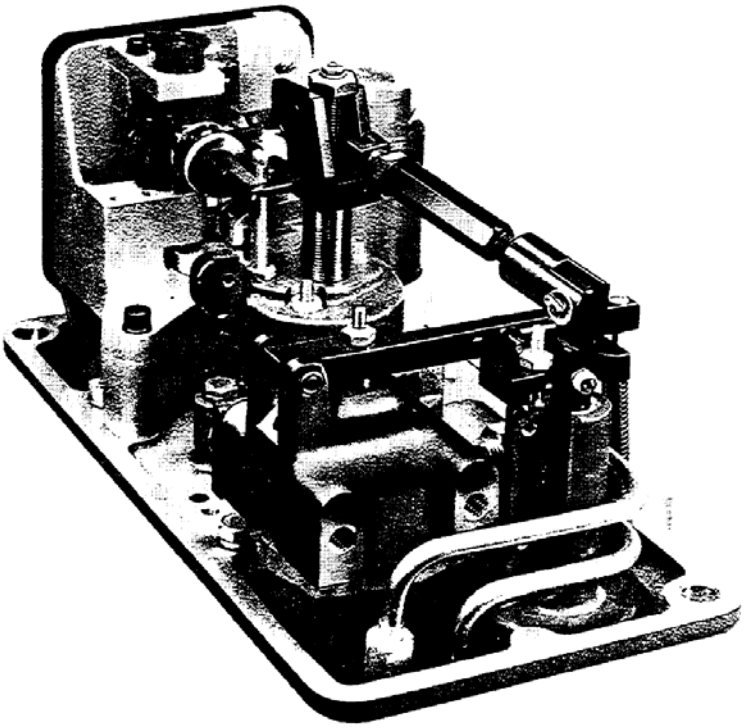
WOODWARD

Product Manual 36670
(Revision NEW)
Original Instructions



Proportional Pneumatic Output Signal for PG Governors

Operation Manual

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. To verify that you have the latest revision, check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, on the *publications page* of the Woodward website:

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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. Be sure to check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Revisions—Changes in this publication since the last revision are indicated by a black line alongside the text.

Warnings and Notices

Important Definitions

This is the safety alert symbol. It is 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*.

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
   - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

Proportional Pneumatic Output Signal for PG Governors

Introduction

PG governors with long columns can be equipped with a pneumatic transmitter which provides on air pressure signal as a function of the decrease in engine speed below 100% speed. Governors with this feature are often used on marine engines driving controllable pitch propellers. The pneumatic signal is used to override the manually. programmed control signal to the adjustable pitch propeller. By decreasing propeller pitch at such times, it can effectively reduce engine load and thereby increase engine and propeller speed.

Engines used in this type of service have positive stops on the fuel rocks to limit maximum fuel to the amount required to operate at full load. A “yield” is also incorporated in the linkage between the governor output connection and engine fuel racks.

The upper portion of a governor fitted with this pneumatic transmitter is shown in Figure 1.

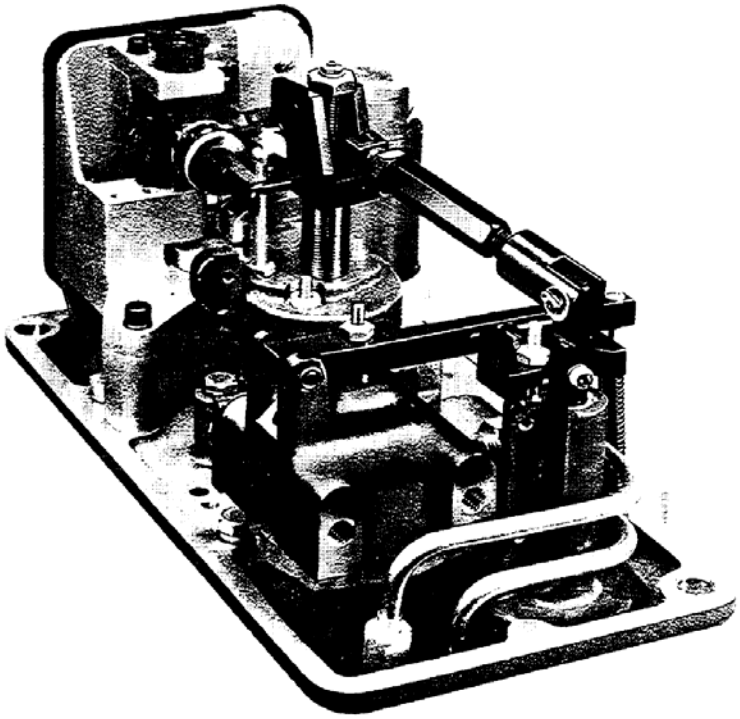

Figure 1. Proportional Pneumatic Output Transmitter

Operation

A schematic arrangement showing the addition of the pneumatic transmitter and associated linkage to the basic elements of a PG governor is shown in Figure 2.

