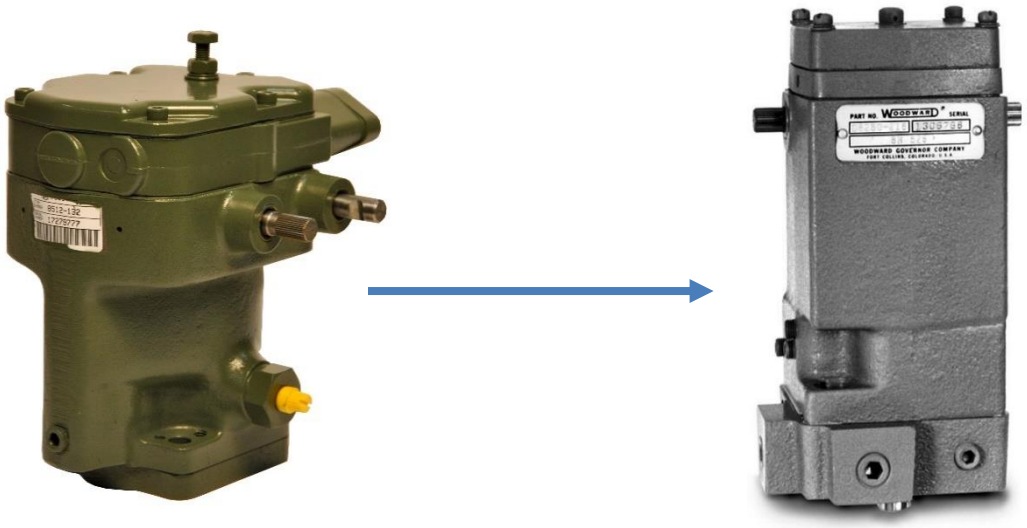
WOODWARD

Application Note 51653
(Revision -, 10/2024)
Original Instructions



SG to EG Actuator + Controller + MPU Retrofit Guide

General Precautions

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.

Practice all plant and safety instructions and precautions.

Failure to follow instructions can cause personal injury and/or property damage.

Revisions

This publication may have been revised or updated since this copy was produced. The latest version of most publications is available on the Woodward website.

http://www.woodward.com

If your publication is not there, please contact your customer service representative to get the latest copy.

Proper Use

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. The latest version of most publications is available on the Woodward website.

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Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

If your publication is not on the Woodward website, please contact your customer service representative to get the latest copy.

Revisions— A bold, black line alongside the text identifies changes in this publication since the last revision.

Application Note 51650

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Important Definitions

This is the safety alert symbol used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER** - Indicates a hazardous situation, which if not avoided, will result in death or serious injury.
- **WARNING** - Indicates a hazardous situation, which if not avoided, could result in death or serious injury.
- **CAUTION** - Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury.
- **NOTICE** - Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT** - Designates an operating tip or maintenance suggestion.

⚠WARNING

Overspeed / Overtemperature / Overpressure

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

⚠WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

⚠WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

⚠WARNING

Automotive Applications

On- and off-highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

NOTICE

Battery Charging Device

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual *82715*, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Chapter 1.
Basic Differences

Overview

The SG (Simple Governor) has been an important product line of Woodward's extensive mechanical hydraulic governor product offerings over the years. The SG governor has served the market for diesel engines, gasoline engines, steam turbines, or gas turbines since the early 1940's. However, after more than 80 years of availability, the market demand for new SG governor applications has diminished to the point that Woodward can no longer manufacture this product line with cost effectiveness. With options for mechanical upgrades to the PSG (see Application Note 51650), as well as electronic governing systems with EG-3P, Woodward has decided to inactivate and stop all production of SG governor moving forward.

EG-3P actuators are electronically controlled actuators which utilize oil pressure (either generated internally or supplied externally) to output torque across their 42° range. With many models available that match SG base and SG driveshaft options, the EG-3P is a popular option for customers who wish to upgrade to an electronic control system.

The basic governor function of the SG governor is based on a fixed droop setting, resulting in engine speed reduction (drooping) when load on the engine is increased. The EG actuator series provides a rotary output proportional to the electrical signal that it receives from a controller. The controller can operate in isochronous mode or fixed droop mode depending on how the controller is set up.

Switching your engine from an SG governor to a EG actuator requires a controls system upgrade and consulting applications engineer to check the SG governor configuration and possible engine specific settings. Based on these parameters, a specific controller can be suggested along with the necessary speed sensors, typically using a couple MPUs (Magnetic Pickup).

Definitions

Customer Service Representative (CSR)	Woodward member responsible for the ASI/AISF account administration and daily interface with ASI/AISF (i.e., quotes and order administration).
Authorized Independent Service Facility (AISF)	Provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf.
Authorized Systems Integrators (ASI)	Independent organizations approved by Woodward, which incorporate products as part of a complete solution for energy control technologies, and which will provide service and training as needed.
OEM	Original equipment manufacturer, including any related service organization or dealer network that manufactures engines, turbines, compressors, or generator sets.
End User	User who, in the ordinary course of business, uses the products in their own facility for their own needs, does not resell the products, and takes "final & permanent" (i.e., not for the purpose of resale) title to the products.
Help Desk	Woodward defined help desk application used by ASI/AISFs.

