - Terminal 6 to potentiometer Terminal 3
  - Terminal 7 to potentiometer Terminal 2
2. Set the potentiometer to the application you want to use it for. For example, if using the potentiometer for variable speed, in Physical Input mapping set the following:
  - a. At Speed A Input, select Override and select On.
  - b. At Speed B Input, select Override and select On.
  - c. Quick Access to the far right now says Selected Speed: Variable.
3. To calibrate the potentiometer:
  - a. Open Engine Tuning → Variable Speed.
  - b. Set the potentiometer to the full CCW position and click Calibrate Minimum.
  - c. Turn the potentiometer CW all the way and click Calibrate Maximum.
  - d. Note the input actual



Terminals	
Potentiometer	EEG7500
1	11
2	7
3	6



## ADJUSTING FOR BASIC STABILITY WITH FIXED SPEED

Once the engine is running at operating speed, with no load, use the GAConfig Tool to adjust the parameter settings to increase engine stability. Each speed parameter (Speed 1, 2, 3) has its own Gain parameter (Gain 1, 2, 3) setting. The speed mode and active Gain are shown in the Engine Tuning tab.

Stability is achieved by balancing PID: Gain (P), Stability (I), and Deadtime (D).

- **Gain** (Proportional) changes the initial response of the governor. Increasing gain makes the engine more responsive to load changes while decreasing gain makes it less responsive to load changes. Avoid engine instability due to high gain when adjusting this parameter.
- **Stability** (Integral) changes the steady state response of the engine. Increasing stability allows the system to come to steady state speed faster, while decreasing the stability results in a more gradual transition to steady state speed.
- **Deadtime** (Derivative) sets the transient response of the engine to high or low and affects the stability parameter during transient load changes. Increasing deadtime decreases the percent of overshoot and settling time during a transient load change while decreasing deadtime increases them. Setting Deadtime to High can cause random speed instability during steady state since small speed errors are amplified by this parameter.

To improve basic performance at no load applied to the engine:

1. Open the GAConfig Tool open the Engine Tuning menu, and at the PID Tuning block, perform the following for each Speed setting:
  - a. Increase the Gain parameter by updating parameter until instability develops. Gradually decrease the Gain until stability returns. Decrease the adjustment one count further to ensure stable performance.
  - b. Increase Stability parameter on the until instability develops. Gradually decrease the Stability until stability returns. Decrease the parameter by one to ensure it is stable. If there is no instability leave set at 50.
  - c. Set Deadtime (D) to Low. If instability persists, change Deadtime (D) to High.

Additional adjustments may be required after engine load is applied. Normally adjustments made at no load achieves satisfactory performance.

The screenshot displays the GAConfig Tool interface for the EEG7500 engine, specifically the Engine Tuning tab. The interface is organized into several panels:

- System Status:** Shows engine parameters: Actual Engine Speed (0 rpm), Desired Engine Speed (0 rpm), Magnetic Pickup Frequency (0 Hz), and Selected Speed Mode (Not Set). It also shows Actuator parameters: Actuator Duty Cycle (0 %) and Actuator Current (0.0 A).
- System Setup:** Includes Control Mode (Non-Feedback Speed Control (NFSC)), H-Bridge Mode (Half Bridge), and Set-Up parameters: Flywheel Teeth (120), Overspeed (1800 rpm), and Fuel Limit (100 %).
- Start-Up / Ramp Control:** Shows Actuator Start Fuel (100 %), Actuator Ramp Rate (10 %/s), Starter Cutoff (400 rpm), Acceleration (300 rpm/s), and Deceleration (300 rpm/s).
- Speed Configuration:** Features a Speed Mode dropdown (Other) and two sub-sections: Fixed Speed (Speed 1, 2, 3 all set to 1500 rpm) and Variable Speed (Speed Minimum, Variable Speed Start Gain, Speed Maximum, Variable Speed End Gain, Input Minimum, Input Maximum, and Input Actual).
- Tuning:** Contains PID parameters: Gain 1 (P1) (50), Gain 2 (P2) (50), Gain 3 (P3) (50), Stability (I) (50), and Deadtime (D) (High). It also includes checkboxes for Lead Circuit, Light Force Governing, and Speed Anticipation. A Feedback Speed Control (FSC) Fuel Limit section shows the FSC Fuel Limit Table, Calculated Fuel Limit (0.00 %), and Operator Requested Speed (0 rpm).

## 10 TUNING WITH THE EEG7500 (CONTINUED)

### SETTING VARIABLE SPEED WITH A POTENTIOMETER

Using the single remote speed adjustment potentiometer to adjust the engine speed continuously over a specific speed range. Other variable speed input devices include other controllers as well as J1939 data. Potentiometer wiring is shown in the [Wiring](#) section of this manual and in [Adding a Potentiometer](#).

1. Set Selected Speed to Variable on Engine Tuning → Speed Mode and select Variable Speed.
2. I/O Configuration → Analog Input Mode select the analog voltage settings that map to the voltage of the actuator you are using. In this case the Position A Input - Analog Input 1 maps to the 0 - 5 V DC potentiometer.
3. The Quick Access view should now show Selected Speed Mode: Variable. Recheck Input Mapping for the potentiometer and related wiring if Selected Speed Mode is not Variable.
4. Set the potentiometer to the full clockwise position.
5. Set Variable Position Input Minimum and Input Maximum by either manually adding settings or use the automatic calibration buttons.
  - a. To set calibration automatically:
    - Turn the potentiometer fully CCW and click Calibrate Minimum.
    - Turn the potentiometer fully CW and click Calibrate Maximum.
  - b. To set each manually:
    - Set Input Minimum to between 0 to 75 %
    - Set Input Maximum to at least 25 % greater than the Minimum value. Values entered which are not 25 % different are automatically reset to the closest accepted value by the GAConfig Tool.

#### Analog Input (AI) Mode

AI 1 0 - 5 V DC  
 AI 2 0 - 10 V DC  
 AI 3 4 - 20 mA  
 AI 4 0 - 5 V DC

#### Physical Input Mapping

Run/Stop Input Disabled  Override  
 Speed Select A  Off  On  Override  
 Speed Select B  Off  On  Override  
 Variable Speed Input Disabled  Override  
 Auxiliary Input Disabled  Override  
 Speed Trim Input Disabled  Override  
 Speed Increment Input Disabled  Override  
 Speed Decrement Input Disabled  Override  
 Position A Input Analog Input 1  Override  
 Position B Input Analog Input 2  Override  
 Redundant Feedback Input 0.0 % (0.0-100.0)  Override  
 Variable Position Input 0.0 % (0.0-100.0)  Override  
 Position Increment Input  Off  On  Override  
 Position Decrement Input  Off  On  Override

#### Variable Position

Variable Position Start 0.0 %  
 Variable Position End 0.0 %  
 Variable Position Input Minimum 50 %  
 Calibrate Minimum  
 Variable Position Input Maximum 75 %  
 Calibrate Maximum  
 Variable Position Input Position 0.0 %

#### NOTE

Variable Position Input Position shows the potentiometer value when a potentiometer is used.

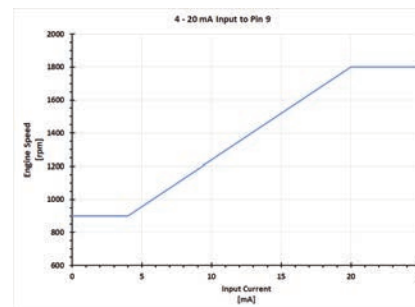
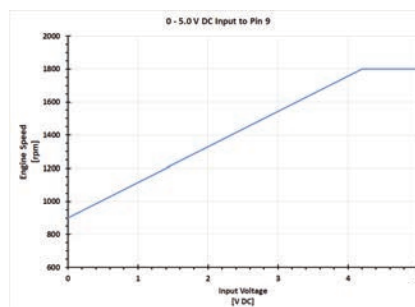
#### NOTE

If minimum speed is higher than maximum speed increasing the speed input signal position will decrease the rpm.

#### Conversion Formulas:

$$\text{Hertz}_{\text{MAG PICKUP}} = \frac{(\text{rpm} \times \# \text{Teeth})}{60}$$

$$\text{rpm} = \frac{(\text{Hertz}_{\text{MAG PICKUP}} \times 60)}{\# \text{Teeth}}$$



### ADJUSTING VARIABLE SPEED STABILITY

Use the Tuning menu to adjust gain and to set each endpoint of the speed range to add additional stability.