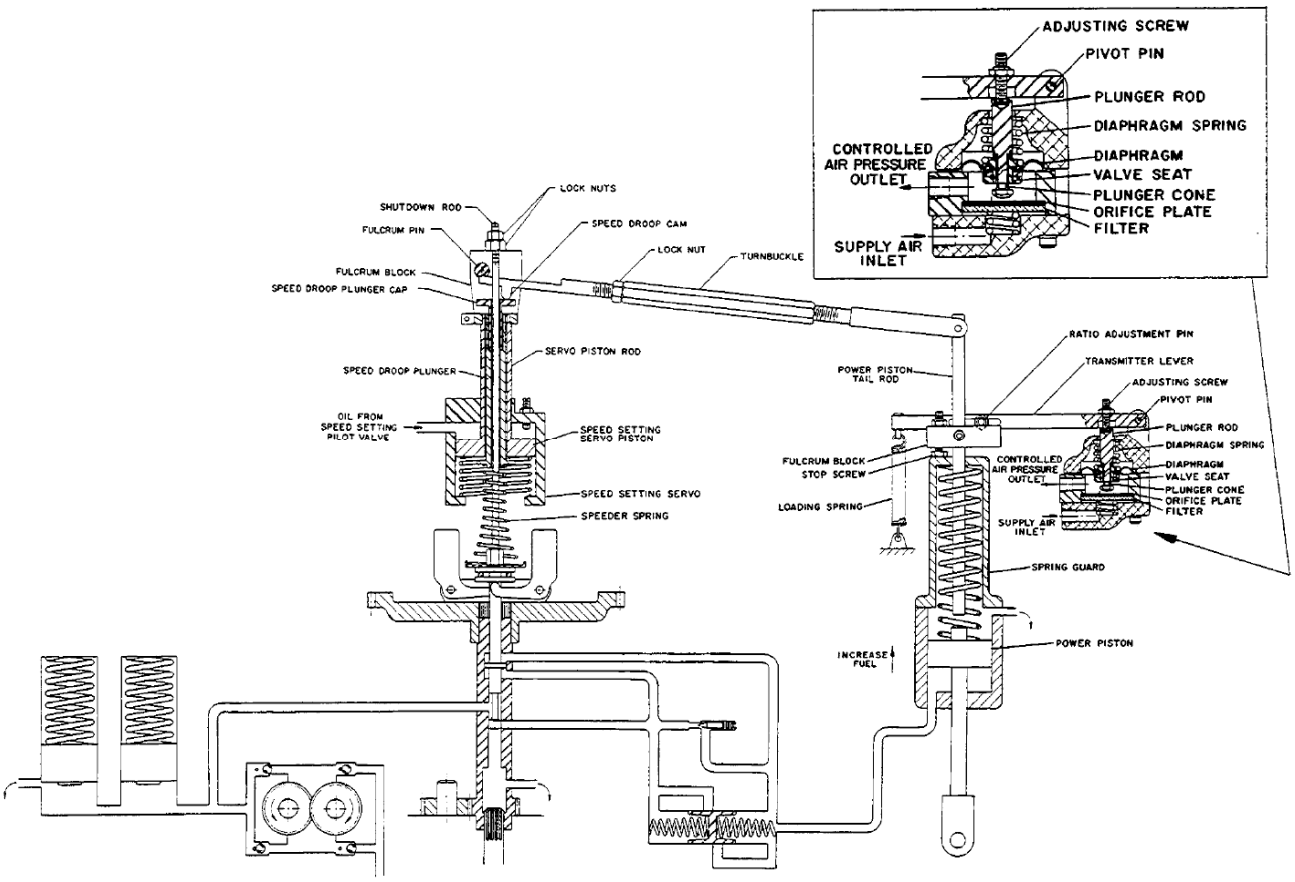

Figure 2. Pneumatic Transmitter Schematic

Supply air, admitted through the inlet part, passes through a sintered bronze filter and an orifice plate before filling the area below the diaphragm. The air pressure below the diaphragm is connected to the device receiving the transmitter signal.

The pressure beneath the diaphragm increases until it is just sufficient to overcome the force of the diaphragm spring on the upper side of the diaphragm. When the diaphragm moves up, the valve seat is moved up a minute distance off the plunger cone, allowing the air below the diaphragm to escape to atmosphere through the clearance hole about the plunger rod in the cover of the transmitter. When the rate at which the air escapes to atmosphere is the same as the rate at which it posses through the orifice plate, the pressure below the diaphragm remains constant.