Chapter 2.
SG Governor Overview

The SG governor is a hydraulic speed droop governor that is used on diesel engines, gas engines, steam turbines, or gas turbines where isochronous (constant speed) control is not required. The design of a droop governor is such that as load is increased, the desired speed of the governor is decreased, achieving stability in the governed system.

SG governors are supplied with a useful net torque output of 11.3 and 28.8 in-lbs. over a terminal shaft travel of 36°. A return spring (internal or external and vertical or horizontal) is used to move the power piston toward minimum fuel. Therefore, the actual torque developed during a speed decrease is 11.3 in-lbs. or 28.8 in-lbs. plus the return spring force. During an on-speed condition, the force developed by the power piston is equal to the return spring force. The relief valve spring used determines whether the unit has a net torque of 11.3 in-lbs. or 28.8 in-lbs.

Normally, the SG governor operates at speeds between 2400 and 3600 rpm but special configurations are available to meet other speed requirements.

The unit will operate vertically or horizontally. In the horizontal position, the mount must be such that the terminal shaft is also horizontal and requires a drain on the lower side of the cover.

Speed Adjustment

Several options are available to adjust the desired speed of the governor.

Speed Setting Shaft

A speed adjusting shaft may be used to change the force on the speeder spring (desired speed). Stop screws can be used for limiting the speed range of the variable speed governor.

Speed Adjusting Motor

Motors may be fitted on the governor cover to enable an operator to adjust the speed of the governor from a remote location. Several types of motors are available: Groschopp, Pittman, and Sawamura types.

- Groschopp motor is a split field, series wound, reversible motor. Motors are available in the following voltages: 115V AC/DC, 125V DC, 64V DC, 48V DC, 32V DC, 24V DC, and 12V DC.
- Pittman motor is a permanent magnet motor and only available for supply voltages of 12V DC and 24V DC.

Pneumatic Speed Adjustment

The pneumatic speed setting assembly is used to change the speed setting of the governor from a remote location and can be direct acting or reverse acting. The pneumatic speed setting mechanism replaces the screws normally used to set high and low speeds. The most common range is 3-15psi, but 6-30psi, 9-15psi, 3-20psi, and 5-60psi ranges are available.

The pneumatic speed setting assembly consists of a diaphragm, housing, oil reservoir, return spring, and a pushrod that extends to the floating lever in the governor. Speed will change proportionally to the change in supply air pressure. As an example, assume that the operator wants to increase the speed of the engine. The desired speed is increased by the operator increasing the air pressure to the reservoir—oil is forced through the orifice to the top of the diaphragm. As the diaphragm and piston move downward, the upward force of the spring is increased as the spring is compressed, re-establishing the force balance. The downward movement of the rod extending to the floating lever increases the speeder spring force (desired speed) and thus increases speed.

Pump and Relief Valve

Supply oil (usually engine oil pressure) is supplied to the oil pump. Oil is carried in the gears around the outside of the gear pocket to the pressure side. As pressure increases, the relief valve plunger moves against the relief valve spring until the plunger exposes the hole allowing pressurized oil to return to sump.