Gain (P), Stability (I), Deadtime (D), and Lead Circuit are shared across the entire variable speed range. For each Fixed Speed create separate gain settings to create shared stability.

To maintain engine stability at the minimum speed setting, add a small amount of droop, available in the Quick Configuration menu. At the maximum speed setting the governor performance will be near isochronous, regardless of the droop adjustment setting.

1. Open Engine Tuning → Variable Speed
2. For each variable speed:
  - Set Gain
  - Set Speed Maximum and Variable Speed End Gain
  - Set Stability

#### Speed Configuration

Speed Mode Variable Speed

**Fixed Speed**  
 Speed 1 1500 rpm  
 Speed 2 1500 rpm  
 Speed 3 1500 rpm

**Variable Speed**  
 Speed Minimum 1500 rpm  
 Variable Speed Start Gain 50  
 Speed Maximum 1500 rpm  
 Variable Speed End Gain 50  
 Input Minimum 0.0 %  
 Calibrate Minimum  
 Input Maximum 100.0 %  
 Calibrate Maximum  
 Input Actual 0.0 %

#### Tuning

Gain 1 (P1) 50  
 Gain 2 (P2) 50  
 Gain 3 (P3) 50  
 Stability (I) 50  
 Deadtime (D) High  
 Lead Circuit   
 Light Force Governing   
 Speed Anticipation   
**Feedback Speed Control (FSC) Fuel Limit**  
 Enable FSC Fuel Limit Table   
 FSC Fuel Limit Table  
 Calculated Fuel Limit 0.00 %  
 Operator Requested Speed 0 rpm

**MAPPING PHYSICAL INPUTS TO SPECIFIC SPEED MODE**

The EEG7500 supports three fixed speeds and one variable speed device. The variable speed can also be used as an additional fixed speed by setting speed minimum and speed maximum to the same value.

By default (GAC factory settings) Selected Speed Mode input is set to Speed 1, typically used as idle speed.

At Physical Input Mapping, the following are default settings:

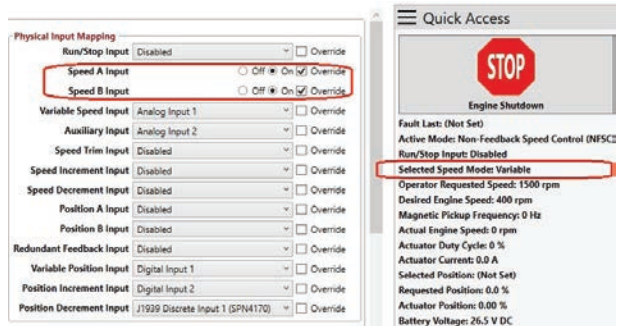
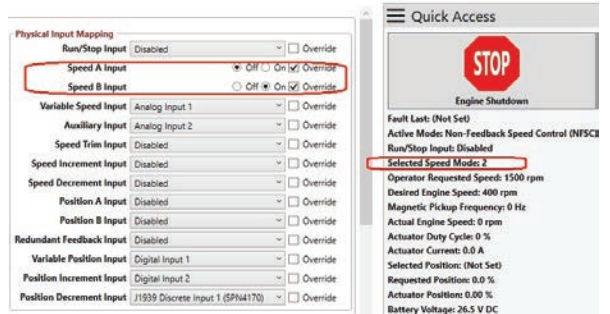
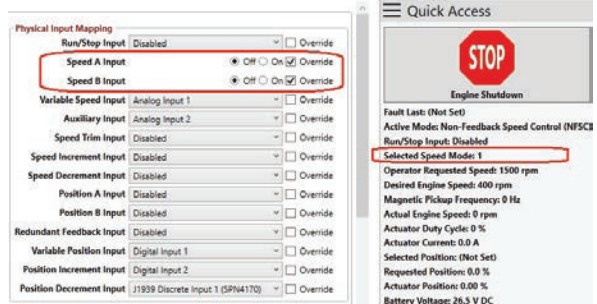
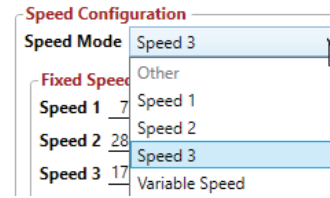
- Speed A Input= Digital Input 1
- Speed B Input= Digital Input 2
- Variable Speed Input = Analog Input 1
- Auxiliary Input = Analog Input 2
- Selected Speed Mode = 1 in the Quick Access view

Speed mode can be selected using a drop down on Engine Tuning → Speed Configuration → Speed Mode. Speed mode can also set using I/O Configuration → Physical Input Mapping.

1. For Speed A Input, check the Override and then check the Off selection. At Speed B Input, check Override and then check On.
2. The Select Speed Mode is now displays 2 in Quick Access.
3. The following table details how the EEG7500 uses Speed A and B Input to determine speed settings based on the state of switch inputs.

Speed Setting	Override	Speed A Input	Speed B Input
Speed 1 (Idle)	Checked	Off	Off
Speed 2	Checked	Off	On
Speed 3	Checked	On	Off
Variable Speed (4)	Checked	On	On

4. Open the **Engine Tuning** menu and set System Setup settings to the Selected Speed Input Mode 2. You can set all the related settings for each Selected Speed Mode using the Engine Tuning menu.



**NOTE**

The Override box lets you manually set the On - Off state of the selected physical input.

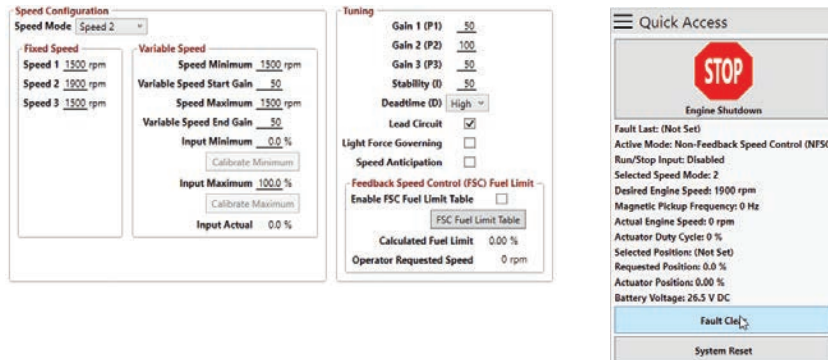
- On = closed state
- Off = open state.

The On - Off state stays set after the EEG7500 is disconnected from PC software.

**EXAMPLE OF MAPPING SETTINGS TO STATUS DISPLAY**

This example sets:

- Speed Mode = Speed 2
- The device mapped to Speed Mode 2:
  - » Fixed Speed 1 = 1900
  - » Fixed Speed 2 = 1500
  - » Gain 1 = 50
  - » Gain 2 = 100



## 11 USING POSITION CONTROL MODE

Position control is the ability to position a proportional or torque motor actuator device to a fixed position, an analog input to a variable position, or use a table to automate control. Wiring for the position control is detailed in the [Wiring](#) in section 5 of this manual. See your actuator documentation for details on its wiring and capabilities.



Position control is an uncommon setup for controlling engines. DO NOT use position control with gaseous engines.

### BASIC POSITION CONTROL MODE

To use input (Position Control) routing, choose Position Control mode as the control mode. Use a potentiometer to make incremental position changes. If the system is not already set to Position Control, restart the system.

1. Wire a potentiometer to the EEG7500 to control the position of the actuator valve.
2. Open the GAConfig Tool.
3. From the Engine Tuning menu, check or change your settings to the following:
  - a. Select Position Control from the Operating Mode drop-down list.
  - b. At H-Bridge Mode select Half or Full Bridge depending on your actuator.
3. If no changes were made, continue to step 5. If changes were made, remove power from the EEG7500 and GAConfig Tool and restart the software and add power to the EEG7500.
4. Reopen the GAConfig Tool.
5. From the I/O Configuration menu:
  - a. Select the appropriate Analog Input (AI) Mode signal for the device you are controlling the actuator with. See your actuator manual for details.
  - b. In the [Physical Input Mapping](#), for Position A Input, select Analog Input 1 from the drop-down list. Uncheck Override if checked.
  - c. Select Analog Input 2 for Position B Input.
4. Open Position Control Tuning → Variable Position.
5. Turn the potentiometer. The Variable Position Input Position parameter changes (example shows 89.7 %) indicating the potentiometer is now controlling position from the EEG7500.