The plunger rod positions the plunger cone. If the rod is moved down, the plunger cane is moved away from the valve seat, thus allowing a greater rate of escape of air to atmosphere. As the air pressure below the diaphragm decreases, the diaphragm spring forces the valve seat down until the rate at which air escapes to atmosphere is again equal to the rate at which air passes through the orifice plate. If the plunger rod moves up, the plunger cone seats against the valve seat thus stopping the escape of air to atmosphere. Air pressure below the diaphragm now increases until it is again sufficient to overcome the diaphragm spring and lift the valve seat. When the rate at which the air escape again equals the rate at which it passes through the orifice plate, pressure below the diaphragm will remain constant. Thus it can be seen then that the controlled pressure is proportional to the position of the rod.

The transmitter lever controls the position of the plunger rod. One end of the lever connects to a pivot pin in the transmitter housing; the ratio adjustment pin in the lever is held in contact with the fulcrum block by a loading spring at the “free” end of the lever. The fulcrum block is attached to the power piston tail rod. Unless restrained by the stop screw, the loading spring keeps the tail rod in contact with the power piston rod. The power piston takes a position as a function of engine load up to full load and, as will be shown, above its full load position, its position is a function of the decrease in engine speed below 100% speed.

If the stop screw is adjusted so that the power piston rod does not contact the tail rod until full engine load is reached, the transmitter lever has a fixed position up to full load. Above full load, its position is o function of the amount the engine is underspeed. Thus the pneumatic transmitter output is a pressure signal that is constant up to full load and increases as engine speed decreases.

As the power piston moves the tail rod up, the linkage to the droop cam raises the cam as the cam pivots about the fulcrum pin. Raising the cam allows the droop plunger to move up and thereby decrease the loading on the governor speeder spring. Decreasing the loading on the speeder spring decreases the speed setting. When the decrease in speed setting equals the decrease in engine speed (from 100% speed), the governor pilot valve will be centered thereby halting further movement of the governor power piston. Thus for each speed value below 100% speed, there is a unique position of the power piston—and hence, transmitter lever.

It is perhaps worth noting that the governor power piston movement positions the fuel racks as required to maintain the set speed for all loads up to full load Though the yield linkage allows the power piston to move beyond the full load position in the “increase fuel” direction, no additional fuel reaches the engine cylinders because of the positive stops on the fuel racks.

Adjustments

The speed droop cam must be positioned to allow for the desired speed decrease in the programmed range of travel of the power piston above its full load position. In other words, if the governor uses 60% of the available travel of its out shaft, the cam must be set to give the desired speed setting change in the remaining 40% of its available travel. Move the cam toward the governor power piston to increase the range.

The adjusting screw in the transmitter lever is used to set the output pressure of the transmitter when the stop in the transmitter lever is touching the spring guard. Turn the screw down to decrease output pressure.

Position the ratio adjustment pin in the transmitter to give the desired Output pressure for a given travel of the power piston tailrod. Move the pin away from the transmitter to decrease the pressure range.

Ref. No.	Part Name	Quantity
36670-1	Hex Hd. Screw (1/4”-28 x 5/8”)	2
36670-2	Split Lockwasher (1/4”)	2
36670-3	Male Connector	2
36670-4	Lock Nut	1
36670-5	Washer	1
36670-6	Split Lockwasher (#8)	1
36670-7	Screw (#8-32 x 3.4”)	1
36670-8	Transmitter Fulcrum	1
36670-9	Lever Carriage	1
36670-10	Column Subassembly	1
36670-11	Bulkhead Elbow	2
36670-12	Split Lockwasher (3/8”)	2
36670-13	Hex Hd. Screw (3/8”-16 x 3/4”)	2
36670-14	Transmitter Bracket	1
36670-15	Extension Spring	1
36670-16	Headed Pin	1
36670-17	Power Piston Tail Rod	1
36670-18	Screw	1
36670-19	Nut	3
36670-20	Transmitter Lever	1
36670-21	Set Screw (#10-32)	2
36670-22	Valve Plunger Rod	1
36670-23	Fulcrum Pin	1
36670-24	Oilite Bushing	2
36670-25	Valve Seat	1
36670-26	Gasket	1
36670-27	Diaphragm	1
36670-28	Diaphragm Retainer Assembly	1
36670-29	Gasket	1
36670-30	Orifice Plate	1
36670-31	Gasket	1
36670-32	Filter Disc	1
36670-33	Cover Gasket	1
36670-34	Cover	1
36670-35	Split Lockwasher (#10)	4
36670-36	Socket Hd. Screw (#10-32 x 5/8”)	4
36670-37	Case	1
36670-38	Control Spring	1
36670-39	Damping Spring	1
36670-40	Washer	2
36670-41	Keyed Retaining Washer	1
36670-42	Diaphragm Nut	1
36670-43	Valve Plunger	1
36670-44	Self Locking Nut	1
36670-45	Filter Load Spring	1
36670-46	Fulcrum Assembly	1
36670-47	Droop Pin	1
36670-48	Lock Nut	1
36670-49	Nut	1
36670-50	Speed Droop Cam	1
36670-51	Nut	1
36670-52	Turnbuckle	1
36670-53	Droop Plunger Cap	1
36670-54	Power Piston Assembly	1
36670-55	Speed Droop Plunger Assembly	1