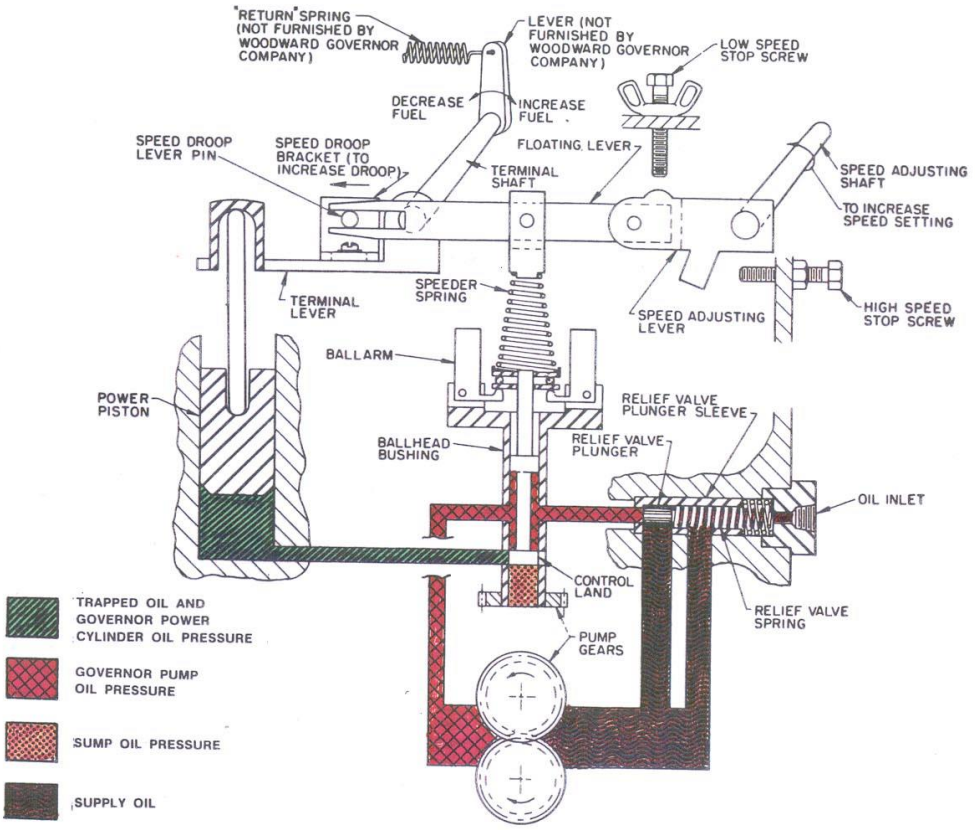

Figure 2-1. SG Governor

Ballhead, Pilot Valve, Bushing, Speeder Spring Assembly

This assembly allows the governor to compare desired speed to actual speed and make a decision whether to add, decrease, or make no change to the terminal shaft position, which controls fuel to the engine. A force balance exists between the ballhead and the speeder spring. The speeder spring force is the desired speed force and the centrifugal force of the ballhead (actual speed) acting opposite to the downward force of the speeder spring. During an on-speed condition, the forces balance and no oil is ported to or from the power piston. If the forces are not equal, pressurized oil will be ported to or from the power piston, resulting in a change in terminal shaft position. The bushing rotates, driving the ballhead at a speed proportional to the engine speed. Its rotation reduces the frictional forces between the pilot valve and bushing. Different speeder springs, bushings, and ballheads are available for variations of speed and engine response.

Power Piston

The power piston provides the force to move the terminal shaft to increase or decrease fuel to the engine. The piston is single acting, only exerting hydraulic force in the increase direction. When the pilot valve is lowered in the increase fuel direction, governor pressurized oil is ported through the rotating bushing to the power piston, which moves upward. In a decrease fuel direction, the pilot valve raises allowing trapped oil to move from the power cylinder through the bushing to drain. The downward force that causes this movement comes from the return spring. The force applied to the lower side of the power piston during steady state operation is equal to the force applied by the return spring. In an increase transient or at blocked servo at max fuel the pressure will be equal to that generated by the pump plus the

supply pressure. At minimum fuel and blocked servo, the servo pressure will be zero with only the return spring force urging the power piston to minimum.

Speed Droop Adjustment

Droop is defined by an increase in load and a resulting decrease in speed setting. This is quantified as the change in rpm between maximum fuel and minimum fuel. Droop accomplishes three things:

1. Stability
2. Load limiting
3. Ability for multiple engines driving a common load to share load

The SG governor accomplishes this with a speed droop bracket and lever. As load increases and the power piston moves upward, the speed droop bracket and lever raise, lifting the floating lever which decreases the force on the speeder spring, thus lowering the desired speed of the engine. As the droop slider is moved away from the terminal shaft, the amount of droop is increased.

A minimum amount of droop (0.5% to 7%) is necessary to stabilize an engine operated with a governor without a compensation system. If negative droop is present, the governor will be unstable.

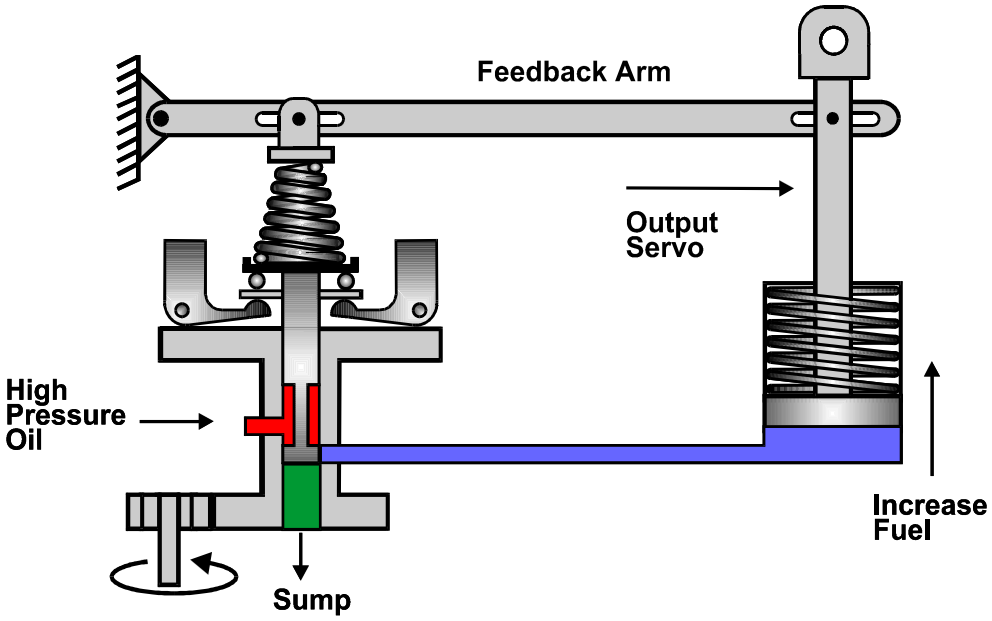

Figure 2-2. Basic Droop Governor

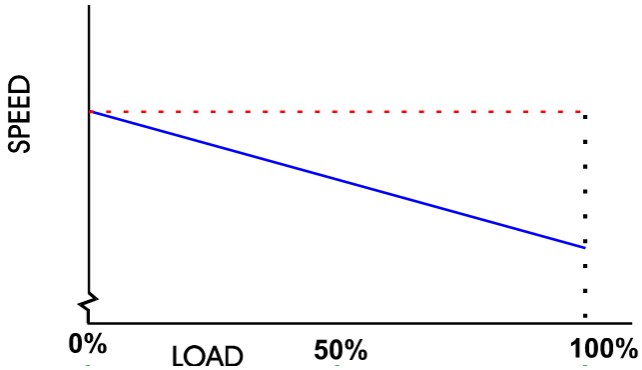

Figure 2-3. Speed Droop Curve

Example of Operation

Assume that the operator wants to increase the speed of the engine, or an additional load is added to the system. The governor responds by:

1. The ballhead moves inward allowing the pilot valve to move downward below its “null” position.
2. Pressurized oil is ported through the bushing to the power piston moving it upward.
3. The terminal lever rotates clockwise increasing fuel to the engine.
4. As the engine accelerates from the added fuel, the flyweights move outward, lifting the pilot valve to its “null” position and stopping the increase of fuel.