Control Mode	
Operating Mode	Position Control (PC)
H-Bridge Mode	Half Bridge

Analog Input Mode	
Analog Input 1	0-5VDC
Analog Input 2	0-10VDC
Analog Input 3	0-5VDC
Analog Input 4	0-5VDC

Physical Input Mapping		
Run/Stop Input	Disabled	<input type="checkbox"/> Override
Speed A Input	Digital Input 1	<input type="checkbox"/> Override
Speed B Input	Digital Input 2	<input type="checkbox"/> Override
Variable Speed Input	Analog Input 1	<input type="checkbox"/> Override
Auxiliary Input	Analog Input 2	<input type="checkbox"/> Override
Speed Trim Input	Disabled	<input type="checkbox"/> Override
Speed Increment Input	Disabled	<input type="checkbox"/> Override
Speed Decrement Input	Disabled	<input type="checkbox"/> Override
Position A Input	Analog Input 1	<input type="checkbox"/> Override
Position B Input	Analog Input 2	<input type="checkbox"/> Override
Redundant Feedback Input	Disabled	<input type="checkbox"/> Override
Variable Position Input	Disabled	<input type="checkbox"/> Override
Position Increment Input	Disabled	<input type="checkbox"/> Override
Position Decrement Input	Disabled	<input type="checkbox"/> Override

Variable Positioner Settings	
Variable Position Start	0.0 %
Variable Position End	0.0 %
Variable Position Input Start	0.0 %
Set Var. Pos Start	
Variable Position Input End	100.0 %
Set Var. Pos End	
Variable Position Input Position	89.7 %

#### NOTE

The Position Increment and Position Decrement Input parameters in I/O Configuration → Physical Input Mapping menu control the actuator position by a fixed amount each time a switch is closed and then opened again. **These inputs require the use of momentary switches.** Contact GAC for more information if required.

### CALIBRATE THE POSITION FEEDBACK SENSOR

A position feedback actuator must be calibrated **before** starting the engine when using either Feedback Speed Control or Position Control mode.

1. Ensure the engine is NOT cranking or running.
2. On the Position Control Tuning → Position Feedback Setup → Feedback Auto-Calibrate. The EEG7500 controller directs the actuator to sweep between the minimum and maximum positions to calibrate the actuators sensor signal range. This step takes approximately 3 s to complete.
3. In Tuning, click Auto-Tune to automatically tune the position control Position Gain and Stability. This is **not** the same as engine speed control PID gain and stability. While calibrating, the controller will direct the actuator to move several times. This step may take up to 30 s to complete.
4. Once calibration is complete you have a baseline for position control.

Position Feedback Setup	
Active Position Sensor	Primary Input
Position Feedback Low	1.00 V DC
Position Feedback High	4.00 V DC
Redundant Position Feedback	<input checked="" type="checkbox"/>
Redundant Feedback Low	10.00 %
Redundant Feedback High	100.00 %
Redundant Position	0.00 %
Feedback Auto-Calibrate	

Tuning	
Position Gain (P)	100
Position Stability (I)	50
Auto-Tune	
Position Control Table	<input checked="" type="checkbox"/>
Position Control Table	

# 11 USING POSITION CONTROL MODE (CONTINUED)

## FIXED POSITION SETTINGS USING POSITION SELECTOR SWITCHES

Similar to speed and variable speed setup, position control can be set using selector switches for fixed position or analog input for variable position.

1. Attach a position selector switch to the speed controller.
2. From the GAConfig Tool, open the Position Control Tuning menu.
3. Ensure the Enable Position Table is NOT checked.
4. Enter the desired positions in the Fixed Position Settings box.

If only variable position control is desired, make sure both Position A Input and Position B Input are set to Override and On (closed).

Position Increment and Position Decrement adds control of the actuator position by a fixed amount each time a switch is closed and then opened again. These inputs require the use of momentary switches. Contact your GAC representative for more information is required.

Dashboard | Engine Tuning | Position Control Tuning | I/O Configuration | Advanced Configuration | Quick Configuration

**Position Configuration**  
Position Mode: Position 1

**Fixed Position**  
Position 1: 30.0 %  
Position 2: 26.0 %  
Position 3: 80.0 %

**Variable Position**  
Variable Position Start: 50.0 %  
Variable Position End: 90.0 %  
Variable Position Input Minimum: 10.0 %  
Variable Position Input Maximum: 90.0 %  
Variable Position Input Position: 0.0 %

**Position Speed Settings**  
Position Trim Increase Rate: 1.0 %/s  
Position Trim Decrease Rate: 1.0 %/s  
Position Offset: 0.0 %

**Position Feedback Setup**  
Active Position Sensor: Primary Input  
Position Feedback Low: 1.00 V DC  
Position Feedback High: 4.00 V DC  
Redundant Position Feedback:   
Redundant Feedback Low: 10.00 %  
Redundant Feedback High: 100.00 %  
Redundant Position: 0.00 %

**Tuning**  
Position Gain (P): 50  
Position Stability (I): 50  
Enable Position Control Table:   
Variable Position Input Position: 89.7 %

## VARIABLE POSITION SETTINGS

1. Ensure System Setup → Control Mode → Operating Mode is set to Position Control (PC).
2. Select Position Mode → Other. This sets Speed Mode to Variable and Speed A Input and Speed B Input in the Physical Input Mapping to Override and On.
3. In Variable Position, set the Variable Position Start and Variable Position End to the desired position control range. The analog input signal for variable position is interpreted as a number between 0 % to 100 %, regardless of signal type.
4. Set the position input signal, such as a potentiometer, to the start position of the potentiometer and click Calibrate Minimum.
5. Set the position input signal to the end position and click Calibrate Maximum. Note the Variable Position Input Position calibration %.
6. Ensure the Position Control Table is NOT checked in the Position Control menu.
7. To ensure inputs are working as expected, review the selector switch positions or sweep the analog input signal range, observing the changes in the Quick Access view on the right tool pane.

**Variable Positioner Settings**  
Variable Position Start: 0.0 %  
Variable Position End: 0.0 %  
Variable Position Input Start: 0.0 %  
Variable Position Input End: 100.0 %  
Variable Position Input Position: 89.7 %

## 12 ADDITIONAL SETTINGS

**Light Force Governing** provides finer adjustment resolution for smaller actuators. It is designed to work with low current small actuators, like T1 ATB, ALR/ALN, 100/103/104 series and normally closed Cummins EFC actuators. Select the **Light Force Governing** block in the PID Tuning block when using small actuators to improve adjustments as they respond very quickly to input changes over a smaller range of operating current, using a fraction of the PID and current output of a normal actuator.

**Lead Circuit** (default is ON) enables the governor to be more responsive and typically increases the range of gain adjustment. This function allows for more active control to increase the performance in typically slow engines.

**Speed Trim Control** is used with a potentiometer (or voltage input) to vary the engine speed remotely.

**Idle** is part of the Speed 1 setting and is set in one of the speed control settings on the Engine Tuning menu.

**Start Fuel** is an adjustment in the Engine Tuning menu. Start Fuel sets the actuator % applied during crank to control visible exhaust smoke.

**Ramp Control** and **Speed Trim** settings **Acceleration** and **Deceleration** and **Trim Increase Rate** and **Trim Decrease Rate** set the rpm per sec when switching between speeds and to and from idle.

**SAE J1939** CAN bus device communication is supported to receive and display J1939 messages.

**Auxiliary Input** (Terminal 8) enables connections to synchronizing and load sharing equipment. Aux / Load Sharing in the GAConfig Tool allows the adjustment of the speed requests through the auxiliary input voltage, accepting a  $\pm 5$  V Nominal, 0 - 10 V DC and selectable response polarity. In response the EEG7500 controller can be set to increase or decrease voltage to maintain constant engine speed. Accessories tied to Aux must be shielded.