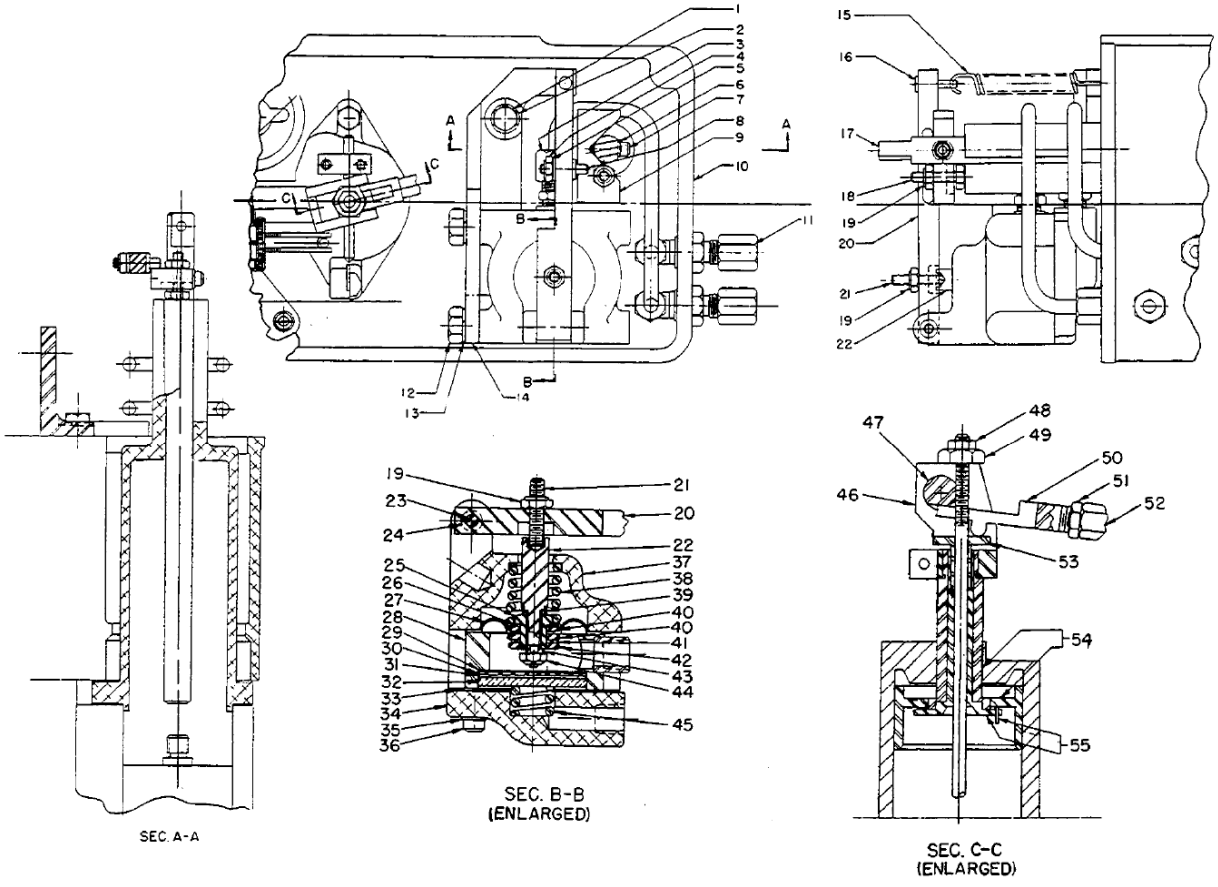

Figure 3. Pneumatic Transmitter Parts

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Send comments to: icinfo@woodward.com

Please reference publication 36670.

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