The high-speed stop screw limits the top end speed of the engine and the low-speed stop screw controls the low speed. Setting these two controls the operating range of the engine.

Chapter 3.
EG Actuator Overview

Overview

The EG-3P and EG-3PC actuators are electro-hydraulic units that use hydraulic pressure to rotate a terminal shaft that controls fuel or steam to a prime mover. The movement of this shaft is proportional to the current input. Additionally, compensation is available with the EG-3PC model when multigrade oil is used.

The essential element of the actuator is the electro-hydraulic transducer, which controls oil flow to and from the power piston. With a proportional increase in current to the coils, a magnet that is connected to the pilot valve plunger moves, upsetting the null position of the plunger and allowing pressurized oil from the pump to be ported to and from the power piston. The models with an oil pump develop 400psi with a useful work capacity of 3 ft. lbs. The models without an oil pump depend on engine oil pressure or an external pump to develop torque at the terminal shaft. The useful work that a unit without a pump can develop is proportional to the amount of oil pressure inlet.

The EG actuator differs from an SG governor in a few ways. First, the EG actuator is only a part of the system that allows the control of speed within a system. In addition to the EG actuator, an MPU and a controller are needed. The MPU uses gear teeth to accurately and quickly send actual speed signals to the controller. The controller compares the actual speed to a desired speed and makes adjustments via the actuator as needed. See Figure 3-1 for an outline of a simple electronic governing system.

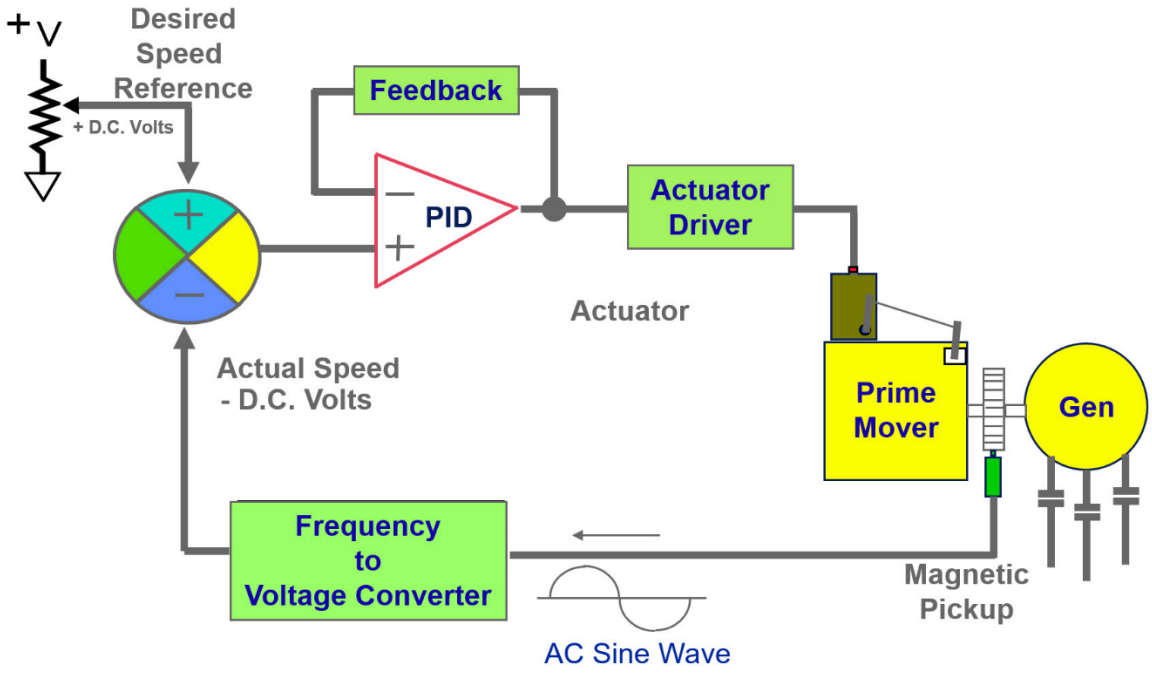

Figure 3-1. Electronic Governing System Diagram

Operation

Oil Pump & Relief Valve vs. Oil Motor

When the actuator is equipped with an oil motor, it does not require a driveshaft. External source i.e. engines oil pressure, supplies the working pressure and force to move the terminal shaft. This pressure also operates the oil motor, which rotates the pilot valve bushing. An orifice to reduce the flow of oil to the motor restricts pressurized oil going to the oil motor.