## 13 IMPORTING AND EXPORTING GACONFIG TOOL SETTINGS

The GAConfig Tool allows settings to be stored, shared, and imported back into the tool for use on other EEG7500 controllers. Settings can be saved and exported at any time while using the GAConfig Tool. It is also useful if you change actuator types often, allowing you to save settings and import settings as you must restart the EEG7500 to change Operating Mode.

### To Export files:

1. EEG7500 must be powered and on and connected to the GAConfig Tool running on the PC.
2. From the toolbar click Export Data. The windows file explorer displays. Drill down to the file location where you want to save the file.
3. Rename the default file name to something better suited for your use.
4. Click Save. Record the file location.

### To Import files:

1. EEG7500 must be powered and on and connected to the GAConfig Tool running on the PC.
2. At the toolbar click Import Data. The windows file explorer displays.
3. Locate and select the file you want to import.
4. Click Open. Click OK when complete.

Best practice is to name these file with dates and intended use as part of the file name to make for easier sharing. The files can also be shared with the GAC support team to aid in producing the best results.

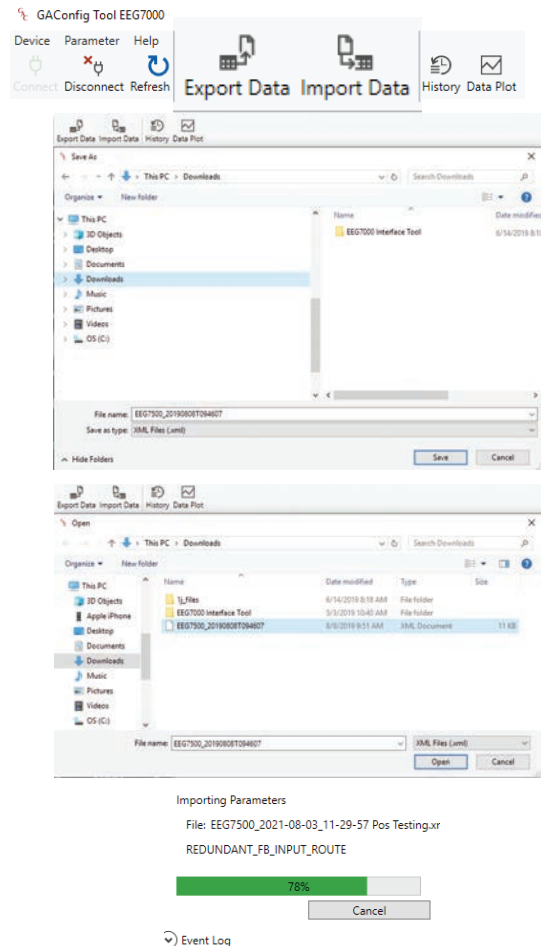
### To restore factory settings:

The system can also be restored to the original GAC factory settings from the Quick Configuration → Advanced Configuration → System Commands → Factory Restore.

System & Status Information - System Commands

System Reset	Performs a software reset of the system.
Engine Shutdown	Software commanded engine shutdown.
Factory Restore	Restores the system to the factory configuration.

This restores the original from factory GAC settings. It does not restore OEM settings if applicable.



## 14 ADDING LOOKUP TABLES

The EEG7500 GAConfig Tool includes the ability to create and store lookup tables for use with Position and Fuel Limit functions. The tool lets you create tables that are then selected for use on the Position Tuning or FSC Fuel Limit menus of the GAConfig Tool. The Lookup tables use a Green plus sign to add new rows, and a red minus to delete rows. The dropdown on each axis allows you to choose from rpm or any of the devices assigned to the system.

The **Position Look Up Table** is commonly used to track analog voltage versus speed (rpm) related to the use of positioning actuators.

This table allows a controller to select the rpm corresponding to the analog voltage signal and commands the actuator accordingly. It can also be used to set up position settings based on other data settings.

The table is enabled with the checkbox on the Position Control menu. When the table is not enabled the default position settings in the Position Control menu are used.

The **FSC Fuel Limit Table** is used to shape or limit the fuel versus rpm curve. The fuel limit table plots engine load during variable speed operation by mapping a fuel limit over the entire speed load operating range.

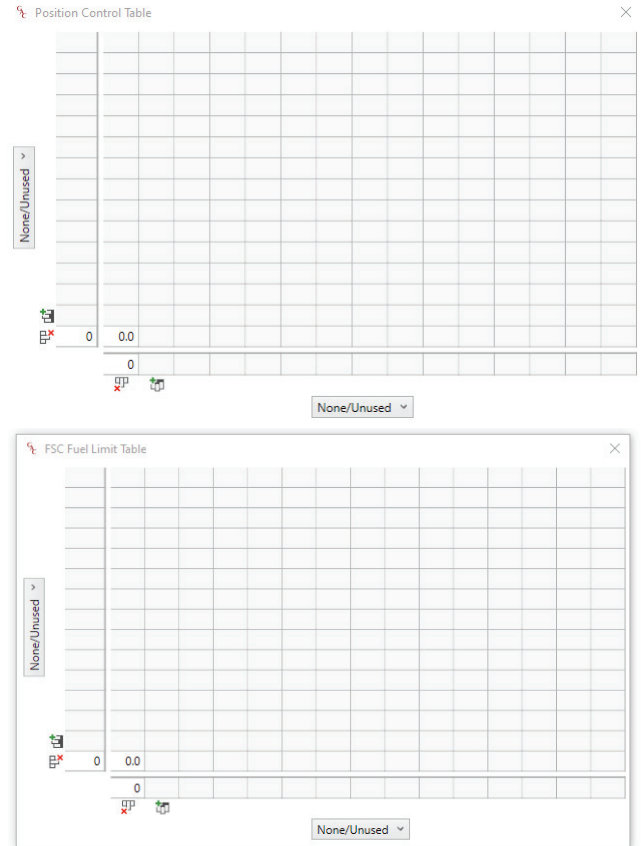
Selecting the FSC Fuel Limit Table checkbox on the Engine Tuning menu enables the variable speed fuel table. When enabled, the table is utilized as a limiting function for the actuator position request coming from the speed PID.

When the table is enabled, the position request will be the minimum available between the Speed PID output and the lookup table output. If enabled, and the table is invalid, the Speed PID output will be used as set in parameters.

### TIPS FOR CREATING A TABLE

The following steps can speed your table creation.

1. Click a plus sign and complete one column or row for your table.
2. Click the green plus sign on the next column or row.
3. Press Enter. The row or column will populate a copy of the previously entered row or column.



## 15 SAVING AND RESTORING PARAMETER SETTINGS

The GAConfig Tool allows settings in the tool to be stored, shared, and imported back into the tool for use on other EEG7500 controllers. Export settings at any time while using the GAConfig Tool for backup.

### To export files:

1. EEG7500 must be powered on and connected to the GAConfig Tool.
2. At the Tool bar click the Export button. The Save as dialog allows you to select the location you want to save the file.

### To import files:

1. EEG7500 must be turned on and connected to the GAConfig Tool.
2. At the Tool bar click the Import button. The Save as dialog allows you to select the location you want to save the file.

Best practice is to export engine settings information once the engine performs as desired. Name the file using dates and intended use as part of the file name. These files are helpful when shared with the GAC support team to aid further enhancing your settings.

### To restore the original GAC factory settings:

1. Shut the engine off. Factory restore can be done when the engine is off but the GAConfig Tool is running.
2. Access the Quick Configuration → Advanced Configuration → System Commands menu.
3. Click Factory Restore to set the EEG7500 to its factory settings. These may not be the same settings if you have an OEM version of the EEG7500.
4. To reset just the software settings, click System Reset.

## J1939 SETTINGS AND DIAGNOSTICS

CAN output supports J1939 protocol for basic engine sensor information and diagnostic troubles codes (DTCs). For J1939 data readers the current implementation provides engine speed, oil pressure, and coolant temperature. The J1939 is set up through Terminals 19 and 20, and using the GAConfig Tool.

The EEG7500 controller responds to J1939 speed requests with the J1939 speed control taking priority over speeds selected by Speed A Input and Speed B Input selections.

J1939 DTC's are divided into two categories, active and stored. Active codes are present when a condition is present. Stored codes are a record that the condition occurred.

The controller can transmit the following DTCs over the CAN Bus. If CAN communication is lost or the controller stops receiving J1939 TSC1 messages, the controller reverts to governing at its configured speed.