Table 3-1. Oil Motor - Orifice Selection

Supply Pressure	Orifice Diameter
80-99 psi (552 to 687 kPa)	. 076” (1.93mm) diameter
100-175 psi (688 to 1210 kPa)	. 062” (1.57mm) diameter
176-300 psi (1211 to 2071 kPa)	. 055” (1.40mm) diameter
301-500 psi (2072 to 3448 kPa)	. 047” (1.19mm) diameter

Table 3-2. Work Output based on Supply Oil Pressure

Actual Operating Pressure (psi)	Useful Work Output (ft. lbs.)
400	3.00
300	2.25
200	1.50
100	1.00

When oil pressure is not readily available at the desired pressure, the actuator pump is driven by the prime mover. Oil from an external supply enters the supply side of the oil pump. Pump gears carry oil in the voids between the teeth around the outside of the gear pocket to the pressure side of the pump. The drive shaft should rotate between 1200 and 3600 rpm. Pressure increases until the relief valve piston moves against the spring far enough to allow the pressurized oil to return to sump or supply side of the pump. A constant pressure is maintained and determined by the spring rate of the relief valve and the location of the port going to drain.

Power Piston

The power piston changes the hydraulic force into a linear force and through linkage, to a rotational force. The piston is differential, meaning that pressurized oil is used to move the piston in both directions. Governor oil pressure is directed to the upper side of the piston at all times and continually urges the piston downward toward minimum fuel. The area on the upper side of the piston is one half of that on the lower side. Since the force is equal to the pressure times the area, then in a steady state, the pressure on the lower side of the piston will only be half of that on the upper side.

Pilot Valve/Bushing

The transducer-magnet assembly controls the position of the pilot valve. In an increase fuel transient, the pilot valve is lowered, allowing pressurized oil to flow to the lower side of the power piston and move the piston upward, causing the terminal shaft to move to increase fuel. To re-center the pilot valve when the desired speed is accomplished, the restoring lever moves toward decreasing the force on the restoring spring, and thus allows the pilot valve to move upward and be re-centered.

By design, the bushing rotates in order to remove frictional forces between the bushing and pilot valve. In a steady state condition, the control land on the pilot valve covers the opening in the bushing. During a transient, pressurized oil passes through the rotating bushing to the piston. The cross-sectional area of the slot or hole in the bushing determines how much the piston moves during a speed transient. Generally, the slotted bushing will allow more oil to flow than a bushing with round holes.

Transducer Assembly

An actuator is not a governor. A governor has a mechanism that can compare a desired speed to the actual speed and make corrections so that desired speed and actual speed are the same. An actuator, by comparison, is a device to carry out a command that comes from a controller. The controller has input from a magnetic pickup that gives the control box the input signal of actual speed. Its signal is an AC voltage that is changed in the control to a negative (-) DC signal. The system operator chooses a desired speed which is also entered into the control as a positive (+) DC signal. Electronically, these two signals are compared, and a corrective signal is sent to the actuator to change the fuel or steam flow.

The signal that is transmitted from the controller to solenoid coils produces a force, which is proportional to the magnitude of the current. This force urges the magnet and pilot valve downward. A force balance is present when the prime mover is running at a steady state. As stated, the signal to the solenoid coils produces a downward force. An additional downward forced is produced by the restoring spring. It varies because the force it produces is proportional to the position of the terminal shaft. The other force is an upward force produced by the level spring. At a loss of signal to the solenoid coils, the level spring would cause the terminal shaft to move to shut down.

As an example, consider a desired speed increase. An increase in the electrical signal is sent from the controller to the solenoid coils. The downward force is increased, causing the force balance to be upset and the pilot valve moves downward. Pressurized oil flows to the underside of the power piston moving it upward. The connecting linkage rotates the terminal shaft toward increase fuel. The feedback linkage raises causing the force exerted by the restoring spring to be decreased. The decreased force counters the increased downward force exerted by the solenoid coils on the restoring spring, which re-centers the pilot valve. The system runs at steady state at the new speed setting.

Compensation System (-3PC)

The purpose of a compensation system is to add stability, specifically for units that use multigrade oil. This is accomplished by supplying extra hydraulic pressure to the compensation land of the pilot valve plunger to assist in returning it to its centered position following a fuel change. Consider a fuel increase situation: The pilot valve moves downward allowing pressurized oil to flow to the lower side of the power piston. As the piston moves upward, oil on the upper side of the piston moves the buffer piston to the right. Pressure on the left side is greater than that on the right side. Oil pressure on the underside of the compensation land is also increased and thus anticipates that the prime mover is approaching its needed speed correction and keeps it from overshooting its target. Oil moves through the needle valve at a controlled, slower rate and the difference in oil pressures on each side of the buffer piston will dissipate and the buffer piston will return to its centered position.

Normally, the needle valve is set at 2-3 turns open. This allows increased stability when the oil is cold because the oil viscosity is greater and does not flow as easily through the needle valve as when the oil is hot and less viscous. The electronic governor has circuitry to provide stability, but with the use of multigrade oil, it is necessary to add hydraulic damping while the oil is cold.

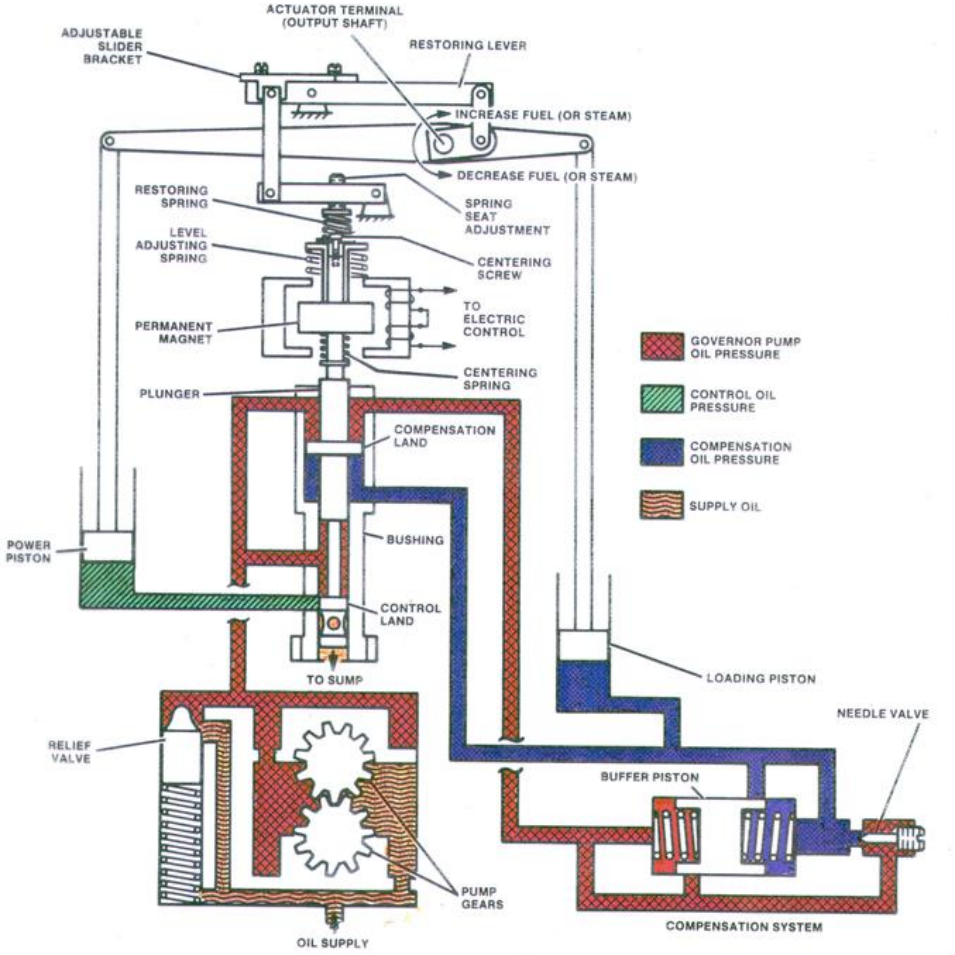

Figure 3-2. EG-3PC Internal Diagram

Chapter 4.
Conversion Considerations

The basic governor function of the SG governor is based on a fixed droop setting. The engine/turbine speed will reduce when engine/turbine load increases. When an electronic governing system upgrade is being considered, there are many benefits over a fixed-droop governor; however, there are also some requirements that need to be considered.

Benefits of Upgrading to Electronic Governing System over SG Governor

- Ability to switch between operating in Droop or Isochronous Mode
- Sense and Control Speed beyond range possible with mechanical governors
- Complex modifications possible with little or no mechanical changes
    - Start-up sequencing
    - Dead band avoidance
    - Limiters (torque, speed, etc.)
    - Changing dynamics
    - Much more!

An application engineer should be consulted to figure out what type of controller will be needed for the application—where an MPU can be mounted, what type of MPU should be used, as well as possible adaptations to mount the actuator where the governor is located.

Controller Options:
2301A – Simple controller for gas and diesel engines, as well as steam and gas turbines.
Peak 200 – Specifically designed for steam turbines with single rack or single valve setups.
505 – A family of products created specifically for use on more complex steam turbines.
easYgen – Specifically designed for use with power control applications.
MicroNet – Custom designed control system for larger operations.

Woodward offers varying levels of controllers to match the application. Some of the applicable options at the time of this publication are listed below with brief descriptions.

MPU Options:
Explosion Proof or Standard
Single Coil or Dual Coil
Different Voltage Peak to Peak (VPP) Values
Metric or Imperial Threads
Various Lengths

Woodward has many different options when choosing the correct MPUs for making the upgrade to electronic governors. Consult with an application engineer to discuss any questions and availability of the below MPU options.

Typical SG to EG Conversion Procedure

1. Send a request to Woodward's HelpDesk team (**Contact Us - Woodward Technical Support**) with the below info.
   a. Part number and serial number of SG currently in use.
   b. What application the SG governor is being used on.
   c. Desires and plan to make the electronic upgrade at your location.
2. Woodward Helpdesk Team will forward your request to Woodward's upgrade team, who will determine if a compatible retrofit EG actuator part number is already available or if it needs to be created.
   a. If a compatible retrofit EG part number is available, the upgrade team will send this information to the respective customer.
   b. If a compatible retrofit EG part number is not yet available, the upgrade team will provide a quotation for Woodward to create a compatible retrofit EG part number.
3. Woodward's upgrade team will propose different options available for the application of the SG governor including MPU and controller.
   a. Quote for controller and MPU can be provided for Woodward parts.
4. Customer retrofits SG governor with EG actuator and makes any necessary modifications to the governor-to-valve linkage.