This document is not intended to describe how to communicate with this controller over J1939.

**SAE J1939 Configuration**

J1939 Address

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**J1939 Torque / Speed Control 1 (TSC1)**

Engine Override Control Mode

Engine Requested Torque / Speed

Speed Ramping

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**J1939 Diagnostic Messages (DM)**

DM1 Status

DM2 Status

DM3 - Reset Logged Faults

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**J1939 Virtual Output Mapping**

Digital Output 1 (SPN4162) Source

Digital Output 2 (SPN4161) Source

Digital Output 3 (SPN4160) Source

Digital Output 4 (SPN4159) Source

Analog Output 1 (SPN4166) Source

Analog Output 2 (SPN4165) Source

Analog Output 3 (SPN4164) Source

Analog Output 4 (SPN4163) Source

### SYSTEM FAULTS / J1939 DTC'S

FAULT CODE	CONDITION	J1939 SPN	J1939 FMI	J1939 LAMP	ACTION
1	Actuator Overcurrent	638 (Actuator)	Current High (6)	Protect	Shutdown, retry 30 seconds
2	Loss of Speed Sensor	636 (Speed Sensor)	Abnormal Signal (8)	Stop	Shutdown
3	Overspeed	190 (Engine Speed)	Data Above Range (0)	Stop	Shutdown
4	User Shutdown	1110 (Eng. Shutdown)	Data Incorrect (2)	Stop	Shutdown
5	Short Circuit	638 (Actuator)	Current High (6)	Protect	None
6	Remote Shutdown	1110 (Eng. Shutdown)	Data Incorrect (2)	Stop	Shutdown
241	EEPROM Read	628 (CPU / Memory)	Out of Cal. (13)	Warning	None
285	TSC1 Unsupported Mode	695 (Override mode)	Data Incorrect (2)	Warning	Revert to selected speed
287	TSC1 Message Count Error	4206 (Message Counter)	Data Incorrect (2)	Warning	Revert to selected speed
288	TSC1 Speed Request Invalid	898 (Requested Speed)	Data Incorrect (2)	Warning	Revert to selected speed
289	TSC1 Invalid Checksum	4207 (Checksum)	Data Incorrect (2)	Warning	Revert to selected speed
305	Service Due	916 (Service Delay)	Data Incorrect (2)	Protect	None

**NOTE** Auxiliary I/Os (PGN 65241, 2048 and 39936) routings are configured on the Quick Configuration menu.

### DATA RECEIVED ON THE J1939 BUS

PGN	NAME	RECEIVE RATE	VALID SPN's	NOTES
0	Torque / Speed Control 1 (TSC1)	Determined by SPN3349	SPN695 - Engine Override Control Mode SPN898 - Engine Requested Speed/Speed Limit SPN3349 - TSC1 Transmission Rate SPN4206 - Message Counter SPN4207 - Message Checksum	Torque Control mode is not supported (SPN695)  After inactivity of 2x transmission rate (SPN3349) the system will revert to governing at the selected speed. NFSC or FSC modes only.
39936	Auxiliary IO 7	Expected at 250 ms or faster	SPN4170 - Aux Channel 15 SPN4169 - Aux Channel 16 SPN4168 - Aux Channel 17 SPN4167 - Aux Channel 18 SPN4174 - Aux Channel 19 SPN4173 - Aux Channel 20 SPN4172 - Aux Channel 21 SPN4171 - Aux Channel 22	Virtual Discrete Input 1 Virtual Discrete Input 2 Virtual Discrete Input 3 Virtual Discrete Input 4 Virtual Analog Input 1. Scaled 0 - 250. Virtual Analog Input 2. Scaled 0 - 250. Virtual Analog Input 3. Scaled 0 - 250. Virtual Analog Input 4. Scaled 0 - 250.
61411	Electronic Brake Controller 1	As Required	SPN970 - Engine Auxiliary Shutdown Switch	Commands remote engine shutdown
61466	Engine Throttle/ Fuel Actuator Control	Expected at 50 ms	SPN633 - Engine Fuel Actuator 1 Ctrl. Cmd.	Position command, Position mode only.



# 16 OUTPUT CONFIGURATION - J1939 AND SPEED SWITCHES

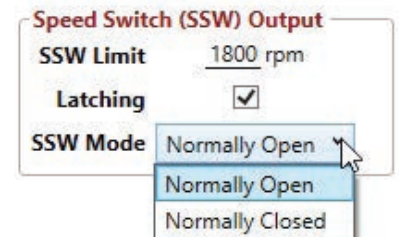
DATA RECEIVED ON THE J1939 BUS				
PGN	NAME	RECEIVE RATE	VALID SPN's	NOTES
61444	Electronic Engine Control 1 (EEC1)	20 ms	SPN190 - Engine Speed rpm	
61443	Electronic Engine Control 2 (EEC2)	50 ms	SPN1 - Accelerator Pedal Position 1 (%) SPN2 - Percent Load at Current Speed (%)	SPN91 is sourced from the variable speed input position. SPN92 is calculated based on NLCU and FLCU values in NFSC mode, or actuator position in FSC mode.
64914	Engine Operating Information (EOI)	250 ms	SPN3543 - Engine Operating State SPN3607 - Engine Emergency Shutdown	
65252	Shutdown (SHUTDN)	1000 ms	SPN2814 - Engine Alarm Output SPN1110 - Engine Protection Shutdown	
65271	Vehicle Engine Power (VEP)	1000 ms	SPN158 - Battery Potential (Voltage), Switched ( V DC)	
65253	Engine Hours, Revolutions (HOURS)	1000 ms	SPN247 - Total Engine Hours (Hrs)	
65216	Service Information (SERV)	1000 ms	SPN916 - Service Delay (Hrs)	If the service timer is disabled, SERV will read 0 hours.
65259	Component Information	5000 ms	SPN586 - Make SPN587 - Model SPN588 - Serial Number SPN233 - Unit Number	Make: GVAMC Model: EEG7500  Unit Number: 1
65242	Software Identification	5000 ms	SPN965 - Number of ID fields SPN234 - Software ID	Number of ID fields fixed at 1
65266	Liquid Fuel Economy	100 ms	SPN51 - Engine Throttle Position	SPN51
65241	Auxiliary IO 1	100 ms	SPN701 - AuxIO 1 SPN702 - AuxIO 2 SPN1083 - Aux Channel 1 SPN1084 - Aux Channel 2	State of the Discrete Input 1 State of the Discrete Input 2 Value of the AI1 Input. Scaled 0 - 64255. Value of the AI2 Input. Scaled 0 - 64255.
2048	Auxiliary IO 5	100 ms	SPN4158 - Aux Channel 3 SPN4157 - Aux Channel 4 SPN4156 - Aux Channel 5	Value of the AI3 Input. Scaled 0 - 64255. Value of the AI4 Input. Scaled 0 - 64255. Value of the AI5 Input. Scaled 0 - 64255.
2048	Auxiliary IO 6	100 ms	SPN4162 - Aux Channel 7 SPN4161 - Aux Channel 8 SPN4160 - Aux Channel 9 SPN4159 - Aux Channel 10 SPN4166 - Aux Channel 11 SPN4165 - Aux Channel 12 SPN4164 - Aux Channel 13 SPN4163 - Aux Channel 14	Virtual Discrete Output 1 Virtual Discrete Output 2 Virtual Discrete Output 3 Virtual Discrete Output 4 Virtual Analog Output 1. Scaled 0 - 250. Virtual Analog Output 2. Scaled 0 - 250. Virtual Analog Output 3. Scaled 0 - 250. Virtual Analog Output 4. Scaled 0 - 250.
65226	Diagnostic Message 1 (DM1)	1000 ms		Active diagnostic troubleshooting codes. Refer to section 12 for common codes.
65227	Diagnostic Message 2 (DM2)	On Request		Previously active diagnostic troubleshooting codes.
65228	Diagnostic Message 3 (DM3)	On Request		Clear Previously Active Faults

## SPEED SWITCH (SSW) OUTPUT

Speed Switch (SSW) Output receives information from sensors for low and high speed settings as well as other speed parameters when using a speed switch in your solution. This outputs a signal when the governor is governing at or above the specified limit.


The SSW parameters adjust between 100 to 6000 rpm. The default value is 1800 rpm and the default state is Normally Open.

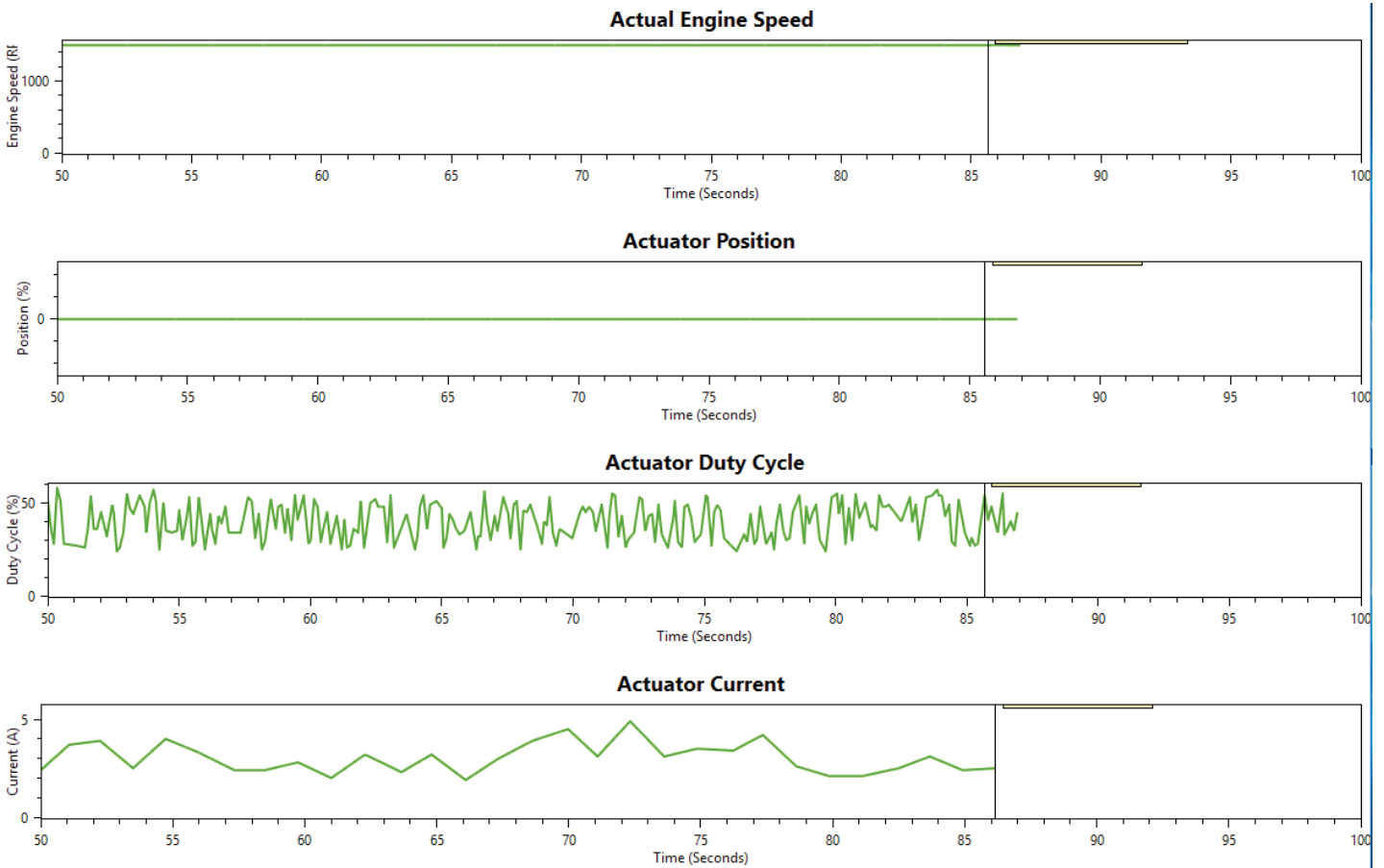
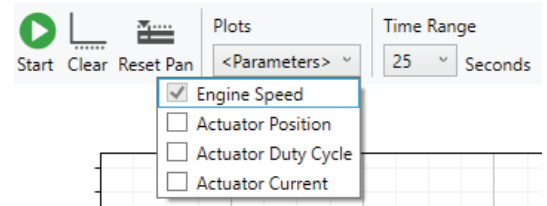
- Select I/O Configuration → Output Configuration → Speed Switches (SSW). Set the rpm limit for each SSW for each output.
- From Digital Output (DO) Mode, for each switch, select one of the following from the drop down menu:
  - Normally Open output from Pin 8 energizes at the set rpm.
  - Normally Closed output from Pin 8 de-energizes at set rpm.
- Select the SSW Latch checkbox to set the SSW output state to fixed until power to the EEG7500 is cycled. When the box is not checked the output state automatically resets to the SSW Limit rpm to 0 without a system reset.



## 17 DATA PLOTTING

Data Plot displays an optimization view of your current results, displaying rpm and actuator duty cycle versus time. The cursor aligns the engine speed and duty cycle plots to display a time relationship.

1. In the GAConfig Tool main menu, select Data Plot.
2. Set the Time Range (in seconds).
3. Click Start. The data displays below.
4. To save the data, click Save. The file is saved as a printable graphic (.png) file.
5. Select Reset Pan  to move the cursor on the grid back to start position.



## 18 GACONFIG TOOL - SETTING ALL VALUES

The Quick Configuration tab accesses all the parameter settings from one location. These descriptions relate to the GAConfig Tool menus.

ENGINE TUNING			
SETTING	OPTIONS	DEFAULT	NOTES
<b>Control Mode</b>			
Operating Mode	NFSC, FSC, or PM	NFSC	System operating mode. <b>Requires a system reset to take effect.</b>
H-Bridge Mode	Half or Full	Half	Sets system H-Bridge mode. Changes do not take effect until after system power cycle. NFSC mode uses half bridge mode by default. <b>Requires a system reset to take effect.</b>
<b>Set-Up</b>			
Flywheel Teeth	60 - 250	120	Number of teeth on the flywheel. The system can govern up to 12000 Hz.
Overspeed	150 - 6000	1800	rpm set to cause automatic engine shut down. Set this value low enough to prevent mechanical damage but high enough to allow realistic load rejection speeds without stopping the engine. As a starting point this should be set to no more than 25 % above rated speed.
Fuel Limit	0 - 100 %	100	Maximum fuel (actuator duty cycle) allowed during governing. Use this parameter to prevent over fueling after the engine has started. During normal starting cycles and short step loads the function will not engage since there is a 1 s delay.
<b>Start-Up/Ramp Control</b>			
Actuator Start Fuel	0 - 100 %	0	Actuator start point during cranking.
Actuator Ramp Rate	1 - 100 %/s	1	Fuel (actuator duty cycle) ramp rate during cranking.
Starter Cutoff	100 - 1000 rpm	400	Crank termination speed in rpm.
Acceleration	25 - 2000 rpm/s	300	Controls rate of acceleration in engine speed. A lower value rpm, allows for a gradual increase in engine speed while a larger value of rpm provides faster acceleration.
Deceleration	25 - 2000 rpm/s	300	Controls rate of deceleration in engine speed. Lower rpm, allows for a gradual decrease in response to engine speed while higher rpm create more rapid deceleration.
<b>Speed Configuration</b>			
Speed Mode	--	--	Use dropdown menu to select the mode you are setting as related to Tuning
Speed 1	0 - 6000	1500	Selected engine speed.
Speed 2	150 - 6000	1500	
Speed 3	150 - 6000	1500	
Speed Minimum Speed Maximum	150 - 6000 rpm	1000	Minimum and Maximum speed settings.
Variable Speed Start Gain	1 - 100	50	PID Gain to use when at the minimum speed while in variable speed. PID Gain to use when at the Maximum speed while in variable speed.
Variable Speed End Gain	0 - 100	50	
Input Minimum	0 - 75 %. Must be 25 % apart.	0	Variable speed input position indicating minimum variable speed setting. Range: 0 to 75 % and must be 25 % apart from end position. This can be calibrated automatically by selecting the Calibrate Minimum button.
Input Maximum	25 - 100 %. Must be 25 % apart.	100	Variable speed input position indicating Maximum variable speed setting. Range: 25 to 100 % and must be 25 % apart from start position. This can be calibrated automatically by selecting the Calibrate Maximum button.
Input Actual	0 - 100 %	50	Feedback of the current variable speed input position.
Gain 1 (P1) Gain 2 (P2) Gain 3 (P3)	1 - 100	50	Gain determines how fast the control responds to transient load changes or a load disturbance occurs as related to corresponding Speed.
Stability (I)	0 - 100	50	Stability changes the steady state response of the engine. Increasing stability allows the system to come to steady state speed faster, while decreasing the stability results in a more gradual transition to steady state speed.
Deadtime (D)	Low - High	High	PID deadtime
Lead Circuit	Selected - Deselected	Selected	Lead Circuit increases range of Gain adjustment improving governor response. Turn Lead circuit ON when there is slow or moderate hunting at higher Gain settings.
Light Force Governing	Selected - Deselected	Selected	Light Force Governor improves resolution when controlling small and low current actuators including GAC T1 ATB, ALR/ALN, 100/103/104 series and normally closed actuators.
Speed Anticipation	Selected - Deselected	Selected	Speed anticipation ON reduces rpm recovery time during high load transients and requires both no load (NLCU) and full load current (FLCU) values are entered.
<b>Feedback Speed Control (FSC) Fuel Limit</b>			
Enable FSC Limit Table	Checkbox and link to table		The FSC Fuel Limit Table checkbox enables the variable speed fuel table. When enabled, the table is utilized as a limiting function for the actuator position request coming from the speed PID. The table must be filled in to be used.