Mechanical Retrofit

- Same options available for many of the bases and drive shafts.
  - Minor differences between SG and EG actuator can be overcome with adaptions of the fuel rack linkage and oil connection (i.e., length).
- See Figures 4-2 and 4-3 showing the physical differences for terminal shaft and oil supply connection. Please note that not all models match exactly the dimensions below.
  - SG terminal shaft is located 4.375" (111.1mm) above the base.
  - EG terminal shaft is located 5.406" (137.3mm) above the base.
    - Note that speed adjustment shafts on EG actuators are not needed. All speed adjustments are made through controller.
  - SG oil inlet connection is 1.5" (38.1mm) above base.
  - EG oil inlet connection is 0.438" (11.1mm) above the base.

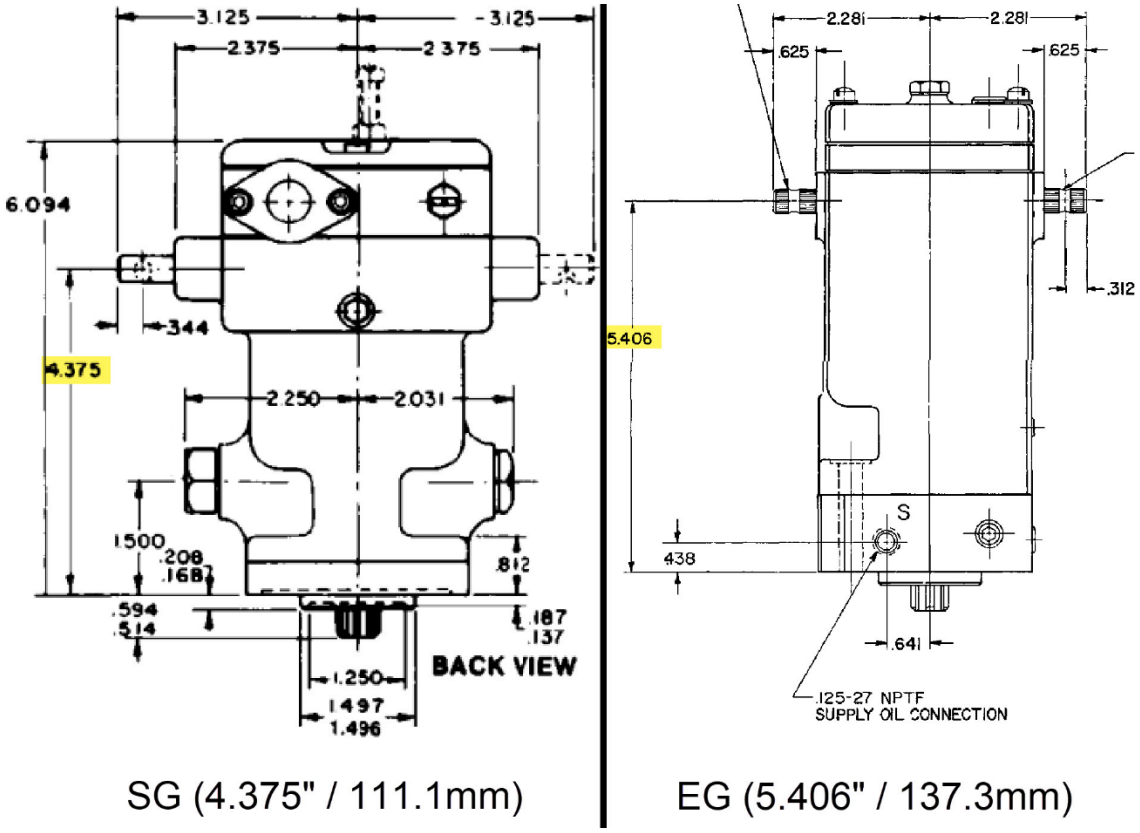

Figure 4-1. Typical Height Differences for Terminal Shafts

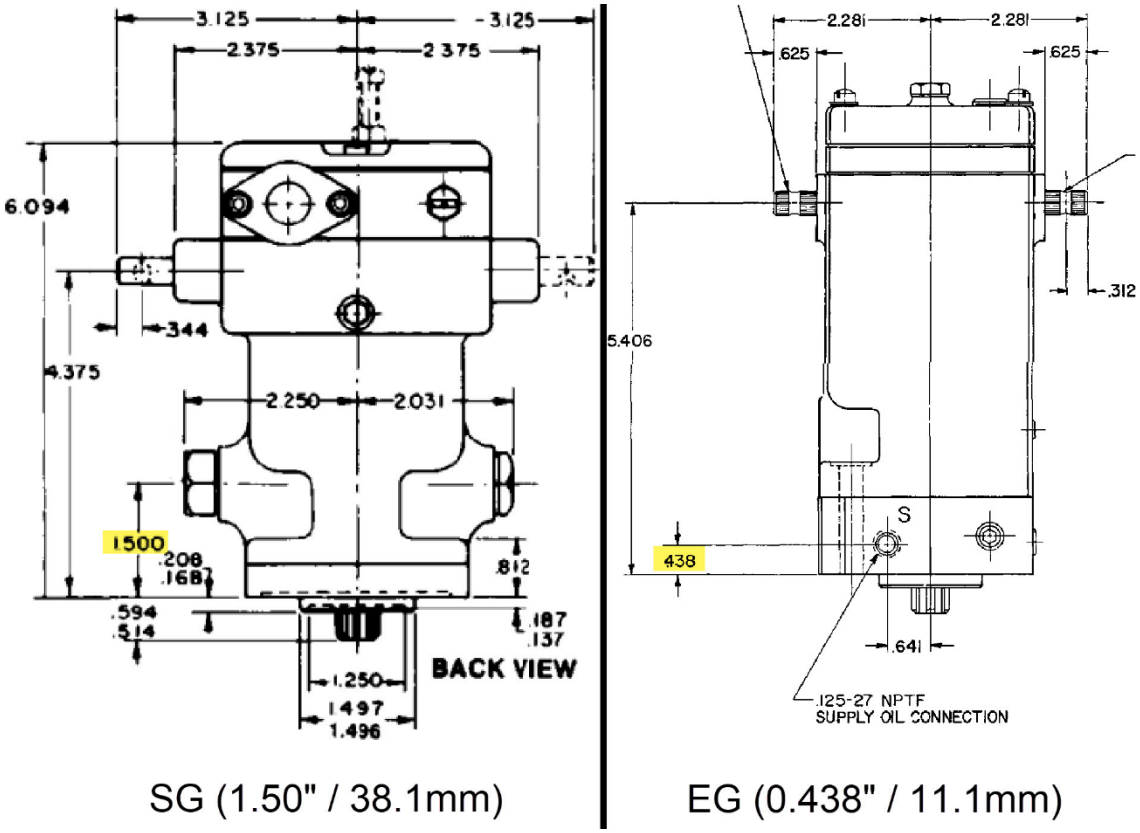

Figure 4-2. Typical Height Differences for Oil Inlet

Chapter 5.
Product Support and Service Options

Woodward Upgrade Team Contact Information

Woodward HelpDesk Team
Contact Us - Woodward Technical Support

OR

Kyle Weinmeister
Sales Support Engineer
Kyle.weinmeister@woodward.com
+1-970-814-3435

Product Support Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full Service Distributor serving your area.
- Contact Woodward technical assistance (see “How to Contact Woodward” later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

OEM or Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.

A current list of Woodward Business Partners is available at:
https://www.woodward.com/en/support/industrial/service-and-spare-parts/find-a-local-partner

Product Service Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (Woodward North American Terms and Conditions of Sale 5-09-0690) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

- Replacement/Exchange (24-hour service)
- Flat Rate Repair

- Flat Rate Remanufacture

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is a flat-rate program and includes the full standard Woodward product warranty (Woodward North American Terms and Conditions of Sale 5-09-0690).

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned within 60 days, a credit for the core charge will be issued.

Flat Rate Repair: Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward North American Terms and Conditions of Sale 5-09-0690) on replaced parts and labor.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in “like-new” condition and carry with it the full standard Woodward product warranty (Woodward North American Terms and Conditions of Sale 5-09-0690). This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:
- Return authorization number
- Name and location where the control is installed
- Name and phone number of contact person
- Complete Woodward part number(s) and serial number(s)
- Description of the problem
- Instructions describing the desired type of repair

Packing a Control

Use the following materials when returning a complete control:
- Protective caps on any connectors
- Antistatic protective bags on all electronic modules
- Packing materials that will not damage the surface of the unit
- At least 100 mm (4 inches) of tightly packed, industry-approved packing material
- A packing carton with double walls
- A strong tape around the outside of the carton for increased strength

NOTICE

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Replacement Parts

When ordering replacement parts for controls, include the following information:

- The part number(s) (XXXX-XXXX) that is on the enclosure nameplate
- The unit serial number, which is also on the nameplate

Engineering Services

Woodward offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact. Emergency assistance is also available during non-business hours by phoning Woodward and stating the urgency of your problem.

Product Training is available as standard classes at many of our worldwide locations. We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from many of our worldwide locations or from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact one of the Full-Service Distributors listed at **https://www.woodward.com/en/support/industrial/service-and-spare-parts/find-a-local-partner**

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory at **https://www.woodward.com/support**, which also contains the most current product support and contact information.

You can also contact the Woodward Customer Service Department at one of the following Woodward facilities to obtain the address and phone number of the nearest facility at which you can obtain information and service.

Products Used in Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
Germany	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 (12) 295 13 00
United States	+1 (970) 482-5811

Products Used in Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
Germany	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Products Used in Industrial Turbomachinery Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 8818 5515
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+ 82 (51) 636-7080
The Netherlands	+31 (23) 5661111
Poland	+48 (12) 295 13 00
United States	+1 (970) 482-5811

Technical Assistance

If you need to contact technical assistance, you will need to provide the following information. Please write it down here before contacting the Engine OEM, the Packager, a Woodward Business Partner, or the Woodward factory:

General

Your Name _____

Site Location _____

Phone Number _____

Fax Number

Prime Mover Information

Manufacturer _____

Turbine Model Number _____

Type of Fuel (gas, steam, etc.) _____

Power Output Rating _____

Application (power generation, marine, etc.)

Control/Governor Information

Control/Governor #1

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Control/Governor #2

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Control/Governor #3

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Symptoms

Description _____

_____

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

Revision History

New Application Note—

Released

We appreciate your comments about the content of our publications.

Send comments to: industrial.support@woodward.com

Please reference publication 51653.

B 5 1 6 5 3 : -

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Woodward has company-owned plants, subsidiaries, and branches, as well as authorized distributors and other authorized service and sales facilities throughout the world.

Complete address / phone / fax / email information for all locations is available on our website.