POSITION CONTROL TUNING			
SETTING	OPTIONS	DEFAULT	NOTES
<b>Position Mode</b>			
Position 1 Position 2 Position 3	0 - 100	0	Position % change for fixed position control settings.
Variable Position Start Variable Position End	0 to 100 %	Start - 0 End - 50	Start (End) position for the variable position
Variable Position Input Minimum Variable Position Input Maximum	0 to 75 %		Variable position input position indicating where variable position control starts (ends).
Calibrate Minimum Calibrate Maximum	Button	NA	Automatic calculation tool that sets the variable position input minimum or maximum position based on the current value.
Variable Position Input Position	0 to 100 %	0	Current location of the variable position input control.
Position Trim Increase Rate, Position Trim Decrease Rate	1 to 100 %/s	1	Rate of increase (decrease) when using the trim increment input.
Position Offset	0 to 100 %	0	Current position offset (position trim) added to the position request.
Active Position Sensor	Primary, Redundant	Redundant	The current actuator position as determined by the feedback sensor input
Position Feedback Low Position Feedback High	Range: 0 to 5 V DC	Low - 1 High - 4	The voltage signifying the upper (open) position of the actuator. Must be 0.5 V DC apart from Low.
Redundant Position Feedback	Checkbox	Checked	Enables / Disables the redundant feedback sensor monitoring. Requires the sensor to be routed through the IO routing.
Redundant Feedback Low Redundant Feedback High	0 to 100 %	Low - 0 High - 100	Position of the redundant feedback sensor input representing the actuator closed (open) position. High and low must be 10 % apart.
Redundant Position	0 to 100 %	0	Reports back calculated actuator position based on the redundant feedback sensor input.
Feedback Auto-Calibrate	Button select	NA	Enables and starts the automatic limit calibrations. Valid for FSC and PM modes only.
<b>Position Tuning</b>			
Position Gain (P)	1 - 100	50	Gain of the position loop when in uniform gain mode.
Position Stability (I)	1 - 100	50	Stability/Integrator of the position loop when in uniform gain mode
Auto-Tune	Button select	NA	Enables and starts the automatic PID calibrations. Valid for FSC and PM modes only.
<b>Enable Position Control Table</b>	Enabled - Disabled	Disabled	When disabled uses system settings instead of table settings.

<b>I/O Configuration:</b> Each hardware input source is mapped to ONE data parameter.			
<b>SETTING</b>	<b>OPTIONS</b>	<b>DEFAULT</b>	<b>NOTES</b>
<b>Analog Input</b>			
AI 1	0 - 5 V DC, 4 - 20 mA	0 - 5 V DC	Sets the variable speed input (AI1) to 0 - 5 V DC /Resistive mode of 4 - 20 mA mode for Connector: 2 Pin 7
AI 2	±3 V DC, 0 - 10 V DC	0 - 10 V DC	Sets AI2 to ± 3 V DC Mode for Connector: 2 Pin 8.
AI 3	4 - 20 mA	4 - 20 mA	Connector: 2 Pin 9
AI 4	0 - 5 V DC, 4 - 20 mA	0 - 5 V DC	Sets the variable speed input (AI4) to 0 - 5 V DC/Resistive mode or 4 - 20 mA mode for Connector: 2 Pin 10.
Run/Stop Input		Disabled	Controls the actuator output and is used to put the system into standby state. Set to Override and ON to enable the STOP button operation. From the Physical Input Mapping box on the I/O Configuration tab, set the Run/Stop Input signal to On from the GAConfig Tool.
Speed A Input Speed B Input		Digital Input 1 Digital Input 2	Configures the input data signal routing for the current operating mode. Values may either be a fixed analog, fixed discrete, or mapped to a hardware input source. Each source may only be mapped to ONE data element. NFC and NFSC mode
Variable Speed Input	Analog Input 1		Sets the variable speed input (AI4) to 0 - 5 V DC /Resistive mode or 4 - 20 mA mode for Connector: 2 Pin: 10.
Auxiliary Input	Analog Input 2		Controls the engine synchronization and load sharing operation. NFC and NFSC mode
Speed Trim Input	Override		Sets the amount of speed trim used during fixed speed operation. Settings are adjustable to +/- 10 % of requested fixed speed. NFC and NFSC mode
Speed Increment Input Speed Decrement Input	Override	Disabled	Used to increase or decrease the current speed by a specified rpm, per seconds held in a specific state of a discrete input. This change ends when position source is switched or EEG7500 is re-powered on. Only one function is needed, both do not have to be set. NFC and NFSC mode
Position A Input Position B Input	Override	Disabled	Configures the input data signal routing for the operating mode. Values are either fixed analog, fixed discrete, or mapped to a hardware input source. Each hardware input source may only be mapped to ONE data element.
Redundant Feedback Input	Override	Disabled	Setting this parameter allows the use of another analog input as a redundant feedback position input. It can be set to a different range and polarity from the active position sensor.
Variable Position Input Position	%	0 to 100	Determines the position request during variable speed positioning. Configure for high and low input, position, and gain. The value of the configured position and gain values are interpolated based on the value of the variable position input. Use with NFC and NFSC mode
Position Increment Input Position Decrement Input	Override	Disabled	Sets a temporary % decrease or increase in the current position for a specified number of seconds. This change ends when position source is switched or EEG7500 is re-powered. Only one parameter is needed, both do not have to be set.
SSW 1, SSW 2, SSW 3 Limit	100 to 6000	1800	Speed limit (rpm) for the speed switch 1, 2, or 3 output. MAX speed is limited by a converted speed of 12 kHz.
SSW 1, SSW 2, SSW 3 Latch	Selected - Deselected	Selected	Controls speed switch 1, 2, 3 latching function. When deselected the controller can clear this function without a reset.
PSW 1, PSW 2, PSW 3 Limit	0 - 100 %	1-00	Position limit for the position switch 1 output
PSW 1, PSW 2, PSW 3 Latch	Selected - Deselected	Selected	Controls Position switch 1, 2, or 3 latching function.
DO 1	Normally Open, Normally Closed	Normally Open	Selects the default state for Connector: 3 Pin: 16.
DO 2	Normally Open, Normally Closed	Normally Open	Selects the default state for Connector: 3 Pin: 17.
DO 3	Normally Open, Normally Closed	Normally Open	Selects the default state for Connector: 3 Pin: 18.
Digital Output 1 Source Digital Output 2 Source Digital Output 3 Source	Selection list	Speed Switch 1 Alarm Warning	Configures the data source for output 1, 2, or 3. Output data elements may be routed to multiple hardware outputs.
Analog Output 1 Source		Engine Load	Configures mapping for connector3. Pin 15.

**QUICK CONFIGURATION**

PARAMETER	OPTIONS	DEFAULT	NOTES
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**Advanced Governor Settings**

Auxiliary Enable		Not checked	Controls auxiliary / load sharing function
Auxiliary Polarity	Decreasing Speed or Increasing Speed	Decreasing Speed	Auxiliary Input Polarity is set to either increase speed with increased voltage or decreased speed with increased voltage. Aux input is nominally 5.0 ± 5.0 V DC.
No Load Current	%	0.0 A	Actuator current at rated speed, no load.
Full Load Current	%	10.0 A	Actuator current at rated speed, full load.
Fixed Speed 1 Droop Fixed Speed 2 Droop Fixed Speed 3 Droop	%	0.0 % 0.0 % 0.0 %	Percent of droop (% rpm decrease at full load) to incorporate while associated fixed Speed 1, 2, or 3.
Variable Speed Droop	%	0.0 %	Percent of droop (% rpm decrease at full load) to incorporate while in variable speed mode.
Trim Range	0 - 120 rpm		Trim for Speeds 1, 2, 3
Trim Increase Rate Trim Decrease Rate	0 - 120 rpm/s		Rate of change for trim

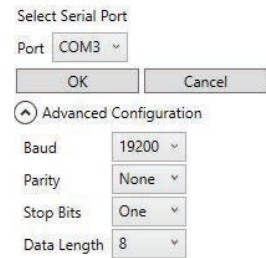
**SAE J1939 Configuration**

J1939 Address		0	Sets the CAN address for J1939 communications
DM1 and DM2 Status			Current number of DM faults in the DTC table.
Engine Override Control Mode		Disabled	Currently unavailable. Will control PGN0 SPN695 Current Torque/Speed Control 1 - Engine Override Control Mode.
Speed Ramping		On	Current TSC1 speed command/limit
DM3 - Reset Logged Faults			Clears all J1939 previously active faults as if a DM3 command was received.
Digital Output 1 (SPN4162) Source	Dropdown selection	Disabled	
Digital Output 2 (SPN4161) Source	Dropdown selection	Disabled	
Digital Output 3 (SPN4160) Source	Dropdown selection	Disabled	
Digital Output 4 (SPN4159) Source	Dropdown selection	Disabled	
Analog Output 1 (SPN4166) Source	Dropdown selection	Disabled	
Analog Output 2 (SPN4165) Source	Dropdown selection	Disabled	
Analog Output 3 (SPN4164) Source	Dropdown selection	Disabled	
Analog Output 4 (SPN4163) Source	Dropdown selection	Disabled	

## GACONFIG TOOL NOT CONNECTING

If the GAConfig Tool is not connecting check the following on your PC-Laptop:

1. Open the GAConfig Tool.
2. Click Connect. The Select Serial Port window displays. Click Advanced Configuration arrow.
3. Select the number of the serial port the controller is connected to. This is usually the last port on the drop down list. If no serial ports display call your GAC representative.
4. Check to make sure your baud rate is set to 19200 and all other settings are as show in this example.
5. If you made changes, restart the PC and try to connect again.
6. If after restarting the PC the software still does not see the controller please call your GAC representative.



## SYSTEM INOPERATIVE

POSSIBLE ISSUE	LOCATION	NORMAL READING	PROBABLE CAUSE
EEG7500 not starting Test voltage	BATT C(-) and D(+)	Battery Supply Voltage (12 or 24 V DC)	<ol style="list-style-type: none"> <li>1. DC battery power not connected.</li> <li>2. Check for blown fuse</li> <li>3. Low battery voltage</li> <li>4. Wiring error</li> </ol>
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.	SPD 1 and 2	1.0 V AC RMS min while cranking	<ol style="list-style-type: none"> <li>1. Gap between speed sensor and gear teeth too great</li> <li>2. Check Gap</li> <li>3. Improper or defective wiring to the speed sensor</li> <li>4. Resistance between 1 and 2 should be 300 to 1200 Ω. See your specific mag pickup data for resistance. Defective speed sensor.</li> </ol>
	Actuator and Battery B(-) and D(+)	1.0 - 2.0 V DC while cranking	<ol style="list-style-type: none"> <li>1. Check if speed parameters are set too low</li> <li>2. Short/open in actuator wiring</li> <li>3. Possible defective controller or defective actuator. See your actuator publication for testing procedures for the actuator.</li> </ol>
Controller not responding	Engine Shutdown Pane	Fault Last: Not Set	<p>If Fault Last is Error_OS or Error_System, power cycle the GAConfig Tool</p> <ol style="list-style-type: none"> <li>1. At Quick Configuration menu, select Status/System Information tab.</li> <li>2. If not already stopped, click Engine Shutdown then click System Reset.</li> <li>3. Check for power for the EEG7500 from the engine battery.</li> </ol>

## INSTABILITY

INSTABILITY	SYMPTOM	PROBABLE CAUSE OF ABNORMAL READING
Fast Periodic	The engine seems to jitter with a 3 Hz or faster irregularity of speed.	<ol style="list-style-type: none"> <li>1. Readjust the Gain and Stability related to each Speed setting for optimum control.</li> <li>2. Deselect Lead circuit. Readjust the Gain and Stability on the Engine Tuning menu. In extreme cases, change <a href="#">Deadtime</a>.</li> </ol>
Slow Periodic	An irregularity of speed below 3 Hz. (Sometimes severe)	<ol style="list-style-type: none"> <li>1. Re-adjust Gain, Stability, and Deadtime for each related Speed setting.</li> <li>2. Check fuel system linkage during engine operation for: <ol style="list-style-type: none"> <li>a. binding</li> <li>b. high friction</li> <li>c. poor linkage</li> </ol> </li> <li>3. Add a small amount of droop.</li> </ol>
Non-Periodic	Erratic Engine Behavior	<ol style="list-style-type: none"> <li>1. Increasing the Gain for the related Speed parameter 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>a. engine mis-firings</li> <li>b. an erratic fuel system</li> <li>c. load changes on the generator set voltage regulator.</li> </ol> </li> </ol>

**UNSATISFACTORY PERFORMANCE**

SYMPTOM	SUGGESTED TEST	PROBABLE CAUSE IF ABNORMAL RESULT
Engine Overspeeds	1. Do Not Crank. Apply DC power to the governor system.	1. After the actuator goes to full fuel, disconnect the speed sensor at Terminal 3. 2. If the actuator is still at full fuel-speed then the controller is defective.
	2. Manually hold the engine at the desired running speed. Measure the DC voltage between Terminals B(-) and D(+) on the speed controller.	1. If the voltage reading is 1.0 to 2.0 V DC: a. SPEED parameter set above desired speed b. Defective speed controller 2. If voltage reading is > 2.0 V DC then check for: a. actuator binding b. linkage binding 3. If the voltage reading is below 1.0 V DC: a. Defective speed controller
	3. Check Flywheel teeth parameter.	1. Incorrect number of teeth in settings.
Overspeed shuts down engine after running speed is reached	1. Examine the SPEED and OVERSPEED values for the engine.	1. SPEED parameter set too high. 2. OVERSPEED set too close to SPEED. 3. Actuator or linkage binding. 4. Speed controller is defective.
Overspeed shuts down engine before running speed is reached	1. Check resistance between Terminals 1 and 2. Should be 30 to 1200 Ω. See your specific Magnetic Pick-up data for resistance.	1. OVERSPEED set too low 2. If the speed sensor signal is erroneous 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. 7 V DC for a 12 V DC system, or b. 14 V DC for a 24 V DC system, Then: Check or replace battery.
	2. Momentarily connect Terminals B and D. 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 opens. Check for short in actuator or harness.
Engine remains below desired governed speed	1. Measure the actuator output, Terminals A and B, while running under governor control.	1. If voltage measurement is within 2 V 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. SPEED parameter set too low

**FAQs**

**What is PID?**

The EEG7500 controller is a PID controller. This means it uses a correction algorithm that enhances the user added settings for proportional (Gain), integral (Stability) and derivative (dead time), making the engine more responsive to load changes. Gain (P), Stability (I) and Deadtime (D) settings are individually adjusted, and based on the difference between these setting values the speed controller uses the PID algorithm to calculate a correction factor to smooth response times during transient load changes in your engine. To learn more see [What is PID](#) on the GAC website.